



T.C.

ANKARA YILDIRIM BEYAZIT UNIVERSITY

INSTITUTE FOR INTERNATIONAL RELATIONS AND

STRATEGIC RESEARCH

**LIMITATIONS IN REGULATING WEAPONIZATION IN THE
NEW SPACE RACE**

MASTER'S THESIS

KÜBRA YILMAZ

SECURITY STUDIES

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The thesis entitled “Limitations in Regulating Weaponization in the New Space Race” prepared by Kübra YILMAZ is accepted as a master thesis at Ankara Yıldırım Beyazıt University, Institute for International Relations and Strategic Research, Security Studies Program by unanimous vote/majority vote.

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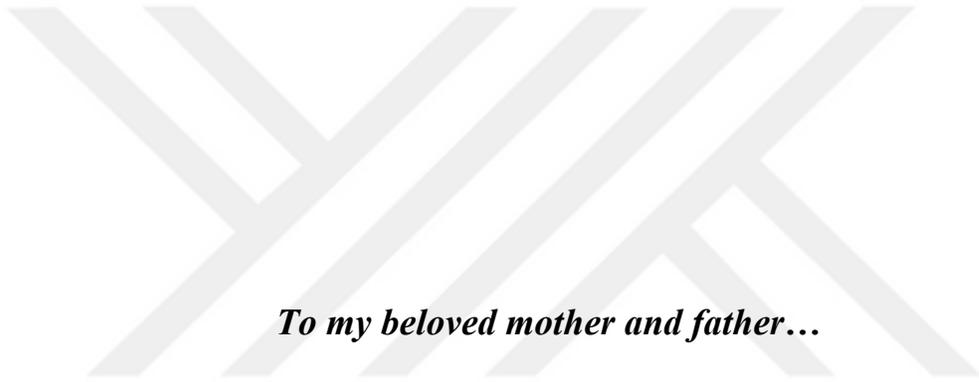
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To my beloved mother and father...

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ABSTRACT

Limitations in Regulating Weaponization in the New Space Race

As states progressively expand their military capacities beyond the atmosphere, the militarization and the weaponization of space became a landmark in human history. Over the years, the space objectives of states shifted from solely attaining military power to having multidimensional smart power which involves commercial and civil aspects. The continuous process of development in space technologies began to have an ongoing impact on weaponization through commercial gains. Therefore, understanding the transformation of the space race through commercialisation is necessary to uncover the structural impediments to disarmament. Along with addressing the role of commercialisation on achieving power in space, this thesis examines three main limitations in regulating weaponization: the surge in non-state actors participating in arms development, dual-use space technologies, and the absence of robust international enforcement mechanisms. It also offers a qualitative analysis on the interplay of the new dynamics in the current international environment which adds layers of complexity to the traditional state-centric paradigm. To develop strategies against the potential threats of space weaponization, these limitations should be an issue of considerable significance to all states.

Keywords: Space Security, Space Race, Weaponization, Non-State Actors, Dual Use Technologies

ÖZET

Yeni Uzay Yarışında Silahlanmanın Önlenmesindeki Sınırlayıcılar

Devletler, askeri kapasitelerini atmosferin ötesine genişlettikçe, uzayın askerileşmesi ve silahlandırılması insanlık tarihinde bir dönüm noktası haline gelmiştir. Yıllar geçtikçe devletlerin uzay hedefleri; yalnızca askeri güce ulaşmaktan, ticari ve sivil boyutları da içeren çok boyutlu akıllı güce sahip olmaya doğru kaymıştır. Uzay teknolojilerindeki sürekli gelişme süreci, ticari kazanımlar yoluyla silahlanmayı da etkilemeye başlamıştır. Bu nedenle, uzay yarışının ticarileşme aracılığıyla olan değişimini anlamak, silahsızlanmanın önündeki yapısal engelleri ortaya çıkarmak için gereklidir. Bu tez, devletlerin uzayda güç elde etmelerinde ticarileşmenin etkisinin yanı sıra, silahlanmanın düzenlenmesindeki üç ana engeli incelemektedir: silah geliştirmeye dahil olan devlet dışı aktörlerin sayısındaki artış, çift kullanımlı uzay teknolojileri ve uluslararası yaptırım mekanizmalarının yetersizliği. Aynı zamanda bu tez, mevcut uluslararası yapıdaki yeni dinamiklerin etkileşimlerini ve geleneksel devlet merkezli paradigmaya eklenen kompleks katmanları nitel bir içerik analizi ile sunmaktadır. Uzayın silahlandırılmasının potansiyel tehditlerine karşı stratejiler geliştirmek için bu engeller, tüm devletler için büyük önem taşıyan bir husus olarak ele alınmalıdır.

Anahtar Kelimeler: Uzay Güvenliği, Uzay Yarışı, Silahlanma, Devlet Dışı Aktörler, Çift Kullanım Teknolojileri

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LIST OF ABBREVIATIONS

ABM	Anti-Ballistic Missile
ABMA	The Army Ballistic Missile Agency
ACC	The Allied Control Council
ASAT	Anti-satellite Weapons
CAS	The Chinese Academy of Sciences
CCP	NASA's Commercial Crew Program
CIS	Commonwealth of Independent States
CNES	The French National Centre for Space Studies
CNSA	The China National Space Administration
CPSU	The Communist Party of the Soviet Union
DOD	The Department of Defense
DSA	Digital Services Act
DTH	Direct-to-Home
ELDO	The European Launcher Development Organization
ELV	Expendable Launch Vehicles
ESA	The European Space Agency
EU	The European Union
EVA	Extravehicular Activity
FLPP	Future Launchers Preparatory Program
GPS	The United States Global Positioning System
GSLV	Geosynchronous Satellite Launch Vehicle
ICBM	Intercontinental Ballistic Missile
IGO	International Intergovernmental Organisation
INCOSPAR	The Indian National Committee for Space Research
INSAT	The Indian National Satellite System
IRS	The Indian Remote Sensing Satellite System

ISRO	The Indian Space Research Organization
ISS	International Space Station
JAXA	Japan Aerospace Exploration Agency
LEO	Low Earth Orbit
NASA	National Aeronautics and Space Administration
NASDA	Japan's National Space Development Agency
NGO	Non-governmental Organization
NSA	Non-state Actor
OSS	The Office of Strategic Services
PLA	The People's Liberation Army
PLASSF	The People's Liberation Army Strategic Support Force
RAE	The Royal Aircraft Establishment
RKA	The Russian Space Agency
SDI	The US and Strategic Defense Initiative
SERC	The Science and Engineering Research Council
START	The Strategic Arms Reduction Treaty
TKS	Transport Supply Spacecraft
UN	The United Nations
USSF	The United States Space Force
USSR	The Union of Soviet Socialist Republics
V-2	Vengeance Weapon Two
WMD	Weapons of Mass Destruction

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1. INTRODUCTION

The Soviet Union and the US engaging in a race fueled by political, ideological, and technological fervor to have superiority in space opened a new chapter in history. As the space race has become an outlining part of the Cold War, military objectives of states began to reach outer space through scientific ambitions. By improving rocket technologies and developing space programs, the US and the Soviet Union were not only after military superiority but also ideological prestige as the world has been dreaming for reaching space for centuries. For both reasons, the cultivation of space power became an integral component of states' national strategy within the contemporary geopolitical landscape and the race for orbital supremacy turned outer space into a major power maximization arena. Although the US began to dominate the realm of space for a while after the dissolution of the Soviet Union, Russia began to reach a critical position in the race by making space as a part of its strategic priority again. Creating collaborations and scientific agreements with Russia, China became another major spacefaring nation after the Cold War (Johnson-Freese, 2013). As states with robust space activities gain a decisive edge in military and intelligence capabilities, new states began to seek space power in order to expand their overall defence mechanisms.

Over the years, the world became more interconnected and commercial aspect of space activities began to rise through scientific collaborations. While outer space remained as a contested domain, it introduced other potential values for humankind and the constitution of the 'space economy' started a different era in history through commercialisation (Variath, 2024). From commercial interests to military surveillance and intelligence, space programs play a crucial role in states' development. Space capabilities provide states multitude advantages which range from enhancing national security through satellite-based surveillance and reconnaissance to enabling precise global navigation and communication systems (Space Foundation). Although privatisation efforts foster international influence and economic prosperity, the commercialisation of space does not automatically eliminate the military aspect of space as the strategic significance of attaining space power for national defence remains. Moreover, considering the beginning of the race which

was due to the aim of carrying hydrogen bombs into space, the power maximization as a national goal is an intensified dynamic discourse which should not be overlooked.

As traditional approaches to disarmament rooted in agreements attained during the Cold War such as the Strategic Arms Reductions Treaties, new agreements and international cooperation began to be needed in order to catch up with the evolution of the space race which introduced dual-use systems and new actors through increased commercialisation. Now that a new version of space race evolved through these improvements, development of commercial space activities shifted the current international environment. For instance, as the US began to seek the power of commercial space industry in order to attain advantage over China, recruiting companies during peacetime became a part of the US' national strategy (Erwin, Pentagon looks to commercial space for an edge, 2023).

While the new space race involves a non-linear progress through ramification of space activities, hybrid threats began to be integrated into commercial and civil aspects. Since preventing weaponization is crucial to promote peaceful and sustainable use of outer space, emerged limitations of disarmament in the new space race should be a global dispute. Some of the main limitations of disarmament include the rise of non-state actors, dual-use systems and lack of international enforcement mechanisms for weaponization in space. While private entities are propelled by technological innovation and economic incentives, they began to have critical roles in attaining space power. Commercial entities began to provide massive advantages for wide range of space systems which are key assets for national security (Harrison & Strohmeyer, 2022). Since civil and commercial aspects of space industries aid military capabilities of states via dual-use space systems, growing concerns regarding the potential weaponization became prominent. While the dual-use mechanisms of numerous space assets are not tied to relative and solid legal restrictions, the increased role of non-state actors also introduced new layers of complexity and ambiguity into the current international environment which still functions with state-centric norms. As the absence of a universally agreed-upon definition of space weapons adds another unknown to the equation, the need for a consensus among states increases for achieving effective disarmament measures.

As commercialisation became the new interface of the new space race, the contemporary realm of space has evolved significantly and transcended the boundaries of state-centric nature of space activities into a dynamic landscape shaped by civil and commercial interests among new spacefaring nations along with non-state actors. The involvement of non-state actors such as non-governmental organisations (NGO) and private companies brought many cooperative advantages. While NGOs played a significant role in creating a common platform for states to discuss the use of space along with the legal boundaries, private companies became crucial to elevate space activities via collaborating space agencies as they are officially independent from governmental branches. Adding mobility and autonomy to the space industry, commercial entities increased the number of satellites launched rapidly and began have higher influence. However, non-state actors pose inherent challenges and complexities into the dispute as they provide limited accountability due to the lack of international regulatory frameworks, make international cooperation more difficult and able to use massive amount of soft power which may create imbalances in international arena.

As military operations have been using space-based systems more than ever, space power has become a crucial parameter for supporting infrastructure for better surveillance and reconnaissance (Hersch & Steer, 2021). Also, the spectrum of threats evolved over the years and physical harm is not the only way to damage a nation's military system because of the intensified reliance on space technologies. Within the limitations of the current international law, employing cyber tactics to disrupt a satellite might be considered lawful despite the potential negative consequences. Therefore, dual-use technologies whether integrated in spacecrafts or through cyber, became another limitation against disarmament. While current space technologies offer civil and commercial advantages, dual-use systems present a double-edged sword in the realm of international security. The vagueness of the design intent of such technologies may intensify proliferation, as states may exploit allegedly civilian space activities for military ends. Thus, the lack of international consensus on the dual-use systems complicates arms control efforts as dissociating commercial and military functions becomes challenging.

With the rise of non-state actors and dual-use mechanisms, the need for further international cooperation and clear regulatory frameworks has raised in order to avoid unintended consequences

of weaponization and ensure the accountable and peaceful use of space technologies. As international agreements play a crucial role in establishing norms and regulations to prevent weaponization of space, establishing international enforcement mechanisms is an important task because they can be a deterrent force against exacerbating tensions and risks. Having such mechanisms is critical not only to avoid an active war but also to provide risk-management against hybrid threats globally. By taking the previous international space treaties and current disputes into consideration, new steps towards better international laws along with enforcement mechanisms should be taken by states. As cooperative approaches are vital for the peaceful and sustainable use of outer space, forging consensus on arms control in space to safeguard the international community is a major necessity. Providing a solid foundation to resolve these and further limitations in arms control also requires a comprehensive approach to transcend international interests and foster a shared commitment for the peaceful use of space.

Finally, in order to enhance international security within the current structure of the space race, attaining new space agreements suitable for the multipolar nature of the world and increasing space diplomacy among nation-states are essential. As the realm of space is moving away from unipolarity with the rising powers, other spacefaring nations such as China began to attain space power despite the US' dominance in the area (Koh, 2022). Therefore, by strengthening and expanding the existing treaties between states, emerging challenges should be addressed in additional agreements on prohibition of activities and technologies which could lead to weaponization. Likewise, the promotion of diplomatic steps towards space security is essential to build reinforcing international agreements along with cultivating responsibility and transparency as the space security is a global domain. Establishing forums for open discussions, crisis-management mechanisms, and other cooperative platforms could also provide a conducive environment for space disputes. As this research aims to provide analysis on the limitations of disarmament of space in the contemporary world, it puts emphasis on the importance of international cooperation and regulatory mechanisms since they are crucial for the prevention of further arms race in space. However, the international space agreements should be suitable to multipolarity therefore, be more inclusive in order to aid international balance. Besides, addressing the current challenges regarding the peaceful use of space requires a sense of collective

responsibility and all states should be subjected to space agreements because outer space is a shared heritage that should be preserved for the benefit of all humankind.

1.1. Methodology

Along with deploying historical comparison of the structure of space activities during the Cold War and post-Cold War eras, this study examines the emerging limitations of arms control efforts in outer space within the framework of the new commercialised nature of the space race through qualitative research. By navigating along the historical milestones of the space age, this study puts emphasis on the changes in power dynamics through new actors and dual-use technologies. The qualitative techniques have been implemented to assess the influence of the new parameters of the domain such as privatisation and commercialisation. The research design is characterized by in-depth exploration and analysis on the influences of the new international structure on de-weaponization efforts in space.

Adopting an explanatory and interpretative methodology, this study is centred on the policy-patterns surrounding weaponization to provide balance for the ongoing power maximisation of states. While it is based on assessing the contemporary limitations of disarmament through deductive approach, the research was mainly built on obtained secondary sources including books, journal articles, news and articles from various media outlets along with the primary sources which consist of speeches of the policymakers and reports regarding the topic. Other formal resources such as statements, agreements and interviews have also been analysed and benefited from.

1.2. Research Questions

This study aims to discuss the current structure of international competition in space, and it has been tried to answer the following questions to achieve the thesis' purpose. More precisely, the research question and the sub questions are:

- What are the current and possible limitations of disarmament in space?
 - Which factors evolved the space race?
 - What is the new space race in current international structure?

1.3. Justification

With the increased use of space, the examination of the transformation of the space race and the emerging limitations in arms control in space constitutes a critical and timely endeavour. This research is justified by several factors which underscore its significance in the contemporary landscape of international security. Shifting from a predominantly state-centric environment into a more diverse and commercially oriented form, space domain began to involve different actors along with different technologies. As this transition brings complexities into the realm, questions about the role of non-state actors and the motivation behind space systems are critical for possible consequences affecting global security.

This research seeks to contribute to the broader discourse of international relations through an analysis on how the new commercialised space race impacts geopolitical objectives. The interplay between private entities and nation-states requires a nuanced understanding of associated power dynamics as the commercialised international structure necessitates assessing implications. While the technical and the technological resources on space weaponization is more accessible, policy analysis on the potential effects of the new technologies becomes a necessity. Therefore, this endeavours to provide insights and contribute the literature as there are fewer studies about the policy analysis of the weaponization of space in the contemporary world.

1.4. Limitation of the Research

While this research endeavours to provide comprehensive insights into the weaponization of space, the main limitation of the study is the integration of the technical and technological information into the realm of international relations to avoid inaccurate or insufficient analysis. Since quantitative scientific activity assessment becomes a necessity to make security policies more

feasible, investigating the technological aspects becomes critical for decision-makers. By attaining technical information about the space technologies to make assessment on dual-use systems, a level of clarity would be provided for decision-makers.

Moreover, without the policy analysis in conjunction with the qualitative data, commercial and military objectives become inseparable since open-source information is already limited around the issue. As this research also involves the intersection of commercialisation and international security concerns, balancing the requirement of transparency with ethical considerations may create challenges. Therefore, contextual boundaries within the study can be interpreted differently in presenting conclusions about topic.

1.5. Discussion

While the exploration and utilisation of space offer transformative advancements in human civilisation, space has the potential to become a new warfare aside from fostering scientific improvements and economic growth. As the findings presented above shed light on the multidimensional challenges surrounding space weaponization within the framework of commercialisation, this discussion addresses implications of these findings through potential strategies.

Although international treaties such as the Outer Space Treaty provide foundational principles for the peaceful use of space, they fell short on underlining the impacts of non-state actors and dual-use systems. Therefore, developing new legal frameworks regulating these two limitations on arms control in space requires navigating jurisdictional progress. Considering the multipolar nature of the world, a multilateral approach needs to be adapted in order to build a consensus on terminologies of weaponization in international treaties. As the state-centric international structure remains, the rise of non-state actors' power in space needs to be regulated by states and international organisations to bring more legal certainties and support a stable and sustainable space environment.

Efforts for disarmament in space need to be strengthened by prioritising diplomacy, international agreements and enforcement mechanism to bring a level of deterrence. In addition to these legal and strategic concerns, ethical dimensions of the use of space also need to be addressed and emphasised in order to prevent colonisation of space. Therefore, by promoting responsible and peaceful coexistence of states in space, policymakers can mitigate the potential threats associated with the weaponization of space and uphold the sustainability of space activities for the benefit of all humanity.

1.6 Literature Review

The literature surrounding the transformation of the landscape of space activities and the weaponization of space presents a dynamic interplay of geopolitical, technological and decision-making processes. As the articles, books and general research on this specific topic are limited, different sources surrounding the issue from different disputes used in this study to assess the significance of each section.

As Brad Townsend examines the evolving dynamics in space activities of states in “Security and Stability in the New Space Age: The Orbital Security Dilemma”, he traces the unexpected longevity of peaceful coexistence in space along with navigating the historical context. By describing the transformation in the space age, he highlights concerns over possible threats to the American dominance in space with the rise of China and contemporary space objectives of Russia. Along with emphasising the economic, military, and scientific advantages which derived from the US supremacy and Townsend introduces the disruptive influence of non-state actors in space industry. He underlines the interplay of space and other war arenas as he introduces Charles L. Glaser’s rational theory as a fundamental framework to understand states’ behaviours with the notion of Security Dilemma. According to him, the challenges to cooperation in space, rooted in mutual distrust and the security dilemma (Townsend, 2020).

