LONDON POLITICA

New Space, New Rules?

Space Legislation Series: An overview of historical and current developments in global space governance

August 2023

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Executive Summary

The exploration and utilization of outer space have entered a transformative phase characterized by two significant trends: the accelerated growth of the private sector's engagement and the multi-polarization of the space sector. As commercial entities venture beyond Earth's boundaries and traditional power centres shift, the global space governance landscape is undergoing profound changes that raise multifaceted challenges and opportunities.

Starting with historical context, this report traces the genesis of space endeavours during the Cold War era, characterized by both competitive rivalry and cooperative ventures. Shifting the focus to the contemporary landscape, the report then scrutinizes the present dynamics shaped by the entry of new actors, notably private entities such as SpaceX, Origin Space, and Safran. This transformative shift has fostered innovation, heightened investments, and diversification across the space sector.

Concurrently, the report navigates the intricate realm of international space governance, reflecting upon the challenges stemming from this evolving landscape. The convergence of multiple stakeholders, each driven by unique interests and objectives, emphasizes the growing need for a new international framework to ensure cohesive and responsible space exploration.

This report aims to give an overview of the current landscape of outer space activities and the challenges faced in global space governance. It underscores the dual interests of private sector engagement and multi-polar collaboration and its implications on the overarching governance of outer space activities.

Section 1: History of Space Development in the Cold War

Laura Autio, Scott Mackie

The Space Race has its roots in the bipolar Great Power Competition associated with the Cold War. In an attempt to ensure dominance over the other competing superpowers, the Soviet Union and the United States invested substantial money and resources into securing dominance in this yet undefined region. These efforts culminated in the launch of the first intercontinental ballistic missile by the Soviet Union in 1957. The R-7 missile, named Sputnik, was in orbit for about three months, before returning to Earth, helping to usher in the realities of a new 'Space Age' within geopolitical arenas. The United States would reach the same milestone a year later, with the Soviets subsequently performing the first human flight into space in 1961 by Yuri Gagarin aboard Vostok 1. This spurred on the US Project Gemini which acted as a precursor to the Apollo program, eventually culminating in the first moon landing by the United States in 1969.

The reactive nature of space politics connotes how early space explorations were heavily rooted in Cold War ambitions. However, space exploration quickly led to increased research and understanding of the territory as a whole. The Soviet Union's launching of the Salyut space Station in 1971 (the first of its kind to be launched into the Earth's lower orbit) paved the way for extended periods of space travel to occur at a time, with the United States Mariner robot spacecraft program leading to the first interplanetary missions by the country. Great power competition led to Scientific breakthroughs and discoveries, with the ever-increasing sophistication of space technology leading to an increased scope of space activity.

1.1 ICBMs

A key driver of space development was the capacity in which the region could be used for warfare, and for ensuring global security. This capacity to use space as a territory simultaneously for national safety and aggressive enemy attack was seen in the 1960s, with the development of Inter-Continental Ballistic Missile warheads. These long-range missiles had the capacity to carry nuclear warheads over vast distances, thus changing the range of scope, and possibility of nuclear warfare, and raising increasingly severe questions about global security. Such fears of a 'Mutually Assured Destruction' spearheaded the beginnings of space regulation talks, with the Partial Test Ban Treaty of 1963 being the first attempt to prevent nuclear warfare and fallout through the active use of these increasingly sophisticated ICBMs by placing limits on the ability for nations to test the weapons. This evolved into a wider range of Test ban Treaties that took shape throughout the 1960s and 1970s.

1.2 Broader Impact of Military Power in Space Development

Notwithstanding the development of ICBMs, the Cold War rivalry between the US and the USSR spurred a technology race that extended into space, fuelled by a drive for technological superiority and ultimately accelerating advancements in space exploration. Military power played a dual role in the development of space capabilities, foreshadowing much of the modern focus we now see. The strategic importance of space-based assets for intelligence gathering, surveillance, and communication became increasingly apparent and both superpowers and their allies recognized that controlling orbital space provided a distinct military advantage, leading to the development of sophisticated satellites for reconnaissance and communication purposes. More broadly, the shared outlook of NATO members led to collaboration across a wide range of areas that extended beyond weapons technology, and encouraged investment in research and education, fostering the growth of scientific talent that would later prove crucial to space exploration and to the development of the commercial space sector.

