ÇAKAMUN25 UNOOSA Study Guide

Building Norms to Govern Behavior in Space so that it is Peaceful and Sustainable for the Benefit of All
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Table of Contents

1. Introduction to UNOOSA

Since its establishment in 1958, the United Nations Office for Outer Space Affairs (UNOOSA) has served as the primary UN body charged with shepherding the peaceful exploration and use of outer space. Born out of a recognition that no single nation could unilaterally manage the boundless reaches beyond Earth's atmosphere, UNOOSA was

tasked with forging international consensus on how to apply new spacefaring capabilities responsibly. As Secretariat to the Committee on the Peaceful Uses of Outer Space (COPUOS), UNOOSA coordinates two vital subcommittees—Scientific and Technical, and Legal—that convene annually to assess emerging scientific advances, review potential risks, and propose updates to existing guidelines. Through these regular dialogues, UNOOSA ensures that Member States remain attuned both to the accelerating pace of space technology and to the collective imperative of maintaining that domain as a shared, conflict-free environment.

At the heart of UNOOSA's mandate lies its stewardship of the five cornerstone treaties that form the backbone of international space law. Beginning with the landmark Outer Space Treaty of 1967, which affirms that outer space is "the province of all mankind," UNOOSA has overseen the negotiation and implementation of the subsequent Rescue Agreement (1968), the Liability Convention (1972), the Registration Convention (1976), and the Moon Agreement (1984). These instruments establish clear rules on state responsibility for national activities in space, the rescue of astronauts, liability for damage caused by space objects, and the registration of launches, while the Moon Agreement ventures into the complex question of governing resources on celestial bodies. Beyond these binding treaties, UNOOSA also drafts and promotes non-binding principles—such as guidelines on remote sensing data sharing and transparency in national space policies—that allow the international community to respond rapidly to novel challenges without waiting for lengthy treaty negotiations.

Complementing its legal and normative work, UNOOSA spearheads a range of capacity-building and technical assistance programs to ensure that all nations, particularly those with nascent space capabilities, can benefit from space science. Through UN-SPIDER, the United Nations Platform for Space-based Information for Disaster Management and Emergency Response, UNOOSA provides satellite imagery, training workshops, and expert support to help countries anticipate, monitor, and respond to natural hazards. Its "Access to Space for All" initiative offers fellowships, hands-on laboratory sessions, and on-site expert missions that guide emerging space agencies in drafting national legislation, developing ground infrastructure, and establishing regulatory frameworks consistent with international law. By empowering developing countries to harness satellite technologies for agriculture, weather forecasting, and telecommunications, UNOOSA promotes a more equitable global distribution of space-based benefits.

In recent years, UNOOSA has broadened its focus to address the evolving complexities of the space environment. It has published detailed Space Sustainability Guidelines that recommend best practices for debris mitigation, end-of-life disposal, and collision avoidance; initiated studies on cybersecurity threats to space assets; and convened expert panels on managing mega-constellation networks, such as those proposed by private operators like SpaceX and OneWeb, to prevent orbital overcrowding. By weaving together treaty stewardship, soft-law development, and hands-on technical cooperation,

UNOOSA continues to adapt its toolkit—ensuring that as humanity's ambitions in space expand, they do so in a manner that is responsible, inclusive, and sustainable.

-Core Functions

1. **Policy & Law Development**
   • Administering treaties:
   – Outer Space Treaty (1967)
   – Rescue Agreement (1968)
   – Liability Convention (1972)
   – Registration Convention (1976)
   – Moon Agreement (1984)
   • Drafting non-binding principles (e.g., remote sensing, transparency).

2. **Capacity-Building & Technical Assistance**
   • UN-SPIDER (disaster management via satellite data).
   • "Access to Space for All" workshops and fellowships.
   • National legislation support and expert missions.

Recent Initiatives

- Space Sustainability: Guidelines on debris mitigation and orbital safety.
- Cybersecurity: Protecting space assets from digital threats.
- Mega-constellations: Advisories on large satellite networks.

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2. The Need for Norms in Space Governance

As humanity's activities in outer space proliferate, the orbital environment has shifted from a sparsely populated domain into a congested, complex, and increasingly contested theater. Today, over 100 Member States maintain governmental or military spacecraft in orbit, and a rapidly growing cadre of private companies launch constellations, service satellites, and even plan for asteroid mining. In this milieu, **norms**—that is, shared expectations of acceptable behavior—serve as the invisible glue that holds cooperation together, mitigates risk, and preserves space as a domain for peaceful and sustainable use.