Paul Meyer expresses the political challenges of peaceful use of outer space in “Diplomacy: The Missing Ingredient in Space Security” section of “War and Peace in Outer Space” which is a part of the Oxford Series in Ethics, National Security, and the Rule of Law series. As Meyer

examines the importance of space activities and the diplomatic challenges in the domain, he considers diplomacy as the missing component in realm of space security and highlights the lack of progress in prevention of an arms race due to the lack of reports and limited international platforms. Meyer also criticises the UN resolutions for being divisive and examine other challenges to emphasise the necessity of diplomatic efforts for enforcement mechanisms against the weaponization of space (Hersch & Steer, 2021).

Aside from investigating the legal background, “The Oxford Handbook of Space Security” involves the analysis of the states’ role in space security and highlights the maintenance of the positive conditions of space security within theoretical framework (Pekkanen & Blount, 2024). By encompassing the global risk factors and benefits stemming from space-based capabilities, the handbook employs a range of IR theories to analyse the private sector and transnational dynamics. Along with providing valuable resource for the contemporary issues regarding outer space, the book examines the transformation of the space security and current policy debates.

Joan Johnson-Freese examines the US space strategy in terms of conflict prevention and offers a proactive and balanced approach rather than relying on being a deterrence as a strategy in his book “Space Warfare in the 21st Century: Arming the Heavens”. Acknowledging crucial role of dual-use mechanisms in space industry, he highlights the possible threats of space warfare and analyses the efficiency of the US military strategy in space. As he emphasises the importance of having superiority in space, the security challenges of the new international structure are also mentioned in his book (Johnson-Freese, Space Warfare in the 21st Century: Arming the Heavens, 2017).

Aside from examining the role of Global Satellite System (GNSS) in different areas, Jean-Christophe Martin and Frédéric Bastide emphasise the importance of space capabilities for national independence, prestige and the significance of becoming a global actor via space missions in “Positioning, Navigation, and Timing for Security and Defense”, 35th section of Springer’s Handbook of Space Security. As military users are the traditional customers of space assets, they address that space activities also benefit other areas by providing services such as critical telecommunication, civilian security, law enforcement and strategic commercial actions (Martin &

Bastide, 2015). It is also mentioned that the disruption of space infrastructures would be critical as they affect both civil and military assets.

Sheng-Chih Wang investigates and proposes a theoretical and distinct dispute which separates constitutive and regulatory outcomes of the transatlantic domain in his book “Transatlantic Space Politics: Competition and Cooperation Above the Clouds”. As well as, addressing the coexistence of competition and cooperation in space, the author analyses transatlantic politics through historical background and emphasises the importance of space domain for it. Sheng-Chih Wang also includes the cost-effectiveness of security strategies of the US and Europe giving an insight on the interplay of cooperative and commercial aspects. (Wang S.-C. , 2013).

Along with involving historical background of the space age, former NASA engineer Linda Dawson includes possible scenarios regarding the disruption of current space systems which are daily used in her book “War in Space: The Science and Technology Behind Our Next Theater of Conflict”. Underlining the escalated tensions between states through warfare technologies, she addresses the difficulties of estimating the number of dual-use systems. The outcomes of potential risks of space activities The author also involves critical research on the protection of space assets along with safeguarding humans from contemporary threats (Dawson, 2018).

While Townsend and Johnson-Freese put emphasis on the importance of attaining space power as a national strategy, Wang and Dawson highlighted the civil and commercial aspects as a tool for further negotiations and agreements among states as cooperation is a rational way-out from the severe outcomes of a potential active war in space. This thesis aims to fill some of the gaps in literature as it examines space weaponization. Therefore, along with providing further information on this topic, this thesis presents a more detailed perspective with further citations from different geopolitical perspectives considering the current multipolar international structure.

2. THE SPACE RACE IN THE COLD WAR ERA

Although the space has always been an intriguing field for centuries, advancements in space technologies were began due to the aim of military superiority. Aside from the comprehensive effects on science and technology, the competition between the two great powers was primarily focused on gaining military advantage in space by exploring spaceflight potentials. Not only with the dual intention of threatening one another, but also to become the deterrent force during the Cold War, the US and the Soviet Union developed large nuclear arsenals. Beginning with the invention of ballistic missiles that travels through the outer space by rising about 1000 miles above the sea level, war elements began to be carried away into the space. This military competition in space between the US and the Soviet Union was the beginning of the space age which held the world in both fascination and apprehension.

2.1. The Space Race Between the Soviet Union and the US

After World War II, the Soviet Union and the US had been working to increase their nuclear strike capabilities by improving their rocket technologies. Along with the nuclear weaponization race, military competition between the US and the Soviet Union has been carried along the space during the cold war. Lasting from the late 1950s to the mid-1970s, space race became a major aspect of the Cold War between the two nations (Tessaleno Devezas, 2012). Ultimately, developments in rocket technologies quickly linked scientific achievements with national security and national prestige.

Both great powers started their rocket research programs based on the Vengeance Weapon 2 (V-2) along with other German technologies. Between 1936 and 1942, V-2 was developed and used against England, France and Belgium by Nazi Germany (Harvey, 2022). By being the world's first long-range guided ballistic missile, V-2 became the harbinger of the Cold War's missile age. Thousands of V-2s were launched towards the end of World War II and later the Soviet Union and the US used captured V-2s to enhance their rocket programs. The US significantly leaned towards

the intelligence programs and operations to achieve a better missile technology, whilst the Soviets developed her own rockets by analysing V-2s including the first intercontinental ballistic missile (ICBM), R-7 Semyorka.

The US gave critical importance on gathering engineers from Germany and formed Joint Intelligence Objectives Agency (JOIA) which was administrating Operation Paperclip (which is also called Project Overcast). The Operation Paperclip was the intelligence program aimed to gather scientists from Germany. It was run by JIOA, and the Office of Strategic Services (OSS) assessing collected intelligence which was gathered through documents and interrogating captured German scientists. Many were invited to work with the US under suitable conditions where German scientists and their families would be financially affluent and protected by law. Including scientists and their families, around 1.600 people had come to the US (Schumm, 2020).

Harry S. Truman, who officially sanctioned the Operation Paperclip, was against recruiting Nazi supporters and members in order to prevent potential problems. As allowing these scientists with war crimes to benefit from immigrant rights in the US violates inter-American agreements, it was politically risky to just take the scientists without considering their crime records. The Assistant Secretary of State for American Republic Affairs, Spruille Braden, also highlighted the importance of keeping these scientists in the US as war prisoners in order not to violate Allied Control Council (ACC) regulations (Gimbel, 1990). However, Harry Truman's interdict was bypassed by the JIOA and OSS officials who strongly believed using the scientists' knowledge and experience to improve scientific programs would have much greater impact on the US' military superiority (Schumm, 2020). Although the ethical cost of whitewashing the German scientists' war crimes was pointed out and criticized, the value of the military advantage that the US had from these technologies during that time, probably exceeded any diplomatic or financial reparation. After all, the US gained chief engineers who had vital roles in space developments through this operation along with benefiting from V-2's technology which helped the US to make a kick-start at the space race.

As the Soviet Union aimed to create her own equivalent to the V-2, on 8 September 1945, Sergei Korolev was sent to Germany to procure technical support by examining hardware and

reaching for technicians left after the Operation Paperclip (ESA, 2007). Many of the crucial scientists who take part during the design of V-2s such as Wernher von Braun were already sent to the US by that time. However, this did not stop the Soviets from taking game changing steps. A year later, Stalin had established the NII-88 as the main engineering organisation to lead the industry in developing long-range missiles (Siddiqi, NASA, 2005). Korolev became the chief designer of a department where he works on long-range missiles and later his department became an independent organisation in the state experimental plant (GOZ-1) called Experimental Design Bureau No. 1 (OKB-1). By initiating the Council of Chief Designers which includes designers with different specialities, Korolev developed R-1 in 1950. R-1 was the forerunner of a range of missiles coded as Scud by NATO.

After three years, development of the world's first intercontinental ballistic missile, R-7, became a breaking point in Space Age as Korolev succeeded to improve energy capacity to launch into the space by reaching 7000 km range (ESA, 2007). R-7 not only proved the Soviets' capabilities of building such technological, industrial and personnel base, but also became a great propaganda victory against the US. After a couple of failed trial, on 7 September 1957, it was launched from Baikonur successfully as planned. This successful launch caused a substantial amount of shock on the US' side since she had been viewed to have the upper hand in the competition. Moreover, history changed on 4 October 1957, when R-7 put the world's first artificial satellite, Sputnik 1, into the orbit. By proving that it is now possible to deliver hydrogen bombs at will, Sputnik 1 extended the warfare and highlighted the importance of technology to reach a level of domination during the Cold War (Wang Z. , 2008). While many considered this success as an ideological symbolic act against the US, others saw it as the clear ability of an Eastern Hemisphere nation to make attack on the ostensibly isolated continent, North America (Shaw, 1999). Either way, by created a momentous shift in scientific capabilities, the Soviet Union left the US deprived from the benefits of becoming pioneer of such technology which brings both military superiority and ideological prestige.

The first satellite to carry an animal into orbit, Sputnik 2 was launched on 3 November 1957. The launch of Sputnik 2 brought awareness to the US about the concerning the potential of the Soviets achieving a superior status in the outer space. Whilst involving better scientific

instruments, sending a living creature, a dog named Laika, to the outer space became another propaganda victory of the Soviets during the space race. With this experiment, Soviet scientists estimated how long the passenger can last with the specified oxygen. Sputnik 2 was also launched on R-7 but unlike Sputnik 1, it wasn't designed to detach from the ICBM (Wilson, 2016). This was due to make assessments on space conditions in order to be able to send astronauts to the outer space for other space missions. These critical steps startled the US' politicians, and the general public, then the fear of falling behind accelerated space programs in the US. Besides, it was clear at that point that military superiority was heavily, if not only, depended on space programs and their success. Although the US had been working on satellite programs, the first successful launch was able to happen after a couple of months.

As the Soviet Union had overtaken the superiority in developing space technologies and hence military advantage, the US confronted with a prospect of vulnerability where the potential outcome of the threat could be incalculable. Therefore, this intense competition between the two great powers eventually exploited a 'missile gap' perception among the US' politicians. Missile gap was referring to the theory of the Soviets' missiles were outnumbering the US' and they were much more powerful. Horace R. Gaither expressed this vulnerability of defence capacity in the Gaither Report which is commissioned by Eisenhower on 7 November 1957. Mainly focusing on the worst-case scenarios, the report played a big role in shaping defence policies and spendings (IV, 2020). Although some considered the estimations as exaggerated due to the lack of clear intelligence evidence, the missile gap perception shaped the US' defence history by affecting US strategic nuclear policy (Roman, 1995). It even became a political factor on John F. Kennedy gaining power over Richard Nixon, Eisenhower's vice president (U.S. Department of State).

Meanwhile, the Army Ballistic Missile Agency (ABMA) which was formed in 1956 was leading projects with Wernher von Braun as the technical director. He directed the development of Jupiter C which was created by V-2 technology as a descendant. After the launch of Sputnik 2, the US sent the first US satellite into the orbit, Explorer 1, which was carried by a modified Jupiter C. Officially known as Satellite 1958 Alpha, Explorer 1 was launched on 31 January 1958 and in the same year, Explorer 2, Explorer 3 and Explorer 4 were launched successfully (NASA). After the launch of Explorer 1, astrophysicist James Van Allen who worked in the magnetospheric field

discovered the radiation belts around the Earth. These zones of energetic charged particles eventually named after him and called Van Allen radiation belt (Howell, Van Allen Radiation Belts: Facts & Findings, 2018). This achievement accelerated advancements in spacecraft technologies since these belts cause harm to both astronauts and spacecrafts. As it is extremely costly to retrieve harmed spacecrafts and the required time to prepare new astronauts for operations creates strategic disadvantage, such scientific improvements were directly affecting the national security of each superpower. Furthermore, Eisenhower took another major step to achieve technological superiority. Aiming to create a new space agency on top of the existing institutions such as the National Committee for Aeronautics (NACA), Eisenhower signed the National Aeronautics and Space Act into law on 29 July 1958 (NASA, 2008). Then, on April 2, National Atlantic Space Agency (NASA) was established with its final name and the program began to expand the US' own space capabilities (NASA, 2008).

As the space race between the two great powers began to gain momentum, second wave arrived with manned space flights. Whilst maintaining the status of the first “space superpower”, the Soviets brought the race to a different stage by sending the first manned spacecraft Vostok 1 into the orbit on 12 April 1961 (Shchegolkova D. V., 2011). The first cosmonaut to orbit Earth Yuri A. Gagarin, landed back safely near the river Volga and proved another victory against the US and pushed the Soviets ahead in the race. Shortly after, the US caught up with the Soviet Union by sending the second human into the orbit, Alan Shepard (Mann, What was the Space Race?, 2023). However, Alan Shepard merely flew on a suborbital flight shortly which was critically embarrassing because Gagarin orbited the earth (Garber, 2013). It was only later in 1962 that the US sent astronaut John Glenn into the orbit. Whereas the US gave critical importance on gathering intelligence and evaluating data to assess the Soviet Union's rocket programs, both great powers used and refined six systems to send humans to the outer space: launching mechanism, spacecraft, life-supporting systems, pilot training, command and control and recovery (National Air and Space Museum). By enhancing required systems and equipment, the US and the Soviets made new sci-fi fantasies possible as the new aspects of the space area unlocked for military, and later commercial race.

As the improvements in space became the main power factor during the cold war, the space race became a propaganda component used by politicians. After last advancements, John F. Kennedy announced his challenging goal to make the US in a world-leading space-faring nation and land a man on the Moon before the Soviets at the Address at Rice University on the Nation's Space Effort on 12 September 1962. Earlier, he mentioned this goal on 25 May 1961 before a special joint session of Congress for the first time. While it took a lot of attention from the media and even the thought of achieving such success was celebrated by many Americans, announcing such goal was also a way preparing the public for further spendings on space technologies. Due to the pressure of catching up with the Soviet's achievements and the Bay of Pigs failure, Kennedy highlighted the power potential of achieving lunar landing by announcing this challenging and dramatic goal (Garber, 2013). Although Kennedy's goal considered unrealistic by some of the American public, he highlighted the necessity of improving the US' space programs to reach a world-leading position and emphasised the critical importance of having the upper hand in the space race once again. After the first trial with Saturn C-1, to achieve such clear triumph, the US still had 7 years to go.

Another important step of the US was the launch of Telstar 1 in 1962 (NASA). It was developed by the American Telephone and Telegraph Company (AT&T) and it became the world's first active communication satellite (National Air and Space Museum). Since subsequent generations of communication satellites built upon Telstar's technology, Telstar is a milestone as becoming the backbone of modern telecommunications infrastructure. Also, it represents the beginning of the commercialisation of the space since it was intended to be used for commercial purposes (Hillger, Toth, & Bette, 2012).

The armament and technology race between the two great powers intensified during the Cuban Missile Crisis in October 1962. The dangerous confrontation and miscommunications between the US and the Soviets almost led to a nuclear conflict and when the tensions resolved due to Khrushchev's achievement of a peaceful approach, Kennedy had the change to clear his reputation by taking a likewise step after the Bay of Pigs fiasco against the Castro regime in Cuba. These events led to the Limited Test Ban Treaty which was signed by the Soviet Union, the US and the UK on 5 August 1963. After years of negotiations due to the rising concerns around a

nuclear fallout and its possible dangers, they signed the agreement which refrain parties from testing nuclear weapons in the atmosphere, in outer space, under water and underground (United Nations).

In 1962 the Soviet Union had another critical step by sending Vostok 3 and Vostok 4 at the same time in order to work on orbital rendezvous. Proving that a contact in the outer space possible, Vostok 4 followed Vostok 3 successfully in the orbit 75 miles apart and this became another victory for the Soviets (IAF, 2008). In 1963, as another first, Valentina Tereshkova became the first woman to go to the outer space and she became another pride in the Soviet space history. In the same year, as the NASA's first human spaceflight program, Mercury, came to an end, new programs developed for the goal of landing people on the Moon. Although the goal was finally reached through the "Apollo Program", it is important to mention the Gemini program which was a critical bridge between the two. While the Mercury program was based on the aim of getting people into the outer space, the Gemini program was focused on how long that they would be able to keep astronauts in the orbit in order to prepare for Apollo lunar trips that lasts a couple of weeks (The Smithsonian's National Air and Space Museum, 2022). During the Mercury and Gemini programs, NASA used ICBMs such as Titan II to launch spacecrafts. However, the Apollo required more specific vehicles for the purpose of carrying a bigger lunar spacecraft. Towards the end of 1964, the Soviets was running similar programs to keep the superior position in the race by having military advantage in space. Then, with Vostok 2, Alexei Leonov became the first person to float in the outer space by leaving his capsule. As the Soviets outpaced American technology in the field once again, NASA was working on to reach that level of scientific advancements before landing people on the Moon.

The first manned Gemini flight, Gemini 3, became the first spacecraft to change its orbit in 1965. This was a major development for the US since practicing orbital rendezvous was a short-term goal of NASA. While the US was working on new developments through Gemini program, improvements on the Apollo missions continued. Later, Titan II was launched Gemini 4 which carried James McDivitt and Edward White into orbit, and Edward White became the first American to flow freely in the outer space on 3 June 1965 (NASA, 2017). As the Gemini program became a media phenomenon because of White's extravehicular activity (EVA) achievement, fundings and

public support accelerated the Apollo missions. Although the mechanics were still lacking certain qualities, the first rendezvous in space was made with Gemini 5 and Gemini 6 on 15 December 1965 (Neufeld, 2015). As NASA improve practicing rendezvous, way to the moon was becoming clearer because mastering such challenging maneuverer was crucial for the goal of finally landing people on the Moon. Aside from the first American spacewalk and rendezvous, the Gemini program achieved another critical milestone when Gemini 8 docked with the Agena Target Vehicle and the first docking of spacecrafts made possible by the US as it was an important accomplishment for the Apollo missions (National Air and Space Museum).

On 3 February 1966, the Soviet spacecraft Luna 9 landed on the moon and the Soviets achieved another historical triumph by making the first lunar soft landing. The pioneering mission revealed that the lunar surface could support the spacecraft's weight and released the concerns around the predictions of spacecrafts could possibly sink into the lunar dust (NSSDCA). Between 1966 and 1968, The US was aiming to survey potential landing sites through the Surveyor program for the Apollo missions. Shortly catching up with Luna 9, American spacecraft Surveyor 1 landed on the moon for the first time on 2 June 1966 (NASA, 2021). Including the first colour photo, Surveyor 1 returned with thousands of images of the Moon. Also, a year ago, American satellite, Mariner 4, brought the first close-up images of the Martian surface after it performed the first successful voyage to Mars on 14 July 1965 (RMG). These photos attracted great amount of attention by showing how far people have gone and how the journey to space came to reality.

Whilst many failed launches and accidents happened so far during this intense competition, in 1967 two important catastrophes took place in the space race. The first tragic accident happened during Soyuz 1 flight in 1967. Colonel Vladimir Komarov was killed because of technical problems of the spacecraft's landing module. In the same year, NASA crew died as a result of a fire in the Apollo 1 mission and the accident impacted NASA's approach to human safety during space explorations. Besides, these incidents became the harsh reminders of the consequences of technical challenges in space activities overall and both the US and the Soviet Union learnt valuable lessons regarding the improvements on design, engineering and reliability overall.

