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THE GEOPOLITICS AND MILITARISATION OF OUTER SPACE

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Abstract

Outer space is becoming increasingly congested, competitive, and contested. This is due to the rising importance of outer space combined with the lack of regulation in this important domain. The potential for conflict and geopolitical squabbles is aggravated by the growing sophistication of dual-use space technologies. A serious space arms race is already under way.

This research paper will examine the key security challenges threatening peace and prosperity in outer space, and provide policy implications and recommendations aimed at preventing a serious arms race in the cosmos.

Introduction

The 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial bodies (OST), regulates the governance of outer space[1]. This treaty was signed by 132 countries, including major space-faring nations such as the United States, Russia, and China[2]. Through this agreement, the global community did something outstanding.

During the Cold War, the Outer Space Treaty (OST) was established to provide an unconventional approach to the policy towards outer space, which differed significantly from how other shared resources were previously governed[3]. OST recognized the potential risks associated with outer

[1] The Future of the Outer Space Treaty – Peace and Security in the 21st Century." 2018. Globalpoliticsreview. October 2018. Accessed December 21, 2023. https://www.globalpoliticsreview.com/publications/2464-9929_v04_i02_p072.pdf.

[2] Ibid.

[3] Ibid.

space, possibilities of it becoming a new domain for colonization, resource exploitation, and militarization. OST thus declared outer space as a common heritage of humanity and limits its use exclusively for peaceful purposes, ensuring that it remains accessible to all nations[4]. Notwithstanding challenges, the OST has facilitated global collaboration, averted an arms race for space weapons, and laid the foundation for future space regulations. The continued success of the treaty depends on effective enforcement and continued participation of all countries adapting to evolving circumstances.

The rapid growth of science, innovation and technology in recent decades has thrust outer space to a realm of increased strategic importance. Contemporary times witness space exploration and technology serving as barometers of a country's strength in the international arena, thereby magnifying the risks of devastating capabilities in outer space warfare. The paper digs into the emerging picture of space power dynamics within a multipolar environment in which major powers such as the United States, China, Russia, EU, Japan and India strategically exploit space assets to maximize national power and implement deterrence measures. This paradigm shift therefore poses an unprecedented security threat, which requires the prompt establishment and implementation of comprehensive international regulatory mechanisms.

In the contemporary era, the militarization of outer space has emerged as an issue of increasing urgency. The proliferation of military initiatives in outer space by both state and non-state actors has significantly escalated in recent years, thereby giving rise to substantial security concerns such as militarization of space, space debris, space traffic management, growing commercialization of space, lack of regulation and many more[5]. The potential for conflict and the ability of space warfare to permanently and irrevocably transform our understanding of combat and the international order necessitates proper legislation and regulations that must be carefully considered. This paper will

[4] Ibid.

[5] Piqué, Jon Amilbia. 2020. "The Problem of the Prevention of the Weaponisation of Outer Space." *ResearchGate*, June. https://doi.org/10.13140/RG.2.2.15372.74881.

deliberate on the policy ramifications associated with the militarization of outer space, the security challenges it presents, and the suggested courses of action to mitigate these concerns.

A lack of universally recognized regulatory frameworks pertaining to the militarization of outer space increases the likelihood of a resurgence of conflicts similar to the cold war, marked by possible confrontations and security dilemmas. The quest for space supremacy has evolved into a combination of hard power represented by increased military capability and soft power a symbol of status and influence on a global stage. The dual nature geopolitics of space emphasizes its complexities and ramifications, posing a danger to states' sovereignty and independence as they negotiate this new frontier in the drive for supremacy.

Security Challenges – Why does Space Matter?

US National Security Space Strategy in 2011 talks about, the evolving landscape surrounding space currently marked by increased congestion, competition, and contention[6]. The increasing importance of outer space, along with the lack of sufficient control and regulation in this critical area, has heightened the possibility of competitive and hostile acts among nations possessing space capabilities and those without space capabilities. The ongoing confrontation between Russia and Ukraine has highlighted the military importance of space, demonstrating how it has transformed into a domain of strategic competition[7]. Nevertheless, the security concerns faced by the international community in outer space go beyond a single geopolitical dispute, including complex and wide-ranging obstacles. The interdependence of space security with terrestrial security is

[6] "National Security Space Strategy." n.d. https://www.dni.gov/index.php/newsroom/reports-publications/reports-publications-2011/620-national-security-space-strategy?highlight=WyJzIiwiJ3MiXQ==.

[7] "The Role of Space in Russia's Operations in Ukraine." n.d. CNA. https://www.cna.org/reports/2023/11/role-of-space-in-russia-operations-in-ukraine.

underscored by the growing reliance on space assets for essential daily functions, worldwide communications, economic endeavors, and military operations, in addition to geopolitical conflict. Any unintentional or malicious interference with space assets directly endangers critical Earth-based activities because of how reliant we are on space-based infrastructure such as navigation, internet access, weather prediction, disaster management, missile targeting systems and banking, etc. The military's growing dependence on space has become evident, indicating the inclusion of space-enabled assets in future conflicts, as underscored by the Ukraine war[8].