Why Norms Matter

Without a clear set of commonly accepted rules and practices, the likelihood of accidental collisions, unintentional interference, or even deliberate hostilities rises sharply. Well-crafted norms help to:

- **Prevent Collisions and Accidents**
  By standardizing maneuvers, coordinating orbital slots, and encouraging pre-launch notification, norms reduce the chance that two satellites or a satellite and debris will stray into one another's paths.

- **Clarify Acceptable Military and Dual-Use Activities**
  Norms draw clear lines between permitted reconnaissance or communications satellites and prohibited weaponization or on-orbit offensive operations, lowering the risk of misunderstanding and escalation.

- **Distribute Benefits Equitably**
  Shared principles ensure that the fruits of space—whether satellite imagery for disaster relief or spectrum for communications—are accessible to all nations, preventing a "first-mover advantage" by a handful of technologically advanced states or corporations.

Legal vs. Soft-Law Instruments

The international space governance toolkit consists of both **hard** and **soft** law:

1. **Binding Treaties**
    - Examples include the Outer Space Treaty (1967) and the Liability Convention (1972).
    - These instruments impose obligations that States must ratify and incorporate into domestic law, offering legal certainty but requiring lengthy negotiation and consensus.
2. **Soft Law**
    - Comprises COPUOS guidelines (e.g., Space Debris Mitigation, 2007) and UN General Assembly resolutions.
    - Although not legally enforceable, these instruments can be updated frequently, allowing the international community to respond nimbly to innovations like mega-constellations or novel propulsion systems.
3. **Customary International Law**

    - Arises when consistent State practice—such as routinely notifying other spacefaring actors of planned launches—acquires binding force over time, even in the absence of a formal treaty.

By combining these layers, the global space community achieves both the stability of binding commitments and the flexibility to adapt to emerging challenges.

The Norm-Building Process

Developing widely accepted norms is inherently a multilateral endeavor. It typically unfolds through:

- **Stakeholder Engagement**
    - National delegations (diplomats and policy-makers)
    - Space agencies and technical experts
    - Private industry representatives
    - Non-governmental organizations and academic researchers
- **Deliberative Venues**
    - **COPUOS Annual Sessions:** In Vienna, Member States and observers negotiate technical and legal guidelines.
    - **UNGA First Committee:** States debate space security issues alongside disarmament topics.
    - **UNOOSA-Hosted Workshops:** Focused events for capacity building, norm drafting, and informal consultations.
- **Consensus Building**
    - Drafting Working Papers: Technical studies and policy proposals circulated among delegates.
    - Informal Consultations: Side-meetings where negotiators refine language and test compromises.
    - Formal Adoption: Member States agree on final texts, which are then published as resolutions or guidelines.

Through this iterative, inclusive process, the spacefaring community evolves a shared rulebook—one that balances national interests, commercial innovation, and the collective need to keep space safe, peaceful, and beneficial for all.

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3. Current Risks and Challenges in Outer Space

As the space environment becomes increasingly crowded with both government and private sector actors, several pressing risks and challenges have emerged, threatening the safety, sustainability, and peaceful use of space. With more nations and companies operating in orbit, the governance of space is facing critical questions that must be addressed to preserve its integrity for future generations. Among the primary challenges are orbital congestion, space debris, weaponization concerns, and jurisdictional issues surrounding liability.

Orbital Congestion

The rapid growth of space infrastructure has led to orbital congestion, where valuable orbital slots are becoming limited, and the risk of collisions is rising. Currently, more than 7,500 active satellites are in orbit around Earth, with thousands more planned for the next decade. These satellites serve a variety of purposes—from communications and Earth observation to scientific research and military applications. However, the rise of small satellites (small-sats) and the proliferation of mega-constellations, like SpaceX's Starlink, which plans to launch up to 42,000 satellites, have compounded the challenge.

The sheer scale of these projects dramatically increases the likelihood of collisions, especially in the increasingly crowded Low Earth Orbit (LEO) region, where most of these satellites are deployed. These collisions can cause significant damage to operational satellites and create even more debris, leading to a vicious cycle of space debris generation, which in turn heightens the risk for other active satellites.