In essence, the Cold War military cooperation acted as a catalyst for collaborative technological advancement that underpins modern commercially led space programs. The legacy of this era continues to shape the trajectory of the commercial space industry today, and the defence alliances of the Cold War continue to work in concert to facilitate breakthroughs, whilst also lowering barriers to entry and inspiring the pursuit of ambitious goals that once were the domain of governments alone.

Section 2: Multi-polarization of the Space Sector

Ben Martin, Scott Mackie

The end of the Cold War has, by no means, de-polarized the space sector. While it did bring about the end of the strictly bipolar competition and the introduction of more collaborative initiatives, like the International Space Station, the end of the Cold War laid the groundwork for a multipolar space sector. This new era of "democratized" space exploitation created competition between different blocs, each with their own agendas and capabilities. Competition in space was no longer a question of simply "East vs. West," particularly as emerging space-faring entities like China and the European Space Agency (ESA) began to assert themselves independently from their traditional, Cold War-era blocs. The proliferation of "small, energy-efficient computers, innovative manufacturing processes, and new business models for launching rockets" (Baiocchi, 98) meant that even countries with no launching capabilities could now contribute to humanity's extraterrestrial adventures. This new ability to access space resulted in the creation of dozens of national space agencies, including nations that had traditionally eschewed space: nations like Brazil in 1994, the UAE in 2006, Singapore in 2007, and South Africa in 2010.

This era is also categorized by a series of ambitious international agreements which sought to improve cooperation in space, while traditional spacefaring nations struggled to determine their role in this post-Cold War era of international competition. From the UN Office for Outer Space Affairs (UNOOSA) came declarations and treaties like *The Principles Relevant to the Use of Nuclear Power Sources in Outer Space* (1992), and the *Space Benefits Declaration* (1996). The epitome of this movement towards international cooperation was the establishment of the International Space Station (ISS) in 1988, which featured the active collaboration between NASA and the former USSR, something that would have been unthinkable just 10 years earlier.

As relations soured between the US and Putin's Russia, and China's meteoric rise began to challenge US hegemony in the early 2000s, the collaborative sentiments of the 1990s wilted and were replaced by fierce competition for supremacy in space. All three major powers tested Anti-Satellite Weapons (ASATs) in the first two decades of the 21st century, sparking fears of a militarized space and rapid securitization of outer-space dialogue. (Peoples, 205) Traditional partners of NASA like the ESA and JAXA have announced that they are pursuing their own strategic autonomy in space. (Cellerino) UNOOSA continues to attempt to adapt space law to keep pace with the rapidly evolving geopolitical realities of the sector through endeavours like the *Open-Ended Working Group on Reducing Space Threats*. However, the multi-polarization of the space sector prevents any truly global binding legal measures from coming to fruition.

Agreements within blocs, like the NASA Artemis Accords or the China-Russia Lunar Exploration Agreement represent the extent of international cooperation in space in this era. This section will introduce the major state players in space during the multi-polarized era of the space sector.

2.1 United States of America (NASA)

In a report released in December of 1992, a Space Policy Advisory Board commissioned by then Vice President Dan Quayle recommended that in a post-Cold War world, the US should "take the initiative in shaping a common international agenda in … space activity to address global problems and to maintain U.S. influence." (2) However, in the decades that followed, the U.S. presented "mixed messages" regarding its intent to be a leader in space, resulting from a "disconnect" between stated policy goals of American space authorities and the implementation of those goals. (Holland & Burns, 9). For the perceived "winners" of the space race, the end of the Cold War brought about a disappointing reality of lower budgets and decreased public interest, ultimately resulting in an unfortunate reality where the US "struggles to decipher its identity as a spacefaring nation." (Halland & Burns, 10)

Collaboration with the private sector has been instrumental to NASA's post-Cold War operations. In the aforementioned Vice-Presidential report, the commission recommends a comprehensive change in NASA's operations to further include the private sector and "foster synergism" among private and public space programs. (1) NASA has since collaborated

extensively with companies like SpaceX and Orbital Sciences Corporation to keep the ISS resupplied.

