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EXPLORING DUALITY IN SPACE

HOW SELECT COUNTRIES APPROACH DUAL-USE SPACE SYSTEMS



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Summary

Space systems play an increasingly vital role in both civilian and military activities. Although dual-use systems—those capable of serving both purposes—are becoming more widespread, the international community has yet to establish a governance regime to ensure that countries deploying such systems uphold commitments to the peaceful use of outer space.

To support future research on potential global governance models, a RAND research team conducted a literature review to map the current landscape of national approaches to dual-use space systems. This report organizes findings by region—the Americas, Europe-Eurasia, the Indo-Pacific—and highlights key elements of each country's approach. These include domestic factors (such as policy frameworks, primary government and private actors, and examples of deployed systems), as well as international engagements (such as global partnerships and contributions to norms-based discussions).

Across these regions, we identified five key themes characterizing today's global landscape:

- Countries frequently view space as a **valuable domain for both civilian and military goals** and deploy space systems that serve both.
- Many countries rely on **international and private partnership**s to access, develop, or deploy dual-use space systems.
- Dual-use capabilities are a common topic in bilateral, multilateral, and international **discussions on norms and responsible behavior in space.**



- Countries commonly adopt **implicit approaches** to distinguish civilian from military space system applications, in which space-related policies, laws, dialogues, and international engagements together characterize a national approach rather than explicit, codified policies.
- In some cases, countries adopt **centralized or deliberately ambiguous strategies** in managing dual-use space systems.

The insights overviewed in this literature review informed subsequent virtual workshops with regional experts and stakeholders, which provided further perspectives on possible definitions of *dual use*, drivers of space system development and operationalization, actively deployed systems, and governance challenges and tools.

As the RAND team advances to future phases of this research, including additional in-person workshops and a report on policy options concerning global governance regimes, this report highlights key considerations for the international community, urging stakeholders to refine definitions, engage in such forums as the United Nations Open-Ended Working Group on Reducing Space Threats, and address critical research gaps.

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CHAPTER 1

Introduction



By Bruce McClintock, David Glickstein, Krista Langeland, Anca Agachi, Jan Osburg, and Nicholas Kong

Space systems play an increasingly vital role in supporting many aspects of daily life, the global economy, and national security objectives. These systems often exhibit a *dual-use* nature, serving both civilian and military purposes. For instance, a satellite may provide civil services, such as Earth observation (EO) and high-speed internet, as well as support military reconnaissance and other national security functions.

Because systems may serve both functions, observers might be unable to determine a nation's true intent—an ambiguity that poses significant implications for space security, governance, and international relations. This lack of clarity can undermine trust and raise the risk of inadvertent escalation in space because misjudging another country's intentions could prompt defensive or preemptive measures. This challenge has intensified in the New Space era, in which dramatically lower barriers to access have prompted a surge of new space actors in recent decades, resulting in greater competition, congestion, and contestation.[1] Efforts to ensure long-term sustainability and stability in space may involve capabilities that resemble weapons, further heightening tensions. Consequently, the dual-use nature of space systems may inherently raise the prospect of conflict.

[1] Bruce McClintock, Katie Feistel, Douglas C. Ligor, and Kathryn O'Connor, *Responsible Space Behavior for the New Space Era: Preserving the Province of Humanity*, RAND Corporation, PE-A887-2, April 26, 2021.

This dual-use character also presents complex legal and policy challenges and underscores the need for responsible space-based behavior to mitigate the risks of misuse.[2] However, no international legal regime explicitly and specifically governs dual-use space systems. Some existing frameworks might offer partial coverage. The 1967 Outer Space Treaty (OST) mentions the use of space for "peaceful purposes," prohibits weapons of mass destruction in orbit, and requires states to act with "due regard" for others; however, except for Article IV, it does not differentiate between civilian and military activities, likely reflecting the historical difficulty in making this distinction.[3] The 1996 Wassenaar Arrangement seeks to prevent the transfer of dual-use goods that could threaten international security.[4] Although states might argue that these or similar frameworks apply to dual-use systems, the frameworks do not explicitly address the unique risks posed by the dual-use nature of space technologies. Furthermore, such legal ambiguities have likely contributed to deadlock on developing formal treaties or nonbinding measures that establish guidelines for responsible behavior in space.[5]

Recent efforts in international forums have acknowledged these legal challenges. The United Nations (UN) Open-Ended Working Group (OEWG) on Reducing Space Threats Through Norms, Rules and Principles of Responsible Behaviours (hereafter referred to as "the OEWG"), which met in 2022 and 2023, highlighted the concept of *peaceful use* and stressed the importance of preventing an arms race in outer space. OEWG documentation further notes that capabilities capable of damaging or destroying space systems could trigger an arms race, threatening international peace, security, and the sustainable, peaceful use of outer space.[6]

Even if the international community interprets the OST or other existing global frameworks as covering dual-use space systems, further questions and complications remain. Policymakers may struggle in distinguishing between civilian and military applications, in determining legally appropriate and proportional targets in space, and in determining whether commercially produced systems that support military operations may become legitimate targets.[7] Furthermore, uncertainty remains over how

[2] Linda Slapakova, Theodora Ogden, and James Black, "Strategic and Legal Implications of Emerging Dual-Use ASAT Systems," *NATO Legal Gazette*, No. 42, December 2021.

[3] Treaty on Principle Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 1967.

[4] The Wassenaar Arrangement, homepage, undated.

[5] However, some progress has been made. See, for example, McClintock et al., 2021.

[6] United Nations General Assembly (UNGA), "Draft Report of the Open-Ended Working Group on Reducing Space Threats Through Norms, Rules and Principles of Responsible Behaviours," A/AC.294/2023/CRP.1/Rev.1, August 31, 2023b.

[7] Anna Hurova, "Does Dual Use of Satellites Challenge the Future Space Governance?" *Advanced Space Law*, Vol. 12, 2023; Almudena Azcaráte Ortega, "Current and Future Space-to-Space Threats by States to Space Systems," presentation to the Open-Ended Working Group on Reducing Space Threats Through Norms, Rules and Principles of Responsible Behaviours, United Nations Institute for Disarmament Research, September 14, 2022; Almudena Azcaráte Ortega, "Not a Rose by Any Other Name: Dual-Use and Dual-Purpose Space Systems," *Lawfare*, June 5, 2023.

the international community should address the risks arising from dual-use space system development and deployment and whether treaties, norms, bilateral or multilateral cooperation, or other mechanisms offer the most effective path.

These unresolved issues underscore the need for research to inform strategies that preserve the peaceful use of space. In 2024, RAND launched a three-year initiative to develop an ambitious yet practical global governance framework that mitigates risks from dual-use space systems, reduces the potential for escalation in space, and safeguards national sovereignty. As an initial step, **this report characterizes the current and emerging global landscape of dual-use space systems and capabilities**, examining the approaches of select countries across the Americas, Europe-Eurasia, and the Indo-Pacific. We identify the status of national policy frameworks, examples of systems that nations are actively developing or deploying, and initiatives promoting the peaceful use of space in international forms.

By establishing this baseline, this report provides a foundation for the project's next phases, including virtual and in-person workshops with regional experts and stakeholders aimed at building a shared understanding of the current environment and defining pathways for adapting national and international approaches. Insights from this work will inform subsequent analysis of policy options to promote norms and enforcement mechanisms that prevent escalation and protect national sovereignty in space.

Scope of Research

The domain of duality in space is vast, encompassing a wide variety of systems, actors, and governance frameworks. Given the breadth of potential research areas, we focus our analysis on well-understood orbital system capabilities, on policy approaches, and on countries that illustrate key dynamics of dual-use space systems.

Defining Dual Use

Our analysis uses *dual use* to describe space systems with capabilities that can support both civilian and military purposes, either in practice or by intent. This broad definition allows for a more inclusive examination of space systems, whereas a narrower definition could significantly limit the range of systems and approaches considered in this analysis. Although we recognize that some stakeholders may identify key systems as strictly military or civilian—and therefore not dual use—such systems may still be featured in this report if they have the capability to support both functions.

We acknowledge the lack of consensus in defining *dual use* in academic and policy circles. A RAND-hosted workshop in May 2025 on dual-use space systems highlighted diverse perspectives, with participants offering definitions based on users of the technology versus owners, capabilities versus applications versus intent, aggressive versus nonaggressive uses, and other constructs.[8] Although we adopt a simplified definition to ensure consistency and include a broad variety of systems, future work in this research effort will examine how best to define the term for global governance purposes.[9]

Dual-Use Space System Capabilities

To ensure the near-term relevancy for policy discussions and avoid overspeculation, **we focus on existing and well-understood orbital technologies and systems**.[10] Although new dual-use capabilities may emerge, our analysis remains grounded in current and near-term developments.

Table 1.1 summarizes space capabilities mentioned in this report that offer possible applications for both civilian and military use. Our analysis includes both long-established capabilities and those with growing application in space operations. The table is representative but not intended to be comprehensive; additional capabilities, such as large-structure fabrication, debris recycling, and space-based solar power, may become increasingly significant and merit closer attention as the governance debate unfolds.

[8] The workshop convened North and Latin American representatives from government, private industry, and academia. More detailed findings from this workshop can be found in Anca Agachi, Krista Langeland, Amal Altwaijri, Mélusine Lebret, David Glickstein, and Bruce McClintock, *Surveying Duality in Space*: Vol. I, A*mericas Workshop Insights on Developing, Deploying, and Governing Dual-Use Space Systems*, RAND Corporation, CF-A4003-1, 2026.

[9] Some sources further consider clear distinctions between *dual use* and *dual purpose*. This distinction emerged in a presentation given during the second session of the OEWG. Whereas the OEWG defines "dual-use space objects" as having "a military and security function, as well as a civilian or commercial one" (Azcaráte Ortega, 2023), the presentation describes "dual-purpose" objects as those "designed to fulfil [sic] a benign objective . . . [but potentially] repurposed to harm other space objects" (Azcaráte Ortega, 2022). The presentation identified the possible overlap of these definitions. See Azcaráte Ortega, 2022; Azcaráte Ortega, 2023; UNGA, "Reducing Space Threats Through Norms, Rules, and Principles of Responsible Behaviors," A/RES/76/231, December 30, 2021d; and United Nations Office for Disarmament Affairs, "Open-Ended Working Group on Reducing Space Threats," webpage, undated.

[10] Although we focus on orbital systems in this report, we acknowledge that countries may also invest in cislunar, lunar, or deep-space systems. We assume that principles discussed here are likely relevant to nonorbital systems, and future analysis in this research effort may further explore distinctions in national approaches to different system types.

Table 1.1 | Key Dual-Use Space System Capabilities

Dual-Use Capability	Description	Possible Civil Application(s)	Possible Military Application(s)
Longstanding dual-use integration			
Satellite communications (**SATCOM**)	Use of orbiting satellites to enable data, voice, and video transmission over long distances	Internet and phone service, television and radio broadcasting, connectivity services	Command and control, surveillance, operational flexibility
Positioning, navigation, and timing (**PNT**)	Global navigation satellite systems (GNSS) providing timing and positional data for navigation and communication	Transportation safety, autonomous vehicle navigation, positional awareness, economic infrastructure	National security operations, resilient communication networks
Remote sensing for Earth observation (**EO**) and space-based intelligence, surveillance, and reconnaissance (**ISR**)	Satellite systems that gather data about Earth's surface and monitor activities globally	Precision agriculture, disaster response, climate monitoring, water resource management	Intelligence-gathering, situational awareness, threat detection, imaging, operational and tactical military support
Space situational awareness (**SSA**)	Monitoring and characterizing objects in Earth's orbit to ensure safe space operations	Collision avoidance, satellite protection, debris tracking	Surveillance of adversary space assets, threat assessment, operational planning
Space launch vehicles (**SLVs**)	Systems used to launch payloads into orbit, such as satellites and spacecraft	Launch of scientific, commercial, and exploratory payloads	Ballistic missile technology, deployment of military space assets
Rendezvous and proximity operations (**RPO**)	Maneuvering spacecraft to approach and interact with other on-orbit objects	Satellite servicing, docking with space stations	Intelligence gathering, disabling or manipulating adversary satellites
Space weather monitoring	Observation and forecasting of solar and geomagnetic activity that can affect space and terrestrial systems	Power grid protection, aviation safety, satellite operation planning	Protection of military satellites and communication systems from solar events

Table 1.1—Continued

Dual-Use Capability	Description	Possible Civil Application(s)	Possible Military Application(s)
More recent dual-use integration			
Active debris removal (**ADR**)	Systems designed to capture and deorbit orbital debris	Mitigation of orbital debris to ensure safe and sustainable space operations	Potential misuse as antisatellite weapons
In-space servicing, assembly, and manufacturing (**ISAM**)	Technologies enabling satellite life extension, on-orbit spacecraft repair, and microgravity processes	Telescope assembly for deep space exploration, long-term exploratory mission support	Military satellite maintenance, deployment, on-orbit logistics
On-orbit servicing	Capabilities that allow repair, refueling, or upgrading of satellites while in orbit	Extending satellite lifespan, reducing replacement costs	Sustainment of military satellites, potential manipulation of adversary assets
Space traffic management (**STM**)	Coordination of space object movement to avoid collisions and interference	Civil spaceflight safety, commercial satellite operations	Secure satellite operations, strategic maneuver planning
Space domain awareness (**SDA**)	Strategic understanding of space activity and threats, building on SSA with military-relevant context	Shared situational awareness, traffic coordination	Threat detection, attribution, space operations planning
Planetary defense	Systems for detecting and potentially mitigating near-Earth object threats	Protection of Earth from asteroid impacts	Cislunar space domain awareness, support for space operations

National Approaches to Policy and International Norms

Although we describe the technical capabilities of existing dual-use space systems, **our analysis centers on domestic policy frameworks governing their use and whether nations have established and clearly articulated such policies**. We also **assess nations' efforts to advance norms and promote responsible use on the world stage**. This approach identifies gaps in governance across nations and offers insights into potential mitigations to the risks these systems may pose. By considering nations' promotion of norms for responsible behavior in space, we aim to identify those most likely to support norms specifically governing dual-use space systems. Although advocacy in the broader domain does not ensure action in this narrower area, this analysis provides a baseline to inform expert and stakeholder dialogues on governance approaches that could earn broad support.

In particular, we examine how select countries engage with key international forums and bilateral or multilateral efforts related to space behavior, which may translate to dual-use space systems. This includes documenting participation in the UN Committee on the Peaceful Uses of Outer Space (COPUOS), support for UN General Assembly (UNGA) resolution A/RES/75/36 on "Reducing Space Threats Through Norms, Rules, and Principles of Responsible Behaviours," and involvement in the resolution's resulting OEWG.

We assess whether countries have sought to lead in advancing norms-based behavior, contributed meaningfully to international dialogues, or, alternatively, pursued parallel initiatives or expressed opposition to continued OEWG proceedings. For each country, we also note any stated positions on transparency and confidence-building measures (TCBMs), moratoriums on direct-ascent antisatellite (DA-ASAT) missile tests, and other measures for advancing norms in this domain.

Although this analysis assumes that national and international governance regimes will play a central role in mitigating duality-related global risks, we acknowledge that some perspectives may question this underlying assumption. Future research will examine the potential escalation of space-based risks and the abilities of governance tools to mitigate them.

This analysis aims to characterize a nation's approach to dual-use space systems by identifying its space-related policies, laws, statements by leadership, dialogues, and international engagements. We do not speculate on individual states' broader objectives in developing or deploying space systems beyond what they express through these channels.

Regional Lens

We employ a regional lens to organize national approaches to dual-use space systems and crosscutting themes. Grouping approaches by region advances two objectives. First, we can consider whether countries' proximities and regional ties—such as economic links or participation in regional, multilateral organizations—associates with how they develop, deploy, or govern space systems. Second, it provides a practical foundation for future project phases involving direct engagement with regional stakeholders and experts. Because scheduling global workshops across vastly different time zones proved unfeasible, the research team divided workshops by broad regions and aligned sessions with participants' local hours. Accordingly, the report organizes national perspectives into three regions: the Americas, Europe-Eurasia, and the Indo-Pacific.

Select Countries

Finally, **we focus our research on select nations that represent diverse approaches around the world**. We intend our selection to encompass an array of technological, economic, and military capacities, as well as varied national approaches to policy development, international collaboration, and engagement in international forums.

To identify our focus countries, we employed a narrative literature review, using an artificial intelligence–enabled, snowballing technique for the source selection. We outline the criteria used to select countries featured in each region, ensuring broad representation of perspectives and approaches.

Source Identification Methodology

The research team conducted an extensive narrative literature search to capture a broad representation of norms, policies, and technologies related to dual-use systems. The objective was to identify relevant publications, extract key insights, and refine country selection for diverse approaches. Sources included peer-reviewed scientific and policy papers, news articles, laws, and native-language documents. The approach involved three sequential steps:

1. Conducting a traditional, keyword-based search of multiple databases available through RAND.

2. Using RAND Chat (an internal large language model [LLM] available to RAND staff) to rate the resulting list of publications for relevance and to create short plaintext summaries.
3. Manually spot-checking the results.

The team executed each step separately for each region of interest with the same search query, except for region- or country-specific terms.

Country Selection Criteria

We applied a qualitative, thematic analysis approach to develop country selection criteria. This iterative process involved synthesizing literature, policy documents, and expert insights to identify four overarching criteria—capabilities, policies and governance, strategic relevance, and data availability—which guided our structured approach to country selection.

Next, we used a retrieval-augmented LLM to extract and summarize additional reference materials specific to dual-use space systems. These sources included academic publications, national strategies, national and international policy statements, and analysis from other nongovernmental organizations. We then consolidated and supplied our sources to the LLM, along with our four country selection criteria. We tasked the LLM to identify which countries best fit our criteria based on available literature. We also tasked the LLM with sorting countries according to the number of criteria they met, binning countries into the following buckets:

- **Essential (meets at least three out of four criteria):** These countries are considered "must include" and are considered core actors within the dual-use space ecosystem. They have significant and diverse operational capabilities; active engagement in international forums, collaborations, and agreements; influential domestic space policies or regulatory frameworks; and strategic relevance in the context of dual-use debates.
- **Key emerging players (meets at least two out of four criteria):** These countries have notable but more limited capabilities or influence. They often play supporting roles through international partnerships, niche applications or capabilities, geopolitical considerations, and growing investment, making them important for regional analysis or highlighting emerging trends.
- **Contextual or notable actors (meets at least one out of four criteria):** These countries may be relevant for specific strategic, regional, or niche considerations, such as limited domestically sourced capacity but strategic positioning (e.g., hosting infrastructure) or unique space consumer-state perspectives.

The results of this automated extraction and filtering process were then reviewed and validated through subject-matter expert analysis and interpretation, ensuring that the final inclusion decisions reflected both evidence from the literature and domain-specific expertise.

Applying these criteria, we selected 20 countries to analyze in this report (see Table 1.2). In the Europe-Eurasia chapter, we additionally include key European multilateral bodies—the European Space Agency (ESA), European Union (EU), and North Atlantic Treaty Organization (NATO)—to explore their roles within the dual-use space system landscape. While these select countries and organizations reflect diverse space capabilities and perspectives, we acknowledge that the selection does not represent a comprehensive analysis; other countries or bodies may present additional valuable perspectives on shaping global governance of dual-use space systems.

Table 1.2 | Countries Included in Analysis

Region	Essential	Key Emerging Players	Contextual or Notable Actors
Americas	United States, Canada, Brazil	Argentina	Mexico
Europe-Eurasia	France, United Kingdom, Germany, Russia	Luxembourg, Ukraine, Iran, United Arab Emirates	Italy, Norway
Indo-Pacific	China, India, Japan, Australia, South Korea		

How We Organize This Report

We characterize the existing landscape of national approaches to dual-use space systems by exploring select countries and organizations in the Americas (Chapter 2), Europe-Eurasia (Chapter 3), and the Indo-Pacific (Chapter 4). For each country, we first examine the following domestic facets of its space duality approach:

- **domestic space policy frameworks**, if any, that provide insight into the country's approach to the development, deployment, and/or governance of dual-use systems
- **primary domestic space stakeholders**, including the major civilian, military, and commercial government entities relevant to the nation's dual-use space systems
- **examples of dual applications of space systems** in which the country uses a system that could serve both civilian and military objectives.

We then examine the following international dynamics of each country's approach:

- **international partnerships**, or examples of the country's collaboration with other nations, if at all, to develop or deploy dual-use space systems
- **promotion of international norms**, or the extent to which each country has sought to advance international norms on the use of dual-use systems.

For each chapter, we identify common themes among the select countries that may reflect broader regional trends in national approaches to dual-use space systems. We then articulate five common themes across all select countries (Chapter 5):

- Countries broadly view space as **valuable for both civilian and military goals**.
- Countries frequently rely on **international and private partnerships** to access, develop, or deploy dual-use space systems.
- International, multilateral, and bilateral dialogues concerning **global norms** commonly include discussions of dual-use space systems.

- Countries commonly adopt **implicit approaches** to duality in space, in which space-related policies, laws, dialogues, and international engagements together help to characterize a national approach rather than explicit, codified policies.
- Some countries feature **centralization** and **ambiguity** in their approach to duality.

We then present considerations for international actors engaged in ongoing global discussions on dual-use space systems, urging stakeholders to refine definitions, engage in such forums as OEWG, and address critical research gaps. Finally, we outline the next research steps, including regional stakeholder workshops to address information gaps from this literature review and to guide our future analysis of a potential global governance regime.



CHAPTER 2

Americas

Krista Langeland, Anca Agachi, Amal Altwaijri, Mélusine Lebret, and Auburn Brown

The Americas feature diverse space capabilities and approaches to the development, deployment, and governance of dual-use space systems. Whereas the United States and Canada possess advanced space capabilities, Brazil, Argentina, and Mexico maintain comparatively nascent programs, steadily investing in their growth. Although their capabilities vary, their approaches to dual-use systems reveal several common trends:

- **Informal policy approaches to dual-use space systems.** Across these national contexts, dual-use space systems are governed less by explicit frameworks and more by combinations of policies, norms of behavior, and access to key technologies.
- **Collaboration with leading space powers.** Collaboration shapes North and Latin American approaches to dual-use systems. The United States and Canada, as leading space powers, closely coordinate on both civilian and military operations and dual-use technology development. In contrast, Latin American countries commonly partner with major powers—such as the United States through the Artemis Accords or China through infrastructure initiatives—rather than with each other.
- **Increasing space industry role.** These select North and Latin American countries increasingly rely on the space industry to meet civilian and national security needs. The United States integrates commercial innovation into defense, Canada leads in commercially

produced robotics and EO capabilities, and Argentina and Brazil focus on economic development by advancing their space infrastructure and domestic manufacturing.[11]

United States

The United States has prioritized integrating commercial capabilities into military space operations, underscoring their dual-use nature. Through explicit policies supporting this integration, such as the space policy directives (SPDs), the United States has led in shaping the global discourse on developing and regulating dual-use space systems, reflecting its commitment to comprehensive frameworks.[12] U.S. strategy also emphasizes international cooperation to promote responsible space behavior and advance shared security and economic interests.

Domestic Factors

Domestic Space Policy Frameworks

Several existing U.S. policy frameworks explicitly or implicitly govern dual-use technologies, often reflecting the growing importance of the private space sector in supporting U.S. national security needs.[13] These include the following:

- the **2020 U.S. National Space Policy**, which emphasizes the importance of fostering a competitive space industry while maintaining national security interests[14]
- the **2024 Commercial Space Strategy** from the U.S. Space Force (USSF), which outlines a shift from government-owned space systems to leveraging commercial assets to enhance military capabilities[15]

[11] U.S. Department of Defense, *Commercial Space Integration Strategy*, 2024; Maximilian Frederik van Oordt, "Latin America's Next Steps in Space," London Politica, undated.

