Jurnal Sosial, Politik dan Budaya (SOSPOLBUD)
Vol. 4, No. 1, 2025: 141-158

Militarisation of Space as a Domain of Warfare: An Indonesian Perspective

Irwan Setyawan[1*], F. G. Cempaka Timur[2], Agus Hasan S. Reksoprodjo[3]
Asymmetric Warfare Study Program, Faculty of Defense Strategy, Defense University of the Republic of Indonesia
Corresponding Author: Irwan Setyawan, isetyawan97.is@gmail.com

ARTICLE INFO

Keywords: Militarization of Outer Space, Space Technology, Indonesia, National Security, S.W.O.T. Analysis

Received : 3, January
Revised : 17, January
Accepted : 31, January

ABSTRACT

The advancement of space technology and the growing acquisition of technology by various nations have transformed outer space into a new battlefield. This article explores the issue of militarization of space, concentrating on Indonesia's role within this context. Utilizing a qualitative research methodology through a literature review and S.W.O.T. analysis, the author assesses the strengths, weaknesses, opportunities, and challenges that Indonesia faces regarding space militarization. Despite notable progress in the development of space technology, Indonesia still encounters various challenges that need to be addressed at both national and international levels. Given the escalating global tensions surrounding the militarization of outer space, it is essential for Indonesia to effectively utilize its strengths and seize opportunities to bolster its capabilities in maintaining security in space.

ISSN-E: 2962-2417
DOI: https://doi.org/10.55927/sospolbud.v4i1.13773
https://journal.formosapublisher.org/index.php/sospolbud

INTRODUCTION

The advancement of technology and the growing ownership of space technology have led to outer space being considered a new battlefield, similar to land, sea, and air (Romulia, et al., 2023; Wehtje, 2023; Boucher, 2022). The term "battlefield domain" is used in military doctrine by the United States and NATO to help the military better understand its operational environment (Kreuzer, 2021). The United States views space as a warfighting domain due to the increasing militarization of space, driven by China and Russia's development, testing, and use of weapons capable of destroying or disabling satellites in orbit (Strout, 2021). "Militarization" is a passive concept that refers to the presence of military forces, and "space militarization" means the presence of military forces in space. Legally, space militarization has two aspects: the placement of military equipment in space and space assets with dual civilian and military functions (Pope, 2021). A third aspect should be added, as military equipment like Anti-Satellite Weapons (ASAT) operates from Earth and has the capability to destroy assets in space (Nagal, 2021).

Space militarization has become a critical issue related to outer space and global security, leading nations to race to develop technological capabilities to strengthen their power and influence in space (Romulia et al., 2023). Space is essentially an area located beyond the Earth's atmosphere (Bartlett, 2022). Technological innovations have facilitated exploration and research in space, motivating many countries to develop their space technology (Romulia et al., 2023). Satellites, a core component of space technology, are integral to modern life, offering numerous benefits for civil, governmental, and military purposes (Smith, 2022). Satellite technology is inseparable from the internet, telecommunications, weather forecasting, disaster management, GPS for navigation, traffic management, civil aviation, financial transactions, and remote sensing for geographic mapping (Steer, 2020). While satellites serve various civil functions, it is estimated that around 75% of satellites are used for military purposes (Pope, 2021). Military satellites assist operational forces by providing early warnings about enemy movements and positions, gathering and disseminating intelligence, and, most importantly, enabling fast and efficient communication for deployed troops in remote and inaccessible areas (Pandey, 2020).

Satellites are crucial national assets, and any hostile nation aiming to disable a country would target these satellites. Weapons capable of disabling satellites are known as Anti-Satellite Weapons (ASAT), whose development coincided with the launch of the first satellite (Smith, 2022). Global advancements in ASAT technology have accelerated rapidly. ASATs are designed to destroy satellites and can operate in various ways, such as Kinetic Energy ASAT (KE-ASAT), which works by firing high-speed missiles at satellites, and Non-Kinetic ASAT, which uses non-physical mechanisms to disable satellites through jamming, cyber-attacks, or laser strikes. ASAT attacks can be launched from the air, low orbit, or Earth. The United States' Bold Orion became the first ASAT weapon after the Soviet Union launched the Sputnik I satellite in 1957 (Blatt, 2020; Smith, 2022).

Currently, an increasing number of countries are competing to utilize outer space for military purposes (Nagashima, 2020). For instance, China successfully tested an anti-satellite (ASAT) weapon by shooting down its non-functional weather satellite in 2007 (Blatt, 2020; Smith, 2022). This testing is being conducted to build space capabilities in response to potential conflicts, particularly in the Taiwan Strait (Nagashima, 2020). In 2015, China's People's Liberation Army (PLA) established a Strategic Support Force to handle space, cyber, and electromagnetic spectrum issues, followed by Russia forming its independent space force (Nagashima, 2020). In reaction to these developments, France also created a space command, while the United States launched the U.S. Space Force in 2019, activities that are expected to heighten the risk of conflict and tensions with rival nations (Shapira & Baram, 2019; Nagashima, 2023).

More countries are developing capabilities in the space domain, with increasing satellite launches every year (Steer, 2020). Nations such as the United States, Russia, China, and India have tested Anti-Satellite Weapons (ASAT) on their own satellites over the past 20 years (Roman, 2024). Indonesia, a pioneer in Southeast Asia's space activities, established the National Institute of Aeronautics and Space (LAPAN) in the 1960s and successfully launched the Palapa A1 satellite in 1976 (Dhayita, 2024). As a large archipelagic country, space technology, especially satellites, is crucial for Indonesia to meet its telecommunications, disaster mitigation, and national security needs. Under President Joko Widodo's administration, space activities have been integrated into efforts to unify Indonesia, exemplified by the launch of the multi-functional SATRIA-1 satellite aimed at enhancing internet connectivity in remote areas (Nugraha & Nugraha, 2021). This remarkable achievement will position SATRIA-1 as the largest satellite in Asia and the fifth-largest globally in its class (Lynn, 2023).