Before the US land the first person on the Moon during the Apollo 11 mission in 1969, NASA developed various vehicles particularly for the Apollo Program such as Saturn V rocket (Mann, 2020). Saturn V rocket was very large and during the first Apollo tests, a smaller variant of the Saturn V, Saturn I, was used to test the hardware and the engines of the program. After the Apollo 1 incident, NASA aimed to resolve previous technical problems and went for wide-ranging redesigns of the command module. During the time when NASA was launching uncrewed missions, investigations were made to scale the Saturn V rocket's performance. NASA began to send manned spacecrafts again after 18 months of preparations and the astronauts were sent with Apollo 8 mission to the Moon but without landing on its surface (Mann, 2020).

Meanwhile the Soviets were working on new space activities through the Soyuz Program which is still ongoing. The first manned launch of the program, Soyuz 1, made from the Baikonur cosmodrome on 23 April 1967 (TASS, 2017). Indeed, Komarov's death which was caused by a number of technical issues had multiple impacts on the development of the Soyuz program and the subsequent Soyuz missions were made under better safety conditions. Similar to the Apollo 1, the incident served as a stark reminder of the risk factors regarding the space activities. In addition to losing important cosmonauts causing critical harm to the program, it was very costly to recover the hardware that was lost. Because of these reasons, the program went for technical changes, and made 6 unmanned launches before sending another manned spacecraft for further Soyuz missions. Cosmonaut Georgy Timofeyevich Beregovoy commanded the first manned flight after the Soyuz 1 incidence, Soyuz 3, on 26 October 1968 (TASS, 2017). He performed various tests on the spacecraft systems and the Soviets' first manual space rendezvous was made during the flight. In 1969, new modifications and developments were made in the Soyuz program and this time two crewed spacecrafts, Soyuz 4 and Soyuz 5, were able to perform rendezvous for the first time. Following them, other Soyuz launches were made which conduct rendezvous and docking exercises later that year.

Before launching the ground-breaking Apollo 11, the US worked on other missions to gather further technical information before landing people on the Moon. Without a lunar module, Apollo 8 was sent to test long-range communication, perform spacecraft navigation and examine the potential lunar landing areas. Despite the technical issues, Apollo 8 successfully returned and

put NASA's space activities on front pages again. The only missing part was the lunar module in the Apollo system. After clarifying the capabilities of the launch system, the first complete test of the Apollo program, Apollo 9, was launched on 3 March 1969. Two months later, second complete version Apollo 10 was launched on 18 May 1969. It encompassed all of the features of a crewed lunar landing but without landing. It also set the record for fastest speed that was reached by a human vehicle at that time (NASA, 2019).

After preparing for various eventualities with practice equipment, the Apollo program reached a level of confidence to finally land astronauts on the Moon. Neil Armstrong and Buzz Aldrin landed the Apollo Lunar Module Eagle and spent two hours and a half on the lunar surface on 20 July 1969. Apollo 11 became a milestone for the US in the space race and strengthened the US' position as a leading spacefaring nation. During the experience, much of the time on the Moon was spent through the ceremonial dues such as speaking with the president and planting the US flag on the Moon. Aside from becoming a historic achievement which solidified the US' space power, the Apollo 11 mission became a major victory against the Soviets after several milestones the Soviets achieved before the US. In order to gain strategic superiority in space, discussions in the US at the end of 1960s were mainly focused on three goals, earth-orbital space stations, a piloted mars mission and enhanced lunar landing missions (Siddiqi, Challenge to Apollo: The Soviet Union and the Space Race, 1945-1974, 2000). Since these goals eventually were reached before 1970, the US was considered to have the upper hand in the space race at that time. As the achievements of the US began to surpass the Soviet Union in space arena, the final lap of the race was finally brought.

At the end of 1960s, the Soviets were aiming to create an orbital station. Russian cosmonaut Konstantin Feoktistov had the idea to install systems and units from the Soyuz to reach that goal. As his proposal to the CPSU Central Committee was supported, the project was approved, and the Soviets began to work on creating the very first space station. On 19 April 1971, Salyut 1 was put into the orbit and became the world's first manned orbital space station as the first in the series of stations (Gibbons, 2008). Including the docked Soyuz spacecraft, the station contained a number of compartments which had different functions. Salyut 1 also became a platform to make further scientific research in a microgravity environment to improve new technologies. Cosmonauts also

conducted biological and medical experiments along with testing wide-angle sight for the accurate positioning to the planets. The research made on the Salyut 1 was valuable because the obtained data provided critical information regarding long-term human stay and work in the outer space. Unfortunately, the mission had a tragic end when Dobrovolsky, Volkov and Patsaev died in the separated vehicle which was depressurized due to the abnormally opened ventilation valve causing a sharp drop in pressure on 29 June 1971. As they became the first people who died in the outer space, by the late 1970s, there weren't any further fatalities (Lee, 2022). Since many rules were revised in the space industry after this tragic incident, new rules were also made such as cosmonauts flying only in spacesuits in order to provide protection against potential depressurization.

The Soviets were working on a secret military space program, the Almaz, which was a series of military reconnaissance orbital platforms. So far, the Soviets already put "spy robots" into the orbit in the mid-1960s and they were the world's first spacecraft operating at a nuclear power plant (Kolesnikova, 2017). Along with other military purposes, the Almaz was designed to have a military reconnaissance role for observations and taking photographs to track military activities such as searching for sea-based targets. As having a space station where it is much easier to detect potential threats would improve national security, the Soviets launched three crewed military stations within the Almaz: Salyut 2, Salyut 3 and Salyut 5. In order to conceal the dual existence of the two programs, Salyut and Almaz, the Soviet Union launched the three stations as a designated part of the Salyut Program. However, the US not only found plenty of evidence of the Almaz, but also managed to discern some of the military features of the Salyut 2 as it was transmitting signals at a specific frequency which was common for Soviet reconnaissance satellites. Another major element of the program was the Transport Supply Spacecraft, TKS, which was never used at that time but became the foundation of the International Space Station (ISS) (Siddiqi, 2001). After Salyut 2 which was launched on 3 April 1973, the Salyut 3 sent into the orbit on 25 June 1974 and then Salyut 5 sent on 22 June 1976. After the Salyut 5 completed its flight on 8 August 1977, the program has been completed.

The US launched the first American long-duration orbiting space station, Skylab on 14 May 1973. Although the first station was sent by the Soviets, a more advanced research laboratory made the US take several steps ahead. Skylab included research in different areas such as astronaut's

health responses during long flights, earth sciences, astronomy and solar physics (Uri, 2023). The Skylab was operated by separate three-astronaut crews: Skylab 2, Skylab 3, and Skylab 4. Also, there were four main sections of the Skylab: The Airlock Module (AM), the Orbital Workshop (OWS), the Multiple Docking Adapter (MDA), and the Apollo Telescope Mount (ATM). The crews were mostly working in the Orbital Workshops where they mainly live. While the Multiple Docking Adapter contained a main and a backup docking port for the spacecraft, astronauts were conducting spacewalk through the Airlock Module (Uri, 2023). Aside from making solar observations, physiological effects of weightlessness for a long period of time were monitored. The success of the Skylab showed that the crews could live and work under space conditions for extended periods of time. Reaching this point, NASA continued working on further goals such as creating reusable spacecrafts and the Space Shuttle programs.

Although by that time several UN agreements were made such as the Outer Space Treaty and the Rescue Agreement, a collaboration through a joint mission between the two great powers still seemed unlikely. However, the first international partnership in space was made through the Apollo-Soyuz Test as it became the first international human spaceflight in 1975 (NASA, 2015). The mission's technical goal was met through an American docking module which was jointly designed, and Deke Slayton, Tom Stafford, and Vance Brand from NASA met the Russian cosmonauts, Valeriy Kubasov and Aleksey Leonov in a Soyuz capsule (NASA, 2015). Meanwhile, the number of joint operations is increased with the establishment of the European Space Agency (ESA). It was established by the ten founding members: Germany, Spain, United Kingdom, Sweden, Switzerland, the Netherlands, Italy, Denmark, Belgium and France. It became a major actor in space activities as it provides international collaboration to this day.

While presenting an international cooperation in space for the first time, the Apollo-Soyuz joint is considered to end the space race according to many resources (Betz, 2020). It is even stated that the race had already ended when the lunar landing goal was achieved by the US in 1969 (HISTORY, 2010). Either way, considering such fierce competition to come to an absolute end through moon landing or a handshake in a joint program, does not represent a complete reality as there is an ongoing aim of power maximization in space. As the interest in gaining power in the outer space of the two great powers remained, the race has never truly ended but changed over

time. Besides, a more complex understanding of the competition, the new space race, has raised. With the US, China and Russia as the main actors, the new space race has risen different concerns but function with the same motive, gaining space power (Costello, 2023). As the race evolved into a multifaceted nature with more actors involved, civil and commercial side of it has become more and more prominent. Nonetheless, military aspect of space persists and should not be overlooked since becoming the deterrent power is a vital goal of states. Since weaponization in space brings disputes regarding the potential negative outcomes, more international collaborations and agreements will be necessary to provide a more stable and balanced international environment.

The space race between the two great powers was the beginning of another shift for a deepened security concept because of how detrimental possible outcomes could be. Therefore, satellites became critical political instruments due to their presence in military and economic areas. Finally, rising concerns pushed states to make certain agreements regarding the space and international security. Although agreements brought some level of structure for states to prevent potential problems that could occur during space activities, they eventually were not able to cover majority of the complications and eventually fell short of current requirements for buffering the probable adverse consequences of power asymmetry in international arena.

2.2. The UN Space Agreements

Throughout the 1960s, there has been a challenging process of establishing a common ground for the reliable and peaceful usage of the outer space within the United Nations framework. While playing a central role in developing international space agreements, the UN provided a forum for members to assign, outline, and adopt these agreements. The outer space agreements of the UN represent a couple of key milestones as they embody some of the international law instruments. While some of the agreements were not participated as much, others are widely embraced and creates a solid ground for space related discussions.

As the UN space agreements play a significant role in bringing a common ground for the governance of outer space activities, they brought many subjects into consideration. From accountability to liability, many topics became available to discuss in a stable and responsible

environment due to these agreements. While some issues remain unsolved and some solutions stay vague, the UN space agreements still provide a legal framework which promotes peaceful and sustainable usage of the outer space, addresses emerging challenges and bring possible solutions.

2.2.1. The Outer Space Treaty

In 1967, after months of negotiation in the Legal Subcommittee of the UN Committee on the Peaceful Uses of Outer Space, the 1967 Outer Space Treaty, formally Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, was signed by the US, the Soviet Union, the UK and several other countries. This treaty forbids the parties from placing nuclear arms or any other kinds of weapons of mass destruction (WMD) in space. Although the term WMD is not defined, presumptively nuclear, chemical, and biological weapons are included as the treaty puts heavy emphasis on using space for peaceful purposes (Kimball, 2020). However, despite the clear prohibition of the placement of WMD in outer space, the treaty does not clearly address militarisation of space in general. Although the Outer Space Treaty represents a significant milestone in attaining international space law, it's lack of comprehensiveness has been criticised. As the treaty was not able to prevent space weaponization and the development of ASAT, it failed to hold weaponizing states accountable (Roberds, 2016).

While the Outer Space Treaty remains crucial in regulating outer space activities, various factors such as mega constellations, space debris and satellite servicing missions challenge its coherence and potentially necessitates new legal frameworks (Johnson, 2018). Despite its limitations, the treaty has played an important role in outlining particular norms of states' behaviours and it served as the foundation for other agreements by fostering international cooperation in space exploration.

2.2.2. The Rescue Agreement

The Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space, shortly known as the Rescue Agreement, was the second agreement of the UN and entered into force on 3 December 1968. It was another revolutionary achievement for the development of space law and contained a solid form of some of the rights and obligations mentioned in the Outer Space Treaty (Gorove, 1970). The agreement involves procedures and protocols regarding the safety of the astronauts and return of space components in case of a landing on a different territory. It aims to provide members' astronauts assistance and return of spacecrafts components in case of an accident or a similar situation.

Although the agreement lacks detailed provisions for implementations, it became the first agreement to state the immediate safety concerns of astronauts. As the UN contributed to the extension of the rule of law in the space domain, the Rescue Agreement provided another international legal framework for the peaceful use of space (Dembling & Arons, 1968). Since space exploration continues to evolve, an updated version of the agreement becomes necessary to attain a more comprehensive approach in order to tackle with the full range of challenges and emerging responsibilities regarding the human spaceflight.

2.2.3. Liability Convention

Convention on International Liability for Damage Caused by Space Objects was adopted by the General Assembly and entered into force on 1 September 1972 (UNOOSA, 2017). The convention addresses problems related to accountability for the damage that is caused by space objects and claims procedures regarding such situations. While addressing the concept of absolute liability for space activities, the convention provides a straightforward mechanism to compensate parties affected by damage caused by space activities.

Although the convention played a significant role in attaining a legal framework regarding space liability, it lacks clarity for the definition of "damage" which is caused by space objects. While it leaves room for disputes among states, the convention still limits states militarising outer

space (Kilibarda, 2015). By outlining the legal framework for providing liability, the convention remains a significant milestone as it provides mechanisms for compensations.

2.2.4. The Registration Convention

Convention on Registration of Objects Launched into Outer Space, also known as the “Registration Convention”, entered into force on 15 September 1976. It promotes transparency and responsibility of members in their space activities by requiring them to register the space objects they launch. As the Convention is a significant development for attaining a level of accountability for the space activities, it made contributions on resolving the issues of compensations.

While the Registration Convention mandates parties register their launched objects, it also provided clarification for the issues regarding the identification of space objects and supported the peaceful use of space by providing such liability (Yun, 2004). However, since space activities evolve through the years, revision on the convention becomes a necessity to overcome challenges regarding the sustainable and long-term use of the outer space.

2.2.5. The Moon Agreement

Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, shortly the “Moon Agreement”, entered into force after long negotiations on 11 July 1984. It took the most time, five years, to enter into force after opening for signature and remained as the most controversial agreement of the UN. The rationale of the agreement was to regulate space activities on the Moon in order to prevent potential conflicts between states and get the approval of the international community for space actions (Marboe, 2021).

Although the Moon Agreement addresses many points about exploration and usage of the moon, many countries have not ratified it because of the concerns around the commercial usage of the lunar resources. For instance, the US did not sign this agreement in order not to withdraw from the opportunities that the space resources would bring (Rosenfield & Smith, 1980). As China has not also ratified the agreement primarily due to strategic and political considerations, Russia also

expressed reservations about the certain provisions of the agreement similar to China. Therefore, while providing an appropriate basis for the explorations and resource utilization, the Moon Agreement remains as a subject of a dispute within the international community.

2.3. Rising Powers in Space

As time goes by the outer space becomes the “ocean of the future” more and more and the military role of the countries evolve around the same desire for an effective control of space (Shaw, 1999). Therefore, after the space race, other countries began to develop their space programs since having space power is essential for their security. Laying the foundation of a highly commercialised version of the space race, new state-actors added new layers of complexities in the realm of space. As more states involve in space domain, traditional dynamics of a bipolar world began to shift towards a multipolar structure which required new international norms and agreements to ensure international security.

2.3.1. China

Although China’s journey to space began years later, the first steps were taken in the following year of the establishment of People’s Republic of China. As Mao Zedong recognised the strategic importance of having space power for national security, his administration articulated a vision which is aligned with the objectives of self-reliance and catching up with the technological advancements required for space activities. Through a combination of strategic planning, collaboration with the Soviet Union and the success of Chinese space programs, China became one of the most important space powers. As China’s growing influence within the outer space activities is widely acknowledged, China’s role in reshaping the power dynamics in space became indisputably prominent.

The Soviet Union and China entered into cooperation and made the Sino-Soviet Treaty of Friendship, Alliance and Mutual Assistance agreement in February 1950. From strengthening the cooperation between the two states to preventing threats of a possible rebirth of Japanese

imperialism, the agreement aimed to resolve multiple issues and guarantee the security of the two states (A. Y. Vishinsky, 1950). While forming one of the most important alliances during the Cold War, the agreement had a significant impact on China's level of security and defence capabilities (Foot, 1997). In 1951, China began to provide uranium ores in exchange for the Soviets' assistance in developing nuclear technology (CIA, 1951). Within this period, the Soviet Union began to transfer rocket technologies to China which laid the foundation of China's early space program. The Soviet Union and China signed another agreement on the assistance for military and civil facilities in 1956 and the Soviet Union provided China the technical documentation and equipment necessary for the production of nuclear weapons. Furthermore, after the success of Sputnik 1, Mao Zedong announced his goal of developing two bombs and one satellite in 1958 (Tatyana Vladimirova Fedorova, 2021). Although the first ballistic missile was tested in 1960s, Mao's recognition of the importance of gaining space power to achieve strategic advantage and national prestige was shaping China's security strategy from back then.

While the China's rise as a space power began to stand out during the 21st century, the development of nuclear weapons in China started the journey to the outer space just like the previous competitors of the space race. Nonetheless, the first official step of China to the outer space was the first launch of an experimental rocket, T-7AS1, on 19 July 1964. In the same year, the first Chinese nuclear test was carried out successfully with the explosion of an atomic bomb at Lop Nur. As the government of the People's Republic of China stated, this was due to the increasing pressure of nuclear threats of the US at that time (USC US-China Institute, 1964). As China became a nuclear weapon state in 1964, Chinese space activities began and China's first satellite Dong Fang Hong 1 (The East is Red no.1) was launched with Changzheng (the Long March) launch vehicle in 1970 (Gauthier, 1999). With this achievement, China became the fifth country to launch an artificial satellite after the Soviet Union, the US, France and Japan (Kolesnikova, 2017).

During 1970s, many important international steps were taken, and the US-China relations began to strengthen. In 1971, the ties between the US and China began to be restored and Henry Kissinger visited China with the aim of improving relations. A few months later, the US and China signed the Shanghai Communiqué which consolidated development in normalizing the relationship between the two states. They signed the Agreement on Cooperation in Science and Technology in

1979 and China- Europe science and space research cooperation began in 1983 (Kolesnikova, 2017).

After Dongfeng-5 being tested successfully in 1980, Fengbao-1 launched three satellites simultaneously for the first time in 1981 (Kolesnikova, 2017). A superior version of the first the Long March was created, the Long March 2C (CZ-2C). The satellite made its first launch on 9 September 1982, and it became the most utilized one (Gauthier, 1999). Before developing the second-generation family of launchers, China used Long March 2 family of vehicles in about the half of the launches. In the 1980s, China continued to advance further space activities and developed more advanced Long March rockets with increased payload capacity such as the Long March 3 and Long March 4. While expanding China's launch capabilities to fulfil a range of missions, the Long March 4 rocket family played another significant role in China's space exploration and satellite deployment over the years.