[12] See, for example, Kevin M. O'Connell, testimony before the Committee on Commerce, Science, and Transportation, U.S. Senate, March 13, 2019; U.S. Department of Defense, 2024; U.S. Space Command, *Commercial Integration Strategy*, 2025.

[13] It is notable that the United States has not signed the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, or Moon Treaty. This agreement from 1979 supports the prevention of commercial exploitation of outer-space resources; however, only a small number of states have ratified it, and the United States has not (Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, signed at New York, December 18, 1979).

[14] White House, *National Space Policy of the United States of America*, December 2020.

[15] U.S. Space Force, *U.S. Space Force Commercial Space Strategy: Accelerating the Purposeful Pursuit of Hybrid Space Architectures*, April 2024a.

- the **2024 Commercial Space Integration Strategy** from the U.S. Department of War (DOW),[16] which outlines a vision for "prioritizing and aligning efforts to integrate commercial solutions into our national security space architecture"[17]
- the **2022 In-Space Servicing, Assembly, and Manufacturing National Strategy** from the National Science and Technology Council, which provides strategic direction for the development of ISAM capabilities across U.S. government, commercial, and academic organizations[18]
- **the 2025 U.S. Commercial Satellite Operator Best Practices for Communicating Mitigation/Maneuver Plans to China**, which, recognizing the interest in spaceflight safety, and the responsible to preserve safety for all operators, provides best practices for U.S. commercial operators for communicating with China's government and commercial operators on spaceflight safety.[19]

These USSF and DOW strategies represent explicit frameworks governing the use of commercially produced space systems for military objectives.

Policies addressing space systems focused on safety and sustainability—such as ADR and ISAM—are less clearly defined. In this area, implicit policy actions, regulations, and legislation aimed at supporting the broader space economy may offer some insight into the U.S. approach.

Additionally, seven **SPDs**, issued from 2017 to 2021, play a crucial role in guiding the development and use of dual-use space systems.[20] These directives not only establish frameworks for the responsible use of these technologies but also emphasize the importance of fostering a competitive commercial space sector while maintaining national security interests. For instance, SPD-7 provides guidance for U.S. PNT programs and capabilities and highlights the growing dependence on these capabilities across military, civilian, and commercial stakeholders.[21]

[16] The Department of War is designated the Department of Defense under Public Law 81-216, National Security Act Amendments of 1949.

[17] U.S. Department of Defense, 2024, p. I.

[18] In-Space Servicing, Assembly, and Manufacturing Interagency Working Group, *In-Space Servicing, Assembly, and Manufacturing National Strategy*, Executive Office of the President, April 2022a.

[19] U.S. Government, "U.S. Commercial Satellite Operator Best Practices for Communicating Mitigation/Maneuver Plans to China," August 2025.

[20] Office of Space Commerce, "Space Policies," webpage, U.S. Department of Commerce, undated.

[21] White House, "Memorandum on Space Policy Directive 7," January 15, 2021.

Primary Domestic Space Stakeholders

U.S. dual-use space system development is characterized largely by the role of private industry in addressing both commercial opportunities and national security needs. The U.S. space sector, often supported by strong public-private collaboration, features a robust and expanding market for space technologies with dual-use capabilities and applications, and the U.S. national security space enterprise is actively seeking ways to leverage these capabilities more effectively while also promoting innovation and economic development. As commercial integration into military space operations deepens, industry will play an increasingly influential role in shaping the future U.S. space policy and dual-use capabilities.

U.S. space companies pursue a wide variety of objectives, including space exploration, tourism, and providing capabilities and services for civilian and military users. SpaceX, founded in 2002, plays a dominant role across the U.S. space market, valued at around $400 billion.[22] The National Aeronautics and Space Administration (NASA) uses SpaceX's Dragon capsule and Falcon 9 rocket to launch astronauts and supplies to the International Space Station (ISS), and its Starlink satellites, which provide civilian services, have also become a critical enabler in military conflict.[23] Private company Blue Origin, founded in 2000, produces a suborbital vehicle, New Shepard, designed for space tourism and research. The firm focuses on reusable rockets and the development of space habitats.[24] Virgin Galactic, founded in 2004, focuses on space tourism and exploration and made history in August 2023 with the first private astronaut space flight.[25]

DOW features several relevant actors: USSF, which trains and equips guardians to provide support from space to meet military objectives, and U.S. Space Command (USSPACECOM), which prepares for and conducts military operations in space. Recently, the USSF has prioritized leveraging commercial capabilities, and one such means of doing so is with the Joint Commercial Operations (JCO) cell.[26] The JCO was established in 2020 by USSPACECOM to better utilize commercial capabilities for improving space domain awareness and continues to support both U.S. military forces and the USSF, as well as allied and partner nations.[27]

[22] Loren Grush, Katie Roof, and Edward Ludlow, "Musk's SpaceX Plans Share Sale That Would Value Company at About $400 Billion," Bloomberg, July 15, 2025.

[23] Magdalena Petrova, "How the U.S. Space Industry Became Dependent on SpaceX," CNBC, August 24, 2025; Andrew Radin, Khrystyna Holynska, Cheyenne Tretter, and Thomas Van Bibber, *Lessons from the War in Ukraine for Space: Challenges and Opportunities for Future Conflicts*, RAND Corporation, RR-A2950-1, May 21, 2025.

[24] Blue Origin, "About Blue Origin," webpage, undated.

[25] Joshua Kupietzky, "History Made: Virgin Galactic Performs 1st Private Astronaut Space Flight," Simple Flying, August 13, 2023.

[26] See, for example, Joseph Clark, "Space Force Official Outlines Roadmap for Commercial Partnerships," U.S. Department of War, April 24, 2024.

[27] Barbara Golf and Anne Konnath, *Joint Commercial Operations (JCO) Introduction and Way Forward*, Advanced Maui Optical and Space Surveillance Technologies Conference, 2024.

Several civilian institutions play key roles in administering U.S. space policy. NASA oversees scientific exploration for civilian objectives, and, under SPD-3, the U.S. Department of Commerce is taking steps to assume responsibility for STM from the USSF.

Examples of Civilian and Military Applications of Dual-Use Space Systems

U.S. space system development spans many dual-use capabilities, including PNT, ISAM, and SATCOM, driven by substantial private sector innovation and sustained government support. In addition, U.S. defense funds are supporting startups that are providing new and less conventional space services. For example, Reflect Orbital is seeking to leverage mirrors on orbit to provide targeted lighting solutions to support disaster response, and Inversion Space is developing reentry capsules for rapid delivery of cargo across the globe; many of these startup capabilities will provide new uses of space with dual-use implications.[28]

The United States is experiencing rapid growth in ISAM development, largely driven by technological advances and rising commercial interest, with a primary focus on servicing of satellites.[29] Backed by government programs, including NASA and the Defense Advanced Research Projects Agency (DARPA), and private sector investments, the United States leads in this emerging field with significant potential for future expansion.[30]

The U.S. space sector features a relatively small but growing space-based alternative PNT market and a rapidly expanding SATCOM market,[31] with expected SATCOM-related revenues approaching $40 billion by 2030.[32] The dual-use nature of these systems reinforces the strategic alignment between commercial and national security interests.

[28] Reflect Orbital, homepage, undated; Inversion, homepage, undated.

[29] Astroscale U.S. Inc., comments before the Federal Communications Commission, November 3, 2022b.

[30] Alec J. Cavaciuti, Joseph H. Heying, and Joshua Davis, "In-Space Servicing, Assembly, and Manufacturing for the New Space Economy," Aerospace Center for Space Policy and Strategy, July 2022; Nonreimbursable Interagency Agreement Between the National Aeronautics and Space Administration and the Defense Advanced Research Projects Agency for Technical Support to the Robotic Servicing of Geosynchronous Satellites (RSGS) Program, August 19, 2024; In-Space Servicing, Assembly, and Manufacturing Interagency Working Group, 2022a.

[31] Jonathan P. Wong, Yool Kim, Krista Langeland, George Nacouzi, Krista Romita Grocholski, Jonathan Balk, Karishma V. Patel, and Barbara Bicksler, *Leveraging Commercial Space Services: Opportunities and Risks for the Department of the Air Force*, RAND Corporation, RR-A1724-1, 2023.

[32] Grand View Research, "U.S. SATCOM Market Size and Outlook, 2024–2030," webpage, undated.

International Considerations

International Partnerships

The United States actively engages with global partners for both civil and national security missions. In 2020, the United States, led by NASA and the Department of State, introduced the civil-focused Artemis Accords with seven other nations seeking to provide "a common set of principles to enhance the governance of the civil exploration and use of outer space."[33] The United States also works with international partners to enhance SSA to support civil, commercial, and military missions.[34]

Promoting International Norms

SSA data-sharing efforts represent one example of the U.S. focus on increasing cooperation with international partners to promote space safety, sustainability, and norms of behavior surrounding dual-use systems.

U.S. policies explicitly outline the expansion of international cooperation as a pivotal goal. The 2020 National Space Policy identifies both increasing commercial cooperation and expanding international cooperation as a foundation activity, and the national strategy on space servicing notes the importance of and opportunities for international collaboration in developing and operationalizing dual-use technologies.[35]

U.S. statements at the OEWG provide insight into its approach to dual-use system norms. Statements have emphasized communication to clarify actions and intent during uncertainty and have highlighted routine dialogue as key to building trust and resolving crises.[36]

[33] The initial signatories were Australia, Canada, Italy, Japan, Luxembourg, the United Arab Emirates (UAE), and the United Kingdom (UK) (NASA, "The Artemis Accords," webpage, last updated May 15, 2025a).

[34] Space-Track.org, homepage, undated.

[35] White House, 2020; In-Space Servicing, Assembly, and Manufacturing Interagency Working Group, *In-Space Servicing, Assembly, and Manufacturing Implementation Plan*, Executive Office of the President, December 2022b.

[36] UNGA, "Proposals of the United States of America Regarding Responsible State Behavior for Outer Space Activities," A/AC.294/2023/WP.5, January 26, 2023a.

Canada

Canada has historically focused on the civilian benefits that space can provide, as evidenced in its 2019 space strategy.[37] As a result, Canada's approach to dual-use space systems reflects a balance between civilian priorities, defense requirements, and international collaboration. Its policy frameworks consistently emphasize peaceful, responsible space use while recognizing that many space systems offer both civilian and military applications. In international forums, Canada has encouraged the responsible development and operations of dual-use systems by advocating for verification mechanisms and international partnerships. Canada has sought to accelerate private innovation by directing government funding toward dual-use system development.

Recently, Canada has shifted its focus in space to military and national security objectives, evidenced by the establishment of the 3 Canadian Space Division (3 CSD) in July 2022 to oversee defense space operations and reflect the growing importance of space in military and national security activities.[38] Canada continues to collaborate in space through the Five Eyes information-sharing agreement and active participation in Multinational Force Operation Olympic Defender (MNF-OOD). Its close partnership with the USSF is evident in Royal Canadian Air Force Brigadier-General Kyle C. Paul's role as Deputy Combined Joint Force Space Component Commander at USSF S4S headquarters in July 2025.[39]

Domestic Factors

Domestic Space Policy Frameworks

Canada's space policy frameworks commonly focus on space capabilities for scientific exploration rather than national security objectives. Although these policies do not explicitly address dual-use space systems, their focus on civilian objectives provide possible insight into a peaceful approach to these technologies. Recent examples of such policies include the following:

- the **2014 Space Policy Framework**, which outlines an approach for promoting exploration, commercialization, and development in space[40]

[37] CSA, *Exploration, Imagination, Innovation: A New Space Strategy for Canada*, May 2019.

[38] "Canada Announces Establishment of 3 Canadian Space Division," Canadian Defense Review, July 22, 2022.

[39] Julian Labit, "Canadian General Assumes Key Role in US Space Command, S4S Leadership," Secretary of the Air Force International Affairs, July 23, 2025.

[40] CSA, *Canada's Space Policy Framework: Launching the Next Generation*, February 2014.

- the **2019 Canadian Space Strategy**, which describes Canada's vision for space, focusing on the commercial sector and scientific exploration[41]
- the **2022 Strategy for Satellite Earth Observation**, which describes an approach for leveraging space to address climate change and other "key challenges of our time"[42]
- the **2024–2025 Space Department Plan**, which highlights EO as a key focus for Canadian space capabilities[43]
- the **2024 Defence Vision,** which outlines Canada's plan to ensure armed force readiness, resilience, and relevancy[44]
- the **2005 Remote Sensing Systems Act**, which regulates data distribution from remote sensing systems to protect national security interests while seeking to promote Canada's leadership in providing these data and services to the broader space community.[45]

Together, these frameworks suggest core principles of Canada's approach to space, particularly its strong emphasis on civilian applications. At the same time, Canada's role in defense and national security uses of space is expanding, evident in the role of space in the 2024 Defence Vision, Canada's contributions to the North American Aerospace Defense Command (NORAD), and ongoing work drafting a space defence policy.[46]

Primary Space Stakeholders

The Canadian Space Agency (CSA) represents the primary stakeholder for administering Canada's civilian space program. In describing its mission, CSA explicitly acknowledges its civilian mission, stating, "We promote the peaceful use and development of space . . . and ensure that space science and technology provide social and economic benefits for Canadians."[47]

The Department of National Defence and Canadian Armed Forces (DND/CAF) enjoys broad responsibility for operationalizing space capabilities for defense and security. Like the CSA, the Royal Canadian Air Force, which administers the DND/CAF Joint and Combined

[41] CSA, 2019.

[42] CSA, "Canada Announces Strategy for Satellite Earth Observation," press release, January 20, 2022a.

[43] CSA, "Operating Context—2024–25 Departmental Plan," webpage, last updated February 29, 2024a.

[44] Government of Canada, "II. Our Vision for Defence," webpage, last updated April 17, 2024a.

[45] Government of Canada, "Remote Sensing Space Systems Act (S.C. 2005, c. 45)," webpage, last updated August 28, 2025b.

[46] Elizabeth Howell, "Canada Outlines Strategy for Space Defence in Face of Russian, Chinese Military Posturing," SpaceQ, July 9, 2024.

[47] CSA, homepage, last updated May 14, 2025a.

Space Program, emphasizes its commitment to peaceful space use and responsible behavior.[48] The recently established 3 CSD also provides a military division focused expressly on space.[49]

Canada's steadily growing commercial space sector earns strong revenue across numerous technologies, with significant development and focus on robotics, as well as SATCOM and EO.[50] The government actively supports private stakeholders, such as MDA Space, which is responsible for the Canadarm—a robotic arm used in space for such tasks as servicing the Hubble Space Telescope—and also specializes in communications satellites, Earth and space observation, and infrastructure development.[51] The Canadian government also supports satellite operator Telesat in its development of a low Earth orbit (LEO) constellation to provide broadband internet.[52] In 2008, Canada launched the Space Technology Development Program, which has since invested nearly $200 million "to support the development of over 300 space-related technologies by over 100 organizations."[53]

Examples of Civilian and Military Applications of Dual-Use Space Systems

Numerous Canadian programs support EO operations. The 2020 smartEarth program funds EO applications to "develop solutions to key challenges on Earth and in our everyday lives," and the 2024–2025 plan frames EO as a primary tool for monitoring agricultural output, ice conditions, and water contamination, as well as supporting domestic CAF missions.[54]

Some frameworks suggest EO's national security role. The 2022 strategy states that the RADARSAT Constellation Mission helps to "both understand our ocean environment and strengthen our national security."[55] This program leverages synthetic aperture radar (SAR) imaging technology, an area of expertise in the Canadian space technology sector.

Canada also focuses on SSA and SDA capabilities. Sapphire, Canada's first operational military satellite, focuses on space debris monitoring and contributes to the U.S.-led Space Surveillance Network (SSN), highly

[48] Royal Canadian Air Force, "Operations," webpage, last updated April 21, 2022.

[49] "Canada Announces Establishment of 3 Canadian Space Division," 2022.

[50] CSA, *State of the Canadian Space Sector Report 2023*, 2024.

[51] MDA Space, "NASA's Gateway Mission: CANADARM3," webpage, undated.

[52] Anne Wainscott-Sargent, "Punching Above Its Weight: The Growing Influence of Canada's Space Industry," *Via Satellite*, October 30, 2024.

[53] CSA, "About the Space Technology Development Program (STDP)," webpage, last updated May 27, 2021.

[54] CSA, "About smartEarth," webpage, last updated January 30, 2020.

[55] CSA, *Resourceful, Resilient, Ready: Canada's Strategy for Satellite Earth Observation*, February 2022b, p. 16.

enhancing Canada's SDA.[56] In addition, Canada established a commercial integration cell in May 2024 that provides a liaison between the Canadian Space Operations Center and private industry in order to bolster information-sharing on space events.[57]

The Canadarm also illustrates a potential dual-use space system. Although designed for civil purposes, Russia has raised concerns about its possible weaponization—concerns likely influenced by China's demonstration of an ability to use a robotic arm to move satellites in and out of geostationary orbit (GEO).

International Considerations

International Partnerships

Recent policies, including the 2014 Space Policy Framework and 2019 Canadian Space Strategy, support Canada's use of international partnerships to deploy dual-use systems and conduct space operations to pursue the peaceful, sustainable, and "imaginative" use of outer space.[58]

Canada frequently partners with the United States and Europe. Canada-NASA collaborations often focus on academic research and space exploration, such as supporting robotics on the ISS and planned Lunar Gateway.[59] Canada participates in numerous commercial partnerships with several actors, including the ESA.[60]

Canada's international collaboration extends to military activities. In addition to supporting the U.S.-led SSN, Canada manages the deployment of many LEO satellites as part of the U.S.-Canada venture NORAD.[61] As a NATO member, Canada further contributes to the Defence Innovation Accelerator of the North Atlantic, an organization that offers companies resources to "find and accelerate dual-innovation capacity across the [NATO] Alliance."[62] Canada is also a close collaborator with the United States, participating in USSPACECOM's MNF-OOD, the Five Eyes intelligence-sharing collaboration, and the Combined Space Operation Center at U.S. Vandenberg Space Force Base.

[56] eoPortal, "Sapphire (Space Surveillance)," webpage, last updated June 14, 2012; Emily Lindahl, "A Gem in Space: Canada's Sapphire Satellite Continues to Shine," Government of Canada, February 24, 2023.

[57] Government of Canada, "Establishment of 7 Wing (Space)'s Commercial Integration Cell," press release, May 30, 2024b.

[58] CSA, 2014; CSA, 2019; Government of Canada, "Canadian Space Industry," webpage, last updated February 16, 2021a.

[59] Government of Canada, "Space Robotics," webpage, last updated February 16, 2021b.

[60] CSA, "Canada Reaffirms International Collaboration with the European Space Agency," press release, last updated June 6, 2025b.

[61] Canadian Armed Forces, "Fact Sheet: NORAD Modernization Project Timelines," last updated November 22, 2024.

[62] Defence Innovation Accelerator for the North Atlantic, homepage, undated.

Promoting International Norms

Canada's space policy has long emphasized the responsible use of outer space and the development of norms. As an early member of COPUOS, Canada played a significant role in developing the Guidelines for the Long-Term Sustainability of Outer Space Activities.[63] To promote responsible space behavior, Canada has consistently advanced TCBMs and, in May 2022, became the first country to join the United States in supporting a moratorium on DA-ASAT testing.[64]

Recent actions in international forums further illustrate Canada's commitment to international space norms. In its submission responding to UNGA resolution A/RES/75/36, Canada recognized the dual-use nature of space systems and the governance challenges they pose.[65] Consistent with its longstanding support of TCBMs, Canada has endorsed information exchange and communication protocols as key tools for reducing misunderstandings or miscalculations associated with dual-use space technologies.

Canada has sought to promote innovations in verification mechanisms—means to verify that nations are using their dual-use systems for peaceful purposes. Canada's Innovation for Defence Excellence and Security program offers funding for defense and security technology projects focused on enhancing clarity in space-based interactions and giving nations a more effective way to signal their intents in deploying dual-use systems.[66]

Brazil

Brazil stands as the most advanced space power in Latin America, strategically leveraging its space capabilities to achieve national security, strategic autonomy, and economic growth. Its space policy framework is comprehensive and multifaceted, integrating dual-use technologies for both civilian and military applications. This approach, supported by substantial domestic and international investments, positions Brazil as a regional space technology and security leader.[67]

[63] CSA, "Canada and Space Sustainability," webpage, last updated September 6, 2024c.

[64] Government of Canada, "Canada's View on Reducing Space Threats Through Norms, Rules and Principles of Responsible Behavior," United Nations General Assembly, May 6, 2022; Shannon Bugos, "Seven Countries Join ASAT Test Ban," Arms Control Association, November 2022.

[65] Government of Canada, 2022.

[66] Government of Canada, 2022; Government of Canada, "IDEaS: Innovation for Defence Excellence and Security (IDEaS)," webpage, last updated February 13, 2025a.

[67] United Nations Institute for Disarmament Research, *Seeking Comprehensive Solutions in Space: The Role of the Americas in Developing Norms of Behavior*, 2013.

Domestic Factors

Domestic Space Policy Frameworks

Brazil's domestic space policy emphasizes strategic autonomy, national security, and socioeconomic growth, as reflected in key frameworks relevant to dual-use systems, including the following:

- the **National Policy for the Development of Space Activities (PNDAE)**, which aims to enhance the country's ability to use space resources for national and societal interests[68]
- the **National Program of Space Activities (PNAE)**, an operational roadmap for implementing the PNDAE strategic vision[69]
- **Law No. 14,946/2024**, establishing a comprehensive regulatory framework governing space activities in Brazil, including launches and satellite operations[70]
- the **Annual Budget Law and Pluriannual Plan**, which position Brazil's government as the principal sponsor of space activities.[71]

The PNDAE explicitly addresses dual-use space systems and mandates that they must comply with government policies on export controls and international export control regimes, ensuring that they are aligned with national security interests while preventing strategic proliferation.

In referencing dual-use systems as "multiple-use technology," the PNAE 2022–2031 introduces strategic ambiguity, allowing system development without overt militarization signals. The strategy calls to "broad[en] the interface" between defense and economic uses, stressing adaptability based on security needs. This framing supports national security while preserving geopolitical neutrality and regulatory compliance.[72]

Law No. 14,946/2024 reinforces the separation of civilian and military space activities by assigning national defense space operations to the Aeronautical Command and civilian initiatives to the Brazilian Space Agency (AEB).

[68] President of the Republic of Brazil, "Política Nacional de Desenvolvimento das Atividades Espaciais" ["National Policy of Development of Space Activities"], Decree No 1,332, December 8, 1994.

[69] Ian Grosner, Suyan Cristina Malhada, and Thaís Zandoná, "The New Brazilian National Programme of Space Activities—PNAE (2022–2031): What to Expect," *Proceedings of the International Institute of Space Law 2022*, 2022; Brazilian Space Agency, *Program Nacional de Atividades Espaciais (PNAE) 2022–2031* [*National Program of Space Activities (PNAE) 2022–2031*], December 2021.

[70] Diário Oficial da União [Official Gazette of the Union], Lei Nº 14.946, de 31 de Julho de 2024 [Law No. 14,946, of July 31, 2024], August 1, 2024.