This article will analyze the development of space militarization as a warfighting domain, which is gaining increasing global attention. It will also explore Indonesia's perspective on the militarization of space. By examining Indonesia's growing interest and investment in space technology, we can observe its efforts to expand its control and management of space assets. While Indonesia has made significant strides in this field, various challenges remain, both domestically such as limited resources and infrastructure and externally, such as international political dynamics and competition, which still need to be addressed. Through the analysis provided in this article, readers will gain a clearer understanding of Indonesia's position in the context of space militarization, as well as the strategies employed by the nation to tackle challenges and maximize its space potential.

LITERATURE REVIEW

S.W.O.T (Strengths, Weaknesses, Opportunities, Threats) Analysis

The article employs a S.W.O.T. (Strengths, Weaknesses, Opportunities, Threats) analysis to evaluate and identify the internal and external factors influencing Indonesia's role in space warfare. S.W.O.T. is a widely used framework in strategic planning to assess various aspects of an organization, plan, project, or

business activity. Through this approach, the author can identify existing strengths and weaknesses within the system under study, as well as opportunities and threats from the external environment. This analytical tool is highly valuable as it provides key insights into both environmental and organizational conditions, helping formulate more effective and targeted strategies (Gürel & Tat, 2017). The article not only presents factual information but also offers in-depth analysis, enabling readers to better understand the dynamics of space militarization and its implications for Indonesia.

METHODOLOGY

In this article, the author employs a qualitative research method with a literature review approach to explore the issue of space militarization and Indonesia's position within it. This method involves analyzing various written sources, including books, journals, and official documents relevant to the topic under discussion. Sugiyono (2016) explains that qualitative research focuses on a deep understanding of social phenomena through direct interaction and observation, emphasizing descriptive data that provides a clear depiction of the research subject. Moleong (2017) adds that the literature review approach, as a method for collecting secondary data, involves searching, gathering, and analyzing information from existing literature to support the research. This approach enables the researcher to gain broader and deeper insights into the topic, facilitating the development of strong arguments and conclusions.

RESULT AND DISCUSSION

The militarization of space began when the Soviet Union launched the R-7 Intercontinental Ballistic Missile (ICBM), carrying the artificial satellite Sputnik into Earth's orbit in October 1957. This was followed a year later by the United States launching its own satellite, Explorer I (Nagashima, 2020; HISTORY, 2020). The early phase of space militarization involved non-offensive military technologies, such as satellites used for communication, tracking, imaging, positioning, navigation, and surveillance (Mills, 2021). Although the space technology deployed at that time was non-offensive, the Soviet Union's demonstration of the R-7 ICBM's capability to launch a satellite with the potential to carry a nuclear warhead over long distances undetected raised alarm in the United States (HISTORY, 2020; Boucher, 2022).

In 1983, U.S. President Ronald Reagan introduced the Strategic Defense Initiative (SDI), aimed at researching advanced technologies to defend against nuclear attacks, with some systems planned to be space-based. This initiative became known as "Star Wars" (Bateman, 2023; Britannica, 2024). The space arms race between the U.S. and the Soviet Union soon followed, with nuclear weapons being a central focus. Such events spurred other nations, like China, to enhance their space capabilities, exemplified by China's 2007 test of an Anti-Satellite Weapon (ASAT) that destroyed its own Fengyun-1C satellite (Boucher, 2022).

According to the 1965 Outer Space Treaty, space is intended solely for peaceful purposes, yet most advanced nations increasingly rely on space for military support (Steer, 2020). The Gulf War in 1991, led by a U.S.-coalition to expel Iraqi forces from Kuwait, was the first military conflict that demonstrated

the success of space-based technology, earning it the title of the "first space war" (Greenemeier, 2016). The U.S. victory was significantly supported by the Global Positioning System (GPS) satellite network, developed during the 1970s and 1980s by the U.S. Department of Defense's NAVSTAR program (Hardy, 2023; HISTORY, 2024).

The United States heavily relies on its space assets to support military operations on Earth. Approximately 95% of U.S. Navy operations utilize space technology, particularly for space-based communications (Muhammad, 2019). The establishment of the U.S. Space Force in 2019 under President Donald Trump was deemed essential for operating and protecting America's space assets. However, this decision sparked intense debates over the potential consequences, as the presence of a Space Force is seen as likely to escalate armed conflicts that could endanger all nations with space assets (Tingley, 2023; Nugraha & Amalia, 2020). Currently, the U.S. is forming alliances with countries like India, Israel, Japan, and South Korea to counter China, which has been significantly advancing its space capabilities, marking the beginning of a new space race in Asia (Awan & Javaid, 2020).

The global shift in space security, led by the U.S., China, and Russia, has significantly influenced the Indo-Pacific region, including India, which has consequently increased its investment in military space technology (Rajagopalan, 2022). India's journey toward becoming a space power began in 1968 with the establishment of the Indian Space Research Organisation (ISRO) and the launch of its first satellite, Aryabhata, in 1975 (Duchaine, 2023). In 2008, the Indian government unveiled its "Defence Space Vision 2020," emphasizing the integration of space defense with a focus on increasing dual-use space assets and the development of specialized military satellites (PwC, 2022). The potential of India's space technology was further demonstrated under Prime Minister Modi's leadership, with the ASAT weapon test during the Shakti mission in 2019. This was a response to China's 2007 ASAT weapon test and the 2008 Mumbai terrorism attack, which underscored the importance of space technology for national security (Banerji, 2023; Wahyudi, 2023).