In response to this growing issue, many countries and commercial actors are working on solutions such as automated collision avoidance systems and the development of more sophisticated orbital traffic management frameworks. However, the lack of a universally agreed-upon system for space traffic management remains a significant gap in international governance.

Space Debris & Kessler Syndrome

One of the most dangerous consequences of orbital congestion is the growing problem of space debris. Space debris includes defunct satellites, spent rocket stages, and

fragments from satellite collisions, all of which pose a grave threat to operational spacecraft and astronauts in space. The risk arises from the fact that objects traveling at orbital speeds—around 7 to 8 kilometers per second—can cause catastrophic damage even to functioning satellites or crewed space stations. A collision, even with an object as small as a paint chip, could damage or destroy vital equipment.

The phenomenon of Kessler Syndrome, proposed by NASA scientist Donald Kessler in 1978, suggests that the density of objects in low Earth orbit could reach a point where collisions between debris fragments create an exponential increase in the amount of debris. This would result in a cascade effect, where subsequent collisions generate more debris, creating a self-perpetuating, uncontrollable situation. If unchecked, this could make certain orbital regions unusable, severely hampering space activities.

The issue of space debris has led to calls for stronger regulatory measures and innovative debris removal technologies. Active Debris Removal (ADR) systems, such as robotic arms or nets to capture and deorbit large pieces of space junk, are under development. Moreover, some space agencies, like the European Space Agency (ESA), have already begun conducting demonstration missions for space debris removal, highlighting the potential for these technologies to help mitigate the growing problem.

Weaponization & ASAT Tests

Another major concern in space governance is the potential weaponization of space. As space assets become increasingly critical for national security, communication, navigation, and global defense systems, the militarization of space is a growing issue. The use of space as a battlefield, or the development of space-based weapons, is a legitimate fear for many states.

A particularly alarming aspect of this militarization is the growing number of Anti-Satellite (ASAT) tests. In recent years, several countries have demonstrated their ability to destroy satellites in orbit, generating clouds of debris. For example:

- **China conducted an ASAT test in 2007, destroying one of its own weather satellites and creating more than 3,000 pieces of trackable debris.**

- **India followed suit in 2019 with its own ASAT test, generating significant debris and raising concerns about the safety of operational satellites in the same orbital zone.**

- **Russia conducted an ASAT test in 2021, which similarly resulted in thousands of pieces of debris, compounding the risk to other satellites in orbit.**

These ASAT demonstrations not only risk damaging civilian and military satellites but also contribute to the growing debris problem. Furthermore, they highlight the dual-use

nature of many space technologies. On-orbit servicing technologies, such as satellite refueling or maintenance, can be used for peaceful purposes, but they also have military applications. For example, the ability to intercept, capture, or alter the trajectory of a satellite could be used for both peaceful purposes (e.g., satellite servicing) and military ones (e.g., disabling enemy satellites). This dual-use nature of space technologies complicates the task of establishing clear norms and regulations for space governance.

Liability & Jurisdiction

As space activities expand, so too do the liability and jurisdictional complexities surrounding them. The Liability Convention (1972) establishes that the launching state is liable for any damage caused by its space objects, whether the damage occurs on Earth or in space. However, there are significant gaps in this framework, particularly when it comes to the accountability of private operators.

Many spacefaring nations have launched satellites through national space agencies or private companies, often with national government support or under national licensing schemes. While the Liability Convention holds states accountable for damage caused by their space objects, there are several issues that complicate this framework:

- **Cross-Border Activities: When space objects are launched from one country and operate over the territory of others, the legal framework for determining liability can become murky.**

- **Private Operators: The rapid expansion of private sector space ventures, such as SpaceX, Blue Origin, and OneWeb, creates complexities regarding accountability, especially when a private company's satellite or rocket causes damage. Many private operators launch satellites under national licenses but may not be directly accountable to the country where the satellite operates, leaving significant gaps in liability in cases of damage or accidents.**

These jurisdictional issues underscore the need for an updated international framework that clarifies the legal responsibilities of private actors and offers a mechanism for resolving disputes regarding liability. Without these updates, the rapid expansion of space activities will only exacerbate the risks associated with these challenges.