[71] Plano Pluriannual, Federal Government Multi-Year Plan for 2024–2027, Decree No. 12,066, Federal Official Gazette, June 19, 2024.

[72] Grosner, 2022.

Primary Domestic Space Stakeholders

In addition to the AEB and Aeronautical Command, key stakeholders include the following:

- the **Institutional Security Cabinet**, which ensures national security alignment in space policy and manages dual-use systems, including potentially for strategic ambiguity[73]
- the **National Institute for Space Research**, which develops and operates satellites and conducts research in remote sensing and space weather[74]
- the **Ministry of Defense**, which oversees national security applications of space systems and coordinates defense requirements for space projects[75]
- the **Ministry of Science, Technology, and Innovation**, which provides funding for space research and promotes international scientific collaborations.[76]

Brazil's private space sector plays a crucial role in supporting national space activities, often in collaboration with government agencies. Telebras, a state-owned telecommunications company, manages dual-use communications infrastructure and works closely with the Ministry of Defense on satellite initiatives.[77] The National Space Activities System coordinates the involvement of government, research institutions, and private entities in space initiatives.[78]

Examples of Civilian and Military Applications of Dual-Use Space Systems

The PNAE overviews numerous developing or deployed dual-use systems, including the following:

- **SATCOM:** The Satélite Geoestacionário de Defesa e Comunicações Estratégicas satellite addresses both civilian and defense communication needs.

[73] Gabinete de Segurança Institucional [Institutional Security Office], homepage, Government of Brazil, undated.

[74] Instituto Nacional de Pesquisas Espaciais [National Institute for Space Research], homepage, Government of Brazil, undated.

[75] Ministério da Defesa [Ministry of Defense], homepage, Government of Brazil, undated.

[76] Ministério da Ciência, Tecnologia e Inovação [Ministry of Science, Technology, and Innovation], homepage, Government of Brazil, undated.

[77] Peter B. de Selding, "Brazil Orders Civil-Military Telecommunications Satellite," *Space News*, November 29, 2013.

[78] Brazilian Space Agency, "Programa Nacional de Atividades Espaciais (PNAE) 2022–2031" ["National Space Activities Program (PNAE) 2022–2031"], webpage, last updated August 14, 2024.

- **Remote sensing for EO:** Programs like Amazonia-1, TURISAT, and Missão AgroBio support forest fire tracking, vegetation mapping, and agricultural productivity.
- **ISR:** The Program Estratégico de Sistemas Espaciais integrates dual-use space systems to support strategic surveillance and defense applications.
- **Space access and launch systems:** The Veículo Lançador de Microssatélites (VLM-1) launcher aims to provide Brazil with autonomous access to space.

International Considerations

International Partnerships

International partnerships contribute to Brazil's development in space. For instance, the Brazil, Russia, India, China, and South Africa (BRICS) Remote Sensing Satellite Constellation Cooperation Initiative seeks to implement a data-sharing framework between BRICS countries.[79]

Brazil also maintains bilateral partnerships with the United States, China, and various European states, and Brazil may be seeking a balance between these new initiatives in a way that promotes Brazilian needs and autonomy.[80] In particular, collaboration with China in space may be increasing, illustrated by the China-Brazil Earth Resources Satellite program that focuses on the deployment of satellites for meteorological and telecommunication purposes in GEO.[81]

Promoting International Norms

Brazil's ratifications of the 1967 OST, 1968 Rescue Agreement, and 1972 Liability Convention align it with core international norms and reinforce its image as a responsible space actor committed to non-weaponization, global cooperation, and space activity liability. Brazil has also played an active role in moving the discussion on space norms forward; for example, in the OEWG, Brazil was key in promoting the merging of two proposed moratoriums, one from the United States banning "destructive direct-

[79] Deborah Faboade, "Excerpts from the BRICS Heads of Agencies Meeting," Space in Africa," May 25, 2024.

[80] Rafael R. Ioris, "Brazil's Multilateral Trajectory and the Challenges the Crisis of Multilateralism Poses to the Global South," E-International Relations, May 21, 2025.

[81] See, for example, Garrett Shea, "Brazil Signs Artemis Accords," National Aeronautics and Space Administration, June 15, 2021b. Also see Irene Mia, "Reshaping Global Governance: The Global South, BRICS, and the West," International Institute for Strategic Studies, October 23, 2024.

ascent anti-satellite missile testing" (UNGA resolution A/RES/77/41) and the other from Russia calling for "no first placement of weapons in outer space" (UNGA resolution A/RES/69/32).[82]

However, Brazil's accession—not ratification—of the 1976 Registration Convention reflects a more cautious stance toward international transparency obligations, maintaining strategic flexibility in the governance of its space objects.[83] This selective adherence allows Brazil to participate in global space governance while preserving national autonomy in dual-use technology deployment. Notably, Brazil has not signed or ratified the 1979 Moon Agreement, banning military use of celestial bodies, aligning with other major spacefaring nations that reject the treaty's potentially restrictive resource-sharing provisions.[84] As the first South American nation to sign the Artemis Accords in 2021, Brazil demonstrates a strategic alignment with the U.S.-led framework for lunar exploration while signaling its acceptance of emerging norms on space resource extraction.[85]

Argentina

Argentina's space policy emphasizes civilian applications alongside support for domestic security objectives, such as border security. It also maintains several international partnerships that advance these goals, notably with China on ground infrastructure in Patagonia and with Brazil on launch capabilities. These collaborations help Argentina leverage space for national security and economic development.

Domestic Factors

Domestic Space Policy Frameworks

The **National Space Plan** is the primary policy framework outlining Argentina's policy toward the use of outer space but does not explicitly outline a policy for dual-use space systems.[86] Although the plan, administered by the Comisión Nacional de Actividades Espaciales (CONAE), guides such civil priorities as satellite development, EO, and scientific cooperation, it does not contain provisions directly addressing dual-use space systems or civil-military integration. The **Control Regime**

[82] UNGA, "Destructive Direct-Ascent Anti-Satellite Missile Testing," A/RES/77/41, December 7, 2022a; UNGA, "No First Placement of Weapons in Outer Space," A/RES/69/32, December 11, 2014.

[83] Convention on Registration of Objects Launched into Outer Space, signed at New York, November 12, 1974.

[84] United Nations Office for Outer Space Affairs, "Status of International Agreements Relating to Activities in Outer Space as at 1 January 2024," A/AC.105/C.2/2024/CRP, April 15, 2024.

[85] Shea, 2021.

[86] Government of Argentina, "Plan Espacial Nacional" ["National Space Plan"], webpage, undated-b.

for Sensitive Exports and War Material oversees sensitive exports, including space-related systems, such as SLVs and missiles.[87] Although CONAE participates in the regime review process for missile-related exports, the regime is not specific to space governance but rather part of a broader export-control framework covering nuclear, military, and generalized sensitive technologies.

Primary Domestic Space Stakeholders

CONAE is Argentina's primary civilian space agency, focusing on scientific research, EO, and telecommunications.[88] Argentina established the agency in 1991, following the cancelation of the military-led Condor II missile program—a move that reflected a broader national strategy to reorient the country's space activities toward peaceful and scientific objectives.[89]

The Ministry of Security and the Prefectura Naval Argentina represent two national security entities concerned with Argentina's space operations. The agencies use CONAE satellite data and capabilities to perform national security activities, such as monitoring illicit activities along national borders and in Argentine waters, illustrating the duality of Argentine space systems.[90]

Private investment in space capabilities in Argentina has the support of Argentina's Ministry of Economy and has produced several companies focused on a variety of capabilities, including a specialized satellite imaging system to support the mining and oil industry and the development of Zonda 1.0, the first commercial biofuel rocket.[91]

Examples of Civilian and Military Applications of Dual-Use Space Systems

Argentina strategically employs a broad spectrum of dual-use space systems to advance both civilian and military objectives while maintaining a civilian-led narrative.

[87] Argentina Decreto No. 603/1992 [Argentina Decree No. 603/1992], Régimen de control de las exportaciones sensitivas y de material bélico [Control Regime for Sensitive Exports and War Material], April 9, 1992.

[88] José Javier Díaz, "Satélites Argentinos para la Defensa" ["Argentine Satellites for Defense"], Pucará Defensa, March 30, 2023; Luis Piñiero, "Satélites Argentinos al Servicio de la Problemática Seguridad Fronteriza" ["Argentine Satellites at the Service of Border Security Issues"], Defensa.com, June 17, 2017; Ministerio de Ciencia, Tecnología e Innovación [Ministry of Science, Technology, and Innovation], "Institucional" [Institutional], webpage, Government of Argentina, undated.

[89] Nuclear Threat Initiative, "Argentina Missile Overview," fact sheet, April 9, 2015; Daniel Blinder, "Argentina Space: Ready for Launch," *Space and Defense*, Vol. 8, No. 1, Spring 2015.

[90] Díaz, 2023; Piñiero, 2017.

[91] "Three Argentine Satellite and Aerospace Industry Companies Set Trends with Unique and Innovative Developments," Latin American Foreign Direct Investment, October 7, 2023; Kristin Houser, "Biofuel Rocket Launch Is a First in Aerospace," Freethink, February 2, 2021.

The ARSAT satellite series, Argentina's national telecommunications infrastructure, enables secure government communications, including for military command and control.[92]

Argentina's active participation in ADR and ISAM underscores its strategic intent to enhance space sustainability while maintaining operational readiness and strategic defense logistics.[93] These technological advancements reflect a possible strategy of strategic ambiguity, in which Argentina may leverage civilian-led systems for national security purposes while maintaining international credibility as a peaceful space actor.

International Considerations

International Partnerships

Argentina engages in numerous bilateral initiatives concerning dual-use space systems. Bilateral collaboration with China underscores Argentina's growing strategic significance to China's military interests. In particular, the Espacio Lejano Station in Neuquén, operated by the China Satellite Launch and Tracking Control General under the People's Liberation Army (PLA), exemplifies this dynamic. Operational since 2017, the China-operated facility—the only such facility in the Americas—has played a role in both civilian and military applications.[94] Although supporting military communication networks and SSA, the station's operations has raised concerns about its potential role as an intelligence-gathering military installation.[95]

Although much of Latin America space cooperation, including with Argentina, is centered on China, Argentina has several engagements with other international entities, such as the ESA, as well as a significant "south-south" cooperative arrangement with Brazil.[96] Argentina and Brazil have cooperated on such projects as SABIA-Mar, a joint EO initiative for oceanic and coastal monitoring.[97] Under this program, both countries develop their own satellites while sharing technical knowledge and mission objectives.[98] Argentina and Brazil further collaborate on suborbital

[92] Ministerio de Defensa [Argentine Ministry of Defense], *Informe de Gestión 2023*, 2023a; Ministerio de Defensa [Argentine Ministry of Defense], "Personal del Ejército instaló antenas de AR-SAT en localidades de Santa Fe para facilitar la conectividad a través del servicio de internet libre y gratuito" [Army Personnel Installed AR-SAT Antennas in Towns in Santa Fe to Facilitate Connectivity Through the Free and Open Internet Service"], November 10, 2023b; ARSAT, homepage, undated.

[93] United Nations Office for Outer Space Affairs, "Space Debris Mitigation Standards—Argentina," undated-c.

[94] "Argentina Strengthens Space Ties Amid Global Scrutiny," *Latin American Post*, April 22, 2024.

[95] Irina A. Chindea, Elina Treyger, Raphael S. Cohen, Christian Curriden, Kurt Klein, Carlos Sanchez, Holly Gramkow, and Khrystyna Holynska, *Great-Power Competition and Conflict in Latin America*, RAND Corporation, RR-A969-4, 2023.

[96] Laura Delgado López, "Orbital Dynamics: The Domestic and Foreign Policy Forces Shaping Latin American Engagement in Space," Center for Strategic and International Studies, July 23, 2024.

[97] CONAE, "Mission Critical Design Review," briefing slides, April 2023.

[98] INVAP, "Construction of SABIA-Mar1 Begins," press release, April 27, 2018.

missions, including the 2007 VS-30 rocket launch, an officially civilian initiative in which CONAE tested dual-use systems for its Tronador program using Brazil's launch vehicle infrastructure.[99]

Promoting International Norms

Argentina participates in key international nonproliferation agreements that pertain to international norms on the use of outer space and dual-use space systems. These include the Missile Technology Control Regime (MTCR) and the Framework Agreement on COPUOS.[100]

Argentina has pursued bilateral initiatives to promote peaceful space use. In 2011, Argentina and the United States, which have maintained a longstanding space science partnership, entered into the Framework Agreement on Cooperation in the Peaceful Uses of Outer Space, reaffirmed in 2023.[101]

Although these agreements suggest Argentina's commitment to peaceful space use, the country has not made explicit regulatory distinctions between civilian and military space roles. Its international partnerships, particularly with China on the Espacio Lejano Station—which has potential for military use—highlights this ambiguity and raises concerns about dual-use potential.[102] This normative ambiguity may provide Argentina flexibility in deploying dual-use systems but may risk Argentina's credibility and alignment with international norms.

Mexico

Mexico maintains an ambiguous stance on dual-use space systems. While its policy frameworks emphasize peaceful applications of space systems, participation in military space exercises suggests an acknowledgment of space's role in supporting defense objectives. Its cooperation with Russia—particularly through an agreement that has enhanced its PNT

[99] Government of Argentina, "30 Años de la CONAE: 2000–2008" ["30 Years of CONAE: 2000–2008"], webpage, undated-a.

[100] Missile Technology Control Regime, "MTCR Partners," webpage, undated; U.S. Department of State, "Argentina (13-730)—Framework Agreement on Cooperation in the Peaceful Uses of Outer Space," July 30, 2013.

[101] U.S. Department of State, "Joint Statement on U.S.-Argentina Bilateral Space Consultations," press release, March 27, 2025; U.S. Department of State, "Argentina (23-731)—Extension of Framework Agreement on Cooperation in the Peaceful Uses of Outer Space," press release, July 31, 2023; Agreement Between the United States of America and Argentina: Extending the Agreement of October 25, 2011, July 31, 2023.

[102] Matthew P. Funaiole, Dana Kim, Brian Hart, and Joseph S. Bermudez, Jr., "Eyes on the Skies: China's Growing Space Footprint in South America," Center for Strategic and International Studies, October 4, 2022; Maria Zuppello, "China's Rapid Expansion in Latin America Targets Space," Dialogo Americas, April 18, 2025.

capabilities—underscores Mexico's interest in leveraging key space technologies and its willingness to collaborate internationally to obtain them.

Domestic Factors

Domestic Space Policy Frameworks

Mexico has not articulated an explicit policy governing dual-use space. However, key frameworks, documents, and policies governing Mexico's space policies suggest an informal approach to duality in space. These include the following:

- the **2010 Law to Create the Mexican Space Agency (AEM)**, which establishes Mexico's primary civilian space agency as responsible for formulating and implementing national space policy, coordinating space activities, and promoting space technology development[103]
- the **2020 Orbit Plan (Plan de Órbita)**, which outlines Mexico's advanced technological priorities in a civilian and commercial context, focusing on economic development and international cooperation rather than dual-use or military purposes[104]
- the **2020 National Program of Space Activities (PNAE)**, operationalizing the Orbit Plan and detailing initiatives in SATCOM, navigation systems, and disaster management.[105]

These policies emphasize peaceful uses for national development, scientific research, and international collaboration while avoiding explicit mention of military applications or dual-use capabilities. The Orbit Plan, a strategic roadmap through 2035, prioritizes civilian and commercial systems focused on economic growth and cooperation.[106] Although it lists national security as an objective and includes such technologies as SATCOM with potential dual use, the plan offers no guidance on military applications.

In 2023, Mexico proposed legal reforms that reflect technological progress and promote transparency by granting Congress authority over space legislation and recognizing space activities as a development priority.[107] The pending National Space Activities Law aims to attract

[103] Cámara de Diputados [Mexican Chamber of Deputies], Ley Que Crea La Agencia Espacial Mexicana [Law to Create the Mexican National Space Agency], June 30, 2010.

[104] Government of Mexico, *Programa Nacional de Actividades Espaciales (PNAE) 2020–2024* [*National Program of Space Activities (PNAE) 2020–2024*], September 2020; Government of Mexico, *Plan de Órbita 2.0—Mapa de Ruta del Sector Espacial Mexicano* [*Orbit Plan 2.0: Space Sector Route Map*], 2017

[105] Government of Mexico, 2020.

[106] Government of Mexico, 2017.

[107] "Mexico's Space Law Nears Approval, Expected by End of 2024," *Mexico Business News*, February 9, 2024.

investment, support technology transfer, and align governance with international norms.[108] While these reforms focus on economic and regulatory goals, they do not directly address dual-use risks or space militarization.

Primary Domestic Space Stakeholders

Mexico established AEM, its primary entity administering Mexican space-related activities, as a decentralized public agency under the civilian Secretariat of Communications and Transportation.[109] AEM's government board ensures oversight across both civilian and military sectors.[110] By integrating leadership from the Secretariats of Government, Foreign Affairs, National Defense, and the Navy, this governance structure balances national security with international cooperation and embeds defense priorities within Mexico's space decisionmaking, introducing inherent ambiguity around the use of dual-use space systems.

Mexico's private space industry prioritizes developing satellites and launch services while also supporting space research, often in collaboration with AEM or academic institutions.[111] Developing its own launch services remains a particular priority for Mexico, given the prohibitive costs of relying on NASA or ESA facilities. The sector also faces regulatory gaps that affect rocket development and launch—challenges that could be addressed through Mexico's recent accession to the newly established Latin American Space Agency.[112]

[108] "Mexico Does Not Have the Legal Framework to Attract Aerospace Investments," *Mexico Now*, February 26, 2025.

[109] Cámara de Diputados, 2010.

[110] Annette Froehlich, Diego Alonso Amante Soria, and Ewerton De Marchi, "Mexico," in *Space Supporting Latin America: Latin America's Emerging Space Middle Powers*, Springer, 2020.

[111] Two notable companies here are Satellogic and Hispasat, which are working to develop EO and communications capabilities for Mexico (MexicoHistorico, "Mexico's Space Industry: New Frontiers in Innovation," webpage, undated; "Mexico's Space Sector Ready for Takeoff," *Mexico Space News*, February 26, 2021).

[112] Secretaría de Relaciones Exteriores, "Mexico Will Host the Latin American and Caribbean Space Agency," press release, Gobierno de Mexico, March 16, 2022.

Examples of Civilian and Military Applications of Dual-Use Space Systems

Mexico has developed and deployed several dual-use space systems, including the following:

- **EO/ISR:** AEM partnered with Satellogic to develop an EO satellite constellation, providing high-resolution imagery for environmental monitoring, urban planning, and national security.[113] The National Institute of Statistics and Geography also uses EO data for urban growth and land-use analysis to inform policy and resource management.[114]
- **SATCOM:** The MEXSAT Program, contracting Boeing, provides 3G+ voice and data for civilian and national security use, with QuetzSat-1 supporting broadcasting and government communications in Mexico and parts of the United States.[115]
- **PNT:** The Galileo Information Centre in Mexico City promotes training and cooperation in satellite navigation technologies.[116]

International Considerations

International Partnerships

Russia is heavily engaged in Mexico's space sector, providing capabilities with civilian and military applications. In 2022, Mexico entered into an agreement with Russia to host Russia's Global Navigation Satellite System (GLONASS) ground stations.[117] Although primarily a Russian military system, GLONASS provides Mexico with enhanced PNT services.[118]

[113] Agencia Espacial Mexicana [Mexican Space Agency], "Firma AEM alianza con Satellogic Argentina para impulsar ciencia geoespacial en México" ["AEM Signs Alliance with Satellogic Argentina to Promote Geospatial Science in Mexico"], December 13, 2022.

[114] National Institute of Statistics and Geography, "Geospatial Data for a Better Future," briefing slides, presentation at IAOS-ISI 2024.

[115] United Launch Alliance, "Atlas V Morelos-3 Mission Overview," 2015; Boeing, "Commercial and Government Satellites: Mexsat," undated; Skybrokers, "QuetzSat-1 at 77° West," webpage, undated-a.

[116] Inside GNSS, "New Galileo Information Center Rises in Mexico to Serve Latin America, Caribbean," March 30, 2021.

[117] "AMLO Confirmó Acuerdo Entre México y Rusia; Aclaró que no Tienen Propósitos de Espionaje" ["AMLO Confirmed Agreement Between Mexico and Russia; He Clarified That There Are No Intentions of Espionage"], infobae, October 22, 2022.

[118] Russia has also established agreements to have stations in Venezuela, Argentina, and Mexico and plans to locate another one in Cuba. Notably, the Mexican government denied the use of the systems for "spying," a relevant development given U.S. concerns about Russian activities after the start of the Russia-Ukraine war and highlighting the intentionality relevant in the use of dual space systems ("Mexico Denies Russia Space Deal Will Aid Spying," *Daily Sun*, October 11, 2022).

Additionally, Mexico's participation in international military exercises, such as Resolute Sentinel and Global Sentinel 2024, highlights its operational interest in SDA and tactical surveillance, reflecting an acknowledgment of the strategic importance of these on-orbit capabilities in global security.

Promoting International Norms

Mexico's strategic engagements reflect some alignment with international norms on peaceful space use and nonmilitarization. By adhering to the five UN space treaties, Mexico preserves legal flexibility for dual-use technology development while avoiding explicit militarization. Through active roles in such bodies as COPUOS, the International Civil Aviation Organization, and the International Telecommunication Union, Mexico reinforces its commitment to peaceful governance and advocates for legal mechanisms to address emerging technologies.[119]

[119] Rosa Ma. Ramírez de Arellano, "Mexico Space Regulation," briefing slides, ICAO/UNOOSA Symposium, Abu Dhabi, United Arab Emirates, March 15–17, 2016; Daniel Leza, *The Creation of the Federal Institute of the Telecommunications of Mexico*, International Telecommunication Union, 2015.



CHAPTER 3

Europe, Eurasia, and European Institutions

James Black, Mélusine Lebret, John Kennedy, and Paul van Hooft

Europe and Eurasia feature a broad variety of national approaches to developing, deploying, and governing dual-use space systems, reflecting diverse political structures, strategic priorities, and relationships to international norms. To capture these contrasts, we examine Europe and the UAE, both of which emphasize cooperative frameworks, norms, and multilateral engagement, in contrast with the more centralized, often norms-challenging approaches of Russia and Iran. Although European states trail the United States and China in advancing cutting-edge space technologies, their approaches to dual-use space systems, grounded in collaboration, specialization, and leadership on norms development, continues to shape Europe's global influence in the space domain. The UAE mirrors many of these patterns, extending their relevance beyond Europe. Key themes that define these approaches to dual-use space systems include the following:

1. **Varied approaches to space governance.** Europe exhibits a diverse status of policy frameworks in its space governance, ranging from explicit and codified regulations to ambiguous policies shaped by geopolitical considerations to mixed or informal arrangements influenced by national interests and regional collaborations.
2. **Role of multilateral institutions in Europe.** Organizations like ESA, the EU, and NATO play a critical role in fostering collaboration and aligning strategies for dual-use space systems. Through joint

programs, shared governance frameworks, and collective investments, the organizations promote resilience, regional autonomy and defense, and responsible behavior in space.

3. **Leadership in international institutions.** Major spacefaring nations—such as France, Germany, the UK, and the UAE—drive global discussions on governing the use of dual-use space systems through international norms, including through their active participation in COPUOS, the OEWG, and minilateral initiatives.