In 2023, India became the fourth country to successfully land a spacecraft on the Moon with its Chandrayaan-3 mission, solidifying its standing as a capable space-faring nation (The Planetary Society, 2024; Jones, 2023). Following this success, India announced plans to send astronauts to the Moon by 2040 and aims to establish a lunar base by 2047 (Jones, 2023). These ambitious plans are encapsulated in the "Roadmap Space Vision 2047" (Goswami, 2023). This vision aligns with the Indian Air Force's (IAF) transformation into the Indian Air and Space Force (IASF), as part of its new military doctrine. The renaming reflects India's broader focus on fully exploiting space capabilities, particularly in intelligence, surveillance, reconnaissance, communications, and navigation (The Economic Times, 2023). This transformation is also a strategic move to keep pace with China's space advancements. The IAF plans to collaborate with domestic space institutions and private industry to pioneer space technology, with an ambitious goal of deploying 100 military satellites within the next 7-8 years (Krisna, 2023).

India's aspirations include the establishment of its own space station, Bharatiya Antariksh, by 2035, as it seeks to catch up with China, which already operates the Tiangong space station (Nadarajah, 2024). India's cooperative approach in space exploration is evident in its upcoming collaboration with Japan on the Lunar Polar Exploration (LUPEX) mission in 2025. This mission aims to explore the far side of the Moon and confirm the presence of water, which could be critical for future human activities on the Moon (Nadarajah, 2024; The Hindu Bureau, 2023; Jones, 2023).

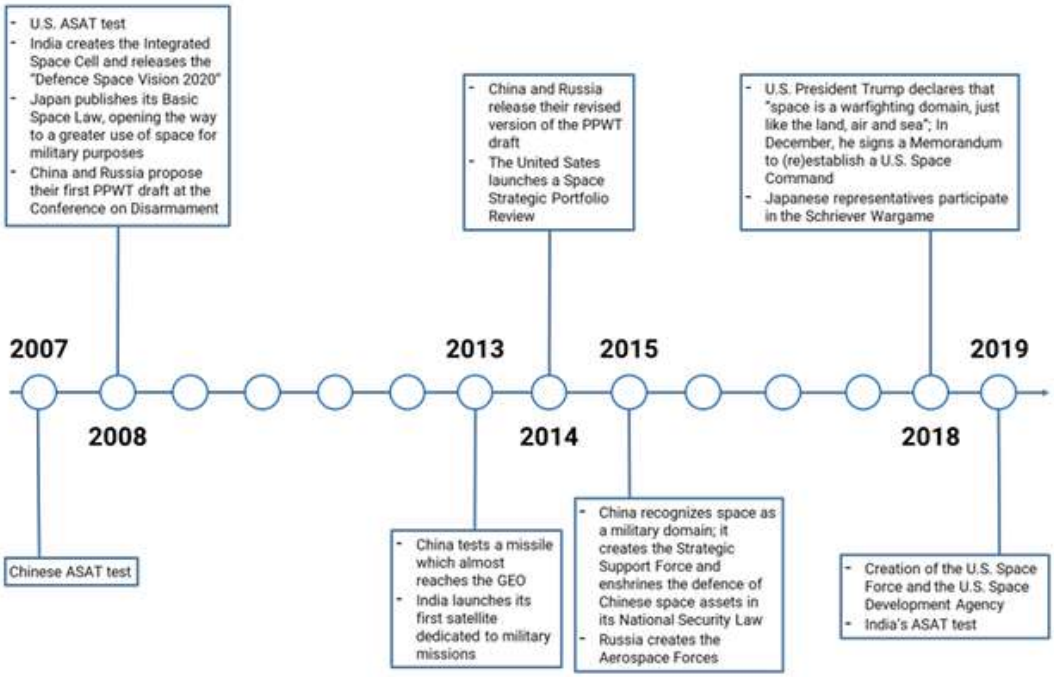

Figure 1.1 Space activities of several countries in the period 2007 – 2019
Source: ESPI (2020)

Militarization involves the active preparation for war, a process that has become increasingly visible in space. According to the satellite database of the Union of Concerned Scientists, it is estimated that around 30 countries worldwide are currently operating military satellites. Many nations have begun preparing by establishing military units and specialized command controls to protect and defend their space assets (West, 2024). Since the Gulf War of 1990-1991, military operations have increasingly relied on space technology, particularly for remote sensing, signal intelligence, telecommunications, positioning, and navigation. The services provided by space technology are essential assets for a country's diplomatic actions and military operations. However, this significant reliance also brings great vulnerability, given the widespread dependency on space technology. Space technology is becoming more sensitive, as attacks on it would cause chaos for countries that heavily depend on such systems (ESPI, 2020).

Efforts to Militarize Space are based on the Categorization of Countries.

In recent years, there has been an expansion of space activities by established countries, as well as the emergence of nations with new space capabilities, often marked by the formation of their space institutions (ESPI, 2020). Several categories have been defined for countries involved in space activities, and this categorization is based on various indicators, primarily focusing on a country's ability to own, develop, and operate certain space technologies. Oniosun and Klinger (2022) in his research, categorized these countries using terms such as "Nations with No Space Involvement," "Non-Spacefaring Countries," "Emerging Space Countries," "Spacefaring Countries," and "Nations of Spacefarers."

Figure 2. Country Classification Mapping
Source : Oniosun and Klinger (2022)

Countries in the “Non-Spacefaring” and “Emerging Space Country” categories, which already have the capability to launch satellites, as well as those in the “Nations with No Space Involvement” category, though they may not have the ability to launch satellites, are likely still using satellite services and can be considered as participants in the militarization of space. However, their involvement is harder to detect due to the "dual-use" nature of space technology, which means space technologies can be used for both military and civilian purposes. For example, navigation satellites commonly serve public transportation systems such as cars, ships, and airplanes, but they can also be used for targeting missiles and drone strikes. Countries in the “Non-Spacefaring” and “Emerging Space Country” categories can also contribute to space

militarization through military alliances such as NATO, sharing access to the space systems of other member countries like the United States (Harvey, 2022).