As space was "democratized" and new state and non-state actors entered the "new space race," the need for global regulation in space to resolve challenges of space debris, militarization, and sovereignty fell at the feet of the perceived international leader in space. Only through recent initiatives like the Artemis Accords has NASA begun to reclaim its leadership status in space, collaborating closely with partners in Europe (through the ESA), Japan, Korea, Canada, and others. NASA's "bloc" of like-minded spacefaring nations increasingly stands in opposition to traditional rivals like China and Russia. The next couple of decades will be crucial to determine whether NASA will be able to keep its bloc together, or whether the multi-polarization of space will spread further, deteriorating NASA's extraterrestrial leadership.

2.2 Russia

Following the Cold War, Russia's space expertise and infrastructure remained intact, positioning it as a key player in the international space community, particularly with the establishment of the Russian Space Agency, *Roscosmos*. This transition marked the beginning of Russia's independent and collaborative contributions to space exploration and technology. Russia's participation in the ISS, alongside the US, ESA, Japan, and Canada, demonstrated its commitment to collaborative endeavours that transcended political differences. Russia's involvement in a wide variety of space missions, as well as its crucial facilitation of satellite launches for a large number of nations, contributed to the diversification of the global space order. Russia's Soyuz rockets became widely used launch vehicles, enabling countries otherwise without the capability to deploy satellites into orbit.

The position of Russia in the global space ecosystem is, at the time of writing, uncertain due to the ongoing, and illegal, Russian military operation against Ukraine. As a result of sanctions, the Russian space sector has been significantly impacted, particularly in terms of satellite launch whereupon a number of nations have cancelled planned launch missions; such as *OneWeb* and sought alternative arrangements with US-based *SpaceX*.

2.3 European Space Agency (ESA)

The emergence of the ESA stands as a testament to international cooperation and unity in the realm of space exploration. Formed in 1975, the ESA was a response to the shifting dynamics of the Cold War era, and the dominance of space exercised by the US and the USSR. European nations recognized the need to consolidate their efforts, expertise, and resources to establish a collective presence in space activities, particularly in the face of the significant costs associated with operating in space.

The ESA's strength lies in its capacity to transcend national boundaries and foster collaboration among its member states. With 22 members, the ESA successfully coordinates efforts across a variety of space-related research, innovation and capability areas including Earth observation, satellite communication, navigation, planetary exploration, and scientific research. As the ESA continues to lead in areas such as the *Galileo* navigation system (though on behalf of the EU), and the continued development of the *Ariane* rocket capability, it continues to reinforce the European continent's status as a major player in space. Ultimately its accomplishments underscore the importance of collaboration in space activities, enabling members to share the costs, risks, and rewards of space missions, while also promoting technological innovation and skill development.

More broadly, the ESA's model of cooperation has inspired similar initiatives beyond its borders. Collaborations such as the European-Russian *ExoMars* program, which aimed to explore the Martian environment, are typical of the ESA's commitment to forging partnerships beyond its membership. Whilst these endeavours have led to a more multi-polar space landscape, polarisation continues to exist, and is often amplified by global events; the *ExoMars* programme, for example, was suspended in the wake of the Russian invasion of Ukraine in 2022. Nevertheless, the ESA provides the opportunity for countries from different regions, though not necessarily wielding the economic power of the traditional space actors, to become influential participants in space, diluting the once-clear divide between the traditional superpowers. In the context of broader polarisation, the ESA's continued success highlights the pivotal role that international cooperation plays in driving progress in space exploration, technology, and scientific discovery. The ability to navigate political complexities, pool resources, and channel diverse talents has positioned it as a global leader in space exploration and science, supporting industry across Europe, and encouraging enhanced cooperation.

