Multidisciplinary Output Research For Actual and International Issue (MORFAI Journal) ISSN (e): 2808-6635
Volumes 5 No. 4 (2025)

STRENGTHENING THE NATIONAL AIR DEFENSE SYSTEM TO COUNTER DRONE THREATS AND AIR ATTACKS IN JAKARTA AS INDONESIA'S CENTER OF GRAVITY

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Received	: 01 August 2025	Published	: 14 October 2025
Revised	: 20 September 2025	DOI	: https://doi.org/10.54443/morfai.v5i4.4242
Accepted	: 05 October 2025	Link Publish	: https://radjapublika.com/index.php/MORFAI/article/view/.4242

Abstract

Jakarta, as the capital city and the center of gravity of Indonesia, is highly vulnerable to modern aerial threats. Its dense population, the presence of government institutions, vital infrastructures, and its role as the nation's political, economic, and diplomatic hub make Jakarta a strategic target for drone attacks and aerial strikes. These threats are asymmetric in nature—fast, precise, difficult to detect, and cost-effective—thus requiring the strengthening of an adaptive and integrated air defense system. This study employs a qualitative descriptive-analytical approach through literature reviews, policy document analysis, and comparative case studies of international practices. The findings reveal that integrating advanced radar technology, early warning systems, Counter-Unmanned Aerial Systems (C-UAS), and the readiness of the Indonesian Air Force are crucial in establishing a layered air defense system in Jakarta. These efforts align with Indonesia's total defense doctrine, emphasizing cross-sector synergy, military-civil collaboration, and defense diplomacy to safeguard national stability.

Keywords: ***Jakarta, air defense, drones, center of gravity, national security.***

Introduction

Jakarta is the nation's capital and also serves as Indonesia's center of gravity (CoG) in political, economic, and defense aspects. The concept of center of gravity, introduced by Carl von Clausewitz in his essay "On War," explains that there is a crucial point in a country that, if attacked or paralyzed, can collapse the entire stability of the country. In the Indonesian context, Jakarta serves as the center of government, economic center, and diplomatic hub, making it a strategic target for various forms of threats, including modern air threats.[1]As a city with a population of over ten million people and economic activity that contributes more than 20% of the national GDP, Jakarta has a high vulnerability to security disturbances.[2]The concentration of vital infrastructure such as the State Palace, the DPR/MPR Building, ministries, embassies, Soekarno-Hatta International Airport, Tanjung Priok Port, the electricity network, and communication centers make Jakarta a potential target. If disrupted, it will have a systemic impact on the continuity of national and state life. Advances in military technology, particularly the use of unmanned aerial vehicles (UAVs), have increased the complexity of the threats facing Jakarta. Modern drones possess asymmetrical characteristics: high mobility, low flight capability, low operational costs, and difficult-to-detect radar signatures.[3]This threat is even more real when looking at international trends, such as the Houthi drone attacks on Saudi Arabian oil facilities in 2019, which were able to cripple most of the country's oil production in a matter of hours.[4]If a similar scenario were to occur in Jakarta, the impact would not only be local but could also destabilize the national economy and politics. From a security

[1]Clausewitz, Carl von. (1984). On War: Edited and translated by Michael Howard and Peter Paret. New Jersey: Princeton University Press.
2Central Statistics Agency (BPS). (2023). Indonesian Statistics 2023. Jakarta: BPS RI.
3Michel, Arthur Holland. (2015). Counter-Drone Systems. Center for the Study of Drones at Bard College.
4Watling, Jack, & Reynolds, Nick. (2022). Operation Z: The Death Throes of an Imperial Delusion. Royal United Services Institute (RUSI).