Based on these facts, it can be concluded that nearly all countries in the world, regardless of their category, are involved in space militarization to some degree, although the intensity and visibility of their involvement vary. This point is further supported by Dr. Bleddyn Bowen, an expert in international space relations from the University of Leicester. Bowen stated that as long as physical machines are used in space, the space environment has been militarized (Drummond, 2024). The following chapter will present Indonesia's perspective on space militarization as a domain of warfare through a S.W.O.T. analysis.

Indonesia's Perspective on Militarisation of Outer Space

Internal	
Strength	***Weakness***
• **National Master Plan for the Development of Space Defense Technology** • **Supporting Policies for the Development of Indonesia's Space Program** • **Domestic Institutions and Industries Involved in Space Affairs** • **Strategic Geographical Location** • **Awareness of Potential Space Threats**	• **Outer space has not yet been established as a domain supporting national defense** • **Lack of mastery over space technology** • **Outer space is not regarded as a territory that needs to be secured** • **The budget for institutions involved in space affairs is relatively low** • **Ambiguity of authority**
Eksternal	
Opportunity	***Threat***
• **Actively participating in international organizations and forums** • **Establishing cooperation with countries that have superpower space capabilities** • **Indonesia becoming a leading actor on space issues in ASEAN** • **Improvements in the STEM field, particularly in nano satellite technology.** • **Indonesia's plan to establish a space unit**	• **Program budgets are relatively low compared to other countries** • **Indonesia's foreign policy of being free and active** • **Dependence on defense equipment from other countries** • **Indonesia's vast territory with inadequate surveillance** • **Challenges of international regulations**

Strength

- Indonesia has established the National Research Master Plan for 2017-2045 concerning defense and security, which also pertains to the development of technology for space defense and security, including (Rafikasari, 2021):
    1) Unmanned aircraft with a range of over 200 km
    2) Guided rockets/missiles over 60 km

3) Smart bombs
4) Fire control systems
5) Prototype radar defense micro-satellites
6) Radar-absorbing coating materials

The government has outlined a defense industry roadmap aimed at mastering defense technology (Rafikasari, 2021).

- Law No. 21 of 2013 on Space Affairs serves as the legal foundation for developing space technology and utilizing outer space for national interests (Hidayatullah, 2015). This specific policy regarding space affairs reflects Indonesia's interest in utilizing outer space, as only a few countries in the world possess such legislation (Hardiana & Fikrana, 2022). Presidential Regulation No. 45 of 2017 on the Master Plan for Space Operations for 2016-2040 also encourages the acceleration of Indonesia's space technology, particularly for mastering rocket technology and establishing spaceports as an effort to launch space vehicles from Indonesian territory (Pradana & Permatasari, 2021; Hardiana & Fikrana, 2022).
- Geographically, Indonesia is located along the equator. The equator is the closest point on Earth to outer space, which provides an advantage for faster launches into space, potentially reducing rocket fuel costs by up to 5.5%. This advantage is a valuable asset that can generate significant revenue for the country and politically position Indonesia as a Spacefaring Country (Hardiana & Fikrana, 2022; Pradana & Permatasari, 2021; Putro & Nugraha, 2023).
- ORPA plays a role in the development of Indonesia's space technology, including the mastery and advancement of micro-satellites. According to its Master Plan, ORPA aims to launch and operate Earth observation, telecommunications, and navigation satellites by 2039 (Pradana & Permatasari, 2021; Rafikasari, 2021). The national defense industry, including PT PINDAD, PT Dahana, and PT LEN, is coordinated by the Defense Industry Policy Committee to achieve self-reliance in defense and security equipment (ALPALHANKAM) (Pradana & Permatasari, 2021; Rafikasari, 2021).
- Indonesia has recognized the potential threats from outer space as the fifth domain of warfare, as outlined in the 2015 Indonesian Defense White Paper. This document states that several space technologies can be utilized for national defense purposes. This was further reaffirmed in the Regulation of the Minister of Defense of the Republic of Indonesia Number 12 of 2021 concerning the Implementation of National Defense for the period 2020 - 2024. This regulation prioritizes the acquisition of defense technologies in space, such as military satellites, tactical and strategic missile systems, subsurface reconnaissance systems, and drone systems (Ministry of Defense of the Republic of Indonesia, 2015; 2021).

Weakness

- Indonesia has yet to recognize outer space as a sector that can support the national defense system, leading to a slow mastery and development of space technology (Pinandito, 2024; Rafikasari, 2021; Hardiana & Fikrana, 2022). Currently, the use of space technology in Indonesia is primarily dominated by commercial and economic functions. This is evidenced by the Indonesian satellites, which are primarily utilized to support economic activities, agriculture, and fisheries, as well as to provide essential telecommunications services (Amalia & Nugraha, 2020; Hidayatullah, 2015).
- The development of space technology in Indonesia is hindered by challenges in technology transfer, budget constraints, and national production capabilities, resulting in stagnation in the advancement of space technology (Rafikasari, 2021).
- Indonesia's Air Force has experienced a regression regarding its primary responsibilities, which should encompass airspace, outer space, and the atmosphere, but are now limited to just airspace as stated in Law No. 34 of 2004 (Amalia & Nugraha, 2020). In fact, Indonesia is estimated to possess a total space area of approximately 5,180,053 square kilometers, which is also crucial to monitor and safeguard (Dhayita, 2024).
- The low budget is a result of the integration of LAPAN into BRIN, which subsequently transformed LAPAN into the Space Research and Flight Organization (ORPA). Although BRIN received an increased budget, this funding must be distributed among several subordinate research institutions, including BRIN itself (Putro & Nugraha, 2023). Consequently, the budget allocated to ORPA is likely to be limited, which will adversely affect the pace of research aimed at advancing Indonesia's space capabilities.
- Before its merger into BRIN, LAPAN was the only government agency not affiliated with a ministry responsible for research, development, and utilization in the aerospace sector. It served as the organizer of Indonesia's space activities and represented Indonesia in international space affairs. However, after the merger, the responsibilities for advancing Indonesia's space capabilities became fragmented and unfocused, leading to significant bureaucratic burdens for the country (Putro & Nugraha, 2023).