Recently the acknowledgment of space as a functional realm is a crucial advancement for armed forces. NATO formally recognized space as a domain in November 2019[9]; the United States Space Capstone Publication also identified it as a crucial domain for military operations[10]. Consequently, satellites, their data linkages, and ground elements were viewed as feasible targets in conflicts because of their critical functions in communication, navigation, and reconnaissance.

Many nations have recently implemented structural modifications to increase their defense capabilities in outer space leading to the potential militarization of space in the near future. France for example, renamed its Air Force as the Air and Space Force, highlighting the strategic significance of the cosmos. In 2015, Russia merged its air force, anti-aircraft, and missile defense systems to form the Aerospace Forces. Germany, the UK, and the US, among other countries, have

[8] Ibid.

[9] "Space, Cyber and Defence Navigating Interdisciplinary Challenges." 2023. *Https://Www.Espi.or.at/Wp-Content/Uploads/2023/11/ESPI-Report_-Space-Cyber-and-Defence-Navigating-Interdisciplinary-Challenges.Pdf*, November.

[10] Ibid.

created new space commands, while Italy launched its Comando delle Operazioni Spaziali in 2020[11].

Militarization of Space

The present issue for states is broadly to integrate space assets into every department while maintaining fiscal independence. The awareness that space has become an essential part of military operations over the past thirty years has prompted this shift. The first Gulf War in 1990 is widely cited as the initial "Space War"[12].The utilization of satellite-based navigation in this fight represented a significant change in approach, allowing for accurate identification and engagement of adversaries, as well as permitting efficient deployment of soldiers while upholding command and control[13].

Previously seen as a place of wonder and scientific inquiry, the enormousness of space is now taking on a concerning new face. The outer space frontier, which was once a tranquil domain for astronomers and astronauts, is becoming ever more militarized as major powers stake their claims. A significant milestone is the formation of specialized space forces as a wing of national defense and security, such as the United States Space Force in 2019 and the United Kingdom Space Command in 2021[14]. Rumors that Russia and China are developing and testing anti-satellite

[11] "The Militarization of Space and Its Transformation into a Warfighting Domain | List of Articles | International Information Network Analysis | SPF." n.d. International Information Network Analysis | SPF. https://www.spf.org/iina/en/articles/nagashima_02.html.

[12] Wehtje, Betty. 2023. "Increased Militarisation of Space – a New Realm of Security." Beyond the Horizon ISSG. June 6, 2023. https://behorizon.org/increased-militarisation-of-space-a-new-realm-of-security/.

[13] Ibid.

[14] Ibid.

weapons capable of destroying the technological infrastructure of the twenty-first century further fuel this trend[15]. The improvement of technology has made it easier for countries to enter the new and developing space race, leading to an increased number of countries building infrastructure in outer space. In addition to the established space powers of China, Russia, and the United States, countries such as France, India, Iran, Japan, and North Korea are also aggressively allocating resources to develop counter-space programs[16]. The increasing dependence on space assets has sparked worries about a possible increase in malicious actions, such as kinetic and non-kinetic attacks, jamming, hacking, and spoofing. Such a trend could accelerate the militarization of space, elevating the risk of future conflicts[17].

The domain of space is currently experiencing a metamorphosis, as countries progressively employ it for military and national security objectives[18]. The transition propelled by the progress of dual-use technologies, which have the ability to both defend and attack. An example of this is a Chinese prototype robotic arm that was initially created with the purpose of removing debris[19]. However, it may also be adapted to be used for capturing other satellites, which might potentially lead to harsh reactions from the owners of such satellites. Without a globally acknowledged framework governing the deployment of weapons in outer space, the increasing rivalry among nations with space capabilities to protect their extraterrestrial resources may evolve into a full-fledged

[15] Ibid
[16] Ibid
[17] Ibid
[18] Ibid
[19] "China's Pursuit of Dual-Use Technologies." n.d. IISS. https://www.iiss.org/research-paper//2018/12/emerging-technology-dominance.

conflict[20]. In the absence of concerted endeavors to develop unambiguous standards and regulations for interactions in outer space, there is a significant risk of a catastrophic escalation of military competition[21].

Chilling are the repercussions of this militarization. Envision a world in which laser beams launched from platforms in space render spy satellites silent, eliminating their vigilance. The infrastructure of our interconnected global society, namely global communication systems, could be instantly rendered worthless [22]. Everything from navigation and weather prediction to fundamental emergency response could be tossed into disarray if the silent sentinels that orbit our planet failed. However, the possible destruction goes beyond disabled infrastructure. The possibility of war at a scale not previously witnessed could break out if the space arms race is allowed to escalate uncontrolled. The use of lasers or kinetic projectiles by satellites might transform our cities into aerial battlegrounds. Unpredictable new battlefields pose a threat to the fragile global power balance that nuclear deterrence has long protected[23].