Although the open sources vary in precision about the total number of Chinese satellites, between 50 to 60 satellite launches were made from 1970 and 1996 approximately (Gauthier, 1999). Chinese satellites were designed with several functions such as photoreconnaissance, communications, remote sensing and meteorology till 1990s. The first Chinese geo-synchronous communication satellite was launched on 8 April 1984. Presently, China's space activities serve so many other goals from Mars explorations to space station development. The progress of the Chinese space program began to lay a foundation for the country to become one of the top tiers of space powers.

The 1966-1976 Great Proletariat Cultural Revolution had a major impact on China's space activities. While many projects were in stagnation during the revolution, many goals were achieved after it. As Mao Zedong put heavy emphasis on the aerospace industry to reach his military and political goals, he supported high-technology endeavours for Chinese national defence. Large number of changes and reorganisations were made within the Chinese Academy of Sciences (CAS) during the revolution, and it has been criticised for academic pursuits shifting into a more ideological structure (Solomone, 2013). However, aside from the fact that the space race has always had an ideological side, Mao's aim to attain political loyalty in the academic field demonstrates the

political objectives of his two military doctrines, the defence doctrine and Maoist doctrine. Both of Mao's military doctrines put strong emphasis on the political objectives of warfare which indicates the human factor as a more decisive dynamic of a war comparing to weapons or technological advantage (Powell, 1968) (Solomone, 2013). Even though he played an important role in space developments through collaborating with the Soviets and developing indigenous capabilities on their rockets, many milestones were reached after his time.

After the end of the Cultural Revolution, CAS and other institutions underwent another process of revitalization and a more pragmatic approach was pursued under Deng Xiaoping (Solomone, 2013). Although his approach is considered to enable CAS to catch up with the Western world and reach beyond the goal of national defence and gain better international prestige, his main political objective, economic modernization, mostly overshadowed space activities. However, most of the space achievements were reached during his time. Also, China's space industry reached a significant point, and it was associated with the social and political effects of the revolution (Solomone, 2013).

As various aspects of Chinese society and scientific developments had been affected by the Cultural Revolution, this period manifests the impacts of ideological objectives on technological advancements. Although China's bigger moves on becoming a great power in space were made years later, both Mao Zedong's military doctrines and Deng Xiaoping's economic modernization objectives were the primary influences on current space activities of China. As space developments are mainly driven by a desire to overcome the pressure of the US, China currently use this transformation to attain the ability to nullify the space systems of the US and reach a level of deterrence (Erwin, 2024).

2.3.2. India

Similar to other space pioneers India's primary motivation for its space activities was national development and self-reliance. Another goal of India was to improve telecommunications and broadcasting services as space-based communication satellites could provide better connectivity to remote and rural areas. Recognising the need for developing space programs, India

took the early steps to space exploration by formulating its first space committee. As India makes significant strides in the improvement of its current space program, space journey of India tracks down to the formation of the Indian National Committee for Space Research (INCOSPAR) on 23 February 1962. INCOSPAR was formed by Pandit Jawahar Lal Nehru whom India achieved space milestones through and the first sounding rocket was launched from Thumba Equatorial Rocket Launching Station (TERLS) within a year on 21 November 1963. The committee's name is changed to the Indian Space Research Organisation (ISRO) on 15 August 1969.

After the experimental phase, it was time for India to use space technology for operational purposes such as the economic and development. In 1975, India's first satellite, Aryabhata, was launched and Rohini Satellite (RS-1) was launched in 1980. These launches made India become one of the spacefaring nations (ASEAN IIT, 2021). India had developed two systems by the early 1980s: the Indian Remote Sensing Satellite System (IRS) and the Indian Satellite System (INSAT) (Brian Harvey, 2010).

As IRS program aimed to utilize satellite technology for Earth observation and collect data for arenas such as agriculture, forestry, cartography disaster management and urban planning, it marked a significant phase in India's space journey during 1980s. IRS functioned as a part of the Natural Resource Management System and carried out systematic surveys of the Earth's surface (Brian Harvey, 2010). Within IRS, the first India's first operational remote sensing satellite, IRS-1A, was launched by Vostok launch vehicle from Baikonur on 17 March 1988. It was an Earth observation satellite with multispectral imaging capability due to its special sensors and played an important role in monitoring agricultural and urban activities such as forest mapping, water resources management and urban planning. The satellite had pioneering role in establishing India's capabilities in the outer space and made a lasting impact on India's space endeavours. The second satellite, IRS-1B, was launched by a Vostok rocket with a new price risen by the Soviets on 29 August 1991 (Brian Harvey, 2010). In 1995, a second-generation IRS, IRS-1C was launched from Baikonur with improved resolution and stereo viewing which makes it the most advanced IRS. The IRS program became an important milestone of India since it improved Indian sustainable development by gathering data for the National Natural Resources Management Systems

(NNRMS). It also supported national and sub national economies in the fields of urban and rural developments.

The second system developed by India was the Indian National Satellite System, INSAT, which was a multipurpose geostationary satellite established in 1983. Plannings for INSAT began in 1968 and with a committee of scientists at the Space Science and Technology Centre, the first steps to many essential services such as satellite-based navigation, surveillance communication, satellite-based internet services and direct-to-home (DTH) television broadcasting were taken. It was and still is promoted by the Indian Space Research Organisation (ISRO). Aside from demonstrating the importance of having advanced technology for foreign policy, INSAT embodied the apprehensions and aspirations related with decolonization (Srinivasan, 1997). As INSAT had a profound impact on Indian space activities by contributing greatly to the country's technological advancement, it represents India's national development quickly after its establishment as a nation-state.

As one of the biggest spacefaring nations, India is pursuing its goal of utilizing space technology for national development and scientific explorations. By collaborating with other space agencies, ISRO delivers international cooperation and promotes the peaceful use of space while achieving India's space goals (ISRO). Important achievements such as IRS and INSAT during the early phases of the space committee, helped India to make a jump-start in space activities in the region and shaped the ongoing space vision of India which includes political, economic and cultural aspects with strategic presence.

2.3.3. France

In the early 1960s, France was another country to recognize the strategic importance of developing a space programs. The French National Centre for Space Studies, Centre National d'Études Spatiales (CNES), was established as the national space agency by President Charles de Gaulle on 19 December 1961. As space activities during the Cold War era became a symbol of national prestige, Gaulle's goal was to make France a leading world power. Particularly within

Europe, CNES also represents France's space policy implementation within the framework of international cooperation (ESA). Furthermore, CNES's goal was both to provide France the most modern space launch capacities and to drive French Guiana's social and economic growth.

From Hammaguir in the Algerian desert, France's first satellite, Asterix, was launched with Diamant which was a small launching vehicle on 26 November 1965. With this achievement France became the world's third space power and shortly after, other experimental satellites were sent to space to test technologies. Ariane 1 was launched on 24 December 1979 and the Ariane launch vehicle family strengthened France's position even more among other spacefaring nations. Though Ariane programme was established a part of European civilian expendable launch vehicles, it became a national pride for France since it was developed and built by CNES. The objective of the Ariane programme was achieving a self-reliant launch capacity which provides an optimized launcher for geostationary telecommunications satellites (M. Bignier, 1984). With better payloads, Ariane 3 and Ariane 4 launches were more capable and powerful. Also, they became momentous achievements for France as they shaped the commercial launch industry and contributed the European space program's overall success.

In 1982, the first western European astronaut to flight on the Soviet Union's Salyut 7 mission became Jean-Loup Chrétien. During the flight, a range of biological and space medicine experiments were performed. Although it is open to criticism as it represents a cynical political move during the Cold War, it also represents a noteworthy progress of France's journey to space (Evans, 2013).

Aside from developing satellites for commercial purposes, France focused on military aspects of space by improving the System of Radio-Communication Using a Satellite (Syracuse) which is a series of military communication satellite operated by France for national defence. By securing telex, telephone and data traffic, the system provided military communication and network management (P. Luginbuhl, 2021). These large-scaled developments enabled France to manage long-range military communications between operational zones and the decision-making centres and still operates for the army, navy and the country's air and space force.

As France places significant importance on space security, it has a comprehensive approach for improving space programs by collaborating with other states and agencies. Enduring the resilience of space-based capabilities, France considers space activities as a critical parameter for its national security and continues to improve systems for Earth observation, communication security and commercial satellites.

2.3.4. Japan

Japan's space exploration began in mid 1950s when Hideo Itokawa, known as the father of Japanese rocketry, started to lead a study team from the Institute of Industrial Science in University of Tokyo (JAXA). The observations of the atmosphere began with a Kappa rocket in 1958 and larger rockets developed to fulfil Japan's goal in 1962 which was sending 30 kg satellite within the following five years. However, this goal hasn't been reached with such ease. As the first five launches of the Lambda 4S, also known as L-4S, failed between 1966 and 1970, the program was strongly criticised by the public. Despite all of the obstacles, Japan's rocket technology improved year by year and the first Japanese satellite Ohsumi was launched successfully on 11 February 1970. This was the fifth launch of the L-4S from the Kagoshima Space Centre which is renamed as the Uchinoura Space Centre after the establishment of Japan Aerospace Exploration Agency, JAXA. Along with becoming the third country to send spacecraft to the Moon and Mars later on, Japan became the fourth nation to venture into space with the success of Ohsumi.

In 1972, Tsukuba Space Centre was established and Kiku satellites were developed and launched between 1975 and 1982. Kiku-1 (ETS-1) was Japan's National Space Development Agency's (NASDA) first satellite launched with the objectives of gathering all-round data for control and tracking on N-series launch vehicles (JAXA). In 1981, Hinotori, as known as Astro-A, satellite was launched from Uchinoura Space Centre. By observing solar flares, the satellite spotted more than 40 flares of various sizes from the Sun. Another big achievement was the launch of Hiten, Japan's first lunar orbiter. Carrying a small satellite, Hiten, as known as Hagoromo, made Japan the third country to achieve, lunar flyby and lunar surface impact on 24 January 1990 (NASA, 2018).

Meanwhile, Japan was also pursuing to have a leading role among the spacefaring nations in Asia. For instance, since China launched its first satellite Dong Fang Hong 1 only a couple of months later than Ohsumi, Japan's geopolitical ambitions were fuelled by it. However, as much as Japan's commitment to regional leadership in space was and still is a big parameter of its policymaking, other external factors became very dominant in Japanese national space policies during 1990s. Japan had been refrained from developing space technologies for national security by the US and adapted "Space Development for Exclusively Peaceful Purposes" due to the quasi-legal limitations (Suzuki, 2023). The basis of these restraints was a Diet resolution adopted in 1969 with the establishment of NASDA. The Diet set a limit for the government and prevented Japan from having any form of defence authority whether through investing or operating related space systems. Thus, Japan's space policy was strictly focused on the two approaches: the *logic of security* and the *logic of technology* (Suzuki, Space Policies of Japan, China and India: Comparative Policy Logic Analysis, 2019). Due to the US's pressure, the focus on the *logic of technology* became much increased with the trade tension between the two states.

As the Bush administrations claimed Japan was protecting its industry through rigid public procurement regulations and restrictive practices, it became hard for the US to penetrate Japanese market. At the end, Japanese government agreed to resolve the dispute by meeting some of the major demands of the US (Pine, 1990). Respectively, Japan agreed on concluding an accord for starting the public procurement procedure of non-R&D satellite for international market in 1990. This agreement was very damaging for Japanese satellite industry because of the inferiority in competitiveness against the US companies. However, by managing to deal with the economic consequences of failing in the satellite market, Japan shifted focus on supercomputer technologies (Suzuki, Space Policies of Japan, China and India: Comparative Policy Logic Analysis, 2019) As a result of this accord, the *logic of commerce* and the *logic of security* was excluded from Japan's space policy since the allowed space activities were very limited. Nonetheless, as the authority of NASDA in policy making increased, the *logic of technology* began to gain importance during 2000s and Japan's space agency developed H-IIB to transport the Japanese unmanned cargo, HTV. As the Japanese space program has evolved, Japan became a dynamic and influential force in space arena.

Japan's space history is characterised by gradual growth in space capabilities and advancements marked by milestones in satellite technology and international collaborations through JAXA and other channels. While continuing to be a key player in the global space community with contributing to different space projects, Japan holds major position in Asian space history if not as major as China due to the restrictions and different national pursuits. However, the limitations did not stop Japan from achieving a critical space power in the region by developing such high technologies, even though the main national space policy is utilizing the outer space for peaceful purposes and international cooperation. Also, by promoting private-sector-led developments, lowering the costs of space activities became one of the key objectives of Japan (Times, 2023).

2.3.5. The United Kingdom

During the Cold War, the UK was another great power who sought space power. Having various motivations such as scientific exploration, national defence and participation international space activities, the UK began its space journey in 1950s. First steps were the tests of the V-2 rockets after the World War II and British engineers began to develop plans for the British space programme. As regarding herself as one of the leading powers, Britain aimed to take her place in the space race. When the UK acknowledged that her V bombers which were recently produced with exceptional bomber designs, have massive vulnerabilities against new missile technologies, the Blue Steel project was developed due to further defence needs (Hill, 2001). Aside from ensuring strategic competency for potential threats, the establishment of the Blue Steel was a part of the broader context of nuclear weapons during that time.

As The UK and the US signed the 1958 Mutual Defence Agreement, not only the information exchange of missile technologies became prominent but also the nuclear partnership of the two countries stood out which considered to be the bigger highlight (Clark, 1994). In the same year, Britain's first indigenous expendable launch project, Black Knight, started and 22 total launches were made after the first launch on 7 September 1958. Black Knight was an experimental project which was primarily designed to test the UK's Blue Streak ballistic missile. However, due

to a scarce research budget, the UK started to experience difficulties around developing satellites despite of the information gathered from the US (Hill, 2001). Therefore, in order to share costs, the European Launcher Development Organization (ELDO), which was one of the precursors to ESA, was formed on 5 July 1964. As The ELDO and Britain faced significant cost overruns, Blue Streak was cancelled for military use and it became an incontrovertible disappointment for many British policymakers, because of the higher potential. Thus, ELDO became a political and technical failure along with many other reasons such as the lack of French and German support and other European countries' inexperienced contribution (Hill, 2001).

In terms of satellite missions, Britain began to develop communication and surveillance systems due to various motivations similar to other spacefaring nations such as gaining economic opportunities and international status. The first British satellite, Ariel 1, was launched on 26 April 1962 (NASA). With the development and launch of Ariel 1, the UK became the third country with a satellite in the orbit. Although Ariel became the first satellite of the UK, it was operated under both NASA and the Science and Engineering Research Council (SERC). So, it was a joint venture with the US. The satellite was used for the US' high altitude nuclear test, the Starfish Prime, to measure electron levels (Hess, 1964). The satellite failed as a result of technical issues during the mission on 9 July 1962. Although failure of Ariel 1 was not directly publicised as a part of the mission and rather expounded as an unfortunate consequence of the nuclear test, the satellite's contribution to the Starfish Prime was an undisputable outcome.

After Ariel 1, the Prospero satellite was launched due to a number of goals from preserving the competitive position of the Britain's space activities to conducting experiments and improving new facilities for the ground to pursue the new projects (Sketch, 1975). Prospero satellite was launched from a Black Arrow rocket on 28 October 1971, and it became the first and only independent satellite launched by Britain (McKie, 2023). Black Arrow was established by the research programs held by the Royal Aircraft Establishment (RAE) and played a key role in the UK's space history. Although Black Arrow did not continue after Prospero, the legacy of the program contributed to the UK's space industry greatly. In the years since Black Arrow, Britain became one of the biggest satellite manufacturers and provided advanced monitoring technologies (UK Space Agency, 2020).

The UK's partnership with ESA also plays a significant role for the UK's space power. In 1975, ESA was established with a joint of ELDO and European Space Research Organisation (ESRO). As one of the founding members, Britain had objectives similar to the times of ELDO. The opportunities that come with participating ESA were much more than the UK developing her own national space program. From budgetary priorities to strategic concerns, many factors played a role in Britain's partnership with ESA. Besides, ESA and the UK partnership was designed to be mutually beneficial. With the alliance, other members of ESA gained a broad technical experience of British scientists and engineers. Also, the UK's political support strengthened members commitment to ESA's endeavours.

After all, Britain's close relations with the US brought new opportunities with NASA programs as it facilitated other European countries as well. Moreover, The UK has historically emphasised a collaborative approach by participating international organisations. By contributing to the advancement of space activities in Europe, The UK's partnership with ESA improves international cooperation in the European context. As ESA coordinates European members states' financial and intellectual resources, it aims to develop various programs such as satellite-based systems and space exploration by implementing a longstanding European space policy. In 1980s, ESA became an important non-state actor in the outer space with the launch of first Spacelab module on the Space Shuttle and ESA's first deep-space mission, Giotto, which encountered Halley's comet and found organic material in a comet for the first time (ESA).

As ESA holds significance for the UK's interest in pursuing space activities, the UK's involvement in ESA is multi-faceted and involves economic, scientific and strategic dimensions. The partnership with ESA provides Britain a platform to contribute and benefit from Europe's joint efforts for enhancing space technologies and exploring the outer space. While the space industry continues to expand, the participation of the UK to space activities has been increased through EU partnership programmes (Martin M. , 2023). Finally, from financial to other aspects, the UK benefits from the opportunities that ESA presents and the joint commitment of all the member states comes with further advantages within a collaborative European framework.

3. THE TRANSFORMATION OF THE SPACE RACE THROUGH COMMERCIALISATION

After the Cold War, while the intensification of the strategic role of space power in military persisted, commercialisation of space became a transformative era for human history. Becoming a realm associated with both scientific explorations and international cooperation, the space gained significance for attaining economic power. Also, as the influence of private entities increased, from cargo supply missions to space tourism, civil use of space extended immensely during the post-Cold War era. Advancements in satellite communication technologies provided global data transmission and fostered scientific discoveries and new economic opportunities. As the commercial utilisation of outer space enhanced power maximisation of states, the complex interplay of technological advancements and strategic interests had a profound impact on power dynamics.

By elevating the role of private entities, commercialisation introduced additional complexities to the realm of space. While the majority of the stakeholders involved in space activities do not associate themselves with the ongoing geopolitical tensions, commercial space activities remain aloof from the military aspect of space (Porrás, 2019). However, since having commercial space activities is interconnected with defence and intelligence capabilities of states, commercial use of space became a game-changing facet in the new space race. While the increase in commercial space activities is highly linked with security objectives of states due to the strategic advantages that comes with the private entities, the dependence of critical infrastructure on space-based assets to enhance national security is acknowledged by states more than ever. As the National Counterintelligence and Security Centre of the US officially stated that the importance of the commercial space industry for the US economy and national security is recognised by foreign intelligence entities, the US began to consider this as a threat (Erwin, 2023). Moreover, the US enhances its space forces with the cooperative and commercial gains through private companies (Taichman, 2021). Since, international collaborations and privatisation began to be used by states as a power maximizing tool for the contemporary requirements of attaining national security, commercialisation has deepened the security concept by shifting power dynamics among the states.

Therefore, this link between the commercial and military aspects of space represents critical limitations on controlling weaponization of space.