2.4 China

The end of the Cold War was a pivotal moment for the Chinese Space Program. While China had been sending spacecraft into space since the 1960s, the establishment of the China National Space Administration (CNSA) in 1993 sparked a flurry of launches and activity in the Chinese space sector. Geopolitical competition between the US and China spilled over into the space sector in 1999 when cooperation between CNSA and NASA was halted on the grounds of American national security. However, the same year also saw the birth of China's Manned Space Program, which shot numerous *Shenzhou* spacecraft into space with Chinese astronauts on board. A number of White Papers on space have directed Chinese policy in the domain in the 21st century. In the past two decades, the CNSA has developed a robust satellite infrastructure and has even established the first module of their *Tiangong* research station, intended as an alternative to the soon-to-be decommissioned ISS.

China's modern extraterrestrial aspirations are focused on lunar and asteroid mining, space settlement, and national security (Goswami, 74). In pursuit of these objectives, China has found

likely and unlikely allies. Cooperation between the Chinese and Russian space sectors represents the second major bloc of space powers counterbalancing NASA and their partners. In what is described as a "comprehensive strategic partnership," China and Russia have expressed their ambitions to establish a permanent base on the moon in the 2030s. This initiative has elicited support from Pakistan, the UAE, Malaysia, Venezuela, and the Asia-Pacific Space Cooperation Organization. China has also been cooperating with Brazil in space since the late 1980s in various capacities in the space sector. China's capabilities and cooperation in the space sector are a driving force of multi-polarization in the space sector.

Section 3: Private Sector Growth in Space Sector and Market Overview

Ridipt Singh, Romain Le Dily, Wedad Kabi

In 2014, a pivotal juncture emerged in the landscape of outer space activities as NASA entrusted the transportation of its astronauts to the ISS to the private sector. This meaningful initiative, known as the Commercial Crew Program, marked a turning point in the role of the private sector in Western countries' space endeavours. This analysis delves into the trajectory of the expanding private sector engagement in outer space activities, focusing on the direction of research and innovation (R&I), the diversification of sectors, and the emergence of key actors within this evolving geopolitical sphere.

The growth of the private sector's involvement in outer space activities has been characterized by a distinct emphasis on research and innovation. This strategic focus is underscored by substantial investments directed toward advancing space technologies, propulsion systems, satellite miniaturization, and sustainable resource utilization. This R&I thrust is underpinned by a growing awareness of the substantial economic potential that outer space holds, encompassing applications ranging from satellite communications to potential interplanetary exploration. Furthermore, the private sector's footprint extends across an array of sectors, encompassing both traditional and emerging domains. While sectors such as satellite manufacturing and launch services have experienced substantial expansion, propelled by the demand for global connectivity and data transmission, emerging domains like asteroid mining, space tourism, and lunar exploration are increasing attention. This diversification of sectors mirrors the private sector's evolving role as a multifaceted contributor to the space domain.

A number of influential private sector actors have risen to prominence, primarily concentrated in Western countries, reshaping the landscape of space exploration. Foremost among them is SpaceX, led by the entrepreneur Elon Musk, which has not only revolutionized launch services but has also outlined ambitious interplanetary colonization plans, notably targeting Mars. Boeing, a stalwart in aerospace, has leveraged its extensive experience to sustain a significant role in the unfolding private sector-dominated landscape. Concurrently, Blue Origin, founded

by Jeff Bezos of Amazon fame, has pioneered reusable rocket technology and is advancing suborbital tourism. These actors are complemented by notable entities like Lockheed Martin, Northrop Grumman, and Rocket Lab, each contributing unique capabilities to the evolving ecosystem.

The surging growth of the private sector in outer space activities holds profound geopolitical implications. It serves as a catalyst for heightened national competitiveness and leadership for Western countries in the global space arena. By propelling innovation and entrepreneurship, this trend contributes to economic expansion, job creation, and technological advancement, especially pertinent in post-pandemic recovery contexts. The private sector's ascendancy also has the potential to reshape diplomatic and strategic alliances. Collaborations between governments and private entities foster international cooperation, spurring joint ventures in space missions, technology development, and knowledge sharing. Simultaneously, the evolving role of the private sector necessitates the establishment of comprehensive legal and regulatory frameworks. The domains of resource ownership, liability, environmental protection, and space debris mitigation demand coordinated international efforts to ensure responsible and sustainable space exploration.