Opportunity

- Indonesia has been an active member of UNCOPUOS since 1973, engaging in global space science and technology advancements while leveraging opportunities for national space development (Dhayita, 2024). Additionally, Indonesia is part of APSCO, collaborating with seven countries, including China, Bangladesh, Iran, Mongolia, Pakistan, Peru, and Thailand, in regional space cooperation outside the UN framework (Dhayita, 2024; Diana, 2016). Indonesia has also strengthened its global space engagement by participating in the Space Economic Leaders Meeting, introduced at the G20 in 2020, and agreed to host the agenda in

2022 (Drozhashchikh, 2021). Moreover, Indonesia actively participates in various international space-related meetings.

- Indonesia's space cooperation with China is based on Presidential Regulation No. 22 of 2019, supporting defense system enhancement through space technology development. From 2015 to 2020, both countries focused on knowledge and technology transfer in satellite launches, Earth observation, communication and navigation satellites, TTC, space facilities, satellite components, space science, and training (Rafikasari, 2021; Pradana & Permatasari, 2021; Dhayita, 2024). Indonesia also collaborates with the U.S., inviting participation in a Space Defense seminar during the 2022 Super Garuda Shield exercise to explore potential cooperation in new warfare domains, including space (IPDefenseForum, 2022). Meanwhile, Indonesia and India formalized cooperation in 2024 through agreements on the transfer, operation, and utilization of Integrated Biak TTC Facilities, continuing collaborations from 1999, which expanded in 2002 and 2005 (Tempo.co, 2024).
- Indonesia is often assumed to be a leader in space issues within ASEAN. This is evidenced by Indonesia frequently expressing its own opinions on nearly all agendas organized by the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), while neighboring ASEAN countries tend to follow the general consensus. In 2020, marked by the adoption of General Assembly Resolution 75/36, "Reducing Space Threats through Norms, Rules, and Principles of Responsible Behaviors," initiated by the United Kingdom to ensure that outer space remains a peaceful environment amidst increasing competition, Indonesia stood out as the only ASEAN country to respond by formulating a legally binding instrument to prevent an arms race in outer space (Drozhashchikh, 2021).
- The Ministry of Defense of the Republic of Indonesia, under the leadership of Minister Prabowo Subianto, has launched the development program for nano satellites through the Republic of Indonesia Defense University Satellite (RIDU-Sat) by the Defense University of the Republic of Indonesia (Unhan RI), aimed at enhancing the mastery of science and technology, particularly in STEM fields. This program focuses on increasing the interest of students and academics in satellite technology, which is crucial for Indonesia's advancement, and is being implemented in collaboration with the Berlin Nanosatelliten Allianz (BNA) from Germany, which has over 30 years of experience in developing small satellites. The first phase of RIDU-Sat will develop a 1U nano satellite with an APRS (Automatic Packet Reporting System) mission and an Amateur Satellite Ground Station (SBSA) at Unhan RI's campus in Sentul to support satellite operations. In addition, Unhan RI is also collaborating with the Satellite Technology Research Center – National Research and Innovation Agency (BRIN), strengthening Indonesia's satellite ecosystem. This program is expected to inspire satellite researchers and practitioners in Indonesia and support the advancement of space exploration technology

in line with Minister Prabowo Subianto's vision (Ministry of Defense of the Republic of Indonesia, 2024)

- The Indonesian Air Force Academy (AAU) held a Focus Group Discussion (FGD) led by AAU Governor, Air Vice Marshal Dr. Ir. Purwoko Aji Prabowo, M.M., MDS., at the Mako Meeting Room, AAU Barracks in Yogyakarta. The discussion centered on the establishment of a Cyber Defense and Space Studies program, a strategic step aligned with the direction of the Air Force Chief of Staff, Air Marshal M. Tonny Harjono, S.E., M.M. During the forum, AAU researchers and faculty presented various materials related to the creation of the new program. The meeting reflected AAU's commitment to advancing Indonesia's air and space defense capabilities. This initiative is part of AAU's effort to significantly contribute to building a modern, competitive air force, with a focus on mastering space technology in today's rapidly evolving global context. The event was attended by AAU Vice Governor Air Marshal Meka Yudanto, S.Sos., M.A.P., directors, officials, faculty, and researchers (AAU, 2024).