perspective, Barry Buzan emphasized that national security encompasses political, economic, military, social, and environmental dimensions. The drone threat to Jakarta can be categorized as multidimensional: politically it could undermine the government's legitimacy, economically it could disrupt business centers, militarily it could damage defense systems, and socially it could create public panic in dense urban areas. Therefore, strengthening Jakarta's air defense system is an urgent strategic necessity.[5]. A number of countries have made protecting their capital cities a top priority in their air defense strategies. Washington, D.C., is protected by a multi-layered defense system that integrates advanced radar, Patriot missiles, and short-range defense systems.[6]Israel has equipped Tel Aviv with the Iron Dome and Drone Dome systems, which are capable of detecting and neutralizing rocket and drone attacks.[7]Russia guards Moscow with a combination of S-400 and Pantsir-S1 systems, while China reinforces Beijing with a multi-layered system including HQ-9 missiles and anti-drone lasers.[8]This comparison provides an important lesson: the nation's capital is a vital object that cannot be defended with conventional systems alone. For Indonesia, protecting Jakarta requires a multi-layered approach. First, the radar system must be enhanced by deploying conventional radar, passive radar, and electro-optical systems around the Jakarta area. Advanced radar, such as over-the-horizon radar, can detect threats from long distances, while artificial intelligence (AI) technology can help identify anomalous movement patterns in urban airspace.[9]Second, the implementation of Counter-Unmanned Aerial Systems (C-UAS) is imperative. This system includes the use of GPS jammers, electromagnetic weapons, and interceptor drones to stop attacks before they reach strategic targets.[10].

Third, the Indonesian Air Force (TNI AU)'s readiness needs to be strengthened by modernizing its defense equipment and integrating a network-centric warfare-based defense system. The presence of Halim Perdanakusuma Air Base and Atang Sanjaya Air Base must be supported by modern fighter aircraft, medium-range air defense missiles, and a command and control system directly connected to Kohanudnas. Joint inter-service exercises with simulated drone attacks must also be conducted regularly to ensure interoperability.[11]Fourth, Jakarta's defense is not solely military in nature, but must also involve civilian roles. The concept of total defense, as outlined in Law Number 3 of 2002 concerning National Defense, emphasizes that all citizens have a role in safeguarding sovereignty. National defense programs, emergency response outreach, and public involvement in reporting suspicious air activity around Jakarta can provide additional layers of defense. This aligns with Supriyatno's view that modern defense cannot be separated from the synergy between military and non-military forces.[12]. Thus, Jakarta, as the capital and center of gravity of Indonesia, faces a real threat from the development of modern air technology. Drone and other air attacks have the potential to undermine political legitimacy, destabilize the economy, and trigger social crises. Therefore, strengthening Jakarta's air defense system must be viewed as a national priority, encompassing aspects of technology, military organization, and community engagement. This paper will discuss in depth the strategy for strengthening Jakarta's air defense, drawing on international experience and Indonesia's geographic and geopolitical context.

Formulation of the problem

The challenges surrounding efforts to strengthen the national air defense system to counter aerial threats to Jakarta constitute a strategic issue that requires serious and in-depth study. This is crucial considering that Jakarta serves as the center of government, economic center, and symbol of national sovereignty, serving as Indonesia's center of gravity. Threats to Jakarta pose a threat to the continuity of executive, legislative, and judicial functions, as well as national political and economic stability. Increasingly complex modern air threats—including the use of unmanned aerial

5Buzan, Barry. (1991). People, State, and Fear: An Agenda for International Security Studies in the Post-Cold War Era. Hempstead: Harvester Wheatsheaf.
6US Department of Defense. (2022). Counter-Unmanned Aircraft Systems Strategy 2022. Washington, DC.
7Shapir, Y. (2021). Israel's Air Defense Systems and the Challenge of Drones. INSS Strategic Assessment, 24(2).
8Kania, E. (2018). Battlefield Singularity: Artificial Intelligence, Military Revolution, and China's Future Military Power. Center for a New American Security (CNAS).
9European Defense Agency. (2020). Countering Unmanned Aerial Systems: European Approaches and Challenges. Brussels: EDA.
10Michel, A.H. (2015). Counter-Drone Systems. Bard College: Center for the Study of the Drone.
11Ministry of Defense of the Republic of Indonesia. (2015). Indonesian Defense White Paper. Jakarta: Ministry of Defense of the Republic of Indonesia.
12Supriyatno, M. (2014). About Defense Science. Yogyakarta: Obor Library Foundation.

vehicles (drones) for espionage, sabotage, or precision strikes—present a real challenge that must be addressed by strengthening the air defense system around Jakarta. Therefore, protecting Jakarta can no longer rely solely on conventional systems, but requires the integration of early detection technology, Counter-Unmanned Aerial Systems (C-UAS), and the Indonesian Air Force's readiness to respond to asymmetric threats.

Based on this background, the problem formulation in this research can be formulated as follows:

1. What is the strategic impact of Jakarta's position as the center of gravity on Indonesia's national stability?
2. What is the strategic and operational role of the Indonesian Air Force in strengthening Jakarta's air defense system, particularly in dealing with threats from drones and other unmanned aerial vehicles?