As the space environment becomes increasingly complex, these risks, orbital congestion, space debris, weaponization concerns, and liability gaps; demand urgent attention from the international community. Developing robust norms, guidelines, and legal frameworks is essential to preserving space as a safe, sustainable, and peaceful domain for the benefit of all humankind. Without such governance, the potential for

catastrophic accidents or even conflicts in space grows, jeopardizing not only space infrastructure but also the global economy and security.

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4. Space Debris and Environmental Sustainability

As space exploration and satellite deployments continue to grow at an unprecedented rate, the accumulation of space debris—non-functional satellites, spent rocket stages, and fragmented remnants from past collisions—poses an ever-growing threat to both the sustainability of outer space activities and the safety of operational spacecraft. This debris, often traveling at speeds upwards of 28,000 kilometers per hour, is not only a hazard to active satellites but also to crewed missions and critical infrastructure such as the International Space Station (ISS). As humanity continues to extend its reach into space, the risks associated with debris must be carefully addressed to ensure that space remains a usable domain for future generations.

Debris Environment Today

The growing issue of space debris is particularly concerning in Low Earth Orbit (LEO), which is home to the majority of operational satellites. Currently, an estimated 900,000 objects larger than 1 cm are circulating in LEO, according to space agencies and debris tracking organizations. While many of these objects are trackable, there are also thousands of smaller, untrackable fragments that pose just as much of a threat. Even small pieces of debris, such as paint flecks or tiny metal shards, can damage or disable spacecraft traveling at orbital velocities.

The risks associated with space debris are not limited to satellite damage alone. Crewed missions in orbit, including those aboard the International Space Station (ISS), face constant risks from high-speed collisions with even the smallest debris. In fact, the ISS regularly conducts debris avoidance maneuvers to avoid collisions with tracked objects. Similarly, the proliferation of debris also affects critical satellite services, including communications, weather monitoring, and Earth observation. A single collision with a piece of debris could result in cascading damage, making certain orbital regions unusable for future missions.

As the number of active satellites continues to rise—particularly with the advent of mega-constellations like SpaceX's Starlink—the likelihood of these risks occurring only grows. Therefore, it is imperative that the international community address space debris through strong mitigation measures and advanced remediation technologies.

Mitigation Guidelines

To mitigate the risks posed by space debris, international guidelines have been developed by various space agencies and organizations, including the Inter-Agency Space Debris Coordination Committee (IADC) and COPUOS. These guidelines aim to reduce the creation of new debris, manage existing debris, and ensure the sustainability of space operations.

Some of the key mitigation guidelines established over the years include:

1. **Post-Mission Disposal Protocols**
   - **One of the most important aspects of space debris mitigation is ensuring that defunct satellites and spent rocket stages are safely disposed of after their missions end. This can involve moving satellites to a disposal orbit (e.g., a "graveyard orbit") or guiding them to re-entry into Earth's atmosphere where they burn up.**
   - **The IADC (2002) and COPUOS (2007) guidelines stress the importance of these protocols to reduce the amount of long-lived debris that remains in orbit after a satellite's operational life.**
2. **<25-Year Orbit Decay for Defunct Objects**
   - **A key recommendation is that defunct objects should be deorbited within 25 years of their operational end. This is meant to minimize the potential for long-term accumulation of debris in popular orbital regions, particularly in LEO, where most new satellite constellations are being deployed.**
   - **While this rule is widely followed by governmental space agencies, it remains a recommendation, and adherence varies, particularly among private companies launching smaller satellites.**
3. **Minimizing Debris During Launches**
   - **Launch vehicles and spacecraft must follow strict guidelines to avoid creating debris during their ascent into space. The COPUOS (2007) guidelines recommend reducing the amount of debris created during launch operations by ensuring that stages are properly disposed of and non-functional parts of launch vehicles are removed from orbit as quickly as possible.**
   - **Further, manufacturers are encouraged to design space vehicles with minimal debris risk in mind, using materials that do not generate debris upon impact or detachment.**

Despite these guidelines, the voluntary nature of the measures and the lack of enforceable compliance have limited their effectiveness, especially with the rapid expansion of private space activities.

Emerging Remediation Technologies

As the threat of space debris intensifies, innovative remediation technologies are emerging that could significantly reduce the amount of debris in orbit and improve space sustainability. These technologies are still in the early stages of development, but they hold considerable promise for addressing the debris crisis.