Threat

- The budget for Indonesia's space program in 2023 is set at $92 million, which represents a decrease compared to previous years (Euroconsult, 2023). The budget has declined from $159 million in 2022 (Euroconsult, 2022) and $189 million in 2021, while several other countries have begun increasing their budgets to invest in space defense technology due to geopolitical tensions stemming from rivalry among space powers (SatNews, 2022).
- Indonesia, which adheres to a foreign policy of active non-alignment and often maintains friendly relations with any country, operates in a global political landscape dominated by conflicts and national interests that could lead to wars between blocs or groups of nations. This situation can indirectly impact Indonesia (Hidayatullah, 2015).
- Indonesia remains dependent on importing defense equipment from other countries, which, if continued, could allow the producing countries to dictate Indonesia's defense capabilities, making them easier to detect. Indonesia's dependency extends not only to its defense equipment but also includes purchasing data and information from the satellites of other countries for defense and security purposes. Consequently, this leads to a situation where Indonesia relies on external sources for more comprehensive and accurate information about its own conditions than it possesses domestically (Rafikasari, 2021; Hidayatullah, 2015).
- Indonesia has a land area of approximately 1,922,570 square kilometers, an ocean area of about 3,257,483 square kilometers, and an estimated total space area of around 5,180,053 square kilometers. It shares direct boundaries with the outer space of several countries, including Australia, Sri Lanka, Singapore, Malaysia, the Philippines, the United States, Papua New Guinea, and India (Dhayita, 2024). Given its vast territory,

monitoring Indonesia's region would be extremely challenging without the assistance of military satellites. Additionally, Indonesia's space boundaries are in proximity to several countries with established space capabilities, which poses a threat to Indonesia, especially since it lacks counter-space capabilities.

- Indonesia is hindered by the Mission Technology Control Regimes (MTCR) in acquiring materials for rocket manufacturing and launch systems (Putro & Nugraha, 2023). The MTCR is an informal association of countries committed to not developing unmanned weapon systems that could produce weapons of mass destruction. It also coordinates the national laws of its member states regarding the licensing of export technologies to other countries (Britannica, 2023). Indonesia, which is not yet a member, faces difficulties in obtaining raw materials from MTCR members, most of whom are established space-faring nations, making it challenging for Indonesia to manufacture and develop its rockets (Putro & Nugraha, 2023).

CONCLUSION

Outer space has now transformed into a new battlefield, with major nations such as China, the United States, Russia, and India making significant advancements in offensive technologies, including anti-satellite (ASAT) weapons. Japan, previously hindered by laws restricting military development, has revised its regulations to strengthen its military capabilities in outer space for defensive purposes. Countries with space capabilities increasingly recognize that outer space is an emerging warfare domain, with some establishing dedicated branches to address this issue. The escalation of militarization in space has created global security uncertainties, compelling other nations to participate in militarization to varying degrees and visibility.

Indonesia has acknowledged the potential of outer space as a warfare domain by releasing a defense white paper in 2015. Although it has developed a master plan and established cooperation with space-capable countries, as well as actively participating in various related organizations, Indonesia's efforts have not matched its ambitions and awareness. The limitations faced both internal, such as bureaucracy and budget constraints, and a focus that leans more towards technological development for economic and social purposes—indicate that defense and security aspects have not been prioritized. Therefore, Indonesia needs to be more consistent in leveraging existing strengths and opportunities to enhance its capabilities in securing outer space, considering the evolving global situation in this domain.

RECOMMENDATIONS

Indonesia must strengthen its role in space security by updating Law No. 21 of 2013 to include military applications, developing a National Space Defense Strategy, and increasing investments in defense satellites and a dedicated Space Command. Expanding international cooperation with China, India, and the U.S., as well as enhancing Indonesia’s role in UNCOPUOS, is crucial for capacity

building. Developing an indigenous space industry through public-private partnerships and R&D collaboration with BRIN and Unhan RI is also essential. Future studies should assess Indonesia's readiness for space defense, its strategic position in ASEAN, and comparative policies of developing nations to identify best practices for enhancing national space security.

FURTHER STUDY

Future research should explore Indonesia's readiness for space defense by assessing its technological, financial, and institutional capacity to develop an independent program, as well as conducting comparative studies with emerging space powers like India and Brazil. Additionally, investigations should examine the strategic implications of space militarization on Indonesia's national security strategy and how its position in ASEAN can shape regional space security policies. A comparative analysis of space policies in developing nations is also essential to understand how they navigate space militarization complexities and identify best practices that Indonesia can adopt to enhance its space security framework.

REFERENCES

Wehtje, B. (2023). Increased militarisation of space – A new realm of security. Retrieved from https://behorizon.org/increased-militarisation-of-space-a-new-realm-of-security/#t6qtnyndid7l

Nugraha, T. R., & Nugraha, R. A. (2021, October 27). Indonesia's foreign, defense policies amid space militarization. The Jakarta Post. Retrieved from https://www.thejakartapost.com/paper/2021/10/27/indonesias-foreign-defense-policies-amid-space-militarization.html

Banerji, A. (2023). The slow militarization of India's space sector. The Diplomat. Retrieved from https://thediplomat.com/2023/09/the-slow-militarization-of-indias-space-sector/

Nagashima, J. (2020). The militarization of space and its transformation into a warfighting domain. SPF International Information Network Analysis (IINA). Retrieved from https://www.spf.org/iina/en/articles/nagashima_02.html

Blatt, T. M. (2020). Anti-satellite weapons and the emerging space arms race. Harvard International Review. Retrieved from https://hir.harvard.edu/anti-satellite-weapons-and-the-emerging-space-arms-race/

Smith, M. (2022). Anti-satellite weapons: History, types and purpose. Space.com. Retrieved from https://www.space.com/anti-satellite-weapons-asats

Muhammad, A. N. (2019). Revisiting U.S – China aggressive use of outer space: A comprehensive international law outlook towards military activities in outer space. Indonesian Journal of International Law, 16(4), Article 3. https://doi.org/10.17304/ijil.vol16.4.761

Nugraha, T. R., & Amalia, P. (2020). Militerisasi ruang angkasa, quo vadis Indonesia? *MIMBAR HUKUM, 32*(3), 377-391.