Research purposes

The purpose of this study is to comprehensively analyze Jakarta's strategic role in maintaining the sovereignty and integrity of the Unitary State of the Republic of Indonesia (NKRI) as the national center of gravity. Jakarta not only has a vital function in the field of defense and security, but also plays a significant role politically, economically, and diplomatically as the center of government and a pillar of national stability. From a defense perspective, an increasingly prominent challenge is the increasing threat from unmanned aerial vehicles (drones), which have the potential to be used for espionage, sabotage, communication disruption, and precision attacks on strategic infrastructure in the capital. In addition, this study also aims to examine the steps taken by the Indonesian Air Force (TNI AU) in strengthening Jakarta's air defense system, including developing early detection capacity, prevention, and countermeasures against asymmetric air threats based on modern technology such as drones.

Research methodology

To achieve the research objectives, the author used a qualitative method with a descriptive approach as a guideline in conducting this study. Qualitative research itself is understood as an investigative process focused on understanding social or humanitarian issues by constructing a comprehensive and complex picture through the use of verbal data.[13]This approach aims to explore and understand the meanings individuals and groups attach to a particular phenomenon. Its exploratory nature allows this method to uncover tendencies in thought patterns, opinions, and events, as well as explore issues in greater depth. Data collection techniques were conducted through literature studies, namely by examining various written sources such as books, articles, notes, and reports relevant to the research topic. Thus, literature studies serve as the primary source supporting the conclusions drawn in this study.

Literature review

In the context of national defense, a concept known as the Center of Gravity (CoG) is recognized. CoG refers to the source of strength, morale, or characteristics that determine an entity's ability to achieve its goals. According to Carl von Clausewitz (1984), the CoG is the center of all power and movement, which, if destroyed, will significantly weaken or paralyze the opponent. The CoG can be a physical entity, such as a geographic region or military force, or a non-physical entity such as political legitimacy or national morale. In the Indonesian context, Jakarta, as the nation's capital, holds a strategic position, serving not only as the center of government but also as a symbol of sovereignty, an economic center, and a diplomatic hub that supports national stability. Therefore, securing Jakarta through an effective air defense system is crucial to prevent infiltration and potential attacks that could weaken the country's center of gravity.

In this context, the emergence of modern aerial threats such as unmanned aerial vehicles (drones) further reinforces the urgency of strengthening the national air defense system. Drones are now a strategic instrument in modern warfare, used not only for reconnaissance missions but also for electronic warfare and armed precision strikes. Technological developments that have made drones increasingly affordable and accessible have made them a real and dangerous form of unconventional threat, posed by both state and non-state actors. This threat is particularly relevant for Indonesia because Jakarta, as the seat of government and the center of vital national activities, houses numerous strategic targets. Infrastructure such as the State Palace, the House of Representatives (DPR/MPR) Building, international airports, major ports, electricity grids, communication centers, and government buildings are vital objects vulnerable to drone-based attacks. This threat is asymmetrical in nature, as attacks can be launched stealthily, precisely, and with difficulty

[13] John W. Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, London: Sage, 2014.

being detected by conventional radar. Therefore, the development of a modern, adaptive, and layered air defense system in Jakarta is an urgent need to ensure the continued function of the capital city as Indonesia's center of gravity. Therefore, the national air defense system must be able to detect, track, and neutralize drone threats quickly, precisely, and effectively, especially in the context of protecting the country's Center of Gravity (CoG) and strategic border areas. Strengthening intelligence capabilities, integrating advanced radars, and deploying tactical air units in border areas are crucial steps in addressing this challenge in an adaptive and measured manner. Furthermore, the concept of CoG in military strategy encompasses both physical and non-physical elements. According to Dr. Joe Strange, a lecturer at the US Marine Corps War College, CoG is not something intangible or a weakness, but rather a strength.[14]. Therefore, the CoG of an armed force in military strategy is then identified with the sources of power or balance. This refers to the characteristics, capabilities, or locations from which the force obtains freedom to act, increases its physical strength, or the will to fight. Furthermore, in United States military doctrine documents, CoG is then also defined as a source of a nation's power that provides moral or physical strength, freedom of action, and the will to act.[15]. Thus, a deep understanding of the Center of Gravity (CoG) concept is a crucial element in designing an effective national defense strategy, particularly in the context of strengthening border areas as the first layer of protection against the country's center of gravity. In Indonesia's current regional development, protection of border areas as Indonesia's CoG includes two main elements, namely: 1) physical elements, such as geographical areas—including borders and vital strategic objects, and 2) non-physical elements, such as political legitimacy and symbols of national sovereignty. Strengthening defense in border areas is essential to ensure that Indonesia's CoG remains protected from all forms of external threats.