1. **Active Debris Removal (ADR)**
    - **Active Debris Removal refers to technologies that involve actively capturing and removing large pieces of debris from orbit. This can be achieved using various methods, such as robotic arms, harpoons, or nets designed to capture defunct satellites or rocket stages.**
    - **One of the most promising ADR technologies is the use of autonomous spacecraft capable of detecting and capturing debris with precision. These spacecraft would move defunct objects to lower orbits, where they would eventually re-enter the atmosphere and burn up, preventing long-term environmental harm. The European Space Agency (ESA) and Japan's Aerospace Exploration Agency (JAXA) are both investing in ADR technologies, including their own debris removal demonstration missions.**
2. **On-Orbit Servicing**
    - **Another emerging technology is on-orbit servicing—the ability to extend the operational life of satellites by refueling, repairing, or upgrading them while they are still in orbit.**
    - **While this technology has obvious benefits for commercial satellite operators, it also has dual-use applications. For instance, military satellites could be serviced or even disabled by hostile forces using similar on-orbit servicing methods. As such, on-orbit servicing presents both opportunities and challenges in maintaining the peaceful use of space.**
3. **De-orbiting Systems**
    - **Some companies and organizations are also developing de-orbiting systems that can be attached to existing satellites or debris to help them re-enter Earth's atmosphere in a controlled and safe manner. These systems could use electrodynamic tethers or drag devices to pull defunct**

objects down, minimizing their time in orbit and preventing future collisions.

While these emerging technologies hold significant promise, their widespread adoption faces significant hurdles. Cost remains a major barrier, particularly for private operators and smaller space agencies with limited budgets. Additionally, international coordination is necessary to ensure that any debris removal operations comply with a unified global framework that prevents the mishandling or mismanagement of debris during the removal process.

Policy Gaps

Despite the existing guidelines and promising technologies, policy gaps persist in space debris management. One of the most pressing issues is the lack of binding obligations for debris removal. While some nations have enacted national regulations requiring their space activities to adhere to debris mitigation guidelines, there is currently no international treaty that mandates the removal of space debris or establishes a legal framework for how debris removal should be conducted.

Key policy gaps include:

1. Lack of Binding ADR Obligations
   Although guidelines for debris removal exist, they are often voluntary and lack enforceability. The growing presence of private sector actors in space has made it increasingly difficult to establish binding international standards for debris removal. A global treaty or regulatory framework for ADR could help mitigate this challenge, ensuring that all actors contribute to the reduction of space debris.

2. Funding and Liability Frameworks for Removal Operations
   A significant barrier to effective debris removal is the lack of a clear funding mechanism. While technologies for debris removal are advancing, cost-sharing models are still under discussion. Should a private company or country be responsible for the costs of debris removal? Who should pay for the clean-up of debris caused by previous missions, especially when debris from earlier missions has a long life?
   Additionally, questions regarding liability arise—if debris is removed or a satellite is captured and damaged, who is responsible? Clear frameworks around funding and liability are necessary to ensure that space debris removal becomes a shared, effective global effort.

5. Commercial and Private Sector Involvement

The commercial and private sectors are playing an increasingly central role in the evolution of space activities, fundamentally altering how space exploration, satellite deployment, and services are conducted. The **New Space Revolution**, as it is often called, is characterized by the growing involvement of **private companies**, such as **SpaceX**, **Blue Origin**, **Rocket Lab**, **OneWeb**, and **Relativity**, in previously state-dominated domains. These companies, with their ability to innovate rapidly and drive down costs, have opened up space for a wider range of participants, transforming the space industry from a niche, high-budget endeavor into a more accessible and competitive field.

New Space Revolution

Historically, space activities were primarily controlled by government entities, with national space agencies like NASA, the Russian Roscosmos, and the European Space Agency (ESA) spearheading satellite launches and space exploration missions. However, the rise of private companies has changed this dynamic. The emergence of companies like **SpaceX** (founded by Elon Musk in 2002), **Blue Origin** (founded by Jeff Bezos in 2000), and **Rocket Lab** (founded in 2006) has introduced new levels of competition, with these companies focusing on reducing the cost and increasing the accessibility of space travel. Their innovations in reusable rocket technology, lightweight satellite design, and advanced manufacturing techniques have already led to **lower launch costs**, faster mission turnarounds, and a significantly **wider range of available services**.