The intensifying engagement of the private sector in outer space activities, catalysed by initiatives like the Commercial Crew program, heralds a transformative epoch in space ventures. This reconfiguration of the outer space landscape reverberates across geopolitical realms, from enhancing national competitiveness and economic vitality to fostering diplomatic cooperation and regulatory frameworks. This indeed raises regulatory and policy challenges in terms of international frameworks aligning with the current landscape.

3.1 Navigating the Dynamic Terrain of International Space Governance: Challenges, Opportunities, and Complexities for the Private Sector

As a matter of fact, for the last 10 years, the landscape of international space governance has appeared to be increasingly intricate and dynamic, fuelled in part by the evolution of domestic regulations like the U.S. Space Act and its affiliated frameworks. The U.S. Space Act, along with related regulations (Japanese, Luxembourg, UAE), exemplifies the challenge of reconciling domestic interests with the broader internationalization of space norms. This legal framework, which encourages commercial space activities while suggesting the ownership and private exploitation of celestial bodies, has stimulated innovation and investment, leading to a surge in private sector involvement. However, the internationalization of these domestic norms prompts discussions about their compatibility with existing international treaties, such as the Outer Space Treaty (1967), and the potential for fragmentation of the space governance regime.

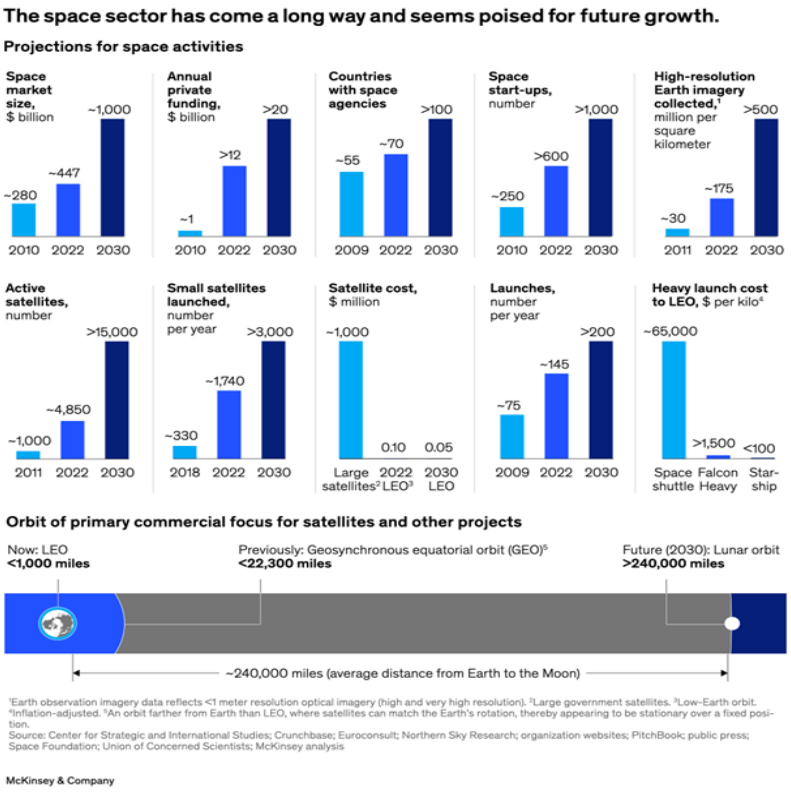
Also, as space activities become more diverse and complex, the question of how to manage cross-border interests and ensure responsible behaviour is increasingly pressing. The international community faces the daunting task of harmonizing national regulations,

commercial ambitions, and security considerations within a framework that respects both existing treaties and the evolving needs of a globalizing space industry. This challenge has led to discussions on mechanisms for transparency, dispute resolution, and the development of new guidelines to address the intricacies of emerging technologies and activities, such as asteroid mining and satellite mega-constellations. However, the emergence of different Space clans within International Relations has made nearly impossible any sort of advancements, leaving International Space Governance with outdated sources of réglementation.