In analyzing the strategic impact of the capital city's position as the Center of Gravity (CoG), a political theory of governance approach is used to understand the relationship between the center of government and national stability as a whole. This theory explains how the structure and location of the capital city influence the distribution of power, political legitimacy, and the effectiveness of government administration functions. In general, the capital city functions not only as the center of government but also as a symbol of sovereignty and a center for strategic decision-making. Therefore, the capital city's existence is closely linked to the border region, which serves as the front line of national defense and sovereignty. A strong and secure border region will support national stability and protect the capital's vital functions, especially from potential external threats that could target the center of state power. Therefore, strengthening defense in the border region is an integral part of the strategy to protect the capital city. The strategic connection between the capital city and the border is not only geographical, but also political and military, because maintaining the integrity of the border means maintaining the security and legitimacy of the center of government itself. Law Number 3 of 2002 concerning National Defense defines defense as an effort to safeguard sovereignty, territorial integrity, and the safety of the nation from various threats and disturbances. Defense is organized through synergy between military and non-military forces to face military, non-military, and hybrid threats.[16]Thus, defense is not solely the responsibility of the armed forces but also requires the involvement of all elements of the nation. Defense reflects a nation's identity and resilience, as it serves as a benchmark for national sovereignty and security.[17]From an academic perspective, defense can be seen as a stand-alone discipline, because ontologically, epistemologically, and axiologically it has fulfilled the requirements as a science that has a clear theoretical basis and concepts.[18]Ontologically, the focus of defense science is on the state's need to maintain and preserve sovereignty, territorial integrity, and the safety of citizens from various forms of threats.[19]In other words, defense science studies all aspects of security on a national scale that are inherent in the objectives of organizing national defense.[20]The scope of defense science is broader than just the art of war or military strategy, because

[14]Michael Krause, Clausewitz & Centre of Gravity Open to Interpretation, accessed January 2, 2025, https://theforge.defence.gov.au/article/clausewitz-centres-gravity-open-interpretation?utm_source=chatgpt.com
[15]US Air Force Doctrine Publication on Operations and Planning, Appendix A: Center of Gravity Analysis Methods, accessed December 27, 2024, https://www.doctrine.af.mil/Portals/61/documents/AFDP_3-0/3-0-D30-Appendix-1-COG-Analysis.pdf?utm_source=chatgpt.com
[16] Ministry of Defense of the Republic of Indonesia, Indonesian Defense White Paper, (Jakarta, 2015), p.2.
[17]Eppler in Syarifudin Tippe, Defense Science: History, Concepts, Theories and Implementation, (Jakarta, Salemba Humanika, 2016), p.1.
[18]Ibid., p. 10.
[19]Indria Samego in Syarifudin Tippe, Defense Science: History, Concepts, Theories and Implementation, (Jakarta, Salemba Humanika, 2016), p. 52.
[20]Ibid., p. 51.

it discusses how a country manages national resources and strength both in peacetime, wartime, and post-war.[21]This includes readiness to face external and internal threats, both military and non-military, to ensure national security. The Indonesian Defense White Paper emphasizes that national defense is built on a comprehensive defense system, involving all citizens according to their roles and functions.[22]This principle of universal defense is based on the rights, obligations, and belief in the capabilities of one's own nation.[23]To support the achievement of national goals, five strategic targets have been established, namely: (1) defense that is capable of facing all forms of threats, (2) securing maritime, land and air areas, (3) contributing to world peace, (4) developing a strong, independent and competitive defense industry, and (5) developing citizens who have a sense of national defense.[24]