One of the most notable advancements in this area has been the creation of **small satellites**, particularly **CubeSats**, which are compact, modular, and much more affordable than traditional satellites. Companies like **OneWeb** and **SpaceX**, through their respective mega-constellation projects, plan to deploy thousands of small satellites into low Earth orbit (LEO) to provide global Internet coverage, improve communications, and offer **Earth observation data**. This revolution has made space more accessible to not only governments but also universities, research institutions, and commercial enterprises that were previously unable to participate in space activities due to cost barriers.

Opportunities

The rise of the private sector in space exploration brings with it a host of **opportunities** that have the potential to revolutionize industries and contribute to global progress. Among the most significant opportunities are:

Expanded Broadband Coverage (Global Internet)

One of the most ambitious initiatives within the **New Space Revolution** is the deployment of large-scale satellite constellations aimed at providing **global broadband Internet coverage**. Companies like **SpaceX** with its **Starlink** project and **OneWeb** are working to deploy thousands of small satellites in **low Earth orbit (LEO)**, which will help deliver high-speed, low-latency Internet access to underserved and remote regions of the world. By bypassing traditional ground-based infrastructure, these satellite constellations have the potential to provide affordable and reliable Internet access in rural and developing areas that lack terrestrial connectivity. This could be a game-changer for education, healthcare, and economic development in remote parts of the world, bridging the digital divide and enabling global connectivity.

Earth Observation Data for Agriculture, Climate, and Disaster Relief

Another key opportunity presented by private sector space companies is the expanded availability of **Earth observation data**. Earth observation satellites, which capture real-time images and data from Earth's surface, have applications in a wide range of sectors. For example, agricultural companies can use satellite imagery to monitor crop health, predict harvests, and optimize water usage. Similarly, climate scientists can track environmental changes, assess the impact of global warming, and monitor natural disasters such as hurricanes, floods, and wildfires. Private companies are increasingly providing **commercially available Earth observation data**, allowing organizations from various industries to leverage this valuable information for decision-making.

In addition, private-sector satellites can play an essential role in **disaster relief**. For example, during a natural disaster, satellite images can help humanitarian organizations identify areas in need of assistance, assess infrastructure damage, and plan logistics. By increasing the availability of high-quality, timely data, the private sector can help enhance global response efforts to climate-related disasters.

Innovation in Launch and Manufacturing

The commercial space sector is also leading to significant **innovations in launch and satellite manufacturing**. Companies like **SpaceX**, with their **Falcon 9** reusable rockets, and **Rocket Lab**, with its **Electron** launch vehicle, have made space launches more affordable and efficient. The development of reusable rockets significantly reduces the cost of each launch by allowing components such as the rocket booster to be used multiple times, which was previously an expensive and unsustainable practice. This innovation opens up the possibility for more frequent and cost-effective missions.

Furthermore, private companies are pushing the boundaries of satellite manufacturing, making satellites lighter, more efficient, and cheaper to produce. This has paved the way for the deployment of large-scale satellite constellations, providing services such as **global Internet** and **advanced imaging capabilities**. The ability to manufacture satellites quickly and cost-effectively, coupled with the ability to launch them at lower prices, allows for greater flexibility and responsiveness in the space sector.

Challenges

Despite the opportunities, the involvement of private companies in space presents **several challenges**, many of which revolve around governance, transparency, and the complex regulation of activities in space. These challenges must be addressed to ensure that the growing commercial space sector operates in a way that is safe, equitable, and sustainable for all stakeholders.

Transparency: Proprietary Flight Data vs. Global Safety

One of the most significant challenges in regulating private space activities is the issue of **transparency**. SpaceX, Blue Origin, and other private companies conduct their operations with varying levels of transparency, often citing **proprietary concerns** and **commercial interests**. However, this lack of transparency creates significant risks for **global safety**. In particular, space debris is an ever-growing concern, and the movement of private satellites must be carefully monitored to avoid collisions. Information about satellite trajectories and launches is critical for collision avoidance, but the reluctance of some companies to share their flight data complicates efforts to create a universal, coordinated space traffic management system.