In order to analyse the transformation of the space race through commercialisation, examining the changing parameters of the space race and the shifts in states' space objectives are required. With privatisation and changing costs of space activities, the space became a more complex and crowded area for competition. Also, with China becoming the third state to launch a crewed spacecraft, the US, Russia and China could be considered the three major spacefaring nations and having a deeper understanding on their space policies are important to shed light on the future of weaponization of space. As this transformation presents issues for international security, new regulations and an international body to govern space activities become a necessity (Broom, 2022). Thus, providing credible international space law regarding the new parameters of the space race and the changing space policies of states are decisive steps towards the peaceful use of space.

3.1. Changing Parameters of the Space Race

Beginning with the intense competition between the US and the Soviet Union, the space race was driven by multitude of factors and parameters. The competition had both qualitative and quantitative factors such as pursuing ideological prestige, attaining deterrence through military implications and developing technologies to build satellites and space stations along with attaining economic power through privatisation. Aside from these objectives, privatization and the lowered costs of space activities became the two main parameters affecting the structure of the space race by introducing contemporary issues in international security and law. As the end of the Cold War shifted the Space Race with collapse of the Soviet Union, the US took the lead to commercialise the space further (Mann, 2023). Along with prioritising the military aspect, the US considered the realm of space as a vital economic asset (Townsend, 2020). Therefore, in order to attain a deterrent posture, the US has started to use commercial infrastructures to achieve sustainable defence mechanisms (Moltz, *The Changing Dynamics of Twenty-First-Century Space Power*, 2019). With

the current form of the space race which includes more states and private companies, the outcomes of commercialisation intensified the economic aspect of space.

Table 3.1. *The Comparison of the Space Race During Cold War and Post-Cold War Eras*

	Cold War	Post-Cold War
Actors	The US and the Soviet Union	The US, Russia, China (As major spacefaring nations)
Use	Military, commercial	Military, commercial, and civil
Agency	Government	Government and Private
Cost	High	Low
International Treaties	The Outer Space Treaty, 1967 The Rescue Agreement, 1968 The Liability Convention, 1972 The Registration Convention, 1976 The Moon Agreement, 1984	Artemis Accords, 2020

Note. Information on this table is adapted from *The New Space Race*, by Royal Museums Greenwich, and *Space Law Treaties and Principles* by UNOOSA.

(RMG) (UNOOSA).

As the growing interest in space exploration is prominent in more and more states, new game-changing steps began to be taken as they enter the space domain. Many states including China began to have critical role in the realm of space with their technological advancements, economic opportunities, and strategic considerations (The Economist, 2018). In order to strengthen Chinese Communist Party’s legitimacy, China has developed space activities astonishingly fast and steadily (Sasaki, 2023). Moreover, India became another space power by prioritising

collaborating with private companies (Varghese, 2024). As they have launched significant programs, They achieved momentous landmarks such as crewed spaceflights, Moon exploration, and Mars operations such as Tianwen-1 of China and Mars Orbiter Mission (MOM) of India.

In addition to national initiatives, the private entities such as Space Exploration Technologies Corporation (SpaceX), Blue Origin, Virgin Galactic and many other companies, began to have major roles in the new space race. These private companies are pioneering reusable rocket technologies, promoting low-cost launches, and expanding the range of commercial space activities into various aspects such as satellite deployment, space tourism and space exploration (Seibert, 2023). Thus, while the space power unquestionable became one of the sources of national power, it was expected to see more states developing their own space programs. However, considering the costs and the required technology to do so, simply building a spacecraft was not the most effective way without any international cooperation or commercial contracts. Therefore, as the commercialism played a massive role in bringing other actors into the picture, the new space race began to have a multipolar nature only in a couple of years after the Cold War.

3.1.1. Privatisation of Space

The first satellite created for commercial purposes, Telstar I, created history when it successfully transmitted the first television signals across the Atlantic Ocean (Hillger, Toth, & Bette, 2012). Since Telstar I demonstrates the US' civilian space efforts, it became a part of the National Air and Space Museum collection (Space Center Houston, 2020). After producing vehicles under the contracts between private companies and NASA, the US enabled companies and foreign governments purchase communication satellites in the early 1970s. Recognising the need for further commercial opportunities, ESA developed Ariane which became the first competitor to NASA for commercial launches (Federal Aviation Administration). As the U.S. phased out most Expendable Launch Vehicles (ELVs) in favour of the space shuttle, private companies began to explore commercial launch options.

Aiming to facilitate commercial launches, the US emphasized the importance of expanding private sector involvement in civil space activities. Setting the stage for increased

commercialisation in the space industry, the Commercial Space Launch Act of 1984 spurred the enlargement of the US space industry with guidelines covering liability insurance, licencing and access to government facilities (Federal Aviation Administration). As the Act involved regulations for commercial space activities, it protected companies for large third-party damages (Space Foundation). Since regulation plays a significant role in the growth of private industries, U.S. Space Priorities Framework became an encouraging factor for the competitiveness of the private companies in the US (Goehring, 2023). As the 21st century has involved much more private organisations and entities including the SpaceX and Blue Origin, the commercial space activities of the US increased immensely (Barton, 2022). By fostering a commercial space industry through policy and legislation, the US sustained its leadership in space throughout the years (Goehring, 2023).

As privatisation shifted many power dynamics on earth, it was also revolutionary for space activities. Considering the Cold War space power model as “Technocracy”, changing power dynamics turned 21st century space power model into a “Netocracy”. While the new model is more international, commercially led and adapted via bottom-up innovation rather than top-down, it is relatively transparent and more network based (Moltz, 2019). The combination of political infrastructures and legally supported dynamic entrepreneurs brought a new range of space technologies along with military advantages. Also, by allowing the sharing of widely available technologies from foreign suppliers, the US facilitated international collaboration in outer space. Likewise, by forging robust public-private partnerships, leveraging the strengths of both sectors to drive innovation and progress, the US supports civil space endeavours. By nurturing space partnerships and committing to prioritise the realm of space, to solidify its position as a preeminent force in space becomes one of the main objectives of the US (Moltz, 2019).

The US divided space activities into three sectors: commercial, civil and security. As the National Space Policy involves strategies regarding each one of them, it also has specific guidelines for cross-sector actions for all agencies (Goehring, 2023). With having a dynamic and deregulatory approach at times, the US reached a favourable position in space by reaching its commercial goals. Therefore, this shows that states relying on solely state-controlled innovation and scientific

development in space may fall behind without the commercial gains that privatisation brings (Moltz, 2019).

As the new space race represents an intensified military and economic competition among states, private companies began to be supported by states in order to fulfil economic and national security objectives. The rising influence of the private entities and the emerging spacefaring nations brought new contracts and opportunities (RMG). However, without the required management and tools for the new international environment to adapt this transformation, the consequences of the new space race could result in further weaponization. The changes in the space race requires new agreements and international platforms as engagement by private entities function under no international enforcement mechanism. Moreover, as the profit-driven nature of the companies prioritize economic gains over environmental and international considerations in the long run. As weaponization and militarisation are the main issues addressed in international agreements, the strong interlink between them and commercialisation brings new dynamics for international security (Brockmann & Raju, 2022). Therefore, as the commercial space sector expands, international cooperation and robust regulatory frameworks become essential for providing international balance and safeguarding the sustainable and peaceful use of outer space.

3.1.2. The Emergence of Low-cost Space Activities

Over the years, the costs of the space activities became much lower (RMG). Therefore, another major parameter changes in the new space race became the lowered space costs which enhanced the space activities of spacefaring nations and added new actors into the field. The privatisation of space significantly lowered the space costs by introducing innovative approaches to space technology deployment. Along with the competitiveness of the private sector spurring advantages, reusable rocket technology adopted by companies such as the SpaceX became revolutionary. In 2022, launching a spacecraft became ten times cheaper than ten years ago and overall costs of spaceflights has expected to drop further by the year 2030 (Venditti, 2022).

As the SpaceX and Blue Origin have established competencies in launching reusable space vehicles, they enabled better operational agility and the US' military access to space became more

affordable (Stockdale, Aughenbaugh, & Boens, 2018). Without costly refurbishment, reusable vehicles became revolutionary components as they pose minimal risk in relaunching. As the low-cost access to space has ignited a fervent debate surrounding the evolving dynamic between government-led initiatives and commercial endeavours in the realm of space, the economic landscape of space activities have gone through profound transformation as it is encouraged for the US military to expand with the private sector (Stockdale, Aughenbaugh, & Boens, 2018).

As the number of satellites launched have increased drastically as the costs of satellites have come down, the space companies began to produce smaller satellites which took the attention of intelligence agencies (Davenport, 2021). Strengthening the correlation between military and civil aspect of space, low-cost access to space increased military capabilities of spacefaring nations. By providing enhanced military and intelligence capacity to the US, the commercialisation of space had radical impacts on its national security (Stockdale, Aughenbaugh, & Boens, 2018). While states' increasing reliance on private-sector contracts for space services is anticipated to persist, the surge in military utilisation of commercial satellite communication services became prominent over the years (Brockmann & Raju, 2022).

The rise of low-cost space activities impacts international dynamics by fostering global participation and fuelling competition among states for achieving in space technologies. As current commercial space sector departs from the state-centric structure, it benefits from diverse instruments for funding and partnerships with the private sector (Brockmann & Raju, 2022). However, non-military actors have the potential to add tension among states through their military capacities (Porrás, 2019). Therefore, the accessibility could be a downside without the regulatory frameworks regarding the private companies which currently make the majority of launches.

3.2. Post-Commercialisation Space Policies of Russia, the US and China

Following the widespread commercialisation of outer space, Russia, the US and China embarked on a transformative stage to adapt their space policies and strategies to the evolving landscape of the space industry. With the rise of private entities and commercial ventures, they undertook

significant objective shifts to align their space agenda with the contemporary structure of the space race. In order to navigate the changes brought by privatisation, a more cooperative and flexible approach was adapted. As the international structure changed through an immense integration of the world economy and emerged diplomacy among the states, the commercialisation of space reshaped the traditional contours of the space race. While the international collaborations, increased technological capabilities, and privatisation of space industry diversified the field and fuelled competition among states, the power dynamics in international security have undergone major changes. In this new landscape, new actors such as China began to take the leading position quite fast and emerging non-state actors also began to have major roles in shaping space history. Since the new dynamics challenge established international norms, the cooperation and commercial use of space represents the beginning of a different era in space history yet blurring the line between peaceful and weaponized use of space.

3.2.1. Russia's Space Program in the Post-Cold War Era

The fall of the Soviet Union had a profound impact on the space activities and from organisational changes to shifts in priorities, many modifications have been made. As Russia reduced the military spendings significantly during the decade of post-Soviet financial turbulence, Russian defence objectives are reshaped within the nature of modern conflict (Defense Intelligence Agency, 2017). With adopting a more pragmatic approach rather than ideological, Russia began to adopt civilian purposes in space and started commercialisation era in Russian space history. From Boris Yeltsin to Vladimir Putin's last presidency, a lot of renovations have been made in Russian military space objectives throughout the years and various factors such as geopolitical dynamics and economic priorities influenced these adopted objectives after the dissolution of the Soviet Union.

As the US and Russia started to have bilateral nuclear relations, the Strategic Arms Reduction Treaty I, START I, became the basis of it when Bush and Gorbachev initiated the treaty in 1991. A year later, as Bush administration was committed to discuss sub-ceilings on Russian strategic forces in depth, START II negotiations were began with a sharp focus on the traditional

Cold War measures of nuclear deterrence and arms control (Pikayev, 1999). Although Gorbachev also prioritised economic and social reforms, he never fully aimed to abandon space area. Moreover, he considered the commercialisation of space as a way to generate revenue for the economic growth. However, along with many other politicians, Boris Yeltsin demanded to stop space programs for the following years opposing to Gorbachev due to budgetary reasons (Tarasenko, 1994). In order to share costs, he aimed for an allied effort for developing space program. After the establishment of Commonwealth of Independent States (CIS), Space Exploration agreement was signed with several former Soviet republics on 30 December 1991. This agreement represented a joint effort for developing space programs much like ESA. Nevertheless, along with political and economic challenges, the pursuit of independent national interests by member states reduced the effectiveness and cohesiveness of the organisation. So, as it provided a platform for collaboration, CIS faced major challenges in accomplishing economic and political integration.

Meanwhile, a substantial amount of space-related industrial potential was not in Russia and the new Russian Ministry of Industries demanded to take over all of the industrial enterprises located outside of Russia as soon as the Soviet Union was dissolved (Tarasenko, 1994). By the end of 1995, all of the strategic nuclear warheads were moved to Russia from Kazakhstan, Belarus and Ukraine (Mehuron, 2000). In 1992, another major step was taken, and the Russian Space Agency (RKA) was formed which became a part of Roscosmos later. By establishing the agency, Yeltsin began to implement the new space policy which was leaned towards civil capabilities. The biggest change was made when the military and civil activities were separated. With the split between the Ministry of Defence and RKA, the shift towards the organisational and collaborative forms combined the legislative branch into the policymaking process (Tarasenko, 1994). Whilst military aspect of the program remained, Russia began to focus on civil use of space and the objectives of the program had gone through a massive transformation. With the adaptation of Law on Space Activities in the Russian Federation in 1993, the civilian aspect of space was highlighted, and some of the new objectives of the space activities were serving practical needs of society, being open to the public and being subjected to the independent assessment. Similarly, military aspect of the program was reformed by the new military space doctrine during Boris Yeltsin.

Table 3.2 *The Military Space Doctrines of the Soviet Union and the Russian Federation*

The Soviet Military Space Doctrine	The New Military Space Doctrine of Russia During Boris Yeltsin
Providing all resources necessary to attain and maintain military superiority in space	Monitoring compliance with international agreements
Maximum space-based military support for offensive combat operations on land, at sea, in air and in space	Providing support for ground operations
Maximum space-based military support for defensive combat operations on land, at sea, in air and in space	Providing warning of attack
Preventing the US to gain superiority in outer space	To deter potential aggression

Note. This table is prepared with the information from *Transformation of the Soviet Space Program after the Cold War* by Maxim V. Tarasenko and the Defense Intelligence Agency document, *Soviet Space Doctrine* (Tarasenko, 1994), (Defense Intelligence Agency, 1984).

As the changes indicate to a highlighted civil structure of space activities and a more defensive military use, space priorities of Russia mark a significant shift from focusing on competition with the US to Russia's civil improvements (Tarasenko, 1994). In 1990s, with the new space objectives, Russia entered into the global commercial launch market with Russian-American agreements. The Strategic Offensive Reduction Treaty, START II, which was signed between Yeltsin and Bush administrations was one of the main motivations of the adjustments in Russian space programs. Although the treaty never entered into force, the economic decline automatically pushed Russia towards lower force levels along with Yeltsin's military reduction policies. As a result, many space programs with different stages of development were stopped such as Energia-Buran heavy launcher which was the most expensive one in 1993 (Tarasenko, 1994). Although this enabled Russia to provide more for the operational systems and R&D efforts, the perceived neglect of the space military industry during this period had long-lasting effects on Russia's space and

military capabilities. Besides, this arms reduction gave the US strategic advantage since gaining Russia's disarmament through formal contracts became almost pointless for the US because of the requirement of concessions from both sides (Pikayev, 1999). Therefore, as the Yeltsin's enthusiasm in nuclear disarmament was not shared by Bush, these negotiations brought a strategic disadvantage for Russia.

As international cooperation in space was one of the main objectives of Yeltsin, important collaborations have been made during his presidency. In 1998, the functional cargo block, Zarya module, was launched as the first component of the ISS and it marked the beginning of the assembly of the ISS. Docking of Russian space station Mir and American space shuttle Atlantis was a historical moment in 1995. A space shuttle was docked with a space station for the first time with this experience. As Yeltsin adopted a cooperative position in space activities, this collaboration does only represent an international scientific achievement but also laid the groundwork for partnership between the US and Russia in outer space. While demonstrating the feasibility and accomplishment of joint endeavours in outer space, the Atlantis-Mir docking laid the foundation for Russia's crucial involvement in the ISS because it was a precursor to the station.

As the main purposes of Russian space activities shifted towards the civilian aspect, Yeltsin's period played a critical role in Russian space history. Although Russian space programs making collaborations with NASA improved diplomatic relations and relieved the Cold War tensions further, the neglected military aspect of one of the two great powers disrupted the balance of power. The START II not entering into force could be given as an example to prove the complex interplay of military power and political strategy. As the Soviet defence spendings began to be reduced after 1988, the shift from prioritising military to civilian use of resources presented challenges for the short run (Pilat & Garrity, 1990). Besides, since the Russian space program witnessed a strategic downsizing and modernisation, Yeltsin's new military objectives still was not placed on a utilizing position in the *guns versus butter* curve as he prioritised market economy to promote civilian use of resources (McFaul, 2000). This caused a power asymmetry which is a decisive factor in both conflict and cooperation in international relations.

After this decade of political and military transformation, space activities began to be prioritized again and became an important part of Russian foreign policy in Vladimir Putin's presidency. Russian space program started to re-assert solid aspirations to regain its prior position (Aliberti & Lisitsyna, 2019). During the early 2000s, Putin set diverse tasks and followed key principles such as multipolarity and territorial integrity. As he gave critical importance to cooperating with other spacefaring nations, Putin recentred the focus on space activities to the military aspect. He created seven federal districts and designated the federal district representatives as new members of the Security Council which he chaired. The Security Council ratified a new military doctrine on 21 April 2000. In the new doctrine, the use of nuclear weapons was not only limited to the case of responding to a nuclear attack but also included the case of a large-scale conventional weapons attack against Russia or its allies (Mehuron, 2000). The doctrine also stressed the terror attacks in Russia as a military threat which highlights the recognition of terrorism as hybrid threat. As having space power has a strategic importance, revitalizing the military aspect of the outer space was a critical step for Russia. Moreover, the strategic nuclear forces remained as the backbone of Russian nuclear capability in the 2000 military doctrine as it includes the qualitative enhancement of the strategic weapons complex (Sokov, 1999).

When Bush formally announced that the US was withdrawing from the Anti-Ballistic Missile (ABM) Treaty on 13 December 2001, as much as it was expected, Putin stated that it was an erroneous decision (Neilan, 2001). Bush administration argued that this decision was necessary to provide flexibility for the enhancement of efficient missile defence systems to protect the US and its allies from possible threats. On the other hand, as Putin was transforming Russian space activities, he gave critical importance on reporting systems of the agencies and made several changes regarding that. In 2004, Roscosmos gained ministerial status and began to report directly to the Government. Therefore, Roscosmos operated autonomously with the executive power in charge of civilian programs and with the authority to coordinate space military actions with the Ministry of Defence in Russia since it became one of the 28 Federal Agencies. It had various responsibilities such as implementing Russian space policy, coordinating international collaborations, managing Russia's property in space infrastructure and managing the operations directed at the Baikonur spaceport (Aliberti & Lisitsyna, 2019). In 2006, Russia ratified the

“Strategy for Development of the Space Industry up to 2015” which was initiating a space industry restriction and involved a new organisational structure by 2010.