In comparison, the United States defines national defense as efforts made through military force and the mobilization of resources in order to support foreign policy and maintain domestic security.[25]Furthermore, national defense in America is also positioned as a diplomatic instrument to strengthen the country's role in the international system.[26]Security is closely related to the survival of a nation and encompasses five main dimensions: political, military, economic, social, and environmental.[27]Meanwhile, national security is defined as the fundamental need to safeguard national interests by utilizing political, economic, and military instruments in facing threats from within and outside the country.[28]In other words, this concept emphasizes efforts to maintain the nation's existence and protect its territorial integrity. Barry Buzan divides security studies into two perspectives: traditional and non-traditional. The traditional view views national security threats primarily as stemming from interstate competition, such as arms races or military buildups. Conversely, the non-traditional approach incorporates both intra-state and transnational security issues. Intra-state threats include potential social conflict stemming from ethnic, religious, racial, and intergroup (SARA) issues, while transnational threats encompass migration, environmental degradation, and population issues such as population explosions. For countries receiving asylum seekers, these non-traditional threats are exclusive and more prominent in non-military forms.[29] The primary focus of national security remains the protection of the nation's independence, sovereignty, and territorial integrity. However, over time, the concept of security has also been expanded to include human security. The National Resilience Council emphasizes that national security can be understood in two ways: as a condition and as a function. As a condition, national security describes a state in which the state, society, and its citizens are free from internal and external threats. As a function, national security encompasses a comprehensive protection mechanism for the nation and homeland, encompassing state security, community security, and individual security from all forms of threats.[30]

The Strategic Role of Border Regions as Indonesia's Center of Gravity

The nation's capital is the epicenter of power, government, and a symbol of national sovereignty, serving as the center of gravity (CoG) for the continuity of national and state life. Indonesia's border regions hold a crucial position as the front line of state sovereignty. Their location, directly adjacent to other countries, makes them vulnerable to various forms of infiltration, whether military, economic, social, or ideological. Due to the capital's geographical location in the center of Indonesia, the stability of the border region is crucial to ensuring that the country's CoG remains intact, protected, and free from external pressure. Threats to border regions will ultimately have a systemic impact on the center of the state, including the center of government in the capital.

[21]Makmur Supriyatno, About Defense Science, (Yogyakarta, Yayasan Pustaka Obor, 2014), p. 28.

[22]Ministry of Defense of the Republic of Indonesia, Indonesian Defense White Paper, (Jakarta, 2015), p.25.
[23]Ibid., p. 27.
[24]Ministry of Defense of the Republic of Indonesia, National Defense Strategy, (Jakarta, 2015), p.54.
[25]US Constitution Chapter 55 – [Title 50. War and National Defense; Title 50 Appendix War and National Defense]
[26]Ibid.
[27]Barry Buzan, People, State, and Fear: An Agenda for International Security Studies in the Post-Cold War Era, (Hempstead, Harvester Wheatsheaf, 1991), p. 23.
[28]National Resilience Council, National Security: A Concept and Security System for the Indonesian Nation, (Jakarta, Secretariat General of the National Resilience Council, 2010), p. 9.
[29]Barry Buzan, et al., Security: A New Framework for Analysis, (USA, Lynne Rienner Publisher, 1998), pp.08-19.
[30]National Resilience Council, op.cit., pp. 9-13.

Strategically, borders serve as buffer zones to detect and mitigate threats early. By strengthening defense, security, and empowering communities in border areas, the state can create a multi-layered defense system that goes beyond protecting the front lines. When border areas are secure, controlled, and empowered, the stability of the nation's core is strengthened. The capital's role as a CoG is not solely determined by its internal strength, but also by national resilience distributed across various regions, particularly the border areas. In this regard, developing defense infrastructure, increasing the preparedness of security personnel, and strengthening intelligence functions in border areas must be national priorities. This strengthening must also include active diplomatic efforts, improving the welfare of local communities, and safeguarding the nation's cultural and ideological resilience. The capital, as the center of political and governmental gravity, also serves as a symbol of national integrity. In this context, the stability of border areas is not merely a territorial matter, but an integral part of a multi-layered, coordinated, and long-term national resilience system. Furthermore, it's important to recognize that in the context of modern threats, infiltration isn't always military in nature, but also occurs through cyberspace, the spread of radical ideology, illicit trade, and social conflicts that can divide border communities. Therefore, efforts to build national awareness, improve the quality of education, and expand access to state services in border areas will help strengthen the nation's foundations from the periphery to the center. By making border areas the vanguard of national defense and resilience, Indonesia can ensure the stability of its capital city as a center of gravity that is secure, resilient, and protected from all forms of threat.