[20] Wehtje, Betty. 2023. "Increased Militarisation of Space – a New Realm of Security." Beyond the Horizon ISSG. June 6, 2023. https://behorizon.org/increased-militarisation-of-space-a-new-realm-of-security/.

[21] Ibid

[22] Ibid

[23] "Whither Arms Control in Outer Space? Space Threats, Space Hypocrisy, and the Hope of Space Norms - United States Department of State." 2020. United States Department of State. December 1, 2020. https://2017-2021.state.gov/whither-arms-control-in-outer-space-space-threats-space-hypocrisy-and-the-hope-of-space-norms/.

The lack of global legislation pertaining to space weaponry creates a huge loophole that can easily be taken advantage of. The 1967 Outer Space Treaty promotes peaceful space use, yet it fails to adequately execute its principles[24]. Due to the lack of an effective arms control agreement, nation-states are enjoying unhindered autonomy to pursue their own interests, unaffected by any consensus at the international level[25]. It is imperative that the international community unite to establish a novel treaty that unequivocally proscribes the advancement and utilisation of space weaponry. Cooperation and compromise will be necessary, but the consequences are simply too high to disregard. It is imperative that we maintain space as a domain devoted to cooperation and exploration, rather than as a fresh front for terrestrial disputes[26].

We cannot possibly afford to sleepwalk into this future. The prospective benefits of space exploration are immeasurable, ranging from resource acquisition to scientific advancements. However, these advantages will remain untapped in the event that space is treated as a battleground[27]. We must act immediately to prevent the militarization of space from escalating. In order to build effective strategies and regulations, it is crucial for nations to have a comprehensive awareness of the unique features of the space domain as they navigate the difficulties of protecting their interests in this realm. The subsequent section delineates the five most pressing difficulties in this context[28].

[24] Wehtje, Betty. 2023. "Increased Militarisation of Space – a New Realm of Security." Beyond the Horizon ISSG. June 6, 2023. https://behorizon.org/increased-militarisation-of-space-a-new-realm-of-security/.
[25] Ibid
[26] Ibid
[27] Ibid
[28] Ibid

Space Debris

Space debris also known as space junk, is any human-origin object in space that no longer serves a useful purpose[29]. Human space research has revealed the wonders of the universe, but it has also had an unforeseen consequence: the accumulation of space junk, often known as orbital debris[30]. This debris, which includes defunct satellites, spent rocket stages, fragments from collisions and spacecraft disintegration, even paint flecks and solidified liquids have created a growing cloud of space debris posing a significant threat to Earth[31]. Despite its apparent innocuous look, space trash poses a significant risk to functioning satellites, spacecraft, and the general future of space exploration.[32]For example in May 2021, a piece of space junk hit the International Space Station and caused damage to the robotic arm by creating a hole[33], this is extremely dangerous and a growing phenomenon which is concerning.

The origin of space debris can be attributed to the initial phase of space exploration when the Soviet Union and the United States launched their satellite and operated spaceflight programs[34]. As missions into space increased, so did the amount of space debris. Over time, the collisions between inactive satellites, used rocket stages, and other debris have created further fragments, leading to a chain reaction called the Kessler Syndrome. This hypothetical scenario portrays a sequence of devastating encounters, resulting in an unusable graveyard of space debris. A growing

[29] https://www.esa.int/Space_Safety/Space_Debris/About_space_debris
[30] Ibid
[31] Ibid
[32] Ibid
[33] Ibid
[34] ———. 2023b. “Increased Militarisation of Space – a New Realm of Security.” Beyond the Horizon ISSG. December 19, 2023. https://behorizon.org/increased-militarisation-of-space-a-new-realm-of-security/.

accumulation of debris presents a pressing threat to the long-term viability of space activities, requiring expensive maneuvers to mitigate it . These maneuvers diminish the operational longevity of satellites, endangering their capacity to communicate, navigate, and observe Earth[35]. Space debris is becoming an omnipresent threat to the cosmos as a result of humanity's voracious need for satellites for communication, navigation, and Earth observation, etc. There are an astounding 9,984 objects in Earth's orbit as of January 2023, with only 6,718 of those being of use; the remaining 3,266 defunct satellites constitute a grave danger with their uncontrolled orbits presenting the risk of collisions in the space[36]. An alarming trend emerged in the first half of this year, with 1,354 launches—more than the collective launches of the last 60 years[37].

Approximately 100 million bits of debris larger than 1 mm currently scattered in Earth's orbit are a result of the cost-intensive and technically challenging process of retrieving these defunct satellites, etc.[38]. The mere velocity of these minute pieces, travelling at more than 25,000 kilometers per hour, is enough to destroy operating satellites, interfere with vital services, and set off additional fragmentation[39].