Boucher, C. (2022). *On space war.* Modern War Institute. Retrieved from https://mwi.westpoint.edu/on-space-war/

Kreuzer, M. P. (2021). *Cyberspace is an analogy, not a domain: Rethinking domains and layers of warfare for the information age.* The Strategy Bridge. Retrieved from https://thestrategybridge.org/the-bridge/2021/7/8/cyberspace-is-an-analogy-not-a-domain-rethinking-domains-and-layers-of-warfare-for-the-information-age

Bartlett, R. (2022). What is outer space? High Point Scientific. Retrieved from https://www.highpointscientific.com/astronomy-hub/post/astronomy-101/what-is-outer-space

Nagal, B. S. (2021). *Weaponization & militarization of space.* Geospatial World. Retrieved from https://www.geospatialworld.net/prime/prime-opinion/weaponization-militarization-of-space/

Roman, N. (2024). *Global status of anti-satellite (ASAT) weaponry and testing.* ACE-USA. Retrieved from https://ace-usa.org/blog/research/research-foreignpolicy/global-status-of-anti-satellite-asat-weaponry-and-testing/

Strout, N. (2021). *Report broadens conversation on space militarization and Space Force satellite defense.* C4ISRNET. Retrieved from https://www.c4isrnet.com/battlefield-tech/space/2021/02/26/report-broadens-conversation-on-space-militarization-and-space-force-satellite-defense/

Greenemeier, L. (2016). *GPS and the world's first "space war".* Scientific American. Retrieved from https://www.scientificamerican.com/article/gps-and-the-world-s-first-space-war/

Hardy, J. (2023, October 25). *Who invented GPS? Powerful minds behind the history of GPS.* History Cooperative. Retrieved from https://historycooperative.org/who-invented-gps/

HISTORY. (2020). *The Space Race.* History. Retrieved from https://www.history.com/topics/cold-war/space-race

Steer, C. (2020). *Why outer space matters for national and international security: A report by the Center for Ethics and the Rule of Law (CERL).* University of Pennsylvania.

Tingley, B. (2023). *What is the U.S. Space Force and what does it do?* Space.com. Retrieved from https://www.space.com/us-space-force-history-mission-capabilities

The Planetary Society. (2024). *The history and motivations behind India's growing space program.* Retrieved from https://www.planetary.org/articles/history-motivations-indias-space-program

Wahyudi, M. Z. (2023). *Learn from India's space technology development.* Kompas. Retrieved from https://www.kompas.id/baca/english/2023/08/30/en-belajar-dari-pengembangan-teknologi-antariksa-india

Awan, F. A., & Javaid, U. (2020). Space militarization race among China, Russia, and the USA: Implications for South Asia. *South Asian Studies: A Research Journal of South Asian Studies, 35*(1), 87–100.

The Economic Times. (2023). *Military satellites, space fighters: How IAF plans to transform into a superpower in space.* The Economic Times. Retrieved from https://economictimes.indiatimes.com/news/defence/military-

satellites-space-fighters-how-iaf-plans-to-transform-into-a-space-superpower/articleshow/105893651.cms?from=mdr

Jones, A. (2023). *India sets sights on a moon base by 2047.* Space.com. Retrieved from https://www.space.com/india-moon-base-2047

Goswami, N. (2023). *India's space program in 2023: Taking stock.* The Diplomat. Retrieved from https://thediplomat.com/2023/12/indias-space-program-in-2023-taking-stock/

Krisna, B. (2023). *Space Vision 2047: IAF unveils ambitious plans to become air and space power, here's all about it.* Swarajya. Retrieved from https://swarajyamag.com/defence/space-vision-2047-iaf-unveils-ambitious-plans-to-become-air-and-space-power-heres-all-about-it

The Hindu Bureau. (2023). *Japanese delegation in talks with ISRO for using data from lunar and solar missions.* The Hindu. Retrieved from https://www.thehindu.com/sci-tech/science/japanese-delegation-in-talks-with-isro-for-using-data-from-lunar-and-solar-missions/article67175270.ece

Jones, A. (2023). *Japan and India plan 2025 moon mission to hunt for water near the lunar south pole.* Space.com. Retrieved from https://www.space.com/japan-india-2025-moon-mission-lunar-south-pole

PwC. (2022). *Space for defence in India.* Price Waterhouse Coopers. Retrieved from https://www.pwc.in/assets/pdfs/aero_defence/space-for-defence-in-india.pdf

Nadarajah, H. (2024). *The emergence of new actors in space.* Asia Pacific Foundation of Canada. Retrieved from https://www.asiapacific.ca/publication/space-intro-emergence-new-actors

West, J. (2024). We can't ignore the militarization of space. *Ploughshares*. Retrieved from https://www.ploughshares.ca/publications/we-cant-ignore-the-militarization-of-space

Romulia, et al. (2023). Small states' efforts on militarization of outer space uncertainties in the twenty-first century: A Kantian triangle perspective. *Journal of Scientific Papers "Social Development and Security"*, 13(6). ISSN: 2522-9842.

ESPI. (2020). *Europe, space and defence: From "space for defence" to "defence of space"*. European Space Policy Institute. Schwarzenbergplatz: ESPI.