4. **Outsized role of small players.** Europe serves as a dynamic arena in which smaller nations, such as Luxembourg and Norway, can focus on such niche areas as space governance and Arctic surveillance. These countries' early adoption of legal frameworks and strategic investments in dual-use technologies allow them to influence international norms and contribute meaningfully to multilateral efforts.

Russia and Iran each pursue distinct space strategies yet share a reliance on dual-use systems to blend civilian innovation with military aims. As these countries often challenge global norms to assert their influence, their approaches reveal how dual-use technologies drive national and geopolitical goals in space. Key themes across these countries include the following:

1. **Blurring the lines between civilian and military space domains.** Russia and Iran integrate civilian and military space activities to maximize strategic utility. Russia explicitly ties space policy to national security, while Iran uses dual-use systems for broader strategic goals.

2. **Centralized leadership driving space ambitions.** Centralized governance drives space strategies in both nations. Russia's Roscosmos controls national space activities, and Iran's Supreme Space Council aligns domestic progress with international treaties.

3. **Dual-use technologies as pillars of strategic capability.** Dual-use systems advance both civilian and military objectives. Russia focuses on technological resilience with systems like GLONASS, while Iran adapts satellites and SLVs for defense.

4. **Shaping global norms and navigating partnerships equivocally.** Russia and Iran challenge global norms, pushing to limit U.S. dominance and resisting dual-use regulations.

European Institutions

Though separate organizations with differing memberships, the EU, ESA, and NATO closely align their strategies in deploying dual-use space systems to address evolving security challenges in space. ESA focuses on technical development, the EU drives strategic policy integration and defense-related initiatives, and NATO emphasizes the strategic relevance of space in collective defense, deterrence, and norms. Together, these organizations shape a European space posture that emphasizes resilience, regional autonomy, and responsible space system use.

European Space Agency

The ESA agenda, set by member states, emphasizes space's role in both scientific discovery and risk mitigation. ESA develops and deploys dual-use systems, such as SATCOM and PNT, and has expanded collaboration with both civil and security European agencies on STM, debris mitigation, and planetary defense.[120] Additional civilian objectives include safeguarding European investments, developing a debris removal market, and launching a space weather observatory.[121] ESA supports national security objectives, including maritime safety, surveillance, and reconnaissance.[122] The close collaboration among members has boosted innovation and competitiveness through technological convergence and large-scale projects.

ESA Strategy 2040 emphasizes dual-use space systems for resilience and defense, noting Europe's lack of coordinated security funding compared with other space powers. The framework encourages ESA members to prioritize resilience, security, and reducing dependencies.[123]

European Union

The EU's **Space Strategy for Security and Defence** outlines the strategic use of dual-use systems to address space- and Earth-based risks, including cyberattacks and counterspace activities. It stresses the sensitivity of dual-use technologies and calls for securing supply chains through export controls and foreign direct investment screening.[124]

[120] ESA, "European Agencies Team Up for Cyber Resilience," press release, October 14, 2021b.

[121] European Commission, "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Space Strategy for Europe," October 26, 2016.

[122] ESA's support for national security objectives aligns with the EU's Common Foreign and Security Policy (ESA, *ESA Agenda 2025: Make Space for Europe*, March 31, 2021a).

[123] European Space Union, *ESA Strategy 2040*, 2025.

[124] European Commission and the High Representative of the Union for Foreign Affairs and Security Policy, "Joint Communication to the European Parliament and the Council: European Union Space Strategy for Security and Defence," March 10, 2023.

The Copernicus EO system and other EU space systems play key security and defense roles. The EU seeks to boost its resilience and autonomy, with support from the European Defense Fund (EDF). Secure communication systems—such as the Infrastructure for Resilience, Interconnectivity, and Security by Satellite (IRIS²)—will support defense missions with resilient communications. The EU also aims to improve SDA to better track space objects, avoid collisions, and reduce dependence on U.S. systems.[125]

The EU's dual-use approach aligns with broader defense industry reforms. Such initiatives as the EDF and proposed European Defense Industrial Development Programme aim to deepen cooperation, reduce market barriers, and boost Europe's commercial competitiveness.[126]

In March 2025, the European Commission—the EU's executive branch—published a **joint defense white paper** reiterating Europe's strategic focus on dual-use space systems that support mobility, communications, navigation, and observation. The paper calls for strengthening cooperation with EU industries to boost dual-use technology supply, procure raw materials, and develop domestically sourced alternatives.[127]

The **EU Space Act**, published in June 2025, proposes a regulatory framework—aiming to be in effect and enforceable by 2030—that would govern all space assets owned by the European Union and its member states, regardless of whether they are managed by governmental or commercial entities. The regulation proposal explicitly includes dual-use assets under civil control and employed for civilian purposes. This approach seeks to harmonize oversight and governance of dual-use space infrastructure across Europe, promoting uniform standards and legal clarity for assets with potential strategic significance.[128]

NATO

NATO has increasingly emphasized space's strategic relevance to collective defense, and recent policy frameworks have connected dual-use space systems to deterrence and norms. NATO's 2022 **Strategic Concept** assigns great importance to space, as "[m]aintaining secure use of and unfettered access to space and cyberspace are key to effective deterrence and defense."[129] In underscoring how space assets can "impair our defence and harm our security," it highlights that even a single space-based attack

[125] European Union, Regulation (EU) 2023/588 of the European Parliament and of the Council of 15 March 2023 Establishing the Union Secure Connectivity Programme for the Period 2023–2027, March 15, 2023.

[126] European Commission, "European Defence Industrial Development Programme 2020," fact sheet, June 30, 2021.

[127] European Commission and the High Representative of the Union for Foreign Affairs and Security Policy, *Joint White Paper for European Defence Readiness 2030*, March 2025.

[128] European Commission, "The EU Space Act," webpage, June 25, 2025.

[129] NATO, *NATO 2022 Strategic Concept*, June 2022, p. 7.

could trigger the NATO Treaty collective defense clause.[130] The concept further notes that NATO recognizes "the applicability of international law," will "promote responsible behavior" in space, and will "boost the resilience" of space systems.[131]

NATO's dedicated **Space Policy** was published in 2019 as an overarching framework and subsequently enhanced by a series of strategic activities that continue to refine NATO's overall approach to space, as highlighted by its 2025 summary.[132] This policy directly addresses the duality of space systems, noting, "Most space capabilities are dual use, serving civilian/commercial as well as military purposes, often at the same time."[133] Consistent with many NATO member space policies, the policy emphasizes the common interest in "the free access, exploration and use of outer space for peaceful purposes" and that Allies will act "in accordance with international law."[134]

NATO's **Commercial Space Strategy**, endorsed by member states in early 2025, represents a pivotal evolution in the alliance's approach to dual-use space assets. It establishes a systematic framework for integrating commercial space capabilities into NATO's operational and defense planning, thereby enhancing interoperability, resilience, and continuous access to space services while addressing the risks and opportunities posed by the rapid expansion of commercial space activities.[135]

While not possessing its own space assets, NATO builds institutional capacity to coordinate functions across the alliance, drawing on military, civilian, and commercial assets across various initiatives. These include the Germany-based NATO Space Center, a strategic SSA system at the Brussels headquarters, and the Alliance Persistent Surveillance from Space initiative establishing Aquila, a "large-scale, virtual constellation."[136] The NATO Defence Innovation Accelerator for the North Atlantic calls on dual-use innovators to apply to the incubator annually, fostering an international drive for developing dual-use space systems.[137]

[130] NATO, 2022, p. 5.

[131] NATO, 2022, p. 7.

[132] NATO, "NATO's Overarching Space Policy," June 27, 2019; NATO, "NATO's Approach to Space," webpage, last updated July 30, 2025b.

[133] NATO, 2019.

[134] NATO, 2019.

[135] NATO, "NATO Commercial Space Strategy," February 13, 2025a.

[136] NATO, 2025b.

[137] Defence Innovation Accelerator for the North Atlantic, undated.

France

France has emerged as Western Europe's foremost military space power. A central EU, ESA, and NATO actor, France has deepened investments in dual-use space systems to serve both civil and defense priorities while playing a prominent role in efforts to build sovereign European capabilities and reduce reliance on the United States.

Domestic Factors

Domestic Space Policy Frameworks

Several recent laws guide France's approach to the use of outer space, including the following:

- the **2008 French Space Operations Act (FSOA)**, which pioneeringly establishes "a national regime of authorization and supervision of national space activities," creating a framework for the defense of space assets themselves[138]
- the **2019 Space Defense Strategy (SSD)**, which plans to strengthen national space defense by enhancing autonomy, SSA, and military capabilities while leveraging New Space innovations[139]
- the **2023 Military Programming Law 2024–2030**, which authorizes funds for strengthening France's military actions in space.[140]

The SSD offers clear insight into France's approach to using dual-use systems. The strategy conveys the dual-use nature of space technologies as a strategic asset that strengthens the national industrial fabric and supports France's space operational autonomy. It further stresses the importance of partnerships with trusted commercial operators to ensure the availability, integrity, and confidentiality of data collected by dual-use systems, which may be critical for national security interests and operations, such as STM.[141]

Other policies fail to explicitly address dual-use systems. The FSOA's absence of a direct mention of duality may indicate a legislative focus on regulating space activities without overtly addressing the strategic implications of dual use. Similarly, the lack of any direct reference to dual-

[138] United Nations Office for Outer Space Affairs, "Space Debris Mitigation Standards—France," undated-d.

[139] Ministère des Armées [French Ministry of the Armed Forces], "Stratégie Spatiale de Défense: Synthèse" ["Defence Space Strategy: Summary"], 2019.

[140] Ministère des Armées [French Ministry of the Armed Forces], *LPM 2024–2030: Les Grandes Orientations* [*LPM 2024–2030: Main Guidelines*], April 2023.

[141] Ministère des Armées, 2019.

use systems in the Military Programming Law may suggest that dual-use considerations might be implicitly integrated and handled separately within the frameworks of the SSD, as well as the strategy contract with the Centre for National Space Studies (CNES).[142]

Primary Domestic Space Stakeholders

CNES represents France's primary space research institution. Both civilian and military ministries—the Ministry of Higher Education and Ministry of Armed Forces, respectively—provide CNES with oversight and funding for projects with confirmed dual-use benefits. CNES oversees many military and dual-use programs.[143] A CNES "defence" team, which includes the General Staff of the Armed Forces and Directorate General of Armaments members, guides funding for enhancing dual-use capabilities, including SATCOM, EO/ISR, and spaceflight systems.

The French Space Command, an interservice military organization responsible for developing and implementing France's military space policy, ensures operational readiness and freedom of access to outer space and oversees military space platforms and operations. It contributes to strategic planning, international cooperation, risk management, and situational awareness while maintaining a permanent command and control center for space operations.[144]

France's private space industry is robust and dynamic, blending established leaders—including Airbus, Safran, Thales, Hemeria, and Ariane Group—with a growing New Space ecosystem of more than 200 startups employing 3,000 people in 2025.[145] With 33,200 workers, more than 1,700 companies, and €10.8 billion in revenue in 2020, the sector benefits from both traditional aerospace expertise and public investment programs, such as France 2030, which has allocated €1.55 billion to foster innovation and competitiveness in the private space sector.[146]

[142] Ministère des Armées, 2023.

[143] Cédric Dupont, Sylvain Pernon, and Jean Oswald, "Ares Rockets Demonstrators of French Space Agency Project Perseus," Centre National d'Études Spatiales, 2013; CNES, "Ness," webpage, last updated January 17, 2025a; CNES, "Perseus," webpage, last updated January 17, 2025b; CNES, "Ceres," webpage, last updated January 20, 2025c; CNES, "CO3D," webpage, last updated April 10, 2025d.

[144] Government of France, Arrêté du 3 Septembre 2019 Portant Création et Organisation du Commandement de l'Espace [Order of September 3, 2019 Creating and Organizing the Space Command], September 3, 2019.

[145] CNES, "French Space Industry Capabilities Catalogue," webpage, undated; Alexandre Boero, "La France Lance sa Révolution Spatiale avec 200 Start-Up Contre Elon Musk et SpaceX" ["France Launches Its Space Revolution with 200 Start-Ups Against Elon Musk and SpaceX"], Clubic, May 5, 2025.

[146] Noémie Morénillas, Murielle Lafaye, and Matéo Bonnassieux, "Dans la Filière Spatiale en France, 1,650 Sociétés Diversifiées et une Soixantaine de Pure-Players" ["In the Space Sector in France, 1,650 Diversified Companies and About Sixty Pure-Players"], *Insee Première*, No. 1919, June 2022; Ministère de l'Économie, des Finances et de la Souveraineté industrielle et numérique [French Ministry of Economics, Finance and Industrial and Digital Sovereignty], "Les Premiers Résultats du Volet Spatial de France 2030 Dévoilés" ["The First Results of the Space Component of France 2030 Unveiled"], July 7, 2023.

Examples of Civilian and Military Applications of Dual-Use Space Systems

France actively develops and deploys dual-use systems that can serve both civilian and military needs. These include the CERES satellite system, NESS nanosatellite, YODA satellite, 3D Optical Constellation (CO3D), and CSO-3 satellite system.[147]

International Considerations

International Partnerships

As an active EU, ESA, and NATO member, France frequently participates in international partnerships in developing and deploying dual-use space systems. Launched in December 2022, the joint NASA-CNES Surface Water and Ocean Topography mission uses advanced satellite technology to produce highly detailed maps of Earth's ocean surfaces. France further supports NATO's Space Center.

Promoting International Norms

France demonstrates its commitment to the peaceful use of outer space through its adherence to key international treaties and participation in COPUOS and the OEWG. In a 2022 joint communique, France stated its support for a moratorium on DA-ASAT tests.[148] France advocates for universal adherence to UN space treaties and the sustainable use of outer space. It supports space law capacity-building by collaborating with universities, contributing to the UN's Space Law program, and engaging with EU initiatives, such as the EU Space Act.[149]

[147] CNES, 2025a; CNES, 2025c; CNES 2025d.

[148] French Ministry for Europe and Foreign Affairs and Ministry of the Armed Forces, "France's Commitment Not to Conduct Destructive Direct-Ascent Anti-Satellite Missile Tests," press release, November 29, 2022.

[149] European Economic and Social Committee, "EU Space Act," webpage, undated.

United Kingdom

Alongside France, the UK is one of NATO's leading defense powers and home to a dynamic space sector. Although it fields fewer sovereign military space capabilities than some European counterparts, it maintains deep integration with the U.S. defense space enterprise. The UK's leadership in international forums reflects its recognition of the need for norms to guide the responsible use of dual-use space systems.

Domestic Factors

Domestic Space Policy Frameworks

UK policy documents concerning the use of dual-use space systems include the following:

- the **2021 National Space Strategy**, a ten-year framework for growing the UK space economy, enhancing security, and addressing global challenges[150]
- the **2022 Defence Space Strategy**, a ten-year framework that supports the National Space Strategy and outlines how the Ministry of Defence will "protect and defend" through "space-related capabilities, operations and partnerships"[151]
- the **2024 Space Industrial Plan**, which establishes "clear visions, missions, and actions to unlock growth and develop resilient space capabilities in the UK."[152]

Together, these strategies recognize the growing importance of space to national security, influence, and prosperity, frequently touching on the role of dual-use space systems.

The UK recognizes the dual-use nature of space technologies in its development and regulation strategies.[153] Its cross-governmental **National Space Capability Plan** aligns civil and military needs and advances an "own-collaborate-access" model that prioritizes sovereign, government-

[150] Government of the United Kingdom, *National Space Strategy*, September 2021.

[151] UK Ministry of Defence, *Defence Space Strategy: Operationalising the Space Domain*, February 2022.

[152] Government of the United Kingdom, "Space Industrial Plan: From Ambition to Action—Advancing UK Space Industry," March 7, 2024.

[153] James Black, Theodora Ogden, Mélusine Lebret, Andy Skelton, Zsofia Wolford, and Henri van Soest, *Implications of Emerging Technology for UK Space Regulation Policy: Findings of a Horizon Scan*, RAND Corporation, RR-A3121-1, 2024.

owned, and government-operated capabilities where necessary, commercial solutions where possible, and international partnerships where beneficial.[154]

Primary Domestic Space Stakeholders

The UK established the National Space Council to promote civil-military integration in its space affairs. The National Space Operations Center brings together inputs from UK Space Command with the civilian UK Space Agency and Met Office, as well as the Department for Science, Innovation, and Technology; the Civil Aviation Authority; and other agencies and commercial operators.[155]

Contributing £7.2 billion to the economy in 2022, the UK boasts a thriving space sector, with such leading companies as Airbus Defence and Space, Surrey Satellite Technology Ltd (SSTL), Inmarsat, Reaction Engines, and Astroscale.[156]

Examples of Civilian and Military Applications of Dual-Use Space Systems

The UK excels in several specific dual-use technologies, including SATCOM (such as through assets SKYNET and OneWeb), space weather monitoring (Solar Orbiter and Vigil), small-sats (SSTL), SAR, ADR, and ISAM (Astroscale UK).

International Considerations

International Partnerships

The UK actively participates in international joint programs. Unlike other major European spacefaring nations, it directs more public funds to ESA than its domestic space agency.[157]

The UK collaborates extensively with the United States through such initiatives as Five Eyes, Operation Olympic Defender, and the Combined Space Operations (CSpO) Initiative, reflecting its reliance on international

[154] Lucia Retter, James Black, and Theodora Ogden, *Realising the Ambitions of the UK's Defence Space Strategy: Factors Shaping Implementation to 2030*, RAND Corporation, RR-A1186-1, 2022.

[155] National Space Operations Centre, "About Us," webpage, Government of the United Kingdom, undated.

[156] The £7.2 billion refers to gross value added. See UK Space Agency, *Size and Health of the UK Space Industry 2023*, July 2024; Gina Marrs, "Announced! Tech Round's Top 28 UK Space Tech Companies," TechRound, January 23, 2025.

[157] Government of the United Kingdom, *The National Space Strategy in Action*, July 2023.

partnerships for dual-use space capabilities.[158] Furthermore, the UK plans to host a site for the Deep Space Advanced Radar Capability system, part of the U.S. SSN.[159]

Promoting International Norms

Reflecting its niche strengths in fostering dual-use space capabilities, as well as its desire for global leadership in technology governance, the UK has been at the forefront of recent international debates concerning dual-use space systems and managing escalation risk. The UK has long participated in the Prevention of an Arms Race in Outer Space (PAROS), COPUOS, and minilateral forums, such as the CSpO Initiative.[160]

The UK has further spearheaded the OEWG to strengthen space governance by promoting norms and responsible space behaviors, including encouraging the adoption of TCBMs and restricting DA-ASAT tests.[161]

Germany

Germany approaches space as a domain requiring global cooperation and responsible governance. As an advocate on the world stage for a rules-based order and building space resilience through civil-military coordination, it emphasizes norms, export controls, and multilateral engagement, reflecting a commitment to managing dual-use system risks.

Domestic Factors

Domestic Space Policy Frameworks

Key policy and strategy documents relevant to Germany's space posture offer insight into its approach to the use of outer space. These include the following:

[158] Bruce McClintock, Andrew Radin, Cortney Weinbaum, Stephanie Anne Pillion, Bonnie L. Triezenberg, Jonathan Cham, Daniel Elinoff, Maggie Habib, Mark Hvizda, Kotryna Jukneviciute, Adi Rao, and Bryan Rooney, *Allied by Design: Defining a Path to Thoughtful Allied Space Power*, RAND Corporation, RR-A1739-1, 2024.

[159] Government of the United Kingdom, "Deep Space Advanced Radar Capability (DARC)," webpage, last updated April 7, 2025.

[160] U.S. Department of Defense, "Combined Space Operations Vision 2031," 2022.

[161] Almudena Azcaráte Ortega and Sarah Erickson, *OEWG on Reducing Space Threats: Recap Report*, United Nations Institute for Disarmament Research, February 2024; Brian Weeden, "Takeaways from the UN Open-Ended Working Group on Reducing Space Threats," Secure World Foundation, October 12, 2023.

- **the 2023 Raumfahrtstrategie der Bundesregierung ("Space Strategy")**, which acknowledges the increased importance of space in recent years and offers an initial policy framework to guide Germany's space activities[162]
- **the 2023 German Defense Policy Guidelines and 2023 National Security Strategy (NSS)**, which underscore the importance of space to Germany's security, society, and prosperity, as well as Europe's strategic autonomy.[163]

Although these documents do not explicitly address the use of dual-use space systems, they together characterize a strong German preference for a rules-based order, adherence to national and international space law and regulations, and cooperation with partners. The Space Strategy identifies counterspace capabilities in particular as increasingly threatening to both civilian and military infrastructure, necessitating a holistic response.[164]

The NSS emphasizes that managing the growing competition in space is a shared civil-military responsibility. It calls for Germany to counter all military threats while advancing cyber defense and protecting space-based infrastructure.[165] The strategy frames SSA as a vital joint civil-military task that requires a network of sensors spanning the globe in cooperation with international partners, research institutions, and commercial firms. Under the Space Strategy, Germany favors export controls to prevent the uncontrolled spread of dual-use technologies.[166]

Primary Domestic Space Stakeholders

The primary German agency responsible for space affairs is the German Aerospace Center (DLR). The National Program for Space and Innovation helps drive innovation of dual-use technologies in German industry and research. Technological development takes place both via the DLR and the private sector.[167]

The German Space Command (WRKdoBw) plays a pivotal role in ensuring national security through its focus on military space use, including the deployment, protection, and defense of space systems. Operating under the Bundeswehr's Space Component Command, the WRKdoBw oversees such permanent tasks as SSA, mission support, and operating Germany's

[162] German Federal Ministry for Economic Affairs and Climate Action, *The German Federal Government's Space Strategy*, September 2023.

[163] German Federal Ministry for Economic Affairs and Climate Action, 2023, pp. 3, 5.

[164] German Federal Ministry for Economic Affairs and Climate Action, 2023, p. 37.

[165] Federal Government of Germany, *Integrated Security for Germany: National Security Strategy*, June 2023, p. 32.

[166] German Federal Ministry for Economic Affairs and Climate Action, 2023.

[167] Susan Bießlich, Sebastian von Engelhardt, Peter Kaufmann, Christiane Kerlen, Sonja Kind, Jakob Kofler, Anja Marcher, Elisabeth Nindl, Martin-Simon Robeck, Karoline Rodriguez, and Guido Zinke, *Evaluation of the National Programme for Space and Innovation*, Institute for Innovation and Technology, March 2021.

military space systems.[168] The WRKdoBw comprises two divisions: the Space Situation Division, which monitors near-Earth space and threats to satellites, and the Department of Planning and Leading Space Operations, which is being developed to coordinate military countermeasures.[169]

Germany's space economy is a dynamic, innovation-driven sector, with leading companies (such as OHB, MT Aerospace, Airbus Defence and Space) and startups (such as Isar Aerospace and Rocket Factory Augsburg) all driving advances in satellite and launch technologies with high dual-use potentials. As the second-largest ESA contributor, Germany benefits from strong public investment and EU initiatives but faces challenges from bureaucracy and global competition, such as SpaceX. German private space companies are under the regulatory umbrella of the upcoming German Space Law and the EU Space Act, overseen by national authorities and the EU Agency for the Space Programme, which sets unified standards and licensing requirements for space activities.[170]

Examples of Civilian and Military Applications of Dual-Use Space Systems

The SAR-Lupe and SARah satellite reconnaissance systems reflect Germany's strategic commitment to autonomous space surveillance capabilities. Prompted by Kosovo War lessons, SAR-Lupe introduced a constellation of smaller radar satellites in 2007 for high-resolution imaging, operable under darkness and cloud cover. SARah, operational since 2023, enhances these capabilities with phased array radar and reflector technology for improved resolution, faster transmission, and increased operational flexibility.[171] These systems reinforce Germany's focus on sovereign infrastructure and LEO broadband amid evolving security challenges.[172]

[168] Bundeswehr [Armed Forces of Germany], "Space Component Command," webpage, undated-a.