[35] Ibid

[36] Union of Concerned Scientists. (2023, January 18). Satellite Database. https://www.ucsusa.org/resources/satellite-database

[37] Ibid

[38] The Aerospace Corporation. (2019, October). Orbital Debris Quarterly Update. https://orbitaldebris.jsc.nasa.gov/quarterly-news/

[39] "Cost and Benefit Analysis of Orbital Debris Remediation." 2023. *Https://Www.Nasa.Gov/*, March.

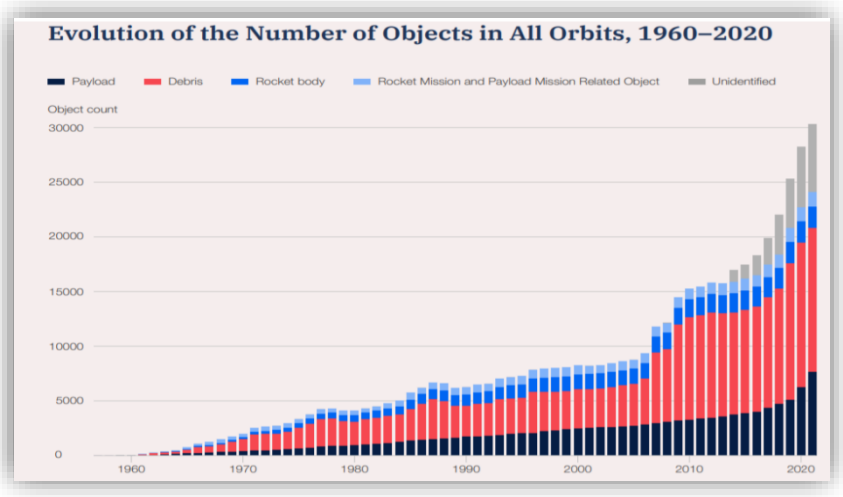

Fig. 1[40]

Efficiently monitoring and detecting space debris necessitates the utilization of ground radars, telescopes, and specialized satellites equipped with advanced sensors.

- Ground-based radars: These powerful instruments can detect objects as small as 10 centimeters in diameter in low Earth orbit (LEO)[41]. Some prominent radar systems include

[40] "As Private Satellites Increase in Number, What Are the Risks of the Commercialization of Space?" 2022. World Economic Forum. May 20, 2022. https://www.weforum.org/agenda/2022/01/what-are-risks-commercial-exploitation-space/.

[41] Carvalho, Jean Paulo Dos Santos, Rodolpho Vilhena De Moraes, and A. F. B. A. Prado. "Analysis of the Orbital Evolution of Space Debris Using a Solar Sail and Natural Forces." Advances in Space Research, July 1, 2022. https://doi.org/10.1016/j.asr.2022.04.014.

the U.S. Air Force Space Surveillance Network (SSN)[42] and the European Space Agency's (ESA) Space Debris Telescope[43].

- Optical telescopes: These instruments can detect even smaller objects, down to a few centimeters in size, but only during nighttime and under clear skies[44]. Some key optical telescopes involved in debris tracking include the NASA Near-Earth Object Wide-field Infrared Survey Explorer (NEOWISE) and the ESA's Optical Ground Station (OGS)[45].

- Space-based sensors: Several satellites carry dedicated sensors for tracking debris, such as the Debris Removal and Observation Mission (DEBRISAT) and the Space Surveillance

[42] Air Force Space Command (Archived). "Air Force Space Command (Archived) > Home," n.d. https://www.afspc.af.mil/.

[43] "About Space Debris," n.d. https://www.esa.int/Space_Safety/Space_Debris/About_space_debris.

[44] Liou, J.-c., and Nicholas L. Johnson. 2006. "Risks in Space from Orbiting Debris." *Science* 311 (5759): 340–41. https://doi.org/10.1126/science.1121337.

[45] Liou, J.-c., and Nicholas L. Johnson. 2006. "Risks in Space from Orbiting Debris." *Science* 311 (5759): 340–41. https://doi.org/10.1126/science.1121337.

Telescope (SST)[46]. These satellites provide continuous coverage and can detect objects as small as 5 millimeters in diameter in GEO orbit[47].

Specialist through painstaking data analysis, alert satellite operators to change trajectories and avoid collisions with space debris However, current systems have limitations when it comes to detecting "micro debris," a serious issue due to the high velocity encountered in collisions[48]. There

[46] "Towards European Space-Based Optical Observations Of Debris And Neos" 2019. Https://Conference.Sdo.Esoc.Esa.Int/Proceedings/Neosst1/Paper/425/Neosst1-Paper425.Pdf.

[47] "Towards European Space-Based Optical Observations Of Debris And Neos" 2019. https://conference.sdo.esoc.esa.int/proceedings/neosst1/paper/425/NEOSST1-paper425.pdf.