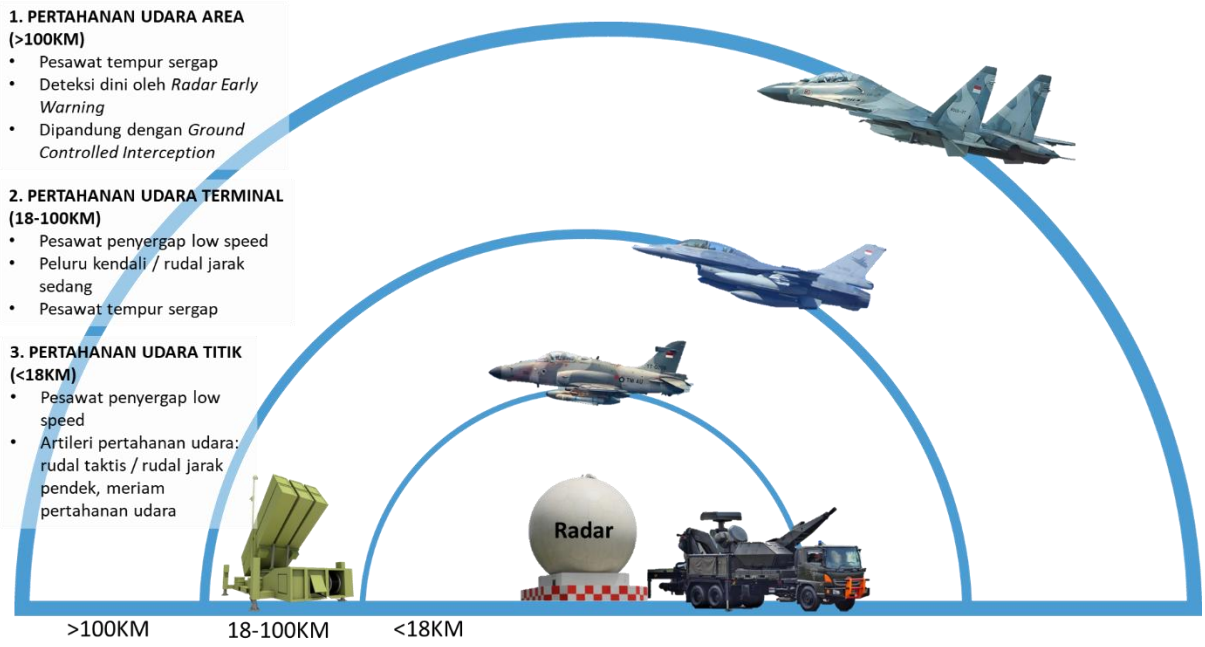
Indonesian Air Force's Air Defense Strategy in Border Areas to Face Drone Threats

In the context of national defense, border areas hold strategic significance as the frontline in safeguarding Indonesia's sovereignty and security. Advances in military technology, particularly the use of drones and other unmanned aerial vehicles, have presented new and complex challenges to air defense systems. These threats are no longer conventional in nature and can now emerge suddenly, undetected, and cross border areas, posing a high risk to vital national assets, including the nation's capital, the center of government. Therefore, an adaptive and integrated air defense strategy is required, with the Indonesian Air Force playing a key role in early detection, rapid response, and technology-based threat mitigation. Strengthening air posts, surveillance radars, interoperability of defense systems, and increasing personnel capacity are crucial elements in building a robust air defense system in border regions. This strategy aims not only to secure territorial boundaries but also to ensure national stability from the ever-evolving threat of modern military technology.

The Indonesian Air Force's role in strengthening the national air defense system, particularly in the context of protecting the nation's capital and border areas, encompasses integrated internal and external dimensions to safeguard the sovereignty and security of Indonesia's airspace. Internal roles include strategic infrastructure development, modernization of primary weapons systems (alutsista), operational readiness, and the utilization of technology and defense digitalization. In the context of the capital as the nation's center of gravity, strengthening the air defense system is crucial given its role as the seat of government, a symbol of sovereignty, and a crucial point of national stability. Therefore, the Indonesian Air Force has a strategic responsibility to ensure the airspace surrounding the capital is protected from all forms of air threats, including asymmetric attacks such as drones and other unmanned aerial vehicles.