[169] Bundeswehr [Armed Forces of Germany], "Weltraumkommando der Bundeswehr" ["Space Command of the Bundeswehr"], webpage, undated-b.

[170] J. C. Kofner, "State and Prospects of the German Space Economy," MIWI Institute, July 27, 2025; Andreas Lenz and Thomas Jansen, "Space Law 2025: Germany, Trends and Development," webpage, Chambers and Partners, last updated July 10, 2025.

[171] Pia Bausch, "Germany's Eyes in Space—the SAR-Lupe and SARah Satellite Reconnaissance Systems," OHB, December 22, 2023.

[172] Peter B. de Selding, "German Military Ready to Ride Budget Wave with LEO Broadband, Reconnaissance Constellations," *Space Intel Report*, April 25, 2025.

International Considerations

International Partnerships

In conducting its space affairs, Germany looks to European partners and its collaborations through the EU and ESA. Germany further collaborates with the United States, including through CSpO, the Artemis Accords, and other bilateral or minilateral partnerships.[173]

Promoting International Norms

Germany has actively contributed to COPUOS and OEWG discussions. As described in the NSS and other statements, Germany's approach to the use of outer space centers on establishing norms for responsible behavior.[174] This includes a unilateral commitment from Germany to refrain from conducting destructive DA-ASAT missile tests.[175]

Italy

Despite its smaller economy relative to other major European powers, Italy has emerged as a significant regional actor in both civil and military space, backed by a robust national space program and active contributions to the EU and ESA. Its investment in dual-use systems supports a broader strategy to advance strategic autonomy and meet both civilian and defense objectives. Italy's consistent support for international cooperation and norms underscores its commitment to the responsible development and use of dual-use space capabilities.

Domestic Factors

Domestic Space Policy Frameworks

The **space policy framework** guiding Italy's space activities, as initially outlined by Prime Minister Giorgia Meloni in January 2025, encompasses national directives and international agreements.[176] The national space policy emphasizes the development of dual-use capabilities and strategic autonomy, supported by the **Legge Spazio**, a national law that governs

[173] German Federal Ministry for Economic Affairs and Climate Action, 2023, pp. 3, 7.

[174] Federal Government of Germany, 2023, p. 63.

[175] Federal Foreign Office of Germany, "Germany Commits in Geneva Not to Conduct Anti-Satellite Direct-Ascent Missile Tests," September 13, 2022.

[176] Giorgia Meloni, *Government Guidelines on Space and Aerospace*, Italian Government Presidency of the Council of Ministers, 2025.

space activities in compliance with international norms.[177] To complement Legge Spazio's strategic autonomy objectives, the nascent **Space Economy Framework Law** establishes comprehensive regulations for space activities, including operator authorization, satellite registration, liability regimes, and space financial planning.[178]

Primary Domestic Space Stakeholders

The Italian Space Agency, Italy's primary domestic space stakeholder overseeing national space policy, manages all space-related requests across the Italian territory, including satellite data, geodesy, interplanetary missions, and space debris tracking. The agency is complemented by national aerospace and defense industry players, including Avio, Leonardo, and Telespazio, some of which support Italy's Vega launcher flagship program.[179]

Examples of Civilian and Military Applications of Dual-Use Space Systems

Italy's own dual-use space capabilities are both extensive and strategic, guided by policies that ensure their responsible use. The COSMO-SkyMed constellation, a series of radar satellites, exemplifies Italy's dual-use strategy, serving both civilian and military purposes by providing critical data for environmental monitoring and defense.[180]

Additionally, Italy prioritizes SSA to monitor debris and potential threats, ensuring the safety and security of its space assets.[181]

International Considerations

International Partnerships

Italy collaborated with France to develop the SICRAL 2 military telecommunications satellite and the ATHENA-FIDUS, a dual-use satellite that offers secure communications for military and civil protection. Italy further participates in the Galileo Program, further illustrating its commitment to provide PNT services for both civilian and military applications.[182]

[177] Italian Civil Code, Legge Spazio [Space Law], Titolo 1 [Title 1], General Provisions.

[178] Italian Parliament, Provisions on Space Economy, Senate Act No. 1415, March 6, 2025.

[179] Agienze Spaziale Italiana [Italian Space Agency], "Chi Siamo" ["Who We Are"], webpage, undated.

[180] ESA, "COSMO—SkyMed," webpage, undated.

[181] Italian Parliament, Disposizioni in Materia di Economia dello Spazio [Provisions on Space Economy], DDL S. 1415, June 11, 2025.

[182] Thales Alenia Space, "SICRAL 2, the French-Italian Defense and Security Telecom Satellite, Reaches Guiana Space Center Launch Site," press release, March 4, 2015.

Promoting International Norms

Italy anchors its space policy in international cooperation and norm-building. It adheres to the 1967 OST, participates in the Artemis Accords,[183] and aligns with UNGA resolutions 75/36 and 76/231 to promote responsible behavior and reduce space threats. Italy's national policies harmonize with the EU Space Strategy,[184] emphasizing security, sustainability, and the peaceful use of outer space.

Through engagement with COPUOS, the OEWG, the CSpO initiative, and ESA, Italy advocates for long-term sustainability and TCBMs to prevent miscalculation.[185] Like other EU members, it has also issued a moratorium on DA-ASAT testing.[186]

Small European Players

Western Europe includes several nations, such as Luxembourg and Norway, that exert outsized influence in space by leveraging strategic niches or geographic advantages. Their approaches to dual-use systems underscore the value of tailored policies and international partnerships in promoting global space governance and peaceful use.

Luxembourg

Luxembourg has emerged as a first mover in dual-use system and space resource governance, regulating space activities through pioneering legislation. Its **2017 Law on the Exploration and Utilization of Space Resources** and **2020 Law on Space Activities** exemplify its proactive approach to establishing legal clarity and fostering space mining

[183] Framework Agreement Between the Government of the United States of America and the Government of the Italian Republic for Cooperation in the Exploration and Use of Outerspace for Peaceful Purposes, signed at Washington, March 19, 2013.

[184] Meloni, 2025.

[185] Permanent Mission of Italy, "National Contribution to the Work of the Open-Ended Working Group on Reducing Space Threats Through Norms, Rules and Principles of Responsible Behaviors," United Nations Office for Disarmament Affairs, March 2022.

[186] Permanent Mission of Italy, 2022.

innovation.[187] Its **2016 SpaceResources.lu** initiative promotes sustainable exploration of space resources, further solidifying its niche in the global space economy.[188]

By providing targeted legal frameworks and substantial financial support, Luxembourg has attracted leading asteroid and lunar mining ventures globally, from such countries as the United States and Japan, while simultaneously serving as a reference model for emerging space economies, including the UAE. The European Space Resources Innovation Centre, established in partnership with ESA and the Luxembourg Institute of Science and Technology, acts as a global research and development and networking hub, hosting the annual Space Resources Week.[189]

Luxembourg actively participates in international forums, including COPUOS, and the Hague International Space Resources Governance Working Group, advocating for norms governing space resource utilization.[190] As an EU, ESA, and NATO member, Luxembourg amplifies its influence by aligning its dual-use space capabilities with broader regional and global security and economic priorities.

Norway

Norway's space posture reflects its geographic and strategic position in the Arctic, where space-based services are essential for civil, commercial, and security needs. As a remote region, the Arctic drives Norway's interest in providing space-based communications systems and EO and PNT services to support isolated communities, shipping, and economic activities. As climate change accelerates in the Arctic, Norway emphasizes space-based environmental monitoring. Proximity to the North Pole also makes such sites as Svalbard vitally important for satellite uplink and downlink stations with dual-use functions.[191]

[187] Journal Officiel du Grand-Duché de Luxembourg [Official Journal of the Grand Duchy of Luxembourg], Loi du 20 Juillet 2017 sur L'exploration et l'utilisation des Ressources de l'espace [Law of July 20th, 2017, on the Exploration and Use of Space Resources], July 20, 2017; Journal Officiel du Grand-Duché de Luxembourg [Official Journal of the Grand Duchy of Luxembourg], Loi du 15 Décembre 2020 Portant sur les Activités Spatiales et Modifiant: La Loi Modifiée du 9 Juillet 1937 sur l'impôt sur les Assurances Dite "Versicherungssteuergesetz"; la Loi Modifiée du 4 Décembre 1967 Concernant l'impôt sur le Revenu [Law of 15 December 2020 on Space Activities and Amending the Amended Law of 9 July 1937 on Insurance Tax Known as the "Versicherungssteuergesetz"; the Amended Law of December 4, 1967 on Income Tax], December 15, 2020.

[188] Luxembourg Space Agency, "Pioneers in Space," webpage, last updated November 18, 2019.

[189] Luxembourg Space Resources Week, homepage, undated.

[190] Leiden University, "The Hague International Space Resources Governance Working Group," webpage, undated.

[191] Benjamin J. Sacks, Scott R. Stephenson, Stephanie Pezard, Abbie Tingstad, and Camilla T. N. Sørensen, *Exploring Gaps in Arctic Governance: Identifying Potential Sources of Conflict and Mitigating Measures*, RAND Corporation, RR-A1007-1, 2021.

Norway is increasing its investments in dual-use space systems—such as the Arctic Surveillance Program, a collaboration between its Norwegian Space Center, armed forces, and other agencies—to deliver EO/ISR services and data to both civil and military users.[192]

Norway actively joins international efforts to promote peaceful space use, such as the CSpO Initiative since 2023.[193] At the UN, Norway has emphasized the growing challenge of avoiding misperception around dual-use systems, calling for responsible states to develop new norms and TCBMs and to avoid unintended consequences from threatening military space assets entangled with critical civilian systems and services.[194]

Ukraine

Guided by explicit policy frameworks, Ukraine's space policy prioritizes dual-use systems. While its State Space Agency leads national efforts, the Ministry of Defence's (MoD's) Space Policy Directorate aims to develop sovereign capabilities through public-private collaboration. Key dual-use technologies have been vital to Ukraine's defense and civilian needs during the ongoing conflict with Russia, supported by private operators, such as Starlink and Maxar. However, in 2022, after Elon Musk restricted Ukraine's access to Starlink—a key wartime asset—Ukraine diversified its satellite communications by integrating the EU-backed IRIS2 network and securing Starshield access via the U.S. DOW, as well as partnering with European companies, such as Eutelsat and Kyivstar, for resilient, redundant connectivity.[195]

Domestic Factors

Domestic Space Policy Frameworks

Ukraine's approach to dual-use space systems is guided by explicit, codified frameworks, including its **National Space Law** and the **National Targeted Scientific and Technical Space Program (2021–2025)**.[196]

[192] Norsk Romsenter [Norwegian Space Agency], "Satellites, Space Infrastructure, and Their Use," webpage, undated.

[193] Norwegian Ministry of Defence, "Joint Statement from the Combined Space Operations Initiative Principals' Board Meeting in Italy to Advance Space Security," press release, December 6, 2024.

[194] "Statement by Norway Under Agenda Item 5: General Exchange of Views," Open-Ended Working Group on Reducing Space Threats Through Norms, Rules and Principles of Responsible Behaviour, May 10, 2022; Tine Mørch Smith, "Statement to the Conference on Disarmament Under Agenda Item 3: 'Prevention of an Arms Race in Outer Space,'" Norway in Geneva, June 3, 2021.

[195] DefenseMirror.com, "Ukraine Allowed Access to Military Satellite Internet—Starshield," December 7, 2024.

[196] United Nations Office for Outer Space Affairs, "Selected Examples of National Laws Governing Space Activities: Ukraine," webpage, undated-b; Yulia Sokolova, "Кабмін схвалив проект космічної програми України до 2025 року: про що вона" ["The Cabinet of Ministers Approved the Draft Space Program of Ukraine Until 2025: What Is It About"], *Fakty*, September 9, 2021.

These documents prioritize the development of space technologies with defense and security applications, such as SATCOM and ISR capabilities. Although operational specifics may sometimes be implied through broader strategies, such as the **National Security Strategy**, the overall governance of dual-use systems is firmly rooted in clear policy objectives across these legal and technical frameworks.

Primary Domestic Space Stakeholders

The State Space Agency of Ukraine, Ukraine's primary state institution overseeing national space activities, claims to rank among the world's top five in space launches.[197]

In March 2025, the MoD launched a Space Policy Directorate to serve as the country's primary customer for space technologies and to lead the development of sovereign SSA, EO/ISR, and space control capabilities by 2030 through public-private collaboration.[198]

Ukraine's commercial space sector has undergone several waves of reform since its 1991 independence, marked by a gradual shift from state-owned enterprises to greater private sector involvement and expanded international collaboration in joint space missions and global supply chain integration.

Dual-use space services provided by commercial operators have played an important role in Ukraine's war effort, with PNT, EO/ISR, and SATCOM supporting both military operations and affected civilians. Private company Starlink provides space-based connectivity that supports drone operations, and Maxar's satellite imagery supports Ukraine's targeting efforts.[199]

Examples of Civilian and Military Applications of Dual-Use Space Systems

The 2015–2020 plan committed significant investment in dual-use space systems, including EO services (notably through cooperation with the EU and ESA on Copernicus), ISR capabilities (such as the People's Satellite), rockets and launch vehicles (such as Tsyklon-1, Tsyklon-4M, Antares, Vega, and Zenit-7N), and lunar instruments and modules for a potential

[197] International Astronautical Federation, "State Space Agency of Ukraine (SSAU)," webpage, undated.

[198] Kateryna Tyshchenko, "Ukraine's Defence Ministry Has New Space Policy Department," *Ukrainska Pravda*, March 29, 2025.

[199] Theodora Ogden, Anna Knack, Mélusine Lebret, James Black, and Vasilios Mavroudis, *The Role of the Space Domain in the Russia-Ukraine War: The Impact of Converging Space and AI Technologies*, Centre for Emerging Technology and Security, February 2024.

Moon mission. The investments further promoted civilian spillovers into civilian sectors and the privatization of state-owned enterprises in the space industry.[200]

International Considerations

International Partnerships

Ukraine participates in joint space missions, including with the United States, EU, ESA, and Canada, and works to integrate Ukrainian firms into global supply chains.

The Russia-Ukraine war has also influenced Ukraine's approach to international cooperation in space operations. Following the 2022 Russian invasion, the EU has agreed to deepen collaboration with Ukraine and integrate it further into such projects as Copernicus and EGNOS. The European Commission's 2025 white paper set out proposals to include Ukraine in the EU Space Program, fund Ukrainian access to dual-use commercial services to diversify from U.S. providers, cooperate on cybersecurity of space assets, and invite Ukraine to participate in the EU Space Information Sharing Analysis Center.[201]

Promoting International Norms

Ukraine was an early signatory of the Artemis Accords, is an advocate of the 1967 OST, and is an active contributor to PAROS, COPUOS, and the OEWG.[202] Official Ukrainian statements in these forums have repeatedly criticized Russian inclusion and conduct in such discussions, as well as Russia's attacks on civil space infrastructure.[203] Ukraine supports UK-led initiatives on space norms, TCBMs, and developing international space traffic management protocols, framing them as steps toward future legally binding treaties. It has criticized Russian proposals for legal mechanisms on space weaponization as lawfare, designed to obscure Russia's own hostile actions in orbit.[204] This includes Russia's veto of a 2024 UN Security Council resolution prohibiting placement of weapons of mass destruction in space.[205]

[200] Igor Sheludchenko, "The Cabinet of Ministers Approves the Space Program of Ukraine Worth ₴41 Billion," GMK Center, October 20, 2021.

[201] European Commission and the High Representative of the Union for Foreign Affairs and Security Policy, 2025.

[202] U.S. Embassy in Ukraine, "Ukraine Becomes the 9th Country to Sign the Artemis Accords," press release, November 17, 2020.

[203] Delegation of Ukraine, "Statement by the Delegation of Ukraine at the 68th Session of the Committee on the Peaceful Uses of Outer Space—Agenda Item 4 'General Exchange of Views,'" June 25–July 2, 2025..

[204] Delegation of Ukraine, Statement by the Delegation of Ukraine at the 67th session of the Committee on Peaceful Uses of Outer Space, June 20, 2024a.

[205] Delegation of Ukraine, Statement by the Delegation of Ukraine at the First Committee Thematic Debate under Cluster 4 'Conventional Weapons' (24 October 2024, New York)," October 20, 2024b.

Russia

Russia's space policy integrates civilian and military activities, focusing on dual-use systems linked to national security and socioeconomic goals. Guided by frameworks including Federal Law no. 5663-1 and the State Program (2013–2036), the Kremlin sets policy, Roscosmos implements, and private entities support Russia's global space ambitions.

Domestic Factors

Domestic Space Policy Frameworks

Key policy frameworks reflect Russia's emphasis on integrating space activities across civilian and military domains. These include the following:

- **the 1993 Federal Law no. 5663-1, "Open Space Activities,"** which establishes the principles and guidelines governing activities of its national space program
- **Space Activities of Russia for 2013–2020**, the State Program—now extended to 2036—that defines major priorities for maintaining Russia's leadership in key space activities.[206]

These frameworks highlight space technologies' broad use across civil, military, and commercial sectors, often using the term *dual use* (*dvoinoe naznachenie*). The Federal Law ties space policy directly to Russia's national security, and the State Program connects dual-use space systems to key national aims, including guaranteed space access, leadership in manned spaceflights, and meeting international obligations, such as operating the Russian ISS segment.

Primary Domestic Space Stakeholders

The Federal Law establishes the Kremlin as the primary decisionmaker on Russia's space objectives and policies.

Roscosmos (the State Corporation for Space Activities) leads the implementation of Russia's State Program and oversees both civilian and military space efforts.[207] Formed in 2015 from the merger of the Federal Space Agency and United Rocket and Space Corporation, Roscosmos reestablished state control over the space sector after post-Soviet

[206] Government of the Russian Federation, "Space Activities of Russia, 2013–2036," Order No. 194-r, February 3, 2025.

[207] Government of the Russian Federation, "About the State Corporation for Space Activities 'Roscosmos,'" Federal Law No. 215-FZ, July 13, 2015.

privatization efforts faltered. Modeled on Russia's management of other strategic sectors, including nuclear, gas, and defense production, it now functions as a national space champion.[208] Significant private players include RSC Energia, the primary ISS contractor; Khrunichev Space Center, producer of Proton M and Angara rockets; and Progress Rockey Space Center, producer of Soyuz launch vehicles.[209]

Examples of Civilian and Military Applications of Dual-Use Space Systems

Russia possesses many dual-use technologies, including GNSS systems (GLONASS), SATCOM and EO/ISR satellites, spacecraft, launch vehicles and complexes, and rocket engines.

Additional notable domestically sourced technologies include a space debris–clearing laser system by Precision Instrument Systems and a nuclear-powered rocket by the Keldys Research Center.[210] While these novel systems illustrate the strength of Russia's research and development base and its occasional ability to produce important world-class technologies, historical shortfalls suggest that Russia might prioritize dual-use capabilities that are less focused on high-end technology.[211]

International Considerations

International Partnerships

Although Russia is a major ISS partner, it announced its departure in 2022 after its invasion of Ukraine and has confirmed cosmonauts will stop any collaborations by 2028.[212]

At times, Russia has turned to China for space collaboration, including in emerging technologies. The two countries jointly established a secure 3,800-km quantum communication channel using the Mozi satellite, enabling the exchange of quantum keys and encrypted images

[208] Seonhee Kim, "Russia," Space Policy and Research Center at the University of Washington, June 2020.

[209] Skybrokers, "RSC Energia," webpage, undated-b; RocketLaunch.org, "Khrunichev State Research and Production Space Center Overview," webpage, undated-a; RocketLaunch.org, "Progress Rocket Space Center Overview," webpage, undated-b; Space Foundation, "Russian Rocket Engines Used by the United States," fact sheet, undated.

[210] Kim, 2020.

[211] Jeff Foust, "Russia Commits to ISS Extension to 2028," *SpaceNews*, April 27, 2023; Bruce McClintock and Mélusine Lebret, "Russian Space Strategy and Capabilities: A Tale of Decline," in Alessandro Gili, ed., *The Sky Is Not the Limit: Geopolitics and Economics of the New Space Race*, 2024.

[212] Bruce McClintock and Jan Osburg, "Russia's Withdrawal from the ISS: Another Sign of Its Space Decline?" RAND Corporation, August 4, 2022; Mike Wall, "Russia Agrees to Stay Aboard International Space Station Through 2028," Space.com, April 27, 2023.

between ground stations. This partnership underscores the potential of satellite-based quantum networks to advance data security and counter cyberthreats.[213]

Promoting International Norms

Russia's approach to international norms on dual-use space systems remains ambiguous; it simultaneously advocates for treaty-based mechanisms to regulate weaponization in space while resisting normative frameworks that could constrain its own capabilities.

To offset gaps in its space capabilities relative to the United States, Russia has used international forums to shape space governance. In 2008, it joined China in proposing a UN resolution to ban space weapons—blocked by the United States—which some analysts view as an effort to "level the playing field in the space weaponization race."[214] More recently, Russia led opposition to the OEWG's final report adoption and opposed a UNGA resolution allowing for follow-on sessions in 2025 and 2026. Instead, Russia, China, and several like-minded nations have driven the formation of a separate, parallel OEWG to push for a treaty-based approach.[215]

Since 1969, primarily under the auspices of providing power for radar ocean reconnaissance satellites serving both civilian and military functions, Russia has launched more than 30 nuclear reactors into space—exceeding the efforts of any other nation to date. This ongoing activity makes Russia the leading authority in space nuclear power, giving it significant influence over the creation of international norms and governance for nuclear activities in space.[216] Because the country is not bound by current safety, licensing, and transparency protocols, this situation is uniquely able to set precedents and strategic standards, potentially steering global practices in ways that could undermine collective security and regulatory strength.

[213] Anton Denisenko, "Russia and China Have Created a Secure Satellite Quantum Communication Channel 3,800 km Long," CNews, April 2, 2024.

[214] Kim, 2020. The 2008 UN resolution was the Treaty on Prevention of the Placement of Weapons in Outer Space, and of the Threat or Use of Force Against Outer Space Objects.

[215] UNGA, "Consensus Scuttled in First Committee over Two Competing Draft Resolutions on Space Security, Creating Parallel Processes, Polarization, Say Speakers," press release, October 31, 2023c.

[216] Pavel Luzin, "Russia's Approach to Nuclear Power in Outer Space," *Eurasia Daily Monitor*, Vol. 18, No. 92, Jamestown Foundation, June 9, 2021.

Iran

Iran's space policy blends civilian and military aims, emphasizing dual-use systems to advance strategic goals. While currently developing a national space law, the Iranian Space Agency (ISA) and the Supreme Space Council maintain central oversight of space activities. Systems like SLVs and reconnaissance satellites highlight Iran's growing capabilities but raise international concerns over military uses and missile development, fueling geopolitical tensions.