[48] Pultarova, Tereza. 2023. "Orbiting Debris Trackers Could Be a Game Changer in Space Junk Monitoring." *Space.Com*, September 6, 2023. https://www.space.com/orbiting-space-junk-trackers-to-prevent-satellite-damage#:~:text=By%20analyzing%20several%20consecutive%20images%2C%20the%20system,assess%20how%20large%20the%20fragment%20actually%20is.

is little room for maneuvering, as micro debris often remain undetected until immediate threat[49]. Even orbiting micro debris can have dire consequences, such as light pollution, which could impede future scientific discovery[50].

The Space Debris team and the Inter-Agency Space Debris Coordination Committee are fighting this problem head-on by inventing new technologies to enhance surveillance and reduce space collisions[51]. Furthermore, NASA and the (European Space Agency) ESA are investing heavily in R&D to discover novel techniques to collect and securely remove decommissioned satellites and other space debris from orbit[52]. The ClearSpace-1 mission, launched by the Swiss firm ClearSpace, is an innovative step in this direction[53]. By rescuing and removing a defunct satellite from orbit, this daring initiative hopes to prove that space junk can be removed. Ensuring the long-term sustainability of space activities relies heavily on the success of such missions[54].

Our future in space is safeguarded by the continued commitment to track and control space debris, which goes beyond satellite protection. By working together, countries and organizations can make

[49] Ibid.
[50] Ibid.
[51] "Space Traffic Management: The Challenge of Large Constellations, Orbital Debris, And The Rapid Changes In Space Operations." 2021. Https://Aerospace.Org. Center For Space Policy And Strategy. 2021.
[52] Ibid.
[53] ClearSpace - A mission to make space sustainable. "ClearSpace - A Mission to Make Space Sustainable," September 26, 2023. https://clearspace.today/.

[54] Ibid.

space exploration safer and more sustainable, which will lead to inventions and discoveries that benefit humanity on Earth and beyond.

Space-Traffic Management

Concerning current and prospective security risks and hazards, a differentiation is established between those of a natural origin and those that stem from human activities. Solar storms and related space weather phenomena, geomagnetic storms, and micrometeoroids are examples of natural dangers that can disrupt damage, disable, or destroy space systems and all of their components[55].

Concerns about Space Traffic Management (STM) have arisen due to the exponential growth of space missions, space debris, and satellites in Earth's orbit[56]. Orbital congestion has worsened as a result of the proliferation of satellite launches for research, communication, and Earth observation by both public and private organizations[57]. Satellites and space debris are more likely to collide due to this crowding, which endangers functioning satellites and creates more fragments that make the problem worse[58]. These fragments can pose a challenge by causing light reflection in space, potentially resulting in data corruption. The problem is made worse by the lack of standardized processes for satellite launches, orbital maneuvers, and end-of-life disposal, which is caused due to the non-existence of comprehensive international laws[59]. The future of Earth's

[55] ("Reducing Space Threats through Norms, Rules and Principles of Responsible Behaviours Report of the Secretary-General" 2021)

[56] "Space Traffic Management: The Challenge of Large Constellations, Orbital Debris, And The Rapid Changes In Space Operations." 2021. Https://Aerospace.Org. Center For Space Policy And Strategy. 2021.

[57] Ibid.

[58] Ibid.

[59] "Best Practices." n.d. https://spacesafety.org/best-practices/.

orbital environment, the security of space activities, and the possibility of devastating collisions are all jeopardized due to the absence of a unified strategy for STM[60].

Space traffic management presents a complex set of problems. Firstly, establishing an agreed-upon definition of STM is important[61]. Secondly, operational satellites and human spaceflight missions are both endangered by the increasing likelihood of collisions in Earth's orbit[62]. Thirdly, there is a lack of unified policy for missions in space due to the **fragmented regulatory landscape**. Fourthly, the current trajectory of space activities is not sustainable in the long term. The growing debris population could render certain orbits unusable and limit future space exploration and utilization. Fifthly, commercial companies and space-faring nations' inadequate data sharing practices hinder effective coordination and collision avoidance[63]. Furthermore, eco-friendly methods must be implemented immediately to deal with the expanding problem of space debris[64]. The accumulation of defunct satellites and fragments poses not only immediate risks but also long-

[60] Ibid.
[61] McCormick, Dan. 2023. "Cross-Domain Lessons for Space Traffic Management: An Analysis of Air and Maritime Treaty Governance Mechanisms." RAND. January 25, 2023. https://www.rand.org/pubs/research_reports/RRA2208-2.html.
[62] "SPACE TRAFFIC MANAGEMENT: THE CHALLENGE OF LARGE CONSTELLATIONS, ORBITAL DEBRIS, AND THE RAPID CHANGES IN SPACE OPERATIONS." 2021. Https://Aerospace.Org. CENTER FOR SPACE POLICY AND STRATEGY. 2021.
[63] "SPACE TRAFFIC MANAGEMENT: THE CHALLENGE OF LARGE CONSTELLATIONS, ORBITAL DEBRIS, AND THE RAPID CHANGES IN SPACE OPERATIONS." 2021. Https://Aerospace.Org. CENTER FOR SPACE POLICY AND STRATEGY. 2021.
[64] "Best Practices." n.d. https://spacesafety.org/best-practices/.

term threats to the accessibility and usability of space and needs to be addressed at a global level to preserve and protect space for the future.