As Global Navigation Satellite System (GLONASS) suffered from the reduction in fundings in 1990s, the constellation of it only consisted of 7 satellites by 2002 (GLONASS IAC). However, in 2002, the system was improved when Russia adopted “Global Navigation System for 2002-2011”. As Putin announced the program as a priority in 2005, new achievements were made such as the modernisation of the ground control segment with better accuracy for GPS and enhancing other systems. In addition to the new accomplishments, the spectrum of space activities has been widened over time with new programs and better fundings (Mathieu, 2008).

Russian space activities showed notable progress during Putin’s first presidency and his space objectives were shaped by the contemporary geopolitical challenges and previous initiatives. Therefore, while he readopted and emphasised the military aspect, he continued and improved the commercial use of space. The collaboration on ISS, improvement of GLONASS -which is a system similar to GPS- and improvements in military space capabilities such as advanced space-based missile warning systems and modernisation of the Strategic Rocket Forces (RVSN) were some of the main objectives of Russian space efforts in this period. As Putin pursued combination of collaboration and military advancements as space objectives, he marked a period of both strategic continuity and innovation. These changes indicates that Russian foreign policy has been shifted from a pro-western attitude towards a multidirectional, balanced and pragmatic line (Mathieu, 2008). Besides, as one of the Putin’s policies was also the promotion of cooperation with Asian neighbours and other non-western countries, space collaborations with these counties started to increase again.

As Dmitry Medvedev aimed to continue Putin’s space vision, the civil budget allocated to the Federal Space Agency was planned to increase. Along with developing new programs, the industry was restructured to become more competitive. In addition to prioritizing space military, Medvedev continued to make collaborations in terms of achieving commercial success in the realm space. In 2008, Russia was in cooperation with India for developing Geosynchronous Satellite Launch Vehicle (GSLV) and KVD-1M engine, Europe for Vega upper stage engine and Future

Launchers Preparatory Program (FLPP), and the US for Atlas RD-180 engine (Mathieu, 2008). These collaborations could take various forms according to different negotiations and agreements such as multilateral forums, working groups and contracts among providers and users. As Russia stayed as an active participant in ISS during Medvedev, modernisations of the armed forces continued for developing the most advanced systems in the meantime. He acknowledged the strategic weight of having space power for maintaining situational awareness and directing military operations in Russia's military doctrine (BBC, 2011).

In the 2014 military doctrine, an increased international competition is mentioned along with the insecure global structure due to the political and economic tensions. With the multipolar structure and destabilised international system as a perception of international relations, the doctrine involves external and internal dangers of Russia (Military Doctrine of the Russian Federation, 2014). Furthermore, as regional conflicts around Russia pose a great danger, Russia emphasised threats in the doctrine in order to protect Russia's territorial integrity and sovereignty. The doctrine reaffirmed that the role of nuclear defence as a deterrence force is crucial for Russia's national security strategy. The need for comprehensive military advancements and developments of new technologies were also outlined. In the doctrine, it is referred as one of the external threats, the use of information & communication systems to violate state security. While Putin considered the nuclear power as an object of deterrence, it was important to take the responsibility to reduce nuclear conflicts among this multipolar system as a great power.

Since 2000, Russia remarked its position in world politics as a nuclear power and many objectives were reshaped after the first decade of the collapse of the Soviet Union. Whilst the first Russian space military objectives had a defensive structure with heavy emphasis on the liberal mechanisms to provide international stability, the pursuit of space activities had major changes throughout the years after Yeltsin. Russia's perception of international system became multipolar rather than unipolar and cooperating with different axis was necessary for providing balance. As the great power revisionism has returned with Putin, Russia began to appear as a threat for the West along with China (Dibb, 2016).

3.2.2. The U.S. Approach to the Military Space in the Post-Cold War Era

Before the dissolution of the Soviet Union, there were two main objectives of the US in space, creating space activities for civil purposes, and using space programs to enhance national defence (Wilkening, et al., 1992). After the Cold War, as the US began to dominate the space, new principles such as offering opportunities to address global programs and an attaining an altered relation between the industry and space activities was adopted by the US. Both the advancements in space technologies and the attained political power led to these developments and reshaped US space activities. Moreover, rising concerns about the proliferation of space activities and budgetary motivations made the US to cultivate a larger scale of space capabilities. After enjoying about two decades of a complete dominance in space, the increasing multi-polar world transformed the US' strategy with new aspects. While prioritizing the military aspect of space as it is an essential component of the military capability, the US considered the space as a vital economic asset (Townsend, 2020).

From the beginning of the space age the United States Air Force developed space hardware and built spacecrafts through contracts with industrial providers. As the Department of Defence (DoD) was relying heavily on space capabilities for the required national defence missions, an offset was necessary to cover the expenses via non-state alternatives (Wilkening, et al., 1992). Consequently, an enhanced model was adopted which was creating contracts for commercial services and this reshaped the definition of commercial space from a military perspective. While the military aspect of space maintained as a supreme priority in the wake of the Cold War, more advanced technologies expanding space-based assets and parameters brought the strategic importance of space power to a higher level over time. As the commercialisation of space appeared as another parameter which is a decisive factor for having space power, the US' space approach has evolved, and a transitioning period began with the shifted focus from satellite reconnaissance and missile warning systems to the integration of space capabilities into military actions via dual systems. With the rising civilian aspect of space, the US started to use investments in space as a control and dominance instrument in order to provide superior defence mechanisms. Prioritising a vibrant economy through commercial use of space, became the basis of the fundings of US' defence initiatives.

Although the symbolic ending of the Cold War with Bush and Gorbachev's mutual non-aggression pact represented a new era for the world, Bush persisted the previous military goals of the US and Strategic Defence Initiative (SDI) continued to be a part of space policy during Bush's first presidency. After 1993, Bill Clinton began to put emphasis on civil and commercial aspects of space and aimed to stimulate private-sector investments while ensuring a strong link between commercial and defence activities including the intelligence mechanisms (Clinton Digital Library). As many objectives adopted such as providing free access to the US Global Positioning System (GPS), creating more NASA partnerships and low-cost access to space, the US accomplished a range of civil, commercial and defence programs during Clinton. During Bush's second presidency, space goals were marked by a renewed emphasis on scientific explorations and improving capabilities in advance. By announcing the aim of completing the international space station before 2010 and aiming to come up with scientific solutions against the space limits such as radiation and weightlessness, Bush focused on the importance of having long-term commitment for the space exploration (The White House, 2004).

During Barack Obama's presidency, the National Space Policy shifted towards environmental and civil goals along with maintaining stability in space and emphasising peaceful usage rather than an expressed military superiority (Office of the Press Secretary, 2010). While balancing exploration, international cooperation and creating sustainability was highlighted, the goal of reaching the moon was discussed with technical and financial costs. The Obama administration also supported the Commercial Crew Program (CCP) which began to provide commercially operated crew transportation service under NASA in 2011. Encouraging an economically constructive approach, Obama began to create stronger partnerships with the private sector, and this altered the US' approach on space activities further. With this new approach, privatization allowed companies to perform service for NASA with the vehicle designing process and by giving the contractor more freedom, an innovative form of government contracting was shaped (Grush, Obama's NASA made strides on commercial space, but stumbled on exploration / How the past eight years have shaped NASA, 2017). Although this model was firstly designed during Bush, Obama enhanced the transition by focusing on the engagement with the private sector.

As the path to the commercial space was paved over more than 10 years before Donald Trump, the foundation for the new privatised model was already laid. During Trump's presidency, NASA's long-term goals were remained, but short-term goals had undergone some changes. Trump prioritised reaching the moon again and accelerated NASA's plan for returning back to the lunar landing (Yen, 2020). Similarly, to Obama, the support for commercial partnerships were supported and Trump took new steps for the space military in addition. The establishment of the United States Space Force (USSF) on 20 December 2019 was a major step for the US during Trump administration. While addressing the space as the newest warfighting domain, Trump emphasised the importance of having American superiority in outer space (Garamone, 2019). Aiming for deterrence and better competitiveness, the US space objectives were mainly focused on having American leadership in space and took the realm of space as a national priority during Trump's presidency. Thus, along with taking significant steps towards privatisation, Trump did not ignore the importance of military aspect of space and addressed its significance mostly as a core element of the US' national strategy.

As the Joe Biden's administration is maintaining the previous priorities which were set by Trump, the key objectives of NASA remained as lunar landing, fostering competitiveness among space companies, inspecting solar systems through robotic spacecrafts, focusing on the Artemis program and providing defence against threats (Grush, 2021). Aside from these goals, Biden issued a new framework which was about tackling climate change. Investing in earth observing satellites, Biden's new space objective was to gain better understanding on climate change.

Space policy of the US before the end of Cold War was mainly followed the sanctuary view of space doctrine which indicates that space should not be an area for military objectives and space activities should be free from weapons. Also, anti-satellite weapons must be prohibited due to their potential threat for the space systems providing scientific capabilities of the spacefaring nations. According to the sanctuary school, for designation of a war-free space satellite reconnaissance systems are necessary because they make nuclear war less likely by fostering stability (Smith M. V., 2002). However, as the US was aiming to put ICBMs into the orbit from the very beginning of the space race and made weaponry experiments such as the Starfish Prime test, the outward weaponization of the US would not be able to provide solely national security without exacerbating

security dilemma since enhancing the security of one state is perceived as threat for others. Besides, determining space weaponization and militarisation is a complex dispute as most space technologies are inherently dual-use which can be used for both military and scientific purposes (Bo, 2021).

From anti-satellite weapons (ASAT) themselves, to satellite passing just too close, many incidents could cause threats. Electronic interference, energy weapons, cyber systems and laser are only some of the potential risk factors. Thus, without a clear consent on the potential threats and label shift between weaponization and self-defence mechanisms, the US mainly continues to exploit space as a critical power projection. On the other hand, privatisation became another crucial strategy of the US over the years, and it provided higher mobility with less transparency for the space activities. Privatisation of space started to play an increasingly integral role in space explorations and satellite services as the ongoing achievements in technologies caused the rapid growth of private companies from 2010.

Private space companies such as SpaceX, Blue Origin and so many others began to dominate the commercial aspect of space both inside and outside of the US. Presently, the US prioritizes commercial and civil space activities by supporting private industries such as SpaceX, and Blue Origin through NASA. For instance, NASA provided \$99.5 million for the Space Act Agreements with Blue Origin and Voyager Space as a part of the US strategy to support the development of alternative commercial stations before the retirement of ISS (Foust, 2024). As the US began privatizing space activities by facilitating private spaceflight companies, the civil and commercial gains became directly proportionate to its military purposes. As the US dominates the commercial industry, other states also began to recognise the importance of the commercial aspect of the space. Russia considers the development of partnership as an effective tool for the implementation of a long-term space strategy which serves national space activities of Russia (Kuznetsov, 2021). Although commercialisation and privatisation represent an alternative motive, it is important to point out that states' interests persist as gaining advantage in space military for their security and military activities also implies this fact.

3.2.3. China's Changing Space Approach

After the Cold War, China became one of the biggest spacefaring nations and rapidly took an entrenched place in the commercial space industry. As China depends its military power on technological capabilities, technology development is China's state-led effort in the new competitive international environment (Pollpeter, Ditter, Miller, & Waidelich, 2020). Therefore, China began to prioritise space activities via commercialising in order to pursue its national strategy. Along with the national effort for better technical capabilities for space missions, the establishment of several commercial space companies contributed China's space capabilities via putting an effort to encourage private sector involvement. As the Chinese government began to allow private companies to develop and launch rockets, commercial advantages fostered competition and innovation. By developing enhanced space activities through dual strategy of increasing privatisation along with prioritising space power as an important national security facet, China has undergone a remarkable transformation and became a major player in the realm of space.

While openly prioritising military aspect of space as a part of Chinese national strategy, China acknowledges the realm of space as a new domain of modern military struggle. Due to attaining superiority in space and cyber, investing in space has become a significant part of national defence for China. As China's military doctrine has reshaped accordingly to the expansion of its economic and political goals, it evolved from a defensive stance towards a more offensive one throughout the years (İlhan, 2020). Between 2001 and 2005, China's space industry improved rapidly and achieved significant milestones. Along with many satellite launches, China laid the groundwork for lunar landing missions and developed Shenzhou mission which was the Chinese manned spacecraft initiative. Furthermore, China developed its lunar exploration program, Chang'e, to achieve China's moon goals and laid foundation for deep space exploration to create a permanent technology base for moon missions (Jones, 2022). In 2007, China's anti-satellite test represented the extent of the People's Liberation Army (PLA) and China's aim to militarise space (Lin, 2023). It created a tremendous number of debris when it destroyed a weather satellite and ISS has still needs to manoeuvre around the debris of it. Alongside with the space station, the US was concerned about China's space capabilities which led to the 2011 law section, Wolf Amendment. As the Public Law No. 112-10, div. B. Section 1340 of title III which provides:

“None of the funds made available by this division may be used for the National Aeronautics and Space Administration or the Office of Science and Technology Policy to develop, design, plan, promulgate, implement, or execute a bilateral policy, program, order, or contract of any kind to participate, collaborate, or coordinate bilaterally in any way with China or any Chinese-owned company unless such activities are specifically authorized by a law enacted after the date of enactment of this division.”

As American astronauts are banned from directly working with Chinese astronauts because of the amendment, NASA has long-standing restrictions regarding Chinese space activities and pursued legal constraints against collaborations which were announced in contracts and in other forms (NASA). However, as the amendment did not fulfil its purpose which was preventing China’s space improvements and not allowing China to reach American space capabilities as Frank Wolf stated, this law section became a big debate in international community as it can cause issues for the lunar explorations in the future (Secure World Foundation, 2022).

Meanwhile, as the foundation for the first Chinese space station, Tiangong, was laid in 2011 with the first launch for the mission, China began to reach another level in the realm of space since Tiangong was going to be the second fully operational space station after ISS. By achieving such key milestones, China proved its space capabilities remarkably and various applications has been further expanded in Chinese space history. Since 2014, China officially opened the space launch market to private capital as numerous restrictions were lifted (Qian Jiwei, 2020). This move carried the dynamism in China’s economy towards the space industry very quickly and private entities began to take significant steps towards various aspects of space activities such as civil and commercial. Another major step was the establishment of the People’s Liberation Army Strategic Support Force (PLASSF) as the 5th branch of PLA in 2015 and it combined China’s military, cyber and electronic warfare units to strengthen security assets especially in areas physically inaccessible for people (Eastin, 2023). Aside from such assets as key steps for China’s military modernisation efforts, “informatization” of wars was another key aspect which doctrinally addressed by the PLA (Anthony H. Cordesman, 2016). As refers to the incorporation and integration of information technology into several aspects of Chinese military strategy, operations, and space capabilities,

China's perception on the importance of information and communication technologies became prominent. China's informatization efforts became a part of its military modernization strategy with the objective of enhancing capabilities in areas such as intelligence, surveillance, and reconnaissance.

Between 2014 and 2021, China's space sector has commercialised massively and over 100 commercial space companies were supported, and they raised about US\$6.5B. Although this number still falls behind of the US\$35B in annual revenues of the main national corporations China Aerospace Science and Technology Corp (CASC) and China Aerospace Science and Industry Corp (CASIC), the rise in commercial entities in China is became prominent (The European Space Agency, 2021). As China's way of commercialising in space represents a unique and complex form includes the dual use of incentives and stakeholders, China shows excellent ability for using standalone systems and a little less efficient in working with integrated mechanisms such as Low Earth Orbit (LEO) mega constellations (The European Space Agency, 2021).

China's 2020 space goals were significantly revolutionary for the nation. From developing new space vehicle series, conducting robotic moon exploration, establishing an all-day, all-weather, reaching global Earth remote sensing capacity, and developing a 60-ton space station to Mars exploration, many goals reflected how committed China was for attaining the leadership position in the realm of space (Pollpeter, Ditter, Miller, & Waidelich, 2020). Although China made a late start in developing space programs since there hasn't been a manned launch before 2003, China pushed for becoming a ranking state with a steady effort and achieved a space station in low Earth orbit and a robotic landing on Mars in 2021 (Davenport, Will China beat the United States back to the moon? It's possible., 2023). But before that, another milestone was the Chang'e-4 lunar landing on the far side of the Moon on 8 December 2018. Loaded with various cameras and different sensors to peer beneath the Moon surface, the success of Chang'e-4 became a game changing step in the new space race. As China continued to build on the mission and forged ahead, the Chang'e-5 mission became another critical achievement with bringing collected soil and rock samples from the Moon to the Earth (Nava, 2023).

With these and further achievements, China began to threaten the space dominance of the US in the long run as China mastered making rendezvous and reached critical cyber capabilities (Kluger, China Will Ultimately Overtake the U.S. in Outer Space, a New Study Warns, 2022). An extended version of the space station of the nation also creates critical competence as it offers an alternative to NASA-led International Space Station (ISS) (Reuters, 2023). Also, China officially achieved the first Chinese long-term space station, Tiangong, which became fully operational at the end of 2022 (Xiang Wang, 2023). As China plans to use it at least 10 years, it seems to stay functioning after the ISS's planned retirement in 2030 (Szondy, 2022). Moreover, China extended its goals for further deep space explorations, space-ground integrated information network and in-orbit maintenance of spacecrafts by 2030. With numerous satellites launches and improved space missions, China's commitment to space technologies and increase in its cooperative approach demonstrates a strong presence among other spacefaring nations. Presently, China became one of the leading states in space by attaining multiple significant achievements as mentioned through the country's space agency, the China National Space Administration (CNSA) (Nava, 2023).

In Conclusion, as China began to actively pursue international collaboration in its commercial space missions by providing launch services for foreign satellites, the country's focus on developing satellite services has led to the enhancement of the Earth observation, communication and navigation satellites which served both domestic and international customers by staging improved systems. Moreover, as the Chinese government policies have played a crucial role in supporting the growth of the private sector, further assistance for financial and regulatory support was provided for the aim of the emerging successful commercial space capabilities. The integration of the space industry into broader economic strategy of China reflects the government's commitment to technological and industrial advancement for initially providing national security. Being parallel to China's economic growth, China's commercial steps towards space demonstrates a strategic and ambitious effort to leverage its economic gain through space power and more importantly attain an upper hand in the realm of space in order to increase national security.

China's shift towards incorporating private enterprises into its space capacities via allowing commercial applications legally also represents a solid recognition of the economic and defence potential that the realm offers. The effective deployment of the private entities such as the

commercial launch providers, private satellite constellations and space tourism initiatives illustrates China's strategic priorities. As China continues to explore opportunities for collaborations and commercial initiatives, future space dynamics began to be changed through the presence of Chinese space capabilities. Ranging from the dual-use satellites to developing mars and moon missions, China has significantly expanded its presence in outer space over the years and continue to compete steadily in the industry to attain geopolitical and economic advantage.



4. THE CURRENT AND PROBABLE FACTORS AFFECTING DISARMAMENT EFFORTS IN SPACE

As the space race involves a diverse version of an arms race with the development of space technologies, the future of space is perceived as either commercialised in cohesion or a new warfare where states continue to maximise their military power with more destructive and critical weapons. As military and economic competition go hand-in-hand, it is important to acknowledge the direct link between the two in terms of attaining superiority in space. Although there is an assumption of war being unlikely since a potential conflict in space affects the whole globe and the economic perks of attaining space activities with collaborations is a win-win, the weaponization of outer space is addressed in international space agreements as a growing issue (Townsend, 2020). Besides, the emerging threats in the new international structure should not be overlooked because preventing weaponization is not solely an issue of an active war. As the concept of war and warfare also extended and transformed, analysing the current structure through traditional warfare elements would be trying to yield rockets with swords.