Similarly, as private companies expand their satellite constellations, the potential for **radiofrequency interference** or **crowded orbital environments** increases. While some private companies voluntarily provide data on satellite trajectories and planned maneuvers, more formalized requirements for data-sharing and transparency could help mitigate these risks.

Regulation: Balancing National Licensing with International Norms

Another significant challenge in the commercial space sector is the tension between **national regulation** and the need for **international coordination**. Private space companies are typically licensed by the government of the country in which they are incorporated, which leads to discrepancies in regulatory standards and requirements. While some countries, like the United States, have robust regulations in place for space activities, others may lack adequate legal frameworks or enforcement mechanisms. As a result, companies operating under different national jurisdictions may have to comply with different rules, potentially creating conflicts or regulatory loopholes.

There is a clear need for **international norms** and **cooperative agreements** that establish a **global framework** for regulating private space activities. While organizations like **COPUOS** and **the UN Office for Outer Space Affairs (UNOOSA)** are working to facilitate discussions, much more work is needed to harmonize national regulations and ensure that private space activities are subject to consistent global standards.

Space Tourism & Resource Extraction: Novel Liability and Insurance Issues

As the private sector moves into new areas of space exploration, **space tourism** and **resource extraction** are among the most ambitious frontiers. Companies like **Blue Origin** and **Virgin Galactic** have already begun offering **suborbital space tourism experiences** to private citizens, and the idea of mining asteroids for precious metals is rapidly becoming a serious business proposition for companies like **Planetary Resources** and **Deep Space Industries**.

However, these burgeoning industries present a host of **novel liability** and **insurance issues**. Space tourism, for example, raises the question of **liability in the event of an accident**. If a private citizen is injured or killed during a suborbital flight, who is responsible? Existing space laws may not be sufficient to address such issues, and new legal frameworks will need to be developed to protect both **space tourists** and **tourism companies**.

Similarly, **resource extraction** in space, particularly asteroid mining, raises important questions about ownership rights, profit-sharing, and environmental impact. If a private company extracts valuable resources from an asteroid, how should the **profits** be distributed? What responsibility do companies have to minimize environmental damage or avoid monopolizing space resources? Clear **legal frameworks** and **international treaties** will be necessary to address these questions and ensure that **space resources** are used equitably and sustainably.

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6. Equitable Access to Space Resources

Development Goals

- United Nations Sustainable Development Goals rely on satellite data for weather, agriculture, health.
- Space technology gap between developed and developing nations.

Resource Ownership

- “Common Heritage of Mankind” under the Moon Agreement vs. national claims in Artemis Accords.
- Licensing versus free-for-all mining.

Capacity-Building

- UNOOSA regional centres for space science education.
- Partnerships: Space agency twinning and hardware sharing.

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7. Best Practices from International Organizations

- **Outer Space Treaty (1967):** Non appropriation and peaceful use.
- **Artemis Accords (2020):** Transparency, interoperability, emergency assistance.
- **ESA Copernicus:** Data sharing for environmental monitoring.
- **JAXA ADR Projects:** Electrodynamic tether experiments and nets.

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8. Possible Policy Recommendations and Frameworks

1. **UN Space Traffic Management Office**
   – Centralized registry, collision alerts, data exchange platform.
2. **Binding Debris Mitigation Treaty**
   – Mandatory end-of-life disposal, penalties for non-compliance.
3. **Resource Licensing under UNOOSA**
   – Equitable revenue-sharing model for asteroid and lunar mining.
4. **Green Propulsion Incentives**
   – Subsidies for reusable launch vehicles and low-emission propellants.

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9. The Role of UNOOSA in Facilitating Compliance

- **Training & Legislation Workshops:** Assist nations in space law adoption.
- **Enhanced Registry & Data Portal:** Public database of active objects and disposal plans.
- **Mediation & Arbitration:** UN-led dispute resolution for collisions and resource claims.

- **Outreach Campaigns:** Public education on space sustainability and peaceful uses.

Page Break

10. Questions to Ponder

1. How can COPUOS evolve binding norms without reopening major treaties?
2. What market or regulatory incentives will drive private actors to remove debris?
3. Where should oversight end and commercial freedom begin in lunar resource exploitation?
4. How can developing nations be assured tangible benefits from space activities?
5. What crisis-response role could a UN Space Traffic Management office fulfill?