Increased Commercialization of Space

There has been an unprecedented change in the space industry over the last 15 years, from historical being dominated by government organizations to the recent emergence of private sector initiatives[65]. Commercial space activity has reached new heights thanks to this change, driven by breakthroughs in rocket technology, the advent of satellite constellations, and the emergence of space tourism and resource exploration[66].

The launch services revolution has played a crucial role in the commercialization of space. Especially since the introduction of reusable rockets, developments in rocket technology has significantly reduced the expenses associated with launching payloads into space. Decreased expenses have helped facilitate universal access to outer space enabling both well-established space agencies such as NASA and entrepreneurial ventures like SpaceX to actively engage in space missions[67]. Prominent instances encompass SpaceX's Falcon 9 rocket, an innovation in reusability that substantially diminished launch costs[68].

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[65] "The Promise and Perils of the New Space Boom | Brookings." 2023. Brookings. June 24, 2023. https://www.brookings.edu/articles/the-promise-and-peril-of-the-new-space-boom-us-china-competition-spacex-international-law/.

[66] ———. 2020b. "The Problem of the Prevention of the Weaponisation of Outer Space." *ResearchGate*, June. https://doi.org/10.13140/RG.2.2.15372.74881.

[67] "Space Race 2.0: Is This Democratisation of Space or a High-Tech Coup?" n.d. https://www.downtoearth.org.in/news/science-technology/space-race-2-0-is-this-democratisation-of-space-or-a-high-tech-coup--64253.

[68] Ibid.

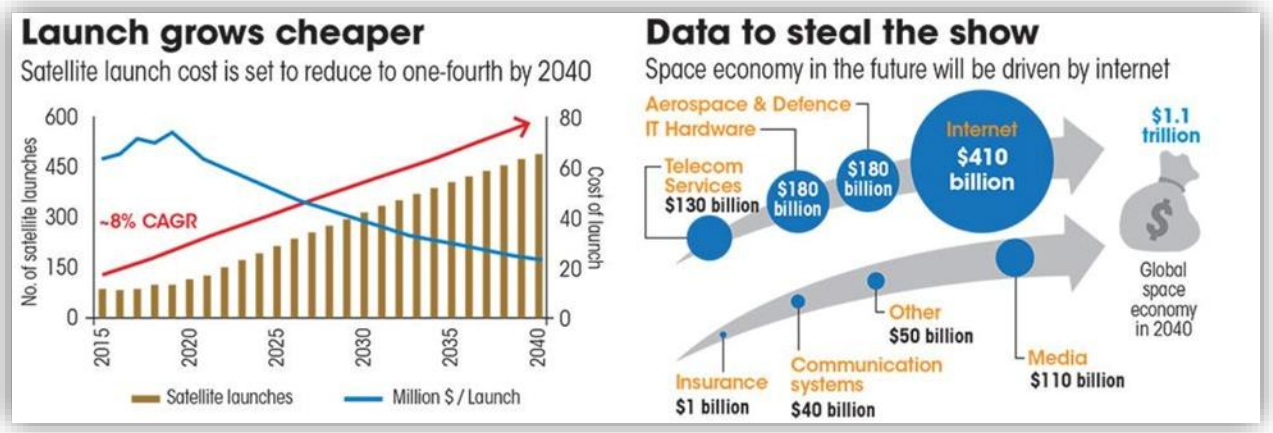

Fig 2[69]

Commercial satellite deployment as demonstrated by ventures such as SpaceX's Starlink project, has evolved into an essential component, facilitating worldwide communications, broadcasting, and internet access. Satellites serve an essential function in not only communication, but those under operation. Planet Labs, provide invaluable data that is utilized for various purposes including but not limited to Earth observation weather monitoring, environmental management, agriculture, and urban planning[70].

[69] "Space Race 2.0: Is This Democratisation of Space or a High-Tech Coup?" n.d. https://www.downtoearth.org.in/news/science-technology/space-race-2-0-is-this-democratisation-of-space-or-a-high-tech-coup--64253.

[70] "The Promise and Perils of the New Space Boom | Brookings." 2023. Brookings. June 24, 2023. https://www.brookings.edu/articles/the-promise-and-peril-of-the-new-space-boom-us-china-competition-spacex-international-law/.

An additional promising domain is space tourism, in which private enterprises like Blue Origin and Virgin Galactic are prominent entities actively striving to provide orbital and suborbital space flights to non-military individuals[71]. These enterprises for example the VSS Unity, operated by Virgin Galactic, is an example of an innovative vehicle that envisage a future in which space travel is readily attainable to a wider demographic[72].

Planetary Resources and Deep Space Industries are among the entities engaged in resource exploration and mining that are investigating the viability of asteroid mining as a means to extract uncommon metals and minerals[73]. Their efforts serve as a prime example of how resource acquisition beyond the planet could be revolutionized.