One concrete step taken is the construction of new air bases and the installation of advanced radars in strategic locations, both around the capital and in border areas. These state-of-the-art radars will be integrated into the national air defense network, enabling real-time monitoring of suspicious or dangerous airborne objects. Ideally, air base locations should be selected based on topography and operational range, such as in highland areas or areas with wide visibility, to optimize radar coverage and the effectiveness of air operations. Jakarta's air defense is designed in layers to ensure optimal protection for the capital city as the national center of gravity (see Figure 1). The outermost layer, the area air defense (>100 km), serves as the front line, supported by early warning radar, Ground Controlled Interception (GCI) guidance, and high-speed fighter jets to detect and intercept threats from long distances. The middle layer, the terminal air defense (18–100 km), is reinforced by medium-range missiles, fighter jets, and low-speed interceptor aircraft to repel threats approaching strategic areas. Meanwhile, the innermost layer, the point air defense (<18 km), serves as the final bastion, directly protecting vital national objects in Jakarta with air defense artillery such as short-range missiles, MANPADS, anti-aircraft guns, and anti-drone units. With this layered system, Jakarta is not only able to detect threats early but also has the multi-layered capability to neutralize them before they reach vital targets.

Furthermore, to counter threats from overseas airspace, the development of long-range radar (over-the-horizon



Picture1 The Indonesian Air Force's Multi-Layered Air Defense Strategy (Author, 2025)

radar) is crucial. This type of radar is capable of detecting objects beyond the coastline or national borders, including the movement of enemy aircraft and ballistic missiles. Radar systems deployed at the border must also be directly connected to the National Air Defense Command (Kohanudnas) to ensure a rapid and coordinated response to potential air violations or attacks. With this approach, the Indonesian Air Force (TNI AU) not only serves as the guardian of the skies around the center of government but also as the vanguard in safeguarding Indonesia's territorial integrity from all forms of air threats coming from the border. Modernization of defense equipment must also be carried out as part of efforts to strengthen air defense. The Indonesian Air Force (TNI AU) plans to deploy medium-range missiles and fighter jets around border areas. This is to provide effective deterrence against potential threats. The TNI AU is focused on developing an air defense posture based on modern technology, including artificial intelligence (AI) and cyber systems. This approach is expected to increase responsiveness and effectiveness in facing multidimensional threats. The TNI AU can utilize fighter aircraft such as the Rafale, Sukhoi Su-35, or KF-21, which are planned to form the backbone of air power. In addition, drones such as the CH-4 or MQ-9 Reaper can be used for efficient air patrols. The TNI AU is also focusing on developing an air defense posture based on modern technology, including artificial intelligence (AI) and cyber systems. This approach is expected to increase responsiveness and effectiveness in facing multidimensional threats. The TNI AU must also conduct training and operational readiness by holding joint exercises to simulate air threats

involving all branches (TNI AU, AD, and AL) to foster operational coordination. Operational readiness must also involve civilian personnel around the border area in evacuation simulations in the event of an air attack. Meanwhile, the Indonesian Air Force's external role can be carried out through cooperation, diplomacy, and participation in security negotiations. The Indonesian Air Force actively collaborates with the mass media to raise public awareness of the importance of air defense in supporting national strategic programs towards the vision of Golden Indonesia 2045. This collaboration aims to increase public understanding of the importance of strong air defense. Furthermore, defense integration between the branches of the armed forces must also be carried out. The Commander of the National Air Operations Command (Pangkoopsudnas) emphasized the importance of integrating air defense systems between the air, land, and sea branches. This integrated approach is necessary to achieve comprehensive border security. The Indonesian Air Force also plays an active role in regional forums to discuss air security issues. This participation is important to build trust and cooperation with neighboring countries in maintaining regional stability.

Referring to Law No. 3 of 2002 concerning National Defense, efforts to build strategic air bases and radar systems around border areas are part of the overall defense system that is a hallmark of Indonesian defense. Air bases function as physical elements of military defense to safeguard sovereignty, territorial integrity, and national safety from military threats, both traditional and hybrid. From the perspective of defense science ontology, the need for this strategic infrastructure is a real effort to fulfill the requirements of the existence of a sovereign state with air sovereignty as one of its important indicators. Modern radar systems and command centers around border areas will function as early detection tools for military threats (such as airspace violations) and non-military threats (such as cyber or drone attacks). In the Indonesian Defense White Paper, modernization of defense equipment, such as the procurement of short- to long-range air defense missiles and surveillance drones, reflects a capability-based defense approach. This aligns with the principle that defense capabilities must be aligned with the threats faced and the country's economic capabilities. This modernization also aims to create a deterrent factor that increases international confidence (confidence-building measures). Meanwhile, strengthening operational readiness, such as air threat simulations, is an effort to address real and potential threats outlined in Barry Buzan's threat theory. Real threats such as terrorism, espionage, or airspace violations can be