The wildness of this evolving landscape lies in the tension between the rapid expansion of space activities and the ongoing efforts to establish a coherent and inclusive governance structure. As the private sector drives innovation and diversification of space endeavours, the need for effective international cooperation becomes increasingly evident. The dynamic interplay between domestic laws and their processes of internationalization (with the Artemis agreements for instance) and the broader international norms exemplify the clash between the Nation's interests and the collective goal of responsible and sustainable space exploration.

3.2 Market Overview

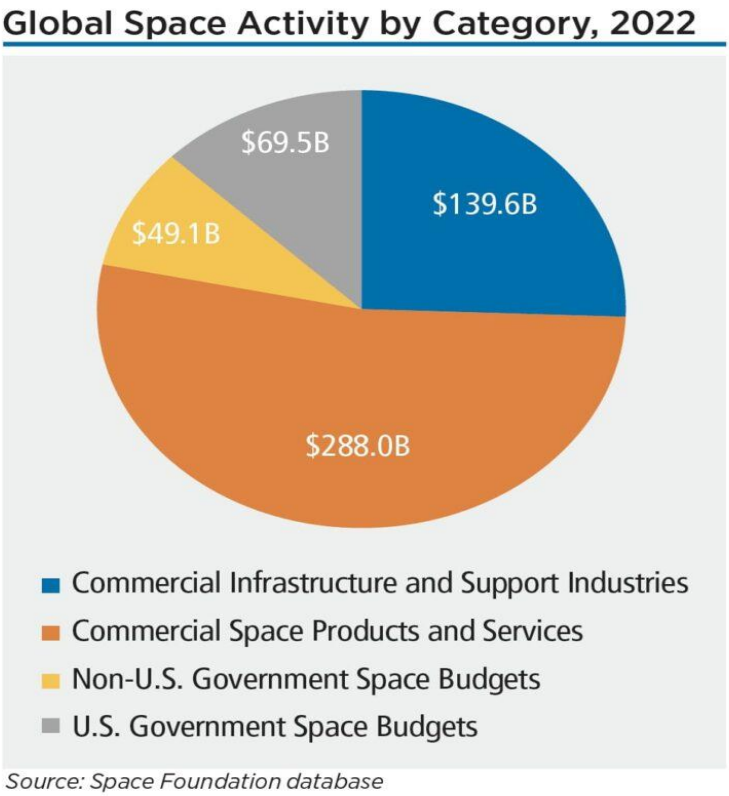
The space economy was valued to be at $388.50 billion in the year 2021 globally. With a growth of 70% in 2010-20. The reason for the boost in space activities can be attributed to two key factors. First, the reduction in the cost of space activities and second, the growing recognition of outer space as a strategic domain.



The above figures from McKinsey & Company suggest that the overall market of the space economy has been projected to be at approximately $447 billion. Rising from $280 billion in 2010, a growth to $1 trillion is expected by 2030. Alongside an exponential rise in annual funding, the industry has seen a rise in space-based start-ups, satellite launches, number of active satellites alongside a massive reduction in the cost of satellites and the cost of heavy launches ($ per kilogram) to the Lower Earth Orbit.

At the end of 2022, investments from Venture Capital (VC) and Private Equity (PE) firms in the space economy accounted for nearly US $ 272 billion. The development of SmallSats and CubeSats has led to increased investments in the field, allowing affordable business models, particularly satellite constellations. SmallSats accounted for 95% of total spacecraft launches in 2022 and are likely to be a major driver of the space economy.

The Space Report 2023 Q2, released by the Space Foundation assessed the growth in the space economy up until 2022. As per the report, with an annual rise of 8%, the commercial growth has reached $427.6 billion and the global space economy is valued at $546 billion. The reported growth is from a revised estimated value of $505 billion in 2021. This assessment was based on considering the actual budgets and government spending from 51 nations and examining 11 subsectors of the commercial space industry.