Commercialization endeavors extend even to the International Space Station (ISS), where commercial modules designed for research, manufacturing, and accommodations are being

[71] Madan, Bharat, and Daphne Halkias. 2020. "Virgin Galactic's NASA Partnership and Space Tourism – a Teaching Case." *Social Science Research Network*, January. https://doi.org/10.2139/ssrn.3820623.

[72] Ibid.

[73] Yarlagadda, Shriya. 2022. "Economics of the Stars: The Future of Asteroid Mining and the Global Economy." Harvard International Review. April 8, 2022. https://hir.harvard.edu/economics-of-the-stars/#:~:text=Opportunities%20in%20Asteroid%20Mining&text=Despite%20only%20being%20projected%20to,meet%20such%20high%20development%20costs.

developed by private companies such as Axiom Space[74]. The commercial space station plans put forth by Axiom Space serve as an exemplification of the progressive characteristics of space habitats that transcend the jurisdiction of governing bodies[75].Axiom Space is also building the first commercial space station.

Companies such as One Web and Amazon's Project Kuiper contribute to satellite constellations that provide global internet coverage as the commercial space sector grows[76]. They are also indicative of the changing environment when it comes to space in terms of growing competition. This exemplifies the sector's economic influence, as it generates employment opportunities and attracts private investments in areas with a significant space industry presence.

The development of space capabilities is being expedited and the collaboration between governments and private entities via public-private partnerships is fostering innovation for example the Commercial Crew Program of NASA, which transports astronauts to the International Space Station through partnerships with SpaceX and Boeing[77]. In this international space race India is one of the leading countries that recently allowed for private sector participation in the space industry for R&D and more. This collaborative strategy promotes innovation and expedites the development of space capabilities. Robust regulatory frameworks are being developed in

[74] "NASA Selects First Commercial Destination Module for International Space Station - NASA." n.d. NASA. https://www.nasa.gov/news-release/nasa-selects-first-commercial-destination-module-for-international-space-station/.

[75] Ibid.

[76] Amos, By Jonathan. 2023. "Amazon Kuiper: Jeff Bezos Joins Satellite Internet Race." *BBC News*, October 6, 2023. https://www.bbc.com/news/science-environment-67023719.

[77] "Space Race 2.0: Is This Democratisation of Space or a High-Tech Coup?" n.d. https://www.downtoearth.org.in/news/science-technology/space-race-2-0-is-this-democratisation-of-space-or-a-high-tech-coup--64253.

tandem with the expansion of the commercial space sector to guarantee safety, security, and sustainability. Concerted endeavors are required to address obstacles such as the harmonization of international regulations and tackling the growing threat of space debris through collective innovation and data sharing. The space industry has a significant economic influence, as it fosters private investment, generates employment opportunities, and contributes to the expansion of the economy in areas where it is prevalent.

Lack of Regulation

In the dynamic landscape of the fast-growing space sector, where breakthroughs occur on a daily basis, the legislation governing such operations is outdated and reminds us of a past, desperate for reform.

Despite its good intentions, the Outer Space Treaty or the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, established in October 1967 it was ahead of its time[78]. However, it does not adequately address the contemporary space concerns such as failure to meet the modern demands of the space industry, prevention of the armament of space and ensuring universal accessibility, Space exploration should be pursued for the benefit of all countries and humankind, Governmental or non -governmental organizations responsibility for all actions and activities in space is the governments. It fails to address important details like the role of private companies and the need for clear rules on issues like resource ownership, space trash management, and space traffic management, etc[79].

International law in the cosmos was further cemented by four other treaties that followed the Outer Space Treaty. International liability for space calamities was defined by the 1972 Liability Convention, while the 1968 Rescue Agreement guaranteed the safe recovery of spacecraft and

[78] Nataly. 2022. "Outer Space Law Is Woefully out of Date." *Orbital Today*, July 8, 2022. https://orbitaltoday.com/2022/07/01/outer-space-law-is-woefully-out-of-date/.
[79] Ibid.

crew[80]. Transparency was imposed four years later with the Registration Convention, which required the registration of all spacefaring projectiles[81]. Lastly, the 1984 Moon Agreement aimed to regulate lunar operations, although its limited implementation reduces its significance[82]. The "Space Treaties" are the cornerstone of humankind's intergalactic pursuits, yet they are ill-suited to the private-sector space industry's current development because they were drafted during the Cold War. There is a need to update the treaties, so they align with the dynamic realities of the modern space age, even though they are still applicable.

Several obstacles and dangers are associated with the space industry's expansion due to the lack of clear and current legislative frameworks. The existing legal framework fails to appropriately address matters such as traffic management and culpability in the case of incidents, which are becoming more frequent due to the increasing space congestion.