Domestic Factors

Domestic Space Policy Frameworks

Iran's approach to dual-use space systems aligns closely with its broader strategic objectives at both domestic and international levels. As key element of this strategy, national leaders view the formation of a new national space law as essential for advancing the space sector across public and private domains. Still under development, the law is intended to establish a clear regulatory framework guiding Iran's civilian and military space activities globally.[217]

Iran has focused on crafting an approach to space that enhances the ISA's capabilities, clarifies the agency's interaction with the defense sector, and defines the private sector's role.

Primary Domestic Space Stakeholders

The ISA and its attached Iranian Space Research Centre, both under the aegis of the Supreme Space Council, are pivotal in implementing policies and drafting the in-progress space law aimed at integrating domestic advancements with international commitments. Officially, the council, chaired by the president, sets the overarching policy and strategic direction, ensuring alignment with international treaties and such forums as COPUOS.

The Supreme Space Council manages Iran's strategic space operations framework. The Ministry of Communications and Information Technology oversees integrating military and civilian efforts at the policy level and encourages private sector engagement. Under this supervision, the country has developed multiple satellite launch facilities, such as the Imam Khomeini Spaceport and the Shahrud Space Agency, which support both civilian and military space missions. These facilities also allow private actors, such as the Omid Faza Company, to launch locally rather than use Russia's Vostochny Cosmodrome, as Iran did for the Koswar

[217] Cabinet of the Islamic Republic of Iran, "Statute of the Iranian Space Agency," June 11, 2005.

and Hodhod satellites in 2024.[218] The Islamic Revolutionary Guard Corps (IRGC), a significant actor in this strategy's military aspects, is affiliated with the Self-Sufficiency Jihad Organization, which has been instrumental in launching Iran's satellite and missile technology.[219]

Examples of Civilian and Military Applications of Dual-Use Space Systems

Iran's space program features several dual-use systems with both civilian and military applications, which have prompted international apprehension, particularly because of the limited transparency surrounding the reality and aims of those hybrid space operations. The IRGC launched the Noor satellite in 2020 using the Qased SLV, highlighting potential links to Iran's ballistic missile development.[220] SLVs Qased, Safir, and Simorgh can be repurposed for missile use, contributing to escalation risks given the lack of transparent mission intents.[221]

Additionally, Iran has launched communication and remote-sensing satellites, such as Omid, Rasad-1, Fajr, and Dousti. Though officially civilian, these systems have reconnaissance and strategic applications. Satellites like Payam, Dousti, and Amir Kabir also possess potential military utility, particularly in reconnaissance and strategic planning.[222]

In January 2025, Iran announced plans to launch the Martyr Soleimani satellite constellation to support the Internet of Things, aiming to deploy 20 satellites and broader plans to boost Iran's technological prowess. The move comes amid intensifying concerns about the overlap between Iran's space and missile programs.[223]

Although Iran maintains that its space activities are peaceful, the dual-use nature of its technology—and therefore potential military applications—has alarmed the United States and its allies. France, Germany, and the UK have expressed concern about missile tests involving technology similar to that used in long-range ballistic systems.[224]

[218] Rasanah International Institute for Iranian Studies, "Iran's Space Program: Timeline and Technology," webpage, April 29, 2020.

[219] Ben Rezaei, Ria Reddy, Ben Schmida, Andie Parry, Carolyn Moorman, Avery Borens, Nidal Morrison, and Annika Ganzeveld, "Iran Update," Institute for the Study of War and American Enterprise Institute's Critical Threats Project, 2025.

[220] Jim Lamson and John Krzyzaniak, "To Geostationary Orbit and Beyond? Assessing Iran's Space Launch Goals and Efforts," Arms Control Wonk, April 4, 2022.

[221] Fabian Hinz, "Have Iran's Space Ambitions Taken a Worrisome New Turn?" European Leadership Network, April 24, 2020.

[222] Rasanah International Institute for Iranian Studies, 2020.

[223] "Iran Expanding Satellite Program Amid Global Concerns over Military Implications," *Iran International*, January 12, 2025.

[224] "Iran to Have Meeting with European Troika in Coming Weeks," Mehr News Agency, February 26, 2025.

International Considerations

International Partnerships

In recent years, Iran has conducted joint-space ventures with such countries as Russia (for instance, launch of two Iranian satellites via a Russian Soyuz rocket in 2024), China, and North Korea, as well as such organizations as the Asia-Pacific Space Cooperation Organization and some members of the Organization of Islamic Cooperation.[225]

Promoting International Norms

Iran has frequently adopted collaborative and peaceful rhetoric at COPUOS. However, its national space strategy has drawn international scrutiny for involving a complex network of actors and a strategic intent that remains opaque and subject to change.[226]

In 2023, Iran demonstrated its opposition to governing the use of dual-use space systems through a normative approach by backing Russia in blocking the agreement of a final report from the OEWG on responsible space behaviors. It similarly joined China, Russia, North Korea, and a few others in voting against the UK-led UNGA resolution to establish further OEWG sessions for 2025 to 2026, instead supporting the Russian and Chinese-led initiative for a separate OEWG process to discuss a treaty banning placement of weapons in outer space.[227]

United Arab Emirates

The UAE's space policy balances peaceful use with dual-use potential, aligning military use with sustainable development goals under its National Space Strategy 2030. Both government agencies and private firms support UAE space operations. Such programs as its global navigation satellite system demonstrate how dual-use systems advance civilian innovation and military resilience and strengthen the UAE's role in the global space sector.

[225] Gabriel Honrada, "A Space Quad: Russia, China, North Korea and Iran," *Asia Times,* June 28, 2024.

[226] Permanent Mission of the Islamic Republic of Iran to the United Nations Office and Other International Organizations in Vienna, "Statement by the Delegation of the Islamic Republic of Iran, the Sixty-First Session of the Scientific and Technical Subcommittee of COPUOS, Agenda Item 12: Future Role and Method of Work of the Committee," February 2, 2024.

[227] Theresa Hitchens, "UN Takes 'Parallel' Paths on Space Security Amid Geopolitical Rift," Breaking Defense, November 8, 2023.

Domestic Factors

Domestic Space Policy Frameworks

The UAE has articulated a clear dual-use stance on its space capabilities, with both national and international dimensions. Relevant frameworks include the following:

- **National Space Strategy 2030**, outlining objectives and initiatives guiding UAE public and private space investments through 2030[228]
- **the 2019 Federal Law No. 12**, which aligns the UAE space sector with treaties, encourages private investment, and addresses safety, liability, permitting, and debris mitigation.[229]

At the national level, the UAE subtly navigates the dual-use paradigm by aligning its national ambitions with a commitment to the peaceful use of space while simultaneously laying the groundwork for potential military applications. Space Strategy 2030 emphasizes that advanced military uses align with sustainable development goals.[230] It also describes how assets categorized as military in the Old Space sector—such as systems performing EO, PNT, and ADR—shift from being institutional to being integral to the New Space commercial models.

Primary Domestic Space Stakeholders

The UAE Space Agency, which operates principally through the Mohammed bin Rashid Space Center and the National Space Science and Technology Center, serves as the UAE's primary domestic stakeholder in space affairs. The agency oversees the nation's space strategy, regulatory framework, and various government entities responsible for coordinating dual-use space activities under Federal Law No. 12.[231]

The UAE's space sector reflects the country's broader strategy of promoting peaceful space use while retaining dual-use potential. Such firms as Al Yah Satellite Communications (Yahsat) and its subsidiary Thuraya operate under commercially oriented models, yet their capabilities support both civilian services and potential defense applications.[232]

[228] UAE Space Agency, *National Space Strategy 2030*, March 2019.

[229] UAE Official Gazette, On the Regulation of the Space Sector, Federal Law No. 12 of 2019, December 19, 2019.

[230] UAE Space Agency, 2019.

[231] UAE Official Gazette, 2019.

[232] UAE Space Agency, "UAE Shaping Future of Earth Observation, Satellites and Space Exploration," UAE Space Agency blog, March 2, 2020.

Examples of Civilian and Military Applications of Dual-Use Space Systems

The UAE's Global Navigation Satellite Systems-Augmentation System program, led by the National Space Science and Technology Center, aims to augment existing GNSS systems, such as the Global Positioning System (GPS) and Galileo, using a LEO CubeSat constellation. This dual-use initiative enhances navigation accuracy and resilience for civilian applications (such as autonomous vehicles, drones, and precision farming) while also addressing military needs (such as cybersecurity and countering jamming or spoofing threats).[233]

International Considerations

International Partnerships

Since initiating its national space agency in 2014, the UAE has participated in numerous international partnerships, such as signing the Artemis Accords, developing EO capabilities with South Korea, and launching the Mars exploration mission with the United States.[234] These efforts reflect its policy of maintaining the peaceful use of space and supporting disarmament and nonproliferation efforts.

Promoting International Norms

Internationally, the UAE has consistently supported COPUOS and its subcommittees, notably during its 2022–2023 chairmanship, and led the creation and chaired the SSA Expert Group in 2025. The UAE has emphasized dialogue and cooperation to leverage space technologies for societal benefit while addressing regulatory challenges posed by rapid technological change.[235] It has also emphasized the importance of space sustainability, security, and accessibility, as highlighted in the twice-hosted Abu Dhabi Space Debate, which has sought to foster global dialogue on pressing space issues.[236]

[233] UAE Space Agency, "Global Navigation Satellite Systems—Augmentation System (GNSSaS)," webpage, undated-b.

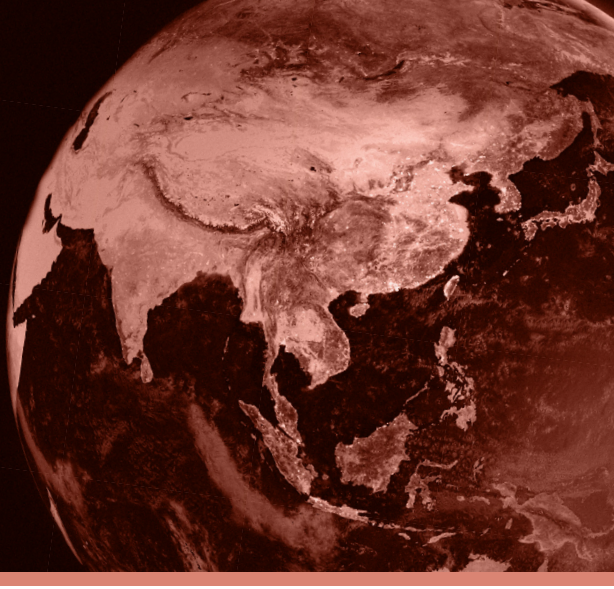
[234] UAE Space Agency, "About the Space Agency," webpage, undated-a; Hubert Foy, "EIAST: The United Arab Emirates Space Program," *Space Safety Magazine*, October 13, 2014; Karin Zeitvogel, "U.S. Partnership Helps UAE Achieve Soaring Success in Space," *Washington Diplomat*, April 8, 2024.

[235] UAE Space Agency, "UAE Hands Over COPUOS Chairmanship to Arab Republic of Egypt," press release, June 20, 2024a.

[236] UAE Space Agency, "Abu Dhabi Space Debate 2024: International Collaboration, Space Sustainability, and Governance at the Forefront of Discussions on the Future of Space," press release, December 16, 2024b.

CHAPTER 4

Indo-Pacific



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The Indo-Pacific region lacks a unified space strategy, yet its leading spacefaring nations are rapidly advancing dual-use space systems to support defense, economic growth, and geopolitical influence. The region features diverse development models; China and India favor state-led models, Japan promotes private sector innovation under regulatory reform, and Australia employs a hybrid civil-military-commercial approach. Despite these variations, the select countries recognize space as a strategically vital domain, reflected in expanding military units, domestically sourced launch programs, and government-backed commercialization. The region also plays a key role in shaping global space governance through multilateral engagement, national regulation, and strategic technology partnerships, particularly with the United States.

Key themes that define the Indo-Pacific's approach to dual-use space systems include the following:

1. **National policy ambiguity and divergence.** Most states do not explicitly define dual-use systems in national space policies yet actively develop and deploy technologies with both civilian and military utility. States commonly frame capabilities publicly in terms of peaceful use, even as their potential military applications grow.

2. **Diverse institutional structures and stakeholders.** The region's stakeholders range from centralized entities, such as in China and India, to hybrid civil-military units. Commercial firms, especially in India and Japan, are increasingly integrated into defense-adjacent supply chains.
3. **Strategic partnerships and technology exchange.** Bilateral and multilateral cooperation is a key enabler of dual-use capacity-building in the Indo-Pacific. The U.S.-led Artemis Accords, Japan-U.S. SDA collaborations, and U.S.-India defense technology initiatives reflect the blending of commercial and security goals through trusted alliances.
4. **Commitment to space norms and transparency.** Although these states advocate for peaceful space use and participation in international norm-setting, their operational investments, such as ISR constellations or responsive launch systems, underscore the strategic tensions between transparency and deterrence.

China

China's space activities often rely on inherently dual-use technologies because of the close integration of its civilian and military space institutions, the dominance of state-owned industry, and the central role of military-linked research organizations. On the global stage, China actively promotes the adoption of its dual-use systems, maintains extensive global partnerships through such technologies, and publicly advocates for peaceful space use.

Domestic Factors

Domestic Space Policy Frameworks

Despite the dual-use characteristics of China's space endeavors, official documents do not always explicitly adopt this language to characterize them. China's most recent **five-year plan** and most recent **official space white paper** do not use the term *dual use*.[237] However, its **official**

[237] "Outline of the People's Republic of China 14th Five-Year Plan for National Economic and Social Development for Long-Range Objectives for 2035" ["中华人民共和国国民经济和社会发展第十四个五年规划和2035年远景目标纲要"], Xinhua News Agency [新华社], March 12, 2021; State Council Information Office of the People's Republic of China, "China's Space Activities in 2021" ["2021中国的航天"], January 28, 2022a.

export control regulations define *dual use* as "goods, technologies and services that have both civilian and military uses or help enhance military potential."[238]

One of China's main initiatives that fosters collaboration between civilian and military sectors is its military-civil fusion (MCF) strategy—China's state "program and plan to leverage all levers of state and commercial power to strengthen and support" the PLA.[239] Central government policy specifically highlights China's space sector as a key area for developing MCF, advocating for major MCF projects, including heavy-lift launch vehicles, space nuclear propulsion systems, deep space exploration, and on-orbit servicing and maintenance systems for spacecraft.[240]

Primary Domestic Space Stakeholders

The state-owned Aerospace Science and Technology Corporation leads China's major space programs, including the Long March rockets and Beidou navigation system.[241] The China Aerospace Science and Industry Corporation, another key defense enterprise, also prioritizes space systems.[242]

In recent years, an increasingly burgeoning Chinese space industry has focused on such technologies as satellites and reusable rockets and launch vehicles. Key commercial players include LandSpace, iSpace, Galactic Energy, Deep Blue Aerospace, and Origin Space.[243]

Examples of Civilian and Military Applications of Dual-Use Space Systems

MCF-related funding supports dual-use space system development, including the Long March-9 heavy launch vehicle, and a spacecraft on-orbit service and maintenance system.[244]

[238] State Council of the People's Republic of China [中华人民共和国国务院], "Regulations on the Export Control of Dual-Use Items of the People's Republic of China" ["中华人民共和国两用物项出口管制条例"], December 1, 2024.

[239] Alex Stone and Peter Wood, *China's Military Civil-Fusion Strategy: A View from Chinese Strategists*, China Aerospace Studies Institute, 2020, p. 2.

[240] General Office of the State Council [国务院办公厅], "Opinions of the General Office of the State Council on Promoting the Deep Development of Military-Civilian Integration in National Defense Science and Technology Industry" ["国务院办公厅关于推动国防科技工业军民融合深度发展的意见"], December 4, 2017.

[241] China Aerospace Science and Technology Corporation, "Space Systems," webpage, undated-b.

[242] China Aerospace Science and Industry Corporation Limited [中国航天可供集团有限公司], "Main Business Areas" ["主业领域"], webpage, undated.

[243] Giulia Interesse, "China's Space Economy: Unlocking Opportunities in Aerospace and Commercial Space Industries," *China Briefing*, February 4, 2025; Andrew Jones, "China Launches Commercial Asteroid Hunter and 3 Other Satellites into Space," Space.com, June 14, 2021.

[244] Additional projects include a space-Earth integrated information network megaproject and next-generation space infrastructure (Stone and Wood, 2020, pp. 97–98).

China has further invested heavily in dual-use space capabilities, including the following:

- **SSA:** Optical and infrared telescopes, radar arrays, and laser ranging systems support both space safety and potential counterspace operations.[245]
- **EO/ISR:** The China High-Resolution Earth Observation System (CHEOS) constellation and Yaogan satellites, used for land mapping and disaster monitoring, also enable military surveillance and strategic reconnaissance.[246]
- **PNT:** The BeiDou system offers civilian PNT services while providing jam-resistant, encrypted military communication and navigation capabilities.[247]
- **Launch services:** The Long March rocket series supports both civilian exploration and military satellite deployment, with commercial launch activities tied to state oversight.[248]
- **ADR and RPO:** Systems like Shijian-21 and Tiangong robotic arms enable debris mitigation but could also be used to disable or disrupt foreign satellites.[249]
- **Planetary defense:** Planned kinetic impactor tests for asteroid deflection could be adapted for counterspace applications involving physical attacks on satellites.[250]

[245] "China Develops Cutting-Edge Observatory on 'Roof of the World,'" Xinhua, May 10, 2023; "China's Sky Survey Telescope Finds Two Near-Earth Asteroids," Xinhua, November 29, 2023; Zhao Juecheng, "China Begins Phase-II Construction on Far-Reaching Radar System, to Boost Defense Against Near-Earth Asteroid Impact," *Global Times*, February 14, 2023; Kristin Burke, "Where Are the PLA's Other Laser Dazzling Facilities?" China Aerospace Studies Institute, June 2023; Brian G. Chow and Henry Sokoski, "U.S. Satellites Increasingly Vulnerable to China's Ground-Based Lasers," *SpaceNews*, July 10, 2020.

[246] China National Space Administration, "China High-Resolution Earth Observation System (CHEOS)," webpage, May 31, 2022; Ministry of Science and Technology of the People's Republic of China, "Major National Science and Technology Projects Fill in Strategic Blanks," *Science and Technology Daily*, undated; "China to Boost Satellite Services, Space Technology Application," *People's Daily Online*, January 29, 2022; China Aerospace Science and Technology Corporation [中国航天科技集团], "China Aerospace Science and Technology Corporation: Long March-4B Rocket Launch Successful! Gaofen-11: 'Five Stars Shine Bright'" ["长四乙火箭发射成功! 高分十一号'五星高照"], July 19, 2024.

[247] Andrew Erickson and Amy Chang, "China's Navigation in Space," *Proceedings*, Vol. 138, No. 4, U.S. Naval Institute, April 2012; Rumi Aoyama, "China's Dichotomous BeiDou Strategy: Led by the Party for National Deployment, Driven by the Market for Global Reach," *Journal of Contemporary East Asia Studies*, Vol. 11, No. 2, 2022; David H. Millner, Stephen Maksim, and Marissa Huhmann, "BeiDou: China's GPS Challenger Takes Its Place on the World Stage," *Joint Force Quarterly*, No. 105, April 2022; Sarah Sewall, Tyler Vandenberg, and Kaj Malden, *China's BeiDou: New Dimensions of Great Power Competition*, Belfer Center for Science and International Affairs, Harvard Kennedy School, February 2023.

[248] Andrew Jones, "Long March 5 Rolled Out for July 23 Launch of China's Tianwen-1 Mars Mission," *SpaceNews*, July 17, 2020.

[249] Colin Clark, "US, China, Russia Test New Space War Tactics: Sats Buzzing, Spoofing, Spying," Breaking Defense, October 28, 2021; Margaret Davis, "China's Tiangong Space Station Shows How Its Massive Robotic Arm Can Crawl Across the Spacecraft," *Science Times*, last updated February 16, 2022.

[250] "China to Implement Near-Earth Asteroid Defense with Combined Observation, Impact," Xinhua, September 5, 2024; Amanda Kerrigan, Jan Osburg, Jonathan Cham, and Yvonne K. Crane, *Planetary Defense amid Strategic Competition: A Comparative Study of the Past, Present, and Future of the United States' and China's Planetary Defense Efforts*, RAND Corporation, 2025, Not available to the general public.

International Considerations

International Partnerships

China maintains extensive space-related cooperation with other countries, including in personnel exchanges, crewed spaceflight, and deep space exploration.[251] The country advances dual-use space cooperation through development and deployment efforts tied to the Belt and Road Initiative (BRI) and organizations in which it holds a leading role, including the Asia-Pacific Space Cooperation Organization, BRICS, the Group of 20 (G20), and the Shanghai Cooperation Organization.[252]

Other Chinese global partnerships involve the expansion of BeiDou's satellite navigation system, marked by cooperation with the League of Arab States and the African Union, and the completion of the first BeiDou center in Tunisia in 2018.[253] Through the BRI, China has constructed the BRI Space Information Corridor, spanning 65 countries and involving a network of satellites and ground stations to develop space-based information services.[254]

Promoting International Norms

China participates in international forums and plays a central role managing space affairs in the UN.[255] China has repeatedly reiterated its positions that the peaceful use of outer space is an equal right of all countries and that it rejects the weaponization of outer space.[256] To this end, China has sponsored several draft UN resolutions aiming to prevent an orbital arms race and has worked with Russia on this effort.[257]

[251] State Council Information Office of the People's Republic of China, 2022a.

[252] Meia Nouwens, "China's Dual-Use Space Sector Goes Global," International Institute for Strategic Studies, July 17, 2025.

[253] Xiang Bo, "BeiDou Navigation System Guides China-Arab Cooperation on 'Space Silk Road,'" Xinhua, April 2, 2019.

[254] Asia-Pacific Space Cooperation Organization, "Development Vision 2030 of the Asia-Pacific Space Cooperation Organization," November 14, 2018; State Council Information Office of the People's Republic of China, 2022a; Xiang, 2019; Jiang Hui, "The Spatial Information Corridor Contributes to UNISPACE + 50," briefing slides, China National Space Administration, undated

[255] State Council Information Office of the People's Republic of China, 2022a.

[256] Ministry of Foreign Affairs of the People's Republic of China, "The Global Security Initiative Concept Paper," February 21, 2023; State Council Information Office of the People's Republic of China, 2022a.

[257] These treaties include UNGA, "Prevention of an Arms Race in Outer Space," A/C.1/76/L.3, October 4, 2021a; UNGA, "No First Placement of Weapons in Outer Space," A/C.1/76/L.50, October 14, 2021c; UNGA, "Further Practical Measures for the Prevention of an Arms Race in Outer Space," A/C.1/76/L.53, October 14, 2021b; and UNGA, "International Cooperation in the Peaceful Uses of Outer Space," A/RES/77/121, December 12, 2022b. This is covered in unpublished RAND research and in Kevin Pollpeter, Elizabeth Barrett, Jeffrey Edmonds, Amanda Kerrigan, and Andrew Taffer, *China-Russia Space Cooperation: The Strategic, Military, Diplomatic, and Economic Implications of a Growing Relationship*, China Aerospace Studies Institute, May 2023, pp. 33–35.

China supports initiatives that enhance trust and transparency among spacefaring nations.[258]

China has further engaged in international forums dedicated to specific space issues, such as space debris, cooperating in the Space Debris Work Group of China-Russia Space Cooperation Sub-Committee and the Sino-U.S. expert Workshop on Space Debris and Space Flight Safety.[259]

India

India's approach to dual-use space systems reflects a pragmatic shift integrating civil, commercial, and military goals. Although it rhetorically promotes transparency and international cooperation, India's space operations suggest a security and strategic alignment. Rising private sector involvement, deeper U.S. security ties, and a strong national security orientation feature in India's approach to space power.