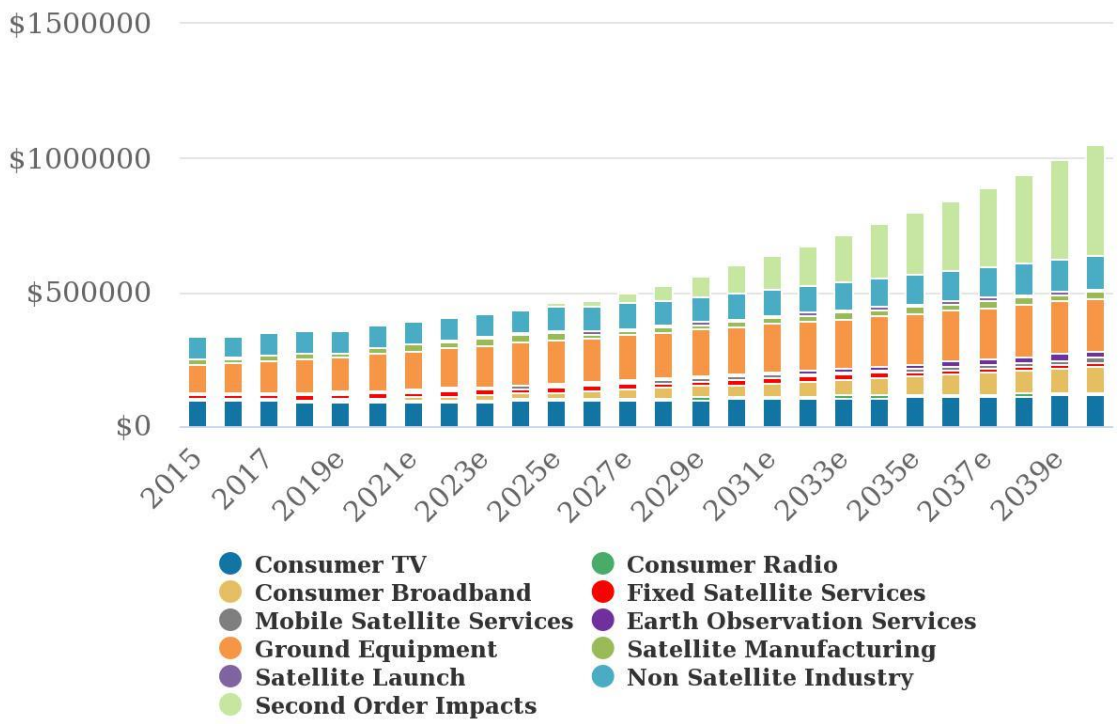


Source: Space Foundation database

The categorical division of space activities from the above figure shows that the space budgets from the US Government accounted for the smallest component and the space economy was largely dominated by commercial services and non-government space budgets.

3.3 Increased Actors and Applications

With advances in technology, space has become increasingly accessible to private actors allowing them to profit from ventures in outer space. Applications in the space sector can be classified into two broad categories. The first category i.e., space-for-earth applications facilitates terrestrial activities and includes internet services, energy, mining, agriculture, agriculture, etc. The second category i.e., space-for-space applications which are activities that only occur in the orbit include R&D, manufacturing, exploration, and habitation. The space sector cuts across multiple industries like aerospace, Information Technology (IT), telecommunications, etc. However, the most significant source of revenue is from providing internet services.



In light of this evolving landscape, it is intriguing to observe the distinctive contributions of companies from different continents within the space economy. We have highlighted three companies—Starlink from SpaceX in North America, Origin Space from China, and Safran from Europe—each representing diverse sectors within the space economy. This selection not only showcases the global reach of private sector involvement but also underscores the collaborative and competitive nature of space exploration and innovation on a worldwide scale while depicting different company sizes.

➔ Starlink

Affiliation : Space X

Headquarters : Hawthorne, California, USA

Commercially launched in : 2019

Starlink is a US satellite internet projected within the space economy sector, operating under SpaceX and led by Elon Musk. The company's primary goal is to establish a constellation of small satellites in low Earth orbit, aiming to provide high-speed, low-latency internet access globally. Through innovative technology and engineering, Starlink is positioned at the forefront of enhancing global connectivity and addressing internet accessibility challenges in remote and underserved regions. With a little less than 4000 satellites currently operating, Starlink operates in 50 different countries and provides internet to 1.5 million subscribers around the globe.