[80] ———. 2023d. "Increased Militarisation of Space – a New Realm of Security." Beyond the Horizon ISSG. December 19, 2023. https://behorizon.org/increased-militarisation-of-space-a-new-realm-of-security/.

[81] Ibid.

[82] Ibid

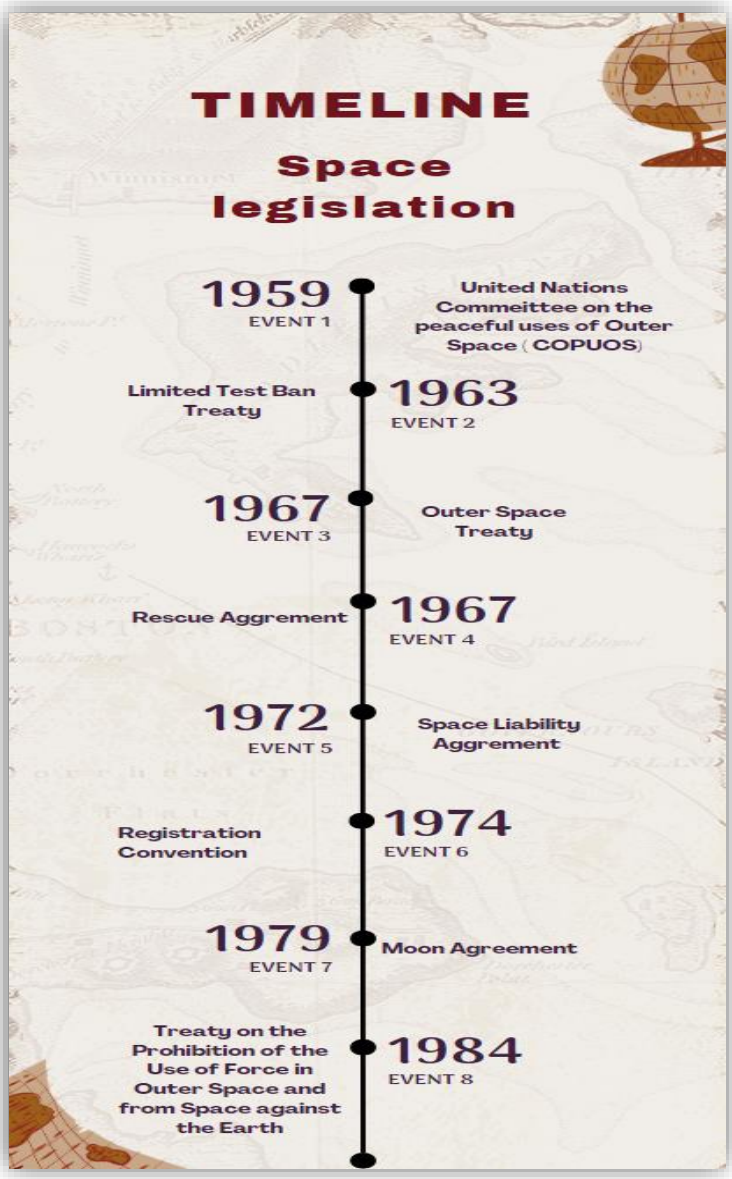

Fig 3[83]

Policy Recommendations

[83] Self-made

Collaboration between nations and prompt action are crucial in addressing this intricate problem. To achieve a sustainable future in space, it is imperative to focus on the advancement and implementation of debris removal technology, the establishment of well-defined laws, and the facilitation of international scientific collaboration.

A multipronged strategy is necessary to overcome these challenges. To guarantee security, and sustainability, it is essential to establish an integrated global regulatory system for operations in space. Launch of satellites, activities while in orbit, disposal at the end of life, and initiatives to reduce debris should all be part of this framework. To get up-to-date information on where objects are in orbit and what their paths are, better space surveillance systems are also required. Efficient data exchange and real-time coordination among spacefaring organizations will be made possible by standardized communication protocols, allowing for successful collision avoidance maneuvers. Putting money into autonomous collision avoidance systems will allow satellites to change their orbits on their own, reducing the likelihood of collisions. To deal with the current levels of space junk, active debris removal technologies are required. These technologies capture and remove debris bits, as well as deorbit obsolete satellites. Lastly, all space stakeholders must work towards a culture of open data sharing and transparency if we are to create confidence, improve coordination, and guarantee the long-term viability of space activities.

Conclusion

Finally, there are several security concerns related to the geopolitics of space, including the following: the military of space, the proliferation of space debris, the ineffective management of space traffic, the increasing commercialization of space, and the absence of worldwide regulation pertaining to space. The stability of the global economy, the environment, and national security are all affected by all these problems. As a result, decision-makers should take the initiative to resolve these concerns to maintain international cooperation and keep space as a peaceful cooperative domain. Since the safety and tranquility of space is an issue that affects every nation equally, international cooperation should involve not just governmental entities but also businesses and non-governmental organisations. The only way to ensure that space remains a haven for cooperative exploration is for nations around the world to work together and pool their resources.

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