The increased number of ways to harm a nation represents the transformation of war through many aspects such as informatisation and digitalisation. Along with terrorism and cyber-attacks space has become another aspect of power maximization. As there is an increased reliance on satellite-based technologies for navigation, reconnaissance and surveillance in both conventional and non-conventional approaches, space power became a significant component of military capacities of states. Consequently, the shifted paradigm reflects the significance of having control over space assets as an integral to military power which influences the outcomes of conflicts on Earth. As space introduces new dimensions, new international norms, platforms and agreements are needed to tackle with the limitations for the international security. Since the stage is set for disputes on an astronomical level, agreed-upon principles become necessity to regulate competition (RMG).

Considering the changes in the nature of the space race through commercialisation, there are a few more extra steps needed to reach a consensus for de-weaponization. New usage areas of

outer space brought new parameters and to make solid international agreements, certain limitations should be issued. Over the years, some of the most notable limitations became the rise of the non-state actors, dual-use space systems and the lack of enforcement mechanisms. As commercialisation has lowered the barriers to entry and expanded opportunities beyond traditional state-controlled endeavours, the non-state actors began to create a sphere of influence in the market. Causing ambiguity in many areas, from accountability to the application of international agreements, the decentralised nature of non-state actors further complicates regulatory and oversight mechanisms. Likewise, when technologies began to serve both civilian and military purposes, dual-use systems increase the complexity of managing space programs in a manner that balances technological advancement with concerns over international security in terms of weaponization (Pražák, 2021). Finally, as managing such great indicator in power dynamics require enforcement mechanisms to safeguard global peace, the need for solid international agreements to strengthen rules and provide a common ground regarding weaponization increases.

4.1. The Rise of Non-State Actors

Along with the nation-states, international system consists non-state actors (NSAs) which are entities that participate in international relations through their power to influence and shape political, social and economic outcomes. As NSAs involve international non-governmental organisations (NGOs), international intergovernmental organisations (IGOs) and private actors, they began to challenge the state-centric international system by transforming it into a more “transnational” one (Ataman, 2003). During the post-World War II era, thousands of international organisations were established and affected societies and states via participating in various international discussions.

As the role of NSAs have increased over the years, their involvement in diverse fields such as business, media outlets, and research institutions became prominent in the contemporary global landscape. Since governments support for research and development (R&D) in space entities from the beginning to improve the use of space for civilians, overall budgets were increased for space activities (OECD, 2011). The involvement of the non-state actors through privatisation was

increased due to the bigger financial support from the governments, public-private partnerships and the commercial space market (Nogueira, Chimenti, & Orlova, 2020). For instance, space sector has grown massively throughout the years in the US and space investment went from \$300 million to \$10 billion between 2012 and 2021 (Bland & Brukaradt, 2022). This high jump in less than ten years represents how fast the industry grows and spreads considering more and more states are now began to benefit from the commercial satellites. The increased participation of NSAs in commercial space activities comes with many opportunities such as providing launch services, space tourism, satellite manufacturing, scientific explorations and space resource utilisation. Although they are not in the level of states, NSAs could attain an active and engaging role in shaping the decision-making process at times (Koechlin & Calland, 2009). However, non-state actors also present an increasing threat for international security in the realm of space due to several factors. Some of the significant limitations are stated under the following headings:

- Limited accountability and the lack of international regulatory frameworks
- Adding difficulties to international cooperation among nation-states
- Ability to use massive soft power through interfering media outlets, NGOs, and advocacy groups creating imbalance.

While these factors present threats for the international security, they necessitate binding legal frameworks reached through international cooperation. As tackling the limitations of disarmament is crucial to advance global peace, concentrated efforts from governments, NGOs and other international institutions to address challenges regarding the weaponization of space are required for the sustainable use of space as well.

4.1.1. Limited Accountability and the Lack of Liability of Non-State Actors

As the non-state actor term covers a broad range of entities such as corporations, trade associations, NGOs along with individuals, their position, status and responsibilities should be addressed in international law because of the increased impact of them in international relations (Kleczkowska, 2020). Because the public international law still primarily regulates nation-state

relations and international organisations, it does not provide a clear definition of what constitutes and regulates the activities NSAs in order to prevent weaponization which can increase through dual-use mechanisms. Therefore, in order to integrate such issues into the international law, non-state actors must be subjects in international regulations to reach a level of liability. However, in the current international structure, it is a complex task involving various crucial points.

Due to the lack of sovereignty element, recognition of other states, limited legal personality and fragmented legal status, non-state also cannot easily be subjected to the international agreements and international law. As their legal personality is predominantly regulated under national law rather than international law, building an international enforcement mechanism for NSAs requires a common platform and build necessary regulations based upon consensus of states without conflicting with their national law. Therefore, the scope of institutional accountability needs to be determined in order to improve the engagement with nation-states. As it will create a sense of ownership for states, international law-making would improve through avoiding domestic processes and doctrinal difficulties (Petrov, 2014). Also, regulatory implications play a fundamental role in both encouraging and discouraging the growth of commercial industry and, in some cases, deregulation may be necessary to improve the industry (Goehring, U.S. Commercial Space Regulation: The Rule of Three, 2023). Nonetheless, to preserve both national and international security, often more regulations on NSAs are needed and the utilisation of the industry should not be solely prioritised as it threatens the balance of power by creating an asymmetric international power structure.

4.1.2. Non-State Actors' Influence on International Cooperation

Aside from subjectification of non-state actors to the international law, another difficulty that the new international structure brings is rising cooperation setbacks among states. There are different perspectives about the involvement of NSAs in public diplomacy. Aside from state-centric perspectives, there are neo-statist, non-traditional, society-centric, accommodative perspectives on the place of NSAs in public diplomacy (Ayhan, *The Boundaries of Public Diplomacy and Nonstate Actors: A Taxonomy of Perspectives*, 2019). While state-centric

perspectives consider diplomacy only between states due to the sovereignty element which NSAs cannot attain, neo-statists offer alternative terms for NSAs' involvement such as social *diplomacy* as well as reserving public diplomacy for states only. As non-traditionalists consider diplomacy in compliance with capabilities instead of the status of actors, they involve NSAs' activities as public diplomacy. Non-traditional perspectives also involve criticism on state-centric public diplomacy for not acknowledging the increased role of NSAs in the changing international environment. On the other hand, society-centric perspectives involve many non-traditional elements and consider *public* as people in addition. Lastly, accommodative perspectives adapt the NSAs in public diplomacy when met with certain conditions such as legitimacy and public interest.

As NSAs need to maintain their independence and neutrality when collaborating with states, defining new frameworks for it is challenging without stalling the decision-making process by falling into excessive bureaucratic process (Valencia, 2006). Although non-traditional perspectives have a growing influence, state-centric perspectives still dominate the international system as it is the most accepted by states (Ayhan, 2019). Therefore, challenges of integrating non-state actors in international cooperation still lay ahead. The ongoing state-centric nature of international structure, it is difficult for states to directly involve NSAs in their public diplomacy. Aside from the absence of the legal framework and mechanisms, the complexity of navigating NSAs' role in international relations requires careful balance between acknowledging their influence and adhering to the state-centric norms as they are primarily implemented within the framework of diplomacy.

As the rise of NSAs present issues regarding the traditional state-centric international structure by not having clear legal boundaries or regulations, they also raise concerns among other states regarding the unclear intentions which seem both commercial and military based. For instance, Russia acknowledges the SpaceX's intelligence capacity claiming their satellites became legitimate targets (Jowitt, 2024). Moreover, as the Wolf Amendment prohibits NASA from collaborating with China, the inclusiveness of the US is criticised (Kluger, 2020). Therefore, China also expressed the need for practical steps towards cooperation (Anadolu Agency, 2023). This shows that the private companies are not fully independent from the governments that they have legal bound to, and they cannot always function inclusively.

4.1.3. Soft Power of the Non-State Actors

As non-state actors such as NGOs, multinational corporations and influential individuals can wield substantial amount of soft power, they can complicate power dynamics by mobilizing public opinion and shape narratives on international issues. Companies with significant economic leverage impacts media outlets and holds the power of challenging traditional state-led efforts in the realm of cultural and public influence. For instance, the founder of SpaceX, Elon Musk buying Twitter for US\$44 billion and changing many aspects of the massive social media platform including its name to X raised many concerns regarding the spread of illegal content and disinformation due to the new policies promoting *free speech*. As European industry chief Thierry Breton gave a 24-hours ultimatum to Elon Musk to take action against the spread of disinformation on X regarding the Israeli-Palestinian conflict, hundreds of accounts were removed from the platform (Gregory, 2023). Furthermore, the European Commission started formal proceedings to assess the activities of X whether it has violated Digital Services Act (DSA) in multiple areas such as risk management, dark patterns, content moderation and transparency (European Commission, 2023).

Similarly, the influence of Facebook on the 2016 US presidential elections has been a subject of considerable scrutiny and debate. There were various accusations against the owner Mark Zuckerberg such as enabling foreign interference via Russian operatives through Facebook (Stubbs, 2020). Through the algorithm, While it is challenging to quantify the direct impact of Facebook on the 2016 election, the investigations and debates raised awareness for the vulnerabilities in cyber political discourse through the micro-targeting of voters. As the massive influence of NSAs on politics and public opinion is well-acknowledged, the range of the power of NSAs in space is even more critical. As space technologies is now a major part of warfare, commercial satellite providers played a major role in tracking and targeting Russian troops during the Ukraine-Russian conflict (The Economist, 2023). However, after the Ukraine's emergency request of activating Starlink which is the world's biggest satellite constellation from SpaceX, Elon Musk claims that he refused it in order to avoid potential conflicts between US and Russia (Reuters, 2023). Whether directly or indirectly, the support that Ukraine received to target the troops during the conflict reveals the potential of near-ubiquitous communications once again. As commercial

satellites are major components of military, commercial space needs to be defended through regulations against military applications (Siegel, 2022).

In conclusion, through low-cost space technologies and collaborations, commercialisation of space increased access for a diverse range of participants. As non-state actors including private entities and NGOs have drastically changed the nature of diplomacy and cooperation in space by modifying the landscape of space explorations and satellite usage areas, companies began to emerge as major players in the new space race. Although NSAs such as multinational corporations and NGOs affect global affairs whether directly or indirectly by staging in various international platforms, engaging in public diplomacy and influencing decision-making through media, they often interact within a framework which is established by states. Whilst NSAs seem to operate independently and pursue private commercial interest, they closely intertwined with the government through space agencies and military organisations. For instance, SpaceX received support from NASA from the beginning and made many collaborations throughout the years and worked with NASA astronauts on missions (Rincon, 2020).

Furthermore, although NASA is a civilian agency, it closely works with DoD and intelligence agencies to utilize facilities to serve both commercial and national interest (David, 2015). Also, NASA's budgets have been aided by DoD for a long time now (Campbell & Horwege, 2021). As NASA's support for SpaceX links private sector with DoD, commercialised entities should not be considered without the military posture of a nation. Therefore, while considering the private companies solely commercial entities would be a highly generalised perspective, referring them a part of states' national security branch would also be defective. However, the effects of the nation-states on NSAs should be taken into consideration when assessing outcomes of space activities because of the interlink between them. Finally, to reduce the potential negative outcomes of the legal gaps regarding the non-state actors, subjectification of them is a decisive point in policymaking and diplomacy. Therefore, instead of presenting them as the new main actors immediately, they should be considered as a part of states' own entities both because of their function under national law and the international structure still remaining state centric.

4.2. The Role of Dual-use Space Assets on Weaponization

Historically, as space power carries discernible dominance among other military aspects, avoidance of igniting an arms race in space requires solution to prevent potential threats. Although the realm of space began to be used for different purposes such as commercial and civilian, military objectives of states should not be overlooked as the beginning of the space race was through attaining military power in space. When Sputnik 1 proved that it is now possible to deliver hydrogen bombs at will, the importance of having technological advancement became prominent during the Cold War (Wang Z. , 2008). As the realm of space remains a crucial aspect for having national power, the new complex nature of the space race involves different threats. The ways in which outer space has involved in warfare differs from other domains because the potentials of space-based instruments' war capabilities are not calculable yet (Hersch & Steer, 2021).

As states use different phrases for the emerging warfare according to their own political agendas, it is difficult to classify space weapons within a consensus. However, based on direction and function, space weapons could be classified as below according to Centre for Strategic and International Studies (CSIS) report (Harrison, 2020):

- Kinetic and Non-kinetic Space-to-Earth
- Kinetic and Non-kinetic Space-to-Space
- Kinetic and Non-kinetic Earth to Space

Kinetic space-to-Earth space weapons could function through weapon's kinetic energy itself or a deployed warhead. With a little warning, anywhere on Earth could be targeted by these types of terrestrial based ballistic missiles. Although there is no open-source evidence on such sort of test, the US has been contemplated the idea of using this type of technology (Harrison, 2020). Space-based global strike such as "Rods from God" could be given as an example for this system which functions in a similar way with kinetic bombardment (Stilwell, 2020). Space-based downlink jammer and space-based high-powered laser could be given as examples for the non-kinetic space-to-Earth weapons which can strike anywhere without warning theoretically (Harrison, 2020). For instance, a non-kinetic weapon carried with a satellite could be used to target

forces on Earth and interfere with radars with a jammer. Similarly, to kinetic space-to-Earth weapons, there is no example in open-source, yet the US military has been contemplating about space-based lasers to improve missile defence. On the other hand, space-to-space weapons could be co-orbital ASAT and Space-Based Missile Defence Inceptors as kinetic weapons along with Co-orbital crosslink jammer and co-orbital high-powered microwave as non-kinetic weapons. Though, the Soviets tested co-orbital kinetic ASAT weapons before, there is no open-source evidence on the use of non-kinetic space-to-space weapons. Kinetic Earth-to-space weapons are Direct-ascent ASAT and they have been tested by the US, China, Russia and India (Harrison, 2020). Non-kinetic Earth-to-space weapons have also been demonstrated by multiple countries. Uplink jammer, laser-dazzler and cyberattacks could be given as examples as they can disrupt satellites without producing orbital debris. As these systems demonstrates how diverse space weaponization could be, a definition of space weaponization which includes only space-to-space weaponry would be narrow (Harrison, 2020).

Aside from developing solely weaponry technologies, integration of some of the functions on commercial space assets is now possible through dual-use space systems. As states strive to harness the advantages of outer space for many usage areas from communication to weather monitoring and navigation, satellite technologies which serve civil and commercial purposes are also capable of serving military and intelligence aspects through functioning in multiple ways. This makes it difficult to distinguish between nonmilitary and military use of space by enabling states to fulfil their military objectives through civil and commercial activities. Therefore, there are two main issues against dealing with the potential threats regarding the current nature of the space technologies: the lack of a consequence-based approach and the lack of legal guidelines regarding the dual-use space assets. With consensus on legal measures and enforcement mechanisms adapted suitable to the multipolar nature of the world, the potential threats of the dual-use nature of the space assets could be diminished for the sustainable use of outer space.

4.2.1. The Lack of a Consequence-based Approach Regarding the Dual-use Space Assets

As the lines between civilian and defence-oriented initiatives have been blurred, arms control in space becomes not only vague but also more threatening. This merge between the civilian and military aspects of the use of space technologies presents the need for a nuanced examination of the objectives, strategies, and the assessment of potential consequences that comes with the deployment of space-based systems. Aside from spacecrafts with weaponry technologies, the cyber aspect of space systems could be stated as limitations against further weaponization of space in this sense. As the development of dual-use technologies has far-reaching concerns for global security, arms control and the prevention of an arms race carried to outer space, the examination of dual-use mechanisms through these lenses is crucial for dealing with the complexities around the issues and navigating the path towards more responsible and peaceful space activities.

As space assets with ostensibly civil use may harbour latent military capabilities, the dual-use mechanisms of space technologies add another layer of ambiguity to weaponization in outer space. Furthermore, to assess the risks of space weaponization profoundly in international law, the definitions must be clear for international agreements and decision-making overall. However, there is no clear definition of ‘space weapon’ in international agreements and disputes regarding to the legality of weaponization does not present solid consensus among states based on fair grounds (Mineiro, 2008). The overlapping functions of space systems require further assessment to make clear definitions of what is a weapon. For instance, an autonomous spacecraft, DART which is launched by NASA, is capable for manoeuvring to satellites and operate as an ASAT. Would that make DART, a repair robot, a ‘space weapon’? There are attempts for defining ‘space weapon’ based on the purpose of design for operational or physical damage (Mineiro, 2008). Nevertheless, two things become an issue with this definition: scaling the ‘purpose’ and assessing non-physical attacks. Relying on the design purpose of a spacecraft could create a *slippery slope*, as dual-use systems need further technical analysis for threat assessment instead of a declaration on the purpose to avoid overgeneralisation.

In order to deal with the interference in outer space, a consequence-based approach is more comprehensive comparing to a behaviour-based approach (Rajagopalan, 2023). When considered

the capabilities of the space assets, behaviour-based approach falls short on preventing the consequences of weaponization. Even if there is no consensus on the terminologies regarding these technologies, they have likely consequences when used for military purposes. As the consequences of such action could be used to determine the level of counteraction and response, a consequence-based approach provides an avenue for dealing with the issues regarding cyber and electronic attacks in outer space (Rajagopalan, 2023).

Unlike other domains, the consequences of actions in outer space can have far-reaching impacts, ranging from orbital debris accumulation to satellite collisions with cascading effects on critical infrastructures. Therefore, in order to lower the geopolitical tensions, developing agreements on an approach that is based on consequences and technical capacities of the space technologies would promote peaceful use of space. By focusing on consequences rather than behaviour or intentions, international space agreements can assess the potential outcomes of the use of dual-use systems. Besides, there would be limits set at times where the range of the technological capacity of space systems reach an unintentional or unnecessary level for the commercial aim. Thus, providing a consequence-based approach is necessary for policymakers to anticipate and address the possible threats to promote international security.

4.2.2. The Lack of Legal Frameworks Regarding the Dual-use Space Assets

Another issue regarding the dual-use systems is with the international agreements which are focused on the use of nuclear weapons, and they overlook the use of non-nuclear weapons (Harrison, 2020). While physical harm intention is mentioned in some of the agreements and interpretations, cyberwarfare indicates a different platform for potential threats. As another aspect of space weaponization, cyber-attacks fall into the “soft kill” category which includes weapons designed to interrupt the function of a spacecraft rather than physically destroying it. Along with other soft-kill weapons such as jamming, altering, monitoring of data communications and “dazzling” by lasers, cyber-attacks could function as damaging as physical attacks if not more. One example could be PLA has reportedly been engaged in “blinding” the US satellites via terrestrial laser systems (Hersch & Steer, 2021). As China has been using PLA’s counterspace dazzling lasers

as protection against satellite imagery reportedly for years, they became a critical part of their defence-capabilities (Burke, 2023). Moreover, although ASAT capabilities could be beyond the grasp of NSAs, the cyber capacity to access such technology is not. Which means along with spacefaring nations, NSAs are now capable of interfering space assets through cyber efforts (Hersch & Steer, 2021). Therefore, existence of such dual-systems and mechanisms increases the need for a more functional international law system in order to prevent serious consequences of space weaponization.