Oniosun, T. I. & Klinger, J. M. (2022). A review of country classification frameworks in the space sector: Priorities, limitations, and global considerations. *Space Policy, 61*, 101491. https://doi.org/10.1016/j.spacepol.2022.101491

Harvey, B. (2022). Military space – how worried should we be?. *Room, Space Journal of Asgardia*. Retrieved from https://room.eu.com/article/military-space-how-worried-should-we-be

Drummond, M. (2024). Warfare is changing: Is space the new military frontier?. *Sky News*. Retrieved from https://news.sky.com/story/is-space-the-new-military-frontier-13072321

SatNews. (2022). Euroconsult projects government space project budgets to reach $1 billion during the next decade. *SatNews*. Retrieved from https://news.satnews.com/2022/01/05/euroconsult-projects-government-space-projects-budgets-to-reach-1-billion-during-the-next-decade/

Euroconsult. (2022). New record in government space defense spendings driven by investments in space security and early warning. *Euroconsult*. Retrieved from https://www.euroconsult-ec.com/press-release/new-record-in-government-space-defense-spendings-driven-by-investments-in-space-security-and-early-warning/

Britannica, T. Editors of Encyclopaedia. (2023, March 20). Missile Technology Control Regime. *Encyclopedia Britannica*. Retrieved from https://www.britannica.com/topic/Missile-Technology-Control-Regime

Tempo.co. (2023). India's Space Agency ISRO and BRIN Sign Bilateral Space Collaboration. *Tempo.co*. Retrieved from https://en.tempo.co/read/1847324/indias-space-agency-isro-and-brin-sign-bilateral-space-collaboration

Rafikasari, A. (2021). Strategi diplomasi pertahanan Indonesia melalui kerja sama keantariksaan dalam era revolusi industri 4.0. *Jurnal Kajian Kebijakan Penerbangan dan Antariksa*, 2(1), 2. https://doi.org/10.30536/jkkpa.v2n1.2

Hidayatullah, P. (2015). Kedaulatan antariksa Indonesia: "Frontir terakhir yang terlupakan". *Jurnal Kajian Lemhannas RI*, Edisi 21.

Hardiana, I., & Fikrana, G. (2022). Gagasan pembangunan bandar antariksa di Indonesia. Sekretariat Kabinet Republik Indonesia. Diakses dari https://setkab.go.id/gagasan-pembangunan-bandar-antariksa-di-indonesia/

Pradana, N. M. E., & Permatasari, Y. (2021). Bandar antariksa Biak dalam diplomasi publik Indonesia. *Jurnal Kajian Kebijakan Penerbangan dan Antariksa*, 1(2), 5. https://doi.org/10.30536/jkkpa.v1n2.5

Putro, Y. M., & Nugraha, R. A. (2023). Space economy is the future, but can Indonesia realize it?. *Asia News Network*. Retrieved from https://asianews.network/space-economy-is-the-future-but-can-indonesia-realize-it/

Pinandito, M. (2024). BRIN Susun Peta Jalan Keantariksaan 2045. *Siaran Pers Badan Riset dan Inovasi Nasional*, No: 14/SP/HM/BKPUK/III/2024. Retrieved from https://www.brin.go.id/press-release/117772/brin-susun-peta-jalan-keantariksaan-2045

Nugraha, T. R., & Amalia, P. (2020). Militerisasi Ruang Angkasa, Quo Vadis Indonesia?. *MIMBAR HUKUM*, 32(3), 377-391.

Euroconsult. (2023). New historic high for government space spending mostly driven by defense expenditures. *Euroconsult*. Retrieved from https://www.euroconsult-ec.com/press-release/new-historic-high-for-government-space-spending-mostly-driven-by-defense-expenditures/

Pope, R. (2021). Space weapons and the increasing militarisation of outer space: Whether the legal framework is fit-for-purpose. *Auckland University Law Review, 27*(1), 263–283.

Shapira, Z., & Baram, G. (2019). The space arms race: Global trends and state interests. *Cyber, Intelligence, and Security, 3*(2).

Lynn, A. (2023). Asia's largest internet satellite, Indonesia's SATRIA-1, launched into orbit. *The Fast Mode*. Retrieved from https://www.thefastmode.com/technology-solutions/32465-asias-largest-internet-satellite-indonesias-satria-1-launched-into-orbit

Pandey, B. K. (2020). Military satellites and their role in conflicts. *SP's Aviation*, 09-2020. Retrieved from https://www.sps-aviation.com/story/?id=2811&h=Military-Satellites-and-their-Role-in-Conflicts

Moleong, L. J. (2017). *Metodologi penelitian kualitatif* (Revisi ed.). PT Remaja Rosdakarya.

Gürel, E., & Tat, M. (2017). SWOT analysis: A theoretical review. *Uluslararası Sosyal Araştırmalar Dergisi The Journal of International Social Research, 10*(51), 994-1006. http://dx.doi.org/10.17719/jisr.2017.1832

Duchaine, D. (2023, December 4). Enter India, the fifth great space power. *The Space Review*. Retrieved from https://www.thespacereview.com/article/4702/1

Drozhashchikh, E. (2021, December 1). Heads Up: Indonesia to boost ASEAN space agenda? *Russian International Affairs Council*. Retrieved from https://russiancouncil.ru/en/analytics-and-comments/analytics/heads-up-indonesia-to-boost-asean-space-agenda/?sphrase_id=112930796

Kementerian Pertahanan. (2022). *Buku Putih Pertahan*. Retrieved from https://www.kemhan.go.id/uploads/2022/08

Dhayita, K. (2024, January 2). Astropolitical developments in Indonesia: Are they the same as developed countries? *Modern Diplomacy*. Retrieved from https://moderndiplomacy.eu/2024/01/02/astropolitical-developments-in-indonesia-are-they-the-same-as-developed-countries/

Ministry of Defense of the Republic of Indonesia. (2024, October 18). Minister of Defense Prabowo's STEM program: Encouraging student innovation in nano satellite technology through the Indonesian Defense University. Ministry of Defense of the Republic of Indonesia. https://www.kemhan.go.id/2024/10/18/program-stem-menhan-prabowo-dorong-inovasi-mahasiswa-di-bidang-teknologi-satelit-nano-melalui-universitas-pertahanan-ri.html

AAU. (2024, October 28). AAU Conducts In-Depth Study on the Formation of Space Units. TNI AU. Retrieved from https://tni-au.mil.id/berita/detail/aau-laksanakan-kajian-mendalam-tentang-pembentukan-satuan-ruang-angkasa