Domestic Factors

Domestic Space Policy Frameworks

India's space strategy reflects a deliberate effort to integrate dual-use systems into both civil and defense frameworks. The **2023 Space Policy** frames the space domain as a key driver of socioeconomic development, scientific exploration, and commercial opportunity while also acknowledging that dual-use capabilities are essential to national defense and deterrence.[260] Describing the weaponization of space as inevitable, India's Chief of Defense Staff General Anil Chauhan called developing dual-use systems a national imperative, reflecting a broader shift in India's defense doctrine that views space as an extension of terrestrial military operations.[261]

Primary Domestic Space Stakeholders

The Indian Space Research Organisation (ISRO), India's principal research and development arm of its Department of Space (DoS), is the primary anchor of India's domestic space sector. Whereas DoS oversees the development of India's space policy, ISRO implements that policy through

[258] Christopher Johnson, "The UN Group of Governmental Experts on Space TCBMs," fact sheet, Secure World Foundation, updated April 2014.

[259] State Council Information Office of the People's Republic of China, 2022a.

[260] Indian Space Research Organisation, Department of Space, *Indian Space Policy—2023*, 2023a.

[261] "War in Space a Possibility, Need to Develop Dual-Use Platforms in That Domain: CDS Chauhan," *Economic Times*, last updated April 11, 2023

the development and deployment of space capabilities, including dual-use space systems.[262] Complementing ISRO, the Indian Ministry of Defence's Defence Space Research Organisation and Defence Space Agency develop and integrate space capabilities into joint military operations.

Commercially, private companies, such as Skyroot Aerospace and Agnikul Cosmos—key players in the domestic launch market—directly support India's strategic space objectives.[263] Operating under India's DoS, the Indian National Space Promotion and Authorization Centre serves as a regulatory body to facilitate the Indian space sector participation while providing approvals and oversight for space-related activities undertaken by nongovernmental entities.[264] This burgeoning commercial and manufacturing ecosystem is further reinforced by the broader Make in India initiative, which has sought to strengthen domestic production capabilities across high-tech sectors, including space and geospatial technologies.[265] Through targeted investment incentives, this program has accelerated the growth of Indian satellite manufacturing and private sector launch capabilities, helping underpin important milestones, such as Skyroot's suborbital Vikram-S launch.[266]

Examples of Civilian and Military Applications of Dual-Use Space Systems

Though often positioning its space systems as peaceful, India's approach to space involves developing assets with both civilian and military utility. Examples include the following:

- **SATCOM:** The GSAT-7 series, India's foray into dedicated military communication satellites, offers enhanced communication and operational coordination within India's defense forces. These satellites may additionally serve civilian applications.[267]

[262] Arindrajit Basu, review of *From Fishing Hamlet to Red Planet: India's Space Journey*, ed. by P. V. Manoranjan Rao, *Astropolitics*, Vol. 14, Nos. 2–3, 2016.

[263] Swati Bharadwaj, "Skyroot Successfully Test Fires 3rd Stage of Vikram-1 Rocket," *Times of India*, April 7, 2025; Sibu Kumar Tripathi, "Agnikul Launches Agnibaan with India's First 3D-Printed Rocket Engine," *India Today*, May 30, 2024.

[264] Namrata Goswami, "India's Space Policy and National Security Posture: What Can We Expect?" *Space Review*, April 24, 2023.

[265] EY India, "The Dawn of the Space Economy in India," Ernst and Young, November 4, 2022

[266] Dimitrios Stroikos, "India's Space Policy: Between Strategic Autonomy and Alignment with the United States," Council on Foreign Relations, June 5, 2025.

[267] Indian Space Research Organisation, Department of Space, "About ISRO," webpage, last updated July 17, 2023b.

- **Launch services:** Polar Satellite Launch Vehicle, a versatile launch vehicle developed by ISRO, launches satellites with surveillance and reconnaissance functions, underscoring its strategic significance.[268]
- **In-orbit docking:** Space Docking Experiment, pioneering ISRO initiative aimed at demonstrating in-orbit docking capabilities, successfully achieved docking in 2025, marking India as the fourth nation to accomplish this feat.[269]

International Considerations

International Partnerships

India's recent U.S. partnerships signal a strategic shift toward deeper technological cooperation. Projects like the Network for Space Object Tracking and Analysis (NETRA) for SSA and new radar and optical tracking systems address civilian needs while strengthening India's capacity to monitor and respond to space threats.[270]

The 2025 U.S.-India summit launched the Catalyzing Opportunities for Military Partnership, Accelerated Commerce and Technology (COMPACT) and Transforming the Relationship Utilizing Strategic (TRUST) initiatives.[271] These frameworks aim to ease technology transfer and boost joint commercial and security ventures. Flagship projects, such as the NASA-ISRO Synthetic Aperture Radar (NISAR) mission, demonstrate how scientific collaboration advances strategic objectives.[272]

Promoting International Norms

India promotes international norms related to dual-use space systems through a blend of treaty commitments, transparency measures, and strategic diplomacy. As a signatory to foundational treaties, such as the OST, Rescue Agreement, Liability Convention, and Registration

[268] Andrew Jones, "India Launches Space Docking Experiment with PSLV rocket, Advancing Major Ambitions," *Space News*, December 30, 2024; Indian Space Research Organisation, Department of Space, "PSLV," webpage, last updated September 21, 2023c.

[269] Nivedita Bhattacharjee, "India Achieves Milestone as Fourth Nation to Succeed in Space Docking," Reuters, January 22, 2025.

[270] Madhumathi D. S., "ISRO Initiates 'Project NETRA' to Safeguard Indian Space Assets from Debris and Other Harm," *The Hindu*, updated September 24, 2019.

[271] White House "United States–India Joint Leaders' Statement," February 13, 2025.

[272] White House, 2025.

Convention, India affirms a commitment to responsible space behavior and engages actively in COPUOS, particularly regarding debris mitigation and long-term sustainability.[273]

ISRO participates in and adheres to the Inter-Agency Space Debris Coordination Committee guidelines and voluntarily publishes SSA data.[274] The NETRA initiative, which tracks space objects and contributes data, reflects India's commitments to norms-based space behaviors and transparency.[275] However, India's 2019 ASAT test introduced complexity and ambiguity surrounding these commitments.[276] The Ministry of External Affairs argued that the test's low-altitude design sufficiently limited the potential for long-term debris and was therefore aligned with India's commitment to not weaponize space.[277] Historically, international regulatory regimes, such as the U.S.-led MTCR, have constrained India's space engagement, although this is gradually shifting as geopolitical alignments evolve.[278] As a result, India's strategic approach to space increasingly balances national security interests with a commitment to global norms.

Japan

Japan's approach to outer space reflects its transition from a strictly peaceful, civilian-focused framework to one integrating security and defense considerations. By advancing dual-use systems, engaging commercial actors, and fostering partnerships (particularly with the United States), Japan is adapting to emerging threats while contributing to regional security. Embracing efforts to advance transparency and international cooperation, Japan's evolution into a space power is defined by its balancing of peaceful norms with practical defense needs.

[273] Delegation of India, "Agenda Item No. 10: General Exchange of Information and Views on Legal Mechanisms Relating to Space Debris Mitigation and Remediation Measures, Taking into Account the Work of the Scientific and Technical Subcommittee," 63rd United Nations Committee on the Peaceful Uses of Outer Space, 2024; Ankita Agarwal, Bulbul Mukherjee, Amit Kandari, B. N. Ramakrishna, A. K. Anil Kumar, "Post-Mission De-Orbiting of Cartosat-2," *Advances in Space Research*, Vol. 70, No. 5, September 2022.

[274] Indian Department of Space, "Parliament Question: Space Debris Management," press release, December 4, 2024; Indian Space Research Organisation, Department of Space, "Indian Space Situational Assessment Report for 2023 Released," April 26, 2024.

[275] Tathagata Bhattacharjee, "Assam to Get ISRO Radar Capable of Tracking 10cm Objects in Space," *Times of India*, April 4, 2025.

[276] Kelsey Davenport, "Indian ASAT Test Raises Space Risks," Arms Control Association, May 2019.

[277] Ministry of External Affairs, Government of India, "Frequently Asked Questions on Mission Shakti, India's Anti-Satellite Missile Test Conducted on 27 March 2019," press release, March 27, 2019.

[278] U.S. Department of State, "Missile Technology Control Regime (MTCR) Frequently Asked Questions," fact sheet, undated; "U.S. Move to Ease Dual-Use Tech Exports to India Likely to Boost Commercial Space Cooperation Ties," *Indian Express*, January 8, 2025.

Domestic Factors

Domestic Space Policy Frameworks

Japan's shift from historically pacifist to pragmatic and national security–focused has reshaped its space strategy. Key legislative milestones in this transition include the following:

- the **1969 Act on the National Space Development Agency of Japan (NASDA)**, an early framework that explicitly restricts national space activities to exclusively peaceful purposes, interpreted domestically as nonmilitary use[279]
- the **2008 Basic Space Law**, redefining *peaceful use* to align with broader international law interpretations, allowing national security uses of space[280]
- the **2016 Space Activities Act**, which regulates spacecraft operations with purpose-specific licensing, requiring applicants to specify purposes and methods of use[281]
- **the 2021 on-orbit servicing guidelines**, which establish transparency and safety standards for high-risk space activities, such as on-orbit servicing.[282]

These and other legal reforms laid the groundwork for Japan to gradually integrate dual-use capabilities into its space program, highlighting space's rising role in its national security.[283]

Additional Japanese policy documents have acknowledged the role of dual-use systems. The **2022 National Security Strategy** urges broad use of commercial technologies for security.[284] The **2023 Basic Plan on Space**

[279] National Diet of Japan, Act on the National Space Development Agency of Japan, Act No. 50, June 23, 1969c. Three institutions—NASDA, the Institute of Space and Astronautical Science, and the National Aerospace Laboratory of Japan—were merged into the Japan Aerospace Exploration Agency (JAXA) in 2003.

[280] National Diet of Japan, Basic Space Law, Law No. 43, August 27, 2008. Discussions of the interpretation of "peaceful purposes" are indicated in National Diet of Japan, Resolution on the Principle of Space Development and Use in Japan, House of Representatives Plenary Session, No. 35, May 9, 1969a, pp. 908–912; National Diet of Japan, minutes from House of Councilors Special Subcommittee for the Promotion of Science and Technology, No. 7, May 15, 1969b, pp. 1–2; National Diet of Japan, minutes from House of Representatives Budget Committee, No. 4, February 5, 1985a, pp. 3–4; National Diet of Japan, minutes from House of Representatives Budget Committee, No. 5, February 6, 1985b, pp. 3–4; and National Diet of Japan, minutes from House of Representatives Budget Committee, No. 3, December 8, 1998, pp. 20–22.

[281] The Japanese government has not shown any movement toward legislation explicitly focused on the dual use of space. It indicates that it is unnecessary to have a special legal system dedicated to dual use because it is possible to identify and govern it from the purposes and methods of use of the spacecraft under the "general licensing system" related to the control of spacecraft (National Diet of Japan, Act on Launching Spacecraft and Launch Vehicle and Control of Spacecraft, Act No. 76, November 16, 2016; National Space Policy Secretariat, Government of Japan, *Guidelines on License Related to Control of Spacecraft*, version 2.2, last updated February 27, 2025).

[282] National Space Policy Secretariat, Government of Japan, *Guidelines on a License to Operate a Spacecraft Performing On-Orbit Servicing*, November 10, 2021.

[283] National Diet of Japan, Law Concerning Japan Aerospace Exploration Agency, Act 161, December 13, 2002. The strict peaceful purposes restriction on JAXA's activities was eased by the 2012 amendment.

[284] National Security Council of Japan, *National Security Strategy of Japan*, December 2022.

Policy aims to create a cycle in which commercial space technology boosts both industry growth and defense capabilities.[285] The **2023 Space Security Initiative** emphasizes support for deploying dual-use systems, including on-orbit services, small SARs, optical communications, and small rockets.[286] These frameworks reflect Japan's growing integration of civilian, commercial, and defense space efforts.

Primary Domestic Space Stakeholders

JAXA represents the primary domestic stakeholder of Japan's civilian space operations. Japan's Ministry of Defense (MOD) and Self-Defense Force (JSDF) represent the primary stakeholders overseeing the nation's military-related space missions. However, even after the Basic Space Law permitted military uses of space, MOD and JSDF are primarily consumers of civilian or commercial systems.[287]

The Cabinet Office coordinates Japan's space exploration and oversees the National Space Policy Secretariat, which operates the Quasi-Zenith Satellite System (QZSS). The Cabinet Satellite Intelligence Center manages information-gathering satellites and analyzes imagery.[288]

Japan growing space sector includes Astroscale Japan, which claims to lead the world's first mission to safely approach and identify large space debris through RPO.[289] These ADRAS-J missions underscore private industry's expanding role in Japanese security. Initially selected by JAXA for space debris removal—a largely civilian application—MOD tasked Astroscale in 2025 with devising a satellite for responsive space operations, including SDA in GEO and intelligence-gathering.[290] This example reflects Japan's awareness of dual-use risks and commitment to transparency. Licensed under on-orbit servicing guidelines, Astroscale and the Cabinet Office publicly share mission details, orbital data, and planned maneuvers; provide information to SSA organizations; and upload emergency disclosure protocols.[291]

[285] Space Development Strategy Headquarters, Government of Japan, *Basic Plan on Space Policy*, June 2023a.

[286] Space Development Strategy Headquarters, Government of Japan, *Space Security Initiative*, June 2023b.

[287] Japan's first domestically sourced defense satellite was the X-band communications satellite Kirameki in 2018. The trend of the defense use of outer space before and after the Basic Space Law is indicated in Yasuhito Fukushima, "Japan's Use of Space for Defense Purposes: Continuity and Change Before and After the Enactment of the Basic Space Law," briefing memo, National Institute for Defense Studies, March 2017.

[288] Cabinet Intelligence and Research Office, Government of Japan, "Cabinet Satellite Intelligence Center (CSICE)," webpage, undated.

[289] Astroscale, "ADRAS-J," webpage, undated.

[290] Astroscale, "Astroscale Japan Secures Contract with Japanese Ministry of Defense to Develop a Responsive Space System Demonstration Satellite Prototype," press release February 27, 2025.

[291] National Space Policy Secretariat, Government of Japan, 2021, pp. 7–8; Cabinet Office, Government of Japan, "Information and Applying for a Permission Related to the Launching of Spacecraft, etc. and License Related to the Control of Spacecraft," webpage, undated; National Space Policy Secretariat, Government of Japan, 2021, p. 8.

While commercial actors, such as Astroscale, have gained global recognition in niche areas, such as space debris removal, Japan's launch sector highlights the broader challenges that its space industry faces in achieving global competitiveness.[292] JAXA and Mitsubishi Heavy Industries (MHI) lead Japan's launch capability with the H-2A and H-2B vehicles, which boast strong reliability but remain more expensive than many international alternatives.[293] Estimates place the H-2A's per-launch cost at $70–90 million—about 50 percent higher than SpaceX's Falcon 9.[294] This cost gap has limited Japan's ability to capture commercial launch contracts, leaving the sector reliant on government contracts. Although new entrants, such as Space One, are developing small SLVs, these capabilities remain nascent.[295] Even the new H3 launcher, by JAXA and MHI, still exceeds most global competitors, despite considerable improvements in efficiency and cost.[296]

Examples of Civilian and Military Applications of Dual-Use Space Systems

Aligning with its constitutional commitment to nonmilitarism, Japan has long maintained a commitment to peaceful uses of space. However, recent developments—such as the increasing capacity of Japan's commercial space sector and its joint ventures with the United States—signify Japan's steady expansion of its civil space activities to its military sector. Recent examples in which the JSDF uses such systems include the following:

- **SATCOM:** Kirameki Satellites provide stable, weather-resistant communications.[297]
- **Meteorology:** The Himawari satellite series, operated by the Japan Meteorological Agency, provides critical data for weather prediction and disaster management.[298]
- **PNT:** The QZSS, a four-satellite constellation, enhances GPS positioning accuracy over Japan and the Asia-Oceania region.[299]

[292] Mateusz Kaczmarek, "Quiet Goodbye, Bold Hello: Japan's H3 Rocket Takes the Torch from H-2A to Slash Costs and Double Cadence," TechStock², June 29, 2025.

[293] Iwao Igarashi, "The Final Frontier: MHI's Expanding Space Business," *Spectra*, February 3, 2025.

[294] Eric Berger, "After a Decade in Development, Japan's H3 Rocket Is Ready for Its Debut," *Ars Technica*, February 15, 2023.

[295] Kantaro Komiya, "Space One's Kairos Rocket Explodes on Inaugural Flight," Reuters, March 13, 2024.

[296] For example, Falcon 9 launches cost an estimated $49 million and India's LVM3 about $63 million. JAXA and MHI aim to lower H3's per-launch costs to roughly $33 million (Kaczmarek, 2025; Tomoko Otake, "Can Japan's New H3 Rocket Compete with Elon Musk's Falcon 9?" *Japan Times,* February 20, 2024.

[297] Japanese Ministry of Defense, *2024 Defense of Japan*, 2024, pp. 288, 296–297.

[298] Japanese Ministry of Defense, 2024, pp. 288, 296–297.

[299] Quasi-Zenith Satellite System, "Frequently Asked Questions About QZSS," webpage, October 1, 2021; Ministry of Defense of Japan, 2024, pp. 288, 296–297.

- **ISR:** Information-gathering satellites provide imagery intelligence for national security purposes; commercial-imaging satellites provide data for civilian and defense needs.[300]

International Considerations

International Partnerships

Japan's national security strategy increasingly incorporates dual-use systems to enhance regional space superiority through international partnerships.[301] A key example is the Japan-U.S. collaboration on SDA initiatives. The Japan Air Self-Defense Force's Space Operations Group is actively developing SDA capabilities while collaborating with U.S. counterparts. The QZSS offers civilian navigation and transmits encrypted government signals to counter jamming and spoofing.[302]

In 2025, the QZS-6 launched with a U.S. SDA payload operated by Space Operations Command's Mission Delta 2, providing near-real-time data to the SSN and enhancing U.S. DOW awareness of the Indo-Pacific GEO regime.[303] This marked the first Japan-U.S. bilateral space security partnership and signaled closer alignment with U.S. defense priorities.

Promoting International Norms

Japan strongly supports transparency and international norms, actively promoting capacity-building efforts regionally and at the UN. Its approach to normative governance stresses safety, sustainability, and alignment with international treaty obligations. Notable initiatives include advancing the COPUOS Guidelines for the Long-Term Sustainability of Outer Space Activities, cosponsoring A/RES/75/36, and hosting the National Space Legislation Initiative to facilitate information-sharing and national policy development.[304]

Although Japan's international efforts address space broadly rather than dual use specifically, Japan recognizes the challenge of defining *dual use* in space and therefore advocates rulemaking focused on objectively assessable

[300] Japanese Ministry of Defense, 2024, pp. 288, 296–297.

[301] National Security Council of Japan, 2022, p. 25.

[302] Quasi-Zenith Satellite System, "Public Regulated Service," webpage, undated.

[303] U.S. Space Force, "Space Systems Command, Japan Launch First Bilateral Space Effort," press release, February 5, 2025.

[304] United Nations Office for Outer Space Affairs, "Guidelines for the Long-Term Sustainability of Outer Space Activities of the Committee on Peaceful Uses of Outer Space Adopted," press release, June 22, 2019; United Nations Office for Outer Space Affairs, "Long-Term Sustainability of Outer Space Activities," webpage, undated-a; UNGA, "Reducing Space Threats Through Norms, Rules, and Principles of Responsible Behaviours," A/RES/75/36, December 7, 2020; Asia-Pacific Regional Space Agency Forum, "Space Policy Law Working Group," webpage, undated.

behaviors and responsible conduct.[305] Japan's statements at the Conference on Disarmament emphasize a behavior-based approach to space threats, focusing on how space objects are used rather than their intrinsic capabilities.[306]

Australia

Australia—a relatively new and emerging player in the space domain—has adopted an approach to space that prioritizes alliance-based cooperation and responsible space behavior. It leverages its geographic advantages to provide ground-based space services, facilitating both economic and diplomatic goals. Rather than deliberately developing dual-use space capabilities, Australia assumes their eventual military use and regulates them using a patchwork of existing civil, military, export control, market access, and international regulatory frameworks.

Domestic Factors

Domestic Space Policy Frameworks

Australia lacks a unified space policy that addresses the use of dual-use space systems. However, Australia regulates dual-use technologies through export controls, including through the **Defence and Strategic Goods List**, which refers to "items generally used for commercial purposes, but with potential military and weapons of mass destruction (WMD) application."[307]

Separate policy frameworks for the civilian and military use of space technologies illustrate Australia's recognition of the dual-use nature of space technologies.[308] The **Space (Launches and Returns) Act of 2018** governs civilian space activities under the Australian Space Agency (ASA), while the **Defence Space Safety Program** regulates military space activities under the Director General of the Defence Aviation Safety Authority (DASA).[309]

[305] Historically, the difficulty of defining terms has been problematic in the space domain, and many proposals for a ban on the weaponization of outer space at the Conference on Disarmament have not come to fruition.

[306] Delegation of Japan to the Conference on Disarmament, "Statement Delivered by Ambassador OGASAWARA Ichiro, Permanent Representative of Japan to the Conference on Disarmament, Plenary Meeting of the Conference on Disarmament," March 30, 2023.

[307] Australian Department of Defence, "Defence and Strategic Goods List," webpage, undated-b.

[308] Mark Waters, "Small States in Space: Space Club Relevancy and National Interest Influence," *Journal of Indo-Pacific Affairs*, May–June 2023, pp. 27–28.

[309] Australian Government, Space (Launches and Returns) Act 2018, Federal Register of Legislation, October 21, 2023. See also Australian Space Agency, "Minister Decisions About Space Activities," webpage, undated; Defence Aviation Safety Authority, Australian Department of Defence, "DASA Appointed Defence Space Safety Regulator," October 30, 2024; Australian Department of Defence, "Defence Sets Sights on Space Safety," November 20, 2024.

Australia's domestic space governance emphasizes peaceful and responsible use, as reflected in the **2013 Satellite Utilisation Policy**, which supports rules-based access, arms control, and transparency measures.[310] These principles are embedded in such laws as the previously mentioned **Space (Launches and Returns) Act of 2018**, the **Civil Aviation Safety Regulations 1998**, and the **Radiocommunications Act 1992** and are echoed in both civil and defense strategies.[311] Public statements, including from military leadership, have underscored a commitment to avoiding space militarization.[312]

Primary Domestic Space Stakeholders

ASA, the primary authority for civilian space activities, oversees Australia's space commercial industry, provides strategic policy advice, and regulates civil space activities to ensure compliance with national and international obligations.[313]

Australia's Defence Space Command consolidates Australia's military space capabilities, including personnel from the three military services, as well as the civilian workforce.[314] Reporting to the Chief of Joint Capabilities, the Defence Space Command assures Australia's access to space by developing space capabilities and integrating space power into joint military operations.[315] Given this integration's growing importance, DASA assumed the role of Defence Space Regulator in 2022 and established a new Directorate of Space to develop and enforce safety regulations.[316] A 2023 ASA-DASA memorandum of understanding established a common approach to regulating national space activities across their respective communities.[317]

Australia's commercial sector is growing, with such companies as Gilmour Space developing Australia's first orbital launch capability and Space Machines specializing in satellite services, including the development of the Optimus Orbital Servicing Vehicle.[318]

[310] Australian Government, *Australia's Satellite Utilisation Policy*, 2013, pp. 13–14.