➔ Origin Space

Affiliation : Independent

Headquarters : Nanjing, Jiangsu, China

Commercially launched in : 2021

Origin Space is a Chinese company operating in the space economy sector. Specializing in asteroid exploration and resource utilization, the company is dedicated to developing technologies for extracting valuable resources from asteroids. By focusing on the potential of space resources, Origin Space aims to contribute to industries on Earth by harnessing the materials found in asteroids. Through their work, the company is making strides in the field of space exploration and sustainable resource development. More peculiarly, it is currently working on the M2 Lunar Rover project, to be released in 2024, which is supposed to advance and enable commercial exploration of lunar resources and verification of mining technology.

➔ Safran

Affiliation : Independent

Headquarters : Paris, France

Commercially launched in : 2005

Safran is a French-established entity with a presence across aerospace, defense, and security sectors. In the space economy arena, the company serves as a notable provider of advanced technologies, particularly in the realm of space propulsion, satellite systems, and aerospace equipment. Its expertise in propulsion systems significantly contributes to satellite launches, space exploration, and crucial missions. Safran's products, including propulsion systems for launch vehicles and satellite propulsion, underline its integral role in advancing space technology and bolstering the efficiency and success of various space missions. It has for example contributed through ArianeGroup (which it owns for 50%) to the development of Europe's Ariane 5 and 6 launchers, providing facilities and high technological pieces.

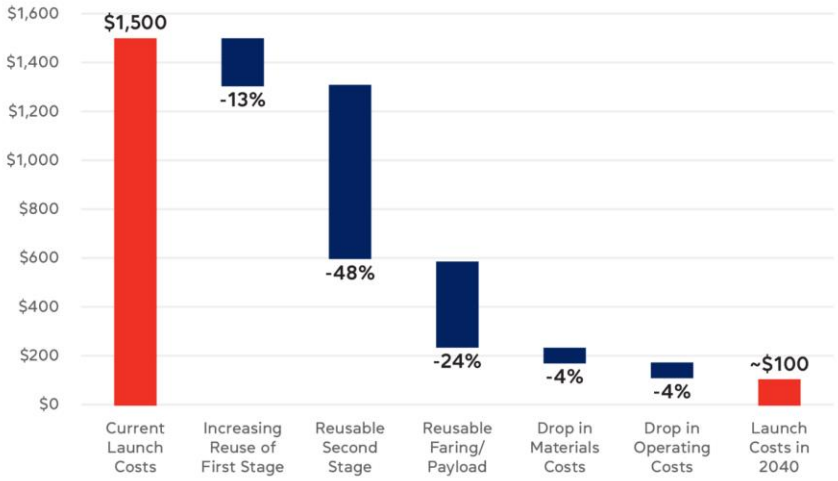
3.4 Satellite Services

The Satellite Industry Association (SIA) in its 25th State of the Satellite Industry Report released in 2022 stated that the commercial satellite industry dominated the global space industry with 1713 commercial satellites in total being launched in 2021 (40% rise from 2020). The report highlighted that in the year 2021 -

- revenue from satellite manufacturing grew to $13.7 billion (12% increase from 2020)
- revenue from launch services was recorded at $5.7 billion (8 increase from 2020),
- revenue from satellite services was at $118 billion (.4 increase from 2020)
- revenue from satellite ground segments was recorded to be $142 billion (5 increase from 2020).

3.5 Reduced Costs

The space economy has witnessed a significant drop in the costs of spacecraft launches. This phenomenon has resulted in increased space activities and has led to increased lunar exploration, the number of satellite constellations, small rocket launches and human spaceflight missions.



With the base year as 2022, there has essentially been a fourfold decline in the cost of launches. The above graph also shows a significant amount of reusable fairing and drop in material as well as operating costs.

3.6 Future Projections

Between revenues generated by the public and private sector activities, the space industry is likely to be a trillion dollar industry by 2040. SpaceX has well established operations in this and the Starship is likely to further cut down launch costs to $10 million for 300,000 pounds delivery to the LEO. The number of satellites in orbit is likely to reach 60,000 by the year 2030. Commercially, private and public entities are likely to gain profits from mining activities in asteroids, lunar surfaces, or other space bodies. Hence, increased investments in these three activities are expected in the near future.