4.3. The Role of Enforcement Mechanisms and Diplomacy in Space Security

Another major limitation in de-weaponization of space is the lack of enforcement mechanisms. As states are compelled to enhance their power in order to attain national security, the necessity of an international enforcement mechanism regarding the space domain is prominent. The development and test of various space technologies particularly with dual-use systems pose global risks by generating space debris and impacting the sustainability of space. In such international environment, as the number of states and non-states developing space programs increase tremendously, further weaponization means further destabilization. Consequently, through whether state or non-state actors, engagement in irresponsible or aggressive behaviors requires facing consequences. Without such deterrence, international agreements and norms regarding space activities could easily be undermined. For instance, the Outer Space Treaty outlines several principles such as using space only for peaceful purposes and states cannot attaining sovereignty in space as it has promoted the idea of space being a global common (Hertzfeld, Weeden, & Johnson, 2016). However, without any enforcement mechanism, effectiveness of the treaty is disputatious as power competition among states may make certain provisions challenging to apply.

Similarly, as the diplomatic efforts to stop space become a “warfighting” area fell short so far, international community should pursue a corrective approach rather than remain passive (Hersch & Steer, 2021). In order to reduce or eliminate the arms race in space, having enforcement mechanisms is crucial for international security. However, the distinctive challenges that the space

poses make the development of effective legal mechanisms more difficult. The absence of a extensive outline for managing space activities, coupled with the ambiguity of dual-use aspect of spacecrafts, leads to unclarity and mistrust among states. Moreover, the power dynamics in the current international system, with the US seeking dominance and Russia advocating for a multipolar approach, further complicate efforts to establish effective and universally accepted regulations. The US having a ban for collaborating with China is another important issue as mentioned in previous chapter. As major powers have such diverse geopolitical interests and different security objectives, along with other international space treaties, Artemis Accords became another major dispute around space exploration. By offering key principles governing space exploration, it pursues a collaborative approach and promotes peaceful use of space. However, the accords also took criticism by being way too US-centric and against multipolar structure of the world (Gross, 2023). Therefore, it is important to examine the disputes surrounding the accords since it is the latest repercussion of an attempt for space regulation for global security.

4.3.1. The Artemis Accords: Advantages and Drawbacks

As the 1967 Outer Space Treaty still regulates space activities with little detail primarily, international space law is relatively undeveloped since current technologies bring different concerns (Smith W. A., 2021). The US targeting the Moon and Mars as main space objectives, the necessity of another international agreement regarding space activities became prominent in order to fill the gaps of the previous treaties. Establishing shared principles based on the Outer Space Treaty, the US offered a number of principles through the Artemis Accords led by NASA to ensure responsibility among states participating space activities including lunar missions. However, the Accords did not appeal to all spacefaring nations as it has contradictions with the multipolar nature of the international system. Alongside with providing critical compensations, the drawbacks of it also present flaws of the Artemis Accords. Therefore, the assessment of the accords from both perspectives contributes valuable information in order to attain a broader understanding for sustainable regulations in space domain.

Along with the US, various countries began to focus on lunar missions. The Artemis Accords developed in response to the increased concentration in lunar activities as NASA's Artemis program outlined the ambition of landing people on the Moon. As the accords address issues related to resource utilization of the Moon, sustainable space exploration, and peaceful cooperation among states, it offers a valuable advance since it attempts to create a common framework to administrate the conduct of states participation in outer space activities. Additionally, the accords provide a foundation for international space collaborations in the growing landscape of lunar and space exploration in general. As the Artemis Accords aim to enhance transparency and ensure international responsibility, it takes another step towards global participation in disputes regarding the space issues. Also, by establishing a sustainable base for the lunar missions, the accords also provide scientific research on the Moon for long periods of time. As a result, the accords contribute to foster a collaborative approach to space exploration with a level of credibility to shape the future of international cooperation in space endeavours. On the other hand, while it represents a significant administrative effort to codify key principles of international space law, many states are refusing to sign the Artemis Accords for various reasons. Having a bilateral approach, lack of clear boundaries against weaponization along with resource utilisation concerns are some of the main disputes surrounding the accords.

While the Artemis accords are designed to enhance international partnership and cooperation, the accords have a bilateral approach setting agreements between the US and other participants which led to concerns about exclusivity. Using a channel for creating space law outside of the previous ones such as the UN Committee on Peaceful Uses of Outer Space, the US making its own quasi-legal norms to pursue international regulation on space activities left some countries hesitant to sign while some others completely rejected the accords (Newman, 2020). Since the Artemis Accords are signed on national level rather than organisational, ESA's involvement with the Artemis mission does not represent all ESA members participation in the Artemis Accords. Additionally, not all ESA member states accepted the accords, and the chance of an immediate unified European support seems considerably low (ESPI, 2020). As previous multilateral approaches through the UN brought more support from European states, bilateral nature of the accords is unpreferable since it is not within the framework of European initiatives. Although bilateral approach can provide flexibility, faster decision-making process and efficiency in

implementations, the other two greatest spacefaring nations, Russia and China are excluded from the accords with the adoption of this approach. Besides, as the Wolf Amendment forbids NASA from collaborating with China, the inclusiveness of the accords was already limited to begin with (Kluger, 2020). The Artemis Accords may not have pursued a deliberate effort to keep Russia out; however, the bilateral approach became a factor in the exclusion of Russia as the head of Roscosmos, Dmitry O. Rogozin, criticised the accords for being “too US-centric” (Kluger, 2020). He also was sceptical about joining the international Lunar Gateway project and demanded an equal footing with NASA in order to take part in it (TASS, 2020). As a result, adaptation of a multilateral approach rather than bilateral is important to be more inclusive and present reliability for all states. As the American rhetoric will naturally be toned down with the right approach, space diplomacy and international cooperation would reach an efficient level to serve global security.

The lack of clear boundaries against weaponization is another critical concern around the Artemis Accords. Although the accords aim to reinforce the commitment of the US by ensuring space activities which serve peaceful purposes according to the 1967 Outer Space Treaty, the treaty itself lacked the specific prohibitions on conventional and unconventional weapons. Consequently, the treaty cannot be considered an international success due to the development of ASATs, space weaponization programs and the space debris deposited by spacefaring nations over the years (Roberds, 2016). Moreover, considering the establishment of USSF as the sixty branches of the US military, the interpretation of what constitutes “weaponization” and space militarisation of the US have been subjects to international security disputes. As the accords recognize the reality of space’s growing commercial and civil influence, it overlooks the military aspect of space by not providing a solid solution against weaponization of space. Besides, as the prioritisation of the private industry is a space objective of the US to enhance its military capabilities, the US is ultimately trading the economic gains through commercial activities with enhancing its Space Force with the member states (Taichman, 2021). Therefore, the Artemis Accords do not pursue an active effort to prevent weaponization, instead fuel American interest by collaborating with other states. Further, without providing a platform for a consensus on the range of weaponry and hybrid threats such as cyber to promote disarmament, the term peaceful-use practically falls short.

Resource utilisation is another prominent concern regarding the Artemis Accords. While the accords acknowledge the potential for extracting and using space resources for sustainable space exploration, the lack of commonly agreed-upon international regulations regarding lunar resource allocation created apprehensions. Without a proper legal framework regarding the issue, it becomes inevitable for economically more capable countries having domination during the extraction and utilisation processes. As Russia rejected the US' interpretation on the legality of resource extraction, Roscosmos has likened the American stance in the accords to colonialism (Ortega, 2020). China also considers the accords as a part of the US political agenda rather than a US-led international effort to enhance the peaceful-use of space. Moreover, as the Moon Treaty of 1979 which provides that the Moon and its sources are common heritage has not been signed by the three main spacefaring nations, Russia, China and the US, it has been considered as another failure in international law. However, it still would have consequences on international relations during an exploitation of extraterritorial resources (Listner, 2011). Considering that the US also have not sign nor ratified the treaty, the US' permissive approach to space activities does not align with other great space powers. Therefore, without attaining key principles regarding the utilisation of natural space resources, relying on a robust commercial space industry for stability would not be the most sufficient approach to promote global security.

In conclusion, the Artemis Accords represents another milestone in the evolving landscape of space exploration, and commercialisation by providing a framework for principles and standards of sustainable exploration, transparency and resource utilisation. While several states supported the accords, due to the bilateral nature of the accords, the lack of clear boundaries against weaponization and concerns around the utilisation of the natural resources, some states did not sign the accords and criticised the American rhetoric buried into the principles of it. As the Artemis Accords stand as a testament to the contemporary complexities of navigating the intersection of global cooperation and national interests, analysing the disputes against it is important for the improvement of further attempts to attain effective international agreements. Due to the multipolar nature of the world, cooperation among states should be more inclusive and comprehensive. Therefore, a more pluralistic treaty, featuring the views and concerns of all states are needed to prevent self-interested inclinations causing economic competition to ensure peaceful cooperation in space (USSC, 2022).

As a result, an effective international approach which is suitable for the multipolar nature of the world should be adopted with enforcement mechanisms attained through international accords. It is an international responsibility to build such mechanisms to provide solutions for the global dispute of space weaponization. Thus, as the militarisation of space remains within the new space race, an inclusive and enforceable framework is vital to deter the development of space-based weapons and prevent the potential threats of dual-use systems. Also, by attaining a generally recognised code of actions regarding outer space, arms control becomes less vague for states. Therefore, international enforcement mechanisms foster peaceful, secure and sustainable use of space along with the cooperative and inclusive space agreements.

5. CONCLUSION

After the World War II, the fervent pursuit of achieving space power changed human history and space explorations began due to having military superiority in the outer space. Following the nuclear arms race, the space race first emerged in order to test if it is possible to carry ICBMs into the space throughout the Cold War. Marking a critical milestone in human history, the space race caused the extension of the warfare through space weaponization. From strategic reconnaissance to nuclear deterrence, having space power became a critical aspect of national security.

Over the years, space activities evolved from solely military based into including more cooperative and civil aspects. With the rise of commercialisation, space activities began to serve civil needs such as remote sensing, environmental observations and mappings (Tarasenko, 1994). New states began to develop space programs for commercial gains and the role of non-state actors increased through privatisation. As the world transitioned from having a bipolar power structure into multipolarity, the commercial space industry has grown and began to enhance military capacities of great powers. While the space collaborations of pioneering states and the UN space agreements demonstrated a cooperative environment, the militarisation and weaponization of space continued to enhance. In the space area, the space race only evolved into a newer version with new actors and more advanced weapons. Rational interests of states may protect space assets for economic reasons, but they do not necessarily guarantee disarmament (Whitman Cobb, 2024). Therefore, although cooperation and commercial use of space represents the beginning of a different era in space history, military aspect of space remained a dominating parameter in boosting national security. Besides, the increase in power race between states within the framework of commercialisation and privatisation intensified military competition through economic and technological enhancements in space. This intensification may eventually become a push for further weaponization of space. Therefore, in order to examine the contemporary limitations of disarmament in the new space race, acknowledging the outcomes of commercialisation within the multipolar structure of the world is necessary.

Considering the space race as just a historical period where the dual power maximization had eventually come to an end via joint operations and agreements would be overlooking the potential problems regarding the new characteristics and functions of the ongoing competition. When the consequences of the budget and risk trade-offs between military improvements and possible commercial/civil inadequacies of the US considered, it was assumed that investments in military space activities would suffer commercial and civil space efforts inevitably (W. Rathgeber, 2010). As a result, the US began to use privatisation as a sustainable tool to enhance its military power through attaining economic and technological advancements. Therefore, the era of privatisation and commercialisation began due to the aim of attaining military superiority in space. Besides, it is inevitable that the states that effectively utilize the economic potential of space will remain great powers (Townsend, 2020).

While the advancement of space technologies and achievement of commercial assets added new layers of complexities into the space race, emerged limitations in arms control efforts became an ongoing global dispute. As some of the main limitations include the rise of non-state actors, dual-use space systems and the lack of international enforcement mechanisms, the necessity of an international effort to address these contemporary issues to provide global security became prominent.

As the role of the non-state actors in attaining space power increased, they began to have major influence on collaborations and space activities in general. Aside from fostering technological innovation and economic incentives, the increased impact of them became a limitation in arms control for three main reasons: the lack of regulatory framework on the position of non-state actors, complicating interstate cooperation, and having major soft power on public. As the international structure is still state-centric, traditional approaches continue to dominate international law. The surge in commercial space entities have outpaced the corresponding regulations since the existing legal structure is not comprehensive enough to tackle with the complexities in interactions involving private entities. Aside from the absence of the legal framework and mechanisms, the complexity of navigating non-state actors' position in international relations became another setback. As the integration of non-state actors in international cooperation is challenging, it is necessary to establish a balance between

acknowledging their impact on the space industry and remaining within the state-centric norms as they are primarily employed within the framework of international relations. At last, the massive amount of soft power that the non-states have also presents a critical challenge for international security since it enables them to influence massive amount of people through different channels. As non-state actors don't usually operate with the same level of accountability as states, they may pursue their potentially harmful interests with higher mobility; thus, quicker. Both through media outlets and commercial activities, non-state actors may threaten the global balance which may indirectly contribute to further weaponization as they may exacerbate the power imbalance among states.

The development of the dual-use space systems became another limitation in attaining arms control during the new space race. Presently, spacefaring nations use outer space for many areas such as weather monitoring, observation and navigation. As satellite technologies which serve civil and commercial purposes are also capable of serving military and intelligence aspects through being used in surveillance, reconnaissance and monitoring critical zones, it became almost impossible to distinguish some of the space assets from space weapons. Although some sources refer to the intention of the design as a differentiating factor, it does not eliminate the capabilities of the dual-use mechanisms in a potential conflict. Considering more state and non-state actors developing satellite technologies currently, the number of spacecrafts with such mechanisms is also difficult to determine (Dawson, 2018). When the lines between commercial and military aspects of space assets blurred, prevention of weaponization becomes harder in space. Thus, this ambiguous and therefore more threatening nature of the space technologies presents the need for a nuanced examination of the objectives and the assessment on these technologies should be based on potential capabilities rather than the announced design purpose. As the development of dual-use space systems has extensive influence on global security, attaining legal restrictions regarding the issue is crucial for navigating the path towards a more responsible and peaceful use of space.

Both the international space law and diplomacy face challenges due to various reasons such as the lack of a globally accepted enforcement mechanism and differing perspectives on the global governance. As states are compelled to enhance their power in order to attain national security, the lack of enforcement mechanisms became also another major limitation in disarmament of space.

In the contemporary international environment, which involves the development and test of various space technologies, engagement in irresponsible or aggressive behaviors must require facing consequences in order to attain international deterrence. It is unfortunate that the diplomatic interactions usually fall short for preventing conflicts as well and states use violence often as resolution (Boothby, 2017). Since the previous international treaties and norms was predominantly undermined, the deterrence element became a necessity to promote peaceful use of space. As further weaponization means further destabilization, effectiveness of the international space agreements is based on accomplishing enforcement mechanisms since power competition among states inevitably makes common provisions hard to apply at times they clash with national interests. Besides, the main reason why international agreements fall short is the perspective differences between the great powers on the international governance. For instance, the US is using carrot and stick approach with the Artemis Accords. As the stick is the further enhancement of the US' space forces, the carrot is the cooperative and commercial gains that other states achieve through the accords (Taichman, 2021). By rejecting the multipolar nature of the international system, the US is ultimately offering to build a US-centric legal structure regarding outer space. On the other hand, Russia and China consider this as a threat to their national sovereignty and emphasise the importance of multipolarity within the current landscape of international structure. As a result, the aspirations of space diplomacy and international law often face obstacles in achieving a harmonized and secure space environment.

With the commercial aspect of space which consists of partnerships and collaborations through joint missions, states and private entities strive to establish presence on the Moon, Mars, and beyond. As the commercial space industry began to play a pioneering role in space access and exploration, it became a gamechanger facet of space offering a new paradigm over the past decades. However, the assumption of states letting go of their power-maximisation efforts and abandon military aspect of space gradually would be a narrow conclusion because of the historical patterns on the evolution of war. The complete reliance on commercialisation as an *invisible hand* to provide international balance does not provide solid solutions for the reality of emerging threats regarding the space. As the space race underwent a transformative shift, the urgent need for transparent and enforceable guidelines to prevent further weaponization of space became more prominent. Thus, instead of choosing short-term commercial gains in space which might lead to long-term loss of

stability in international arena, international enforcement mechanisms suitable for the multipolar structure of the world are necessary to attain effective arms control. Lastly, although the commercial and civil aspects were displayed as an aisle to the *perpetual peace* in space, the interest of constant power-maximisation of states does not seem to decelerate nor become insignificant.



5.1. Findings

As the impact of commercialisation on space activities reveals new complexities regarding the weaponization of space, three main limitations on disarmament of space are identified through this research: “the rise of non-state actors”, “the development of dual-use technologies”, and “the absence of an effective international enforcement mechanism” for space security.

The rise of the involvement of non-state actors in space activities pose new challenges for international security due to several reasons. As they are not complete subjects to the international agreements within the ongoing state-centric international system, attaining norms and regulations regarding non-state actors’ activities become much more difficult among states. Also, as they began to have the ability to use massive amount of soft power through different channels, non-state actors began to create security concerns by provoking imbalance. Therefore, the difficulty of regulating and monitoring a diverse array of non-state actors with varying motives and capabilities complicates efforts to prevent weaponization of space.

Another main finding is the prevalence of the dual-use space systems which blur the line between commercial and military applications. As complicating attaining effective regulations, the dual-use nature of space systems makes it hard to track weaponization activities. Furthermore, cyber aspect of space also pose critical challenges since international agreements does not involve regulatory frameworks on non-physical damage in space. Therefore, dual-use space systems exacerbate concerns around the inadvertent militarisation of space and underline the need for a comprehensive approach to space security.

The lack of international enforcement mechanisms also presents another significant limitation on disarmament of space since there is not an effective deterrent force regarding the area. Due to the lack of attained space diplomacy, states began to maximise their power through commercialisation in space as a part of their national strategies. There are two perspectives on regulating international space activities. While the US pursues a superior position in attaining international space law through the Artemis Accords, China and Russia consider the accords against the multipolar nature of the world due to the bilateral approach. As the geopolitical strains

and opposing interests further hinder the development of enforcement mechanisms, the control of space weaponization becomes less viable.

These findings underscore the persistent challenges and limitations hindering arms control efforts in space against a backdrop of commercialisation. Further analysis on these three limitations requires coordinated efforts among stakeholders, scientists and decision-makers to build enforcement mechanisms for sustainable space activities. As the risk of exacerbating the militarisation and weaponization of space undermines the long-term security of outer space, addressing these challenges becomes a part of international interest and responsibility.



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