[311] Scott Atkins, Martyn Taylor, Holly McAdam, Jack Pembroke-Birss, and Ellen Frances James, "Global Outer Space Guide: Australia," Norton Rose Fulbright, September 2023.

[312] Australian Department of Defence, "Defence Announces Space Division," press release, May 19, 2021.

[313] Australian Space Agency, "About the Agency," webpage, undated-a. See also Australian Trade and Investment Commission, "Australian Space Industry: A Star on the Rise," January 11, 2023.

[314] The three services are the Royal Australian Air Force, the Royal Australian Navy, and the Army (Australian Department of Defence, "Joint Capabilities Group," webpage, undated-c).

[315] Adam Thorn, "Space Command Formally Launches to Joint Capabilities Group," *Defence Connect*, July 5, 2023.

[316] Australian Department of Defence, "About DASA," webpage, undated-a; Benjamin Felton, "Regulatory Changes Signal Australia's Growing Space Ambitions," Overt Defense, July 8, 2022.

[317] "Australian Space Agency Signs MoU with DASA," *Australia Defence Magazine*, March 27, 2023.

[318] "Australia's Gilmour Space Technologies Ready to Launch Maiden Eris Test Flight, the Nation's First Orbital Launch in over 50 Years," SatNews, May 8, 2025; Australian Trade and Investment Commission, "Australian Satellite on Mission to Clean Up Space Junk," March 25, 2024.

Examples of Civilian and Military Applications of Dual-Use Space Systems

Australia deploys numerous dual-use space systems, including those performing SATCOM (such as the Optus C1 communications satellite), PNT (the Southern Positioning Augmentation Network), SSA (LeoLabs' radar systems), and launches (the Woomera Range Complex).[319]

International Considerations

International Partnerships

Economic and strategic priorities drive Australia's investments in international partnerships involving dual-use space systems. Leveraging its geographic advantages, Australia has strengthened both economic and diplomatic ties by serving as a key space services provider, especially in ground-based capabilities, for allies and partners.[320]

The Deep Space Advanced Radar Capability in Western Australia, which will provide constant, all-weather surveillance of GEO-based objects, exemplifies trilateral collaboration with the United States and the UK.[321]

Australia also collaborates bilaterally with such partners as Japan and India, trilaterally with the United States and the UK through the AUKUS security partnership, and multilaterally through the Five Eyes intelligence-sharing alliance between the United States, Canada, Australia, New Zealand, and the UK. A deal between Sydney startup Arlula and Tokyo-based NTT Data will see Australia leveraging its EO expertise to provide satellite imagery and data to the Japanese government.[322] The International Space Investment Initiatives India Project facilitates cooperation on space projects with dual-use potential between Australia and India, including the Space Mission for Australia-India's Technology, Research and Innovation, which will integrate the two nations' capabilities for on-orbit transportation and space debris mitigation.[323]

[319] Alexander Ziegeler and Matthew McKinna, *Summary of Propulsion Technologies: Enabling Sovereign Responsive Access to Space for the Australian Defence Force*, Australian Department of Defence, 2019; Geoscience Australia, "Southern Positioning Augmentation Network (SouthPAN)," webpage, last updated March 14, 2025; Isabella Richards, "LeoLabs' Australian Radar to Exceed U.S. Capability in Space Tracking," *Space Connect*, June 14, 2022; Malcolm Davis, "Seeing Through the DARC, Deep into Space," *The Strategist* blog, December 19, 2023.

[320] Mark Waters, 2023.

[321] Lisa Sodders, "Deep Space Advanced Radar Capability Makes Tremendous Progress in First Year," U.S. Space Force, February 20, 2025.

[322] Peter Parson, "Australia, Japan Strengthen Security Through Dual-Use Tech Innovation," *Indo-Pacific Defence Forum,* March 5, 2025.

[323] Australian Space Agency, "Boosting Australian-Indian Commercial Space Partnerships," press release, April 30, 2024.

Promoting International Norms

Australia's promotion of international norms in space behavior is evident in its international engagements. Australia is proactive in multilateral governance initiatives and has a reputation as a "norms entrepreneur."[324] Among other initiatives, Australia has ratified all five UN treaties governing space activities, led space security work at the Conference on Disarmament and with the UN Disarmament Committee, helped develop A/RES/75/36, and actively participated in COPUOS and the OEWG.[325]

South Korea

South Korea's space sector reflects a growing convergence of civilian and military priorities, driven by security, economic, and technological goals. While traditionally focused on peaceful use, such developments as the Republic of Korea (ROK) Air Force's Space Operations Group and reconnaissance satellite launches reflect a shift toward dual-use capabilities. Government-led efforts remain central, but commercial actors are playing a growing role in expanding South Korea's regional space presence.

Domestic Factors

Domestic Space Policy Frameworks

South Korea's national policy is shaped by the **Fourth Basic Plan for Space Development Promotion**, released in March 2023, which emphasizes the peaceful and scientific use of outer space while also acknowledging the national security value of space systems.[326] Although the policy avoids overtly referencing "dual-use" technologies, subsequent government actions, which include establishing the Air Force's Space Operations Group, reflect growing recognition of space as a contested domain.[327]

[324] Cassandra Steer, "Australia's Maturing Space Capabilities in a National and Regional Context," *Asia Policy*, Vol. 19, No. 4, October 2024, p. 79.

[325] Australian Space Agency, *State of Space Report 1 July 2020–30 June 21*, April 2022, pp. 26–27.

[326] Prior iterations were released in 2007, 2012, and 2018.

[327] Organisation for Economic Co-operation and Development, *The Space Economy at a Glance 2014*, 2014; "S. Korea Vows to Promote Private-Led Space Development by 2030," *Pulse*, February 5, 2018.

Primary Domestic Space Stakeholders

South Korea's civilian space program is led by the Korean Aerospace Research Institute, which oversees satellite development, launch vehicles, and international partnerships, including such projects as the Korea Space Launch Vehicle and Korea Multi-Purpose Satellite (KOMPSAT) series. The Ministry of Science and ICT (Information and Communications Technology) provides policy direction and funding. The newly established Korean AeroSpace Administration (KASA), modeled partly on NASA, will begin operations in 2025 to unify civilian space policy.[328]

On the defense side, the ROK Air Force created a Space Operations Squadron in 2021, expanded into a Space Operations Group in 2024 to improve SDA, missile defense integration, and allied coordination.[329]

South Korea's commercial sector—featuring such companies as Perigee Aerospace, Hanwha Aerospace, and Korean Aerospace Industries—is increasingly involved in dual-use space systems. Hanwha Systems plays a key role in surveillance and SATCOM development aligned with national defense objectives.[330] Though not formally stated, the increasing collaboration between these and other companies and Korean government agencies highlights the expansion of South Korea's dual-use space ecosystem.

Examples of Civilian and Military Applications of Dual-Use Space Systems

Although South Korea has not explicitly prioritized the development of dual-use capabilities in policy or strategic guidance, South Korea has developed a variety of space capabilities that are dual use by nature and therefore could serve both civilian and military purposes:

- **EO/ISR:** The KOMPSAT satellite series provides high-resolution imagery used for agriculture, urban planning, and disaster response, as well as military reconnaissance.[331]

[328] Dennis Normile, "South Korea Launches Its Own NASA," *Science*, May 27, 2024.

[329] Alimat Aliyeva, "Korean Republic Air Force Launches Soaring Eagle Drill," AzerNews, November 25, 2024; Lee Minji, "Air Force to launch Space Operations Group," Yonhap News Agency, June 28, 2024.

[330] Kan Hyeong-woo, "Private Sector-Led Space Industry Gears Up for Launches in 2025," *Korea Herald*, January 31, 2025; Hanwha, "Defense: Space&Air," webpage, undated; Korean Aerospace Industries, homepage, undated.

[331] Clint Work and Seonhee Kim, "It's Not About the Moon: The Military and Economic Logistics to South Korean Space Exploration," Sino-NK, May 31, 2016.

- **SATCOM:** The Army, Navy, Air Force Satellite Information System (ANASIS)-II satellite, launched in 2020, is South Korea's first dedicated military communications satellite that leverages commercial technology.[332]
- **Navigation:** South Korea is developing the Korean Positioning System, which complements GPS for civil users while offering secure navigation for defense.[333]
- **Launch services:** The Nuri (KSLV-II) launch vehicle, designed for both scientific and national security payloads, is launched from the Naro Space Center, South Korea's domestically sourced launch capability.[334]
- **SSA:** South Korea has established ground-based optical and radar systems to monitor satellites and debris, with applications in both civil safety and military threat detection.[335]

International Considerations

International Partnerships

South Korea has deepened space cooperation with the United States through the U.S.-ROK alliance, focusing on missile warning, satellite communications, and joint SSA. A 2014 U.S.-Korean memorandum of understanding enabled SSA data-sharing to enhance both nations' space monitoring abilities.[336] In 2022, the United States announced the activated Space Forces–Korea and announced plans to integrate the Korean Positioning System with U.S-led GPS. South Korea joined the Artemis Accords in 2023, reinforcing its peaceful space commitments while expanding dual-use capabilities via partnerships with the U.S. Space Force. South Korea also signed agreements with the ESA and Japan on technology transfers supporting civil and defense goals.[337]

[332] Thomas Burghardt, "SpaceX Launches ANASIS-II Military Communications Satellite for South Korea," NASA Space Flight, July 20, 2020.

[333] Byung-Kyu Choi, Kyoung-Min Roh, Haibo Ge, Maorong Ge, Jung-Min Joo, and Moon Beom Heo, "Performance Analysis of the Korean Positioning System Using Observation Simulation," *Remote Sensing*, Vol. 12, No. 20, 2020.

[334] Korea Aerospace Research Institute, "Naro Space Center," webpage, undated.

[335] Park Si-Soo, "U.S., South Korea Agree to Cooperate on Space Situational Awareness for Military Purposes," *Space News*, April 26, 2022.

[336] U.S. Strategic Command, "DoD Agrees to Share Space Data with South Korea," press release, September 5, 2014.

[337] U.S. Space Force, "CSO Visits Space Forces Korea," press release, May 8, 2024b; Garrett Shea, "Republic of Korea Joins List of Nations to Sign Artemis Accords," National Aeronautics and Space Administration, May 26, 2021a; Korean AeroSpace Administration, "KASA Expands Horizon of Global Space Cooperation to Europe," press release, January 15, 2025; Japan Aerospace Exploration Agency, "Korea's Growing Space Program Working with JAXA," webpage, undated; Republic of Korea Permanent Mission to the United Nations, statement to the Fourth Committee of the 73rd Session of the UN General Assembly International Cooperation in the Peaceful Uses of Outer Space, undated.

Promoting International Norms

South Korea supports peaceful space use through its participation in COPUOS, contributing to discussions on space sustainability and international space law. South Korea also is a subscribing state to the Hague Code of Conduct against Ballistic Missile Proliferation, committing to transparency measures, such as prelaunch notifications of ballistic missile and SLV tests.[338]

Aligned with its stated commitment to transparency and confidence-building in space activities, South Korea supports the implementation of measures recommended by the UN Group of Governmental Experts on TCBMs to enhance mutual understanding and reduce the risk of conflict in space.[339] Such missions as the Danuri lunar orbiter, which has exercised information-sharing and mission-interference practices, reflect South Korea's commitment to norms of responsible behavior, international data-sharing, and dual-use system transparency.[340]

[338] Hague Code of Conduct, "The Hague Code of Conduct Against Ballistic Missile Proliferation," webpage, last updated March 2024.

[339] Johnson, 2014.

[340] Sangwoo Shin, "Asia's Space Ambitions: Driving the Next Chapter in Global Space Competition—South Korea's Space Policy and Leap to Space Power," *Asia Policy,* Vol. 19, No. 4, October 2024.

CHAPTER 5

Discussion and Next Steps



Bruce McClintock and David Glickstein

In reviewing the literature on national approaches to dual-use space systems across the Americas, Europe-Eurasia, and the Indo-Pacific, we identified key insights into the maturity of national policies, levels of investment, and contributions to shaping international norms governing the use of these systems. Given our limited review of select nations and potential challenges in accessing information on national approaches, we recognize that this research represents only a preliminary effort. This analysis provided a foundation for subsequent virtual workshops with regional experts and stakeholders and will inform further analysis in 2026 and 2027 to inform recommendations on global governance regimes for dual-use systems.

Cross-Regional Insights

Our review of select countries reveals possible trends in how states manage and regulate the development and deployment of dual-use space systems. These insights include the following:

- **Space as a valuable domain for dual goals.** Widespread and extensive space activities across the select countries suggest that states view outer space as vital for both civilian and military objectives, often relying on systems that serve both goals. Although countries often frame these systems as serving civilian functions—such as

communications or environmental monitoring—they frequently use them for military communications, surveillance, and other defense goals.

- **Role of international and private partnerships.** Select countries frequently rely on partnerships with other countries, as well as with their private sectors, to access, develop, or deploy dual-use space systems. Multinational GNSS programs, such as the European Union's Galileo, alongside national systems, such as Russia's GLONASS, provide participating countries with navigational benefits through international collaboration. Countries throughout the surveyed regions have increasingly turned to private industry to support dual-use system development, with flourishing space sectors in the United States, Canada, France, the UK, Japan, and others.
- **Duality in space as a feature of international conversation.** Recent discussions in international forums and in bilateral or multilateral dialogues suggest that dual-use space systems feature in the global norms agenda. Many countries—such as the United States, Canada, the UK, Japan, and EU members—actively contribute perspectives on governing dual-use systems through international norms, TCBMs, moratoriums on DA-ASATs, and other measures, commonly through the OEWG.

We observed a spectrum in how countries differentiate between civilian and military space systems, ranging from clear distinctions in intent and function to more ambiguous classifications in which dual-use capabilities are intertwined and less delineated. Although this literature review does not allow for definitive placement of each country along that spectrum, our analysis reveals two recurring themes that characterize national approaches across the select countries:

- **Implicit approaches to duality.** Countries infrequently articulate clear approaches to dual-use space systems that explicitly distinguish between civilian and military applications. Instead, space-related policies, legal frameworks, national dialogues, and international engagements offer indirect insight into how states may differentiate these capabilities. For example, although such countries as Canada, Germany, and Japan have issued recent policies outlining their general approaches to space, none have explicitly authorized the use of dual-use systems for military purposes. However, their participation in international forums and support for norms development suggests a general endorsement of the peaceful use of outer space that may extend to dual-use systems.
- **Role of centralization and ambiguity.** The approach of some select countries to dual-use space systems conveys the role of centralization of state space affairs and possible strategic

ambiguity. China, Russia, Iran, and the UAE maintain highly centralized space programs in which civilian and military activities are closely coordinated or overseen by state or military authorities. Furthermore, these states maintain possibly intentional ambiguities in whether dual-use systems are operating for civilian or military purposes.

Underscoring divergences in national priorities, partnerships, and approaches to dual-use space systems, these insights help inform the design of a global governance regime by revealing where consensus may be achievable, which mechanisms could be effective, and how rules or incentives might align with existing practices.

International Community Considerations

As RAND advances its research on global governance regimes for dual-use space systems, we recognize ongoing deliberations across the world and within international forums to address the escalating risks these systems pose. We encourage global stakeholders to consider the following possible next steps to inform more constructive dialogues in the years ahead:

- **Consider more precise *dual-use* definitions.** We encourage states to develop a clearly articulated, standardized definition to facilitate global cooperation and policy alignment.
- **Leverage international forums for discussion.** Forums, including the OEWG, present opportunities for countries to better understand duality-related risks and possible mitigation tools, such as norms, TCBMs, and destabilizing activity restrictions.
- **Identify information deficits for further research.** We encourage the United States and other spacefaring nations to identify key aspects of dual-use systems in which targeted research can advance the development of more effective global governance regimes.

Research Considerations and Next Steps

This report reflects only a preliminary effort to characterize the global space duality landscape. Key limitations, which inform the need for further and more robust research, include the following:

- **Narrow national scope.** Our analysis included only select countries, chosen to reflect some key features that emerged during the initial literature search, as well as only select space systems. Accordingly, this literature review does not represent a comprehensive survey of national and regional landscapes of dual-use systems and governance.

- **Information limits.** Our analysis drew on available open-source information, but limited transparency may have restricted our insight into states' intentions and the full extent of their dual-use space system development and deployment.
- **Descriptive approach.** This literature review followed a descriptive approach to characterize the current space duality landscape. Complementing this work with quantitative or more structured qualitative analysis may offer a more comprehensive understanding of this landscape and ways to compare one nation's approach to another.

The analysis also revealed information gaps that we aim to address to shape an ambitious yet realistic governance strategy for dual-use space system risks. Implicit approaches across nations and regions highlight the absence of a shared or formal definition of *dual use* that could serve as a foundation for global governance. To advance specific policy options, we further seek insights on the motivations driving states' development and use of space systems, the primary systems in use today and in the near term, the key challenges to global governance, and the types of mechanisms most likely to gain broad support.

To address these gaps and inform future analysis, the RAND research team held three region-delineated virtual workshops in summer 2025—one each for the Americas, Europe-Eurasia, and the Indo-Pacific—that convened experts and stakeholders on regional approaches to dual-use space systems. Participants included representatives from government, private industry, academia, and research organizations, drawn primarily from countries covered in this literature review, with additional perspectives from Costa Rica, Finland, Sweden, Saudi Arabia, and Singapore. Participants received advance copies of this literature review to help establish a common baseline for discussion. The team designed research questions for participants centered on the following key themes:

1. **Operative definition of *dual use*.** Workshop participants offered their definitions and approaches to defining dual-use space systems. Additional considerations beyond this report's broad definition may inform a more nuanced definition in future analyses and help underpin a coherent global governance regime.
2. **Drivers of development and operationalization.** We solicited perspectives on factors incentivizing countries to pursue dual-use systems, which may help inform robust governance strategies. Factors included economic development, strategic autonomy, space sustainability, and strategic military capability.
3. **Main on-orbit space systems.** Participants identified which systems they consider the most significant examples of dual use in their regions. Noting major systems overlooked in this report will build more comprehensive understanding of the existing landscape.

4. **Investment trends.** Participants provided insights on key investment trends in space system capabilities in the next two to five years.
5. **Global governance challenges.** Participants identified key global governance challenges posed by dual-use systems. Understanding these challenges will be essential to evaluating the feasibility and effectiveness of potential global governance regimes.
6. **Global governance tools.** We sought perspectives on what tools—such as treaties, regional and bilateral cooperation, norms, and market-driven approaches—are today underpinning the development and operationalization of dual-use space systems globally.

Additionally, future research will explore **whether and how artificial intelligence can help reduce risks from dual-use space systems**, such as by helping characterize satellite behavior through detecting anomalies or malicious intent. Such technology could provide policymakers with more nuanced tools for mitigating dual-use system risks.

To advance the project's ultimate goal—recommending an ambitious yet practical global governance regime—RAND researchers will summarize workshop findings and publish further analysis synthesizing those proceedings with this literature review. We will also identify potential metrics for future analysis to help quantify national approaches to dual-use space systems, such as indicators of international engagement and collaboration, levels of public and private investment in space, and the number and type of known satellites and related systems. Identifying such metrics may offer a basis for comparing national approaches and monitoring developments, providing a clearer foundation for designing a governance regime.

Abbreviations

3 CSD	3 Canadian Space Division
ADR	active debris removal
AEB	Brazilian Space Agency
AEM	Mexican Space Agency
ASA	Australian Space Agency
AUKUS	Australia, United Kingdom, United States (trilateral security partnership)
BRI	Belt and Road Initiative (China)
BRICS	Brazil, Russia, India, China, and South Africa
CNES	Centre National d'Études Spatiales (French National Space Agency)
CONAE	Comisión Nacional de Actividades Espaciales (Argentina)
COPUOS	UN Committee on the Peaceful Uses of Outer Space
CSA	Canadian Space Agency
CSpO	Combined Space Operations initiative
DA-ASAT	direct-ascent antisatellite
DASA	Defense Aviation Safety Authority (Australia)
DoS	Department of Space (India)
DOW	U.S. Department of War
EO	Earth observation
ESA	European Space Agency
EU	European Union
FSOA	French Space Operations Act
GEO	geostationary orbit
GLONASS	Global Navigation Satellite System (Russia)
GNSS	global navigation satellite systems
GPS	Global Positioning System
IRGC	Islamic Revolutionary Guard Corps (Iran)
IRIS^2	Infrastructure for Resilience, Interconnectivity, and Security by Satellite
ISA	Iranian Space Agency
ISAM	in-space servicing, assembly, and manufacturing
ISR	intelligence, surveillance, and reconnaissance

ISRO	Indian Space Research Organisation
ISS	International Space Station
JAXA	Japan Aerospace Exploration Agency
JSDF	Japan Self-Defense Forces
KOMPSAT	Korea Multi-Purpose Satellite
LEO	low Earth orbit
LLM	large language model
MCF	military-civil fusion (China)
MHI	Mitsubishi Heavy Industries
MNF-OOD	Multinational Force Operation Olympic Defender
MoD	Ministry of Defence (Ukraine)
MOD	Ministry of Defense (Japan)
MTCR	Missile Technology Control Regime
NASA	National Aeronautics and Space Administration
NASDA	Act on the National Space Development Agency of Japan
NATO	North Atlantic Treaty Organization
NETRA	Network for Space Object Tracking and Analysis (India)
NORAD	North American Aerospace Defense Command
NSS	National Security Strategy (Germany)
OEWG	Open-Ended Working Group
OST	Outer Space Treaty
PAROS	Prevention of an Arms Race in Outer Space (Ad Hoc Committee)
PLA	People's Liberation Army (China)
PNAE	National Program of Space Activities (Brazil and Mexico)
PNDAE	National Policy for the Development of Space Activities (Brazil)
PNT	positioning, navigation, and timing
QZSS	Quasi-Zenith Satellite System
ROK	Republic of Korea

RPO	rendezvous and proximity operations
SAR	synthetic aperture radar
SATCOM	satellite communications
SDA	space domain awareness
SLV	space launch vehicle
SPD	space policy directive
SSA	space situational awareness
SSD	Space Strategy for Defense (France)
SSN	Space Surveillance Network
STM	space traffic management
TCBM	transparency and confidence-building measure
UAE	United Arab Emirates
UK	United Kingdom
UN	United Nations
UNGA	United Nations General Assembly
USSF	U.S. Space Force
USSPACECOM	U.S. Space Command
WRKdoBw	German Space Command (Weltraumkommando der Bundeswehr)

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About This Report

As nations increasingly develop and deploy dual-use space systems—those capable of serving both civilian and military objectives—the international community may consider governance mechanisms to address their potential risks, including miscalculation and escalation in space. This report marks the first phase of a three-year project aimed at assessing those risks and offering policy recommendations to the United States and its allies on the development and enforcement of a global governance regime. In this report, we present the findings of a literature review in which we examined the landscape of national approaches to dual-use space systems across select countries in the Americas, Europe-Eurasia, and the Indo-Pacific. These insights, collected in spring 2025, informed subsequent virtual workshops that summer with regional experts and stakeholders and will serve as a foundation for later project phases in 2026 and 2027, which will include in-person workshops and a final report on potential global governance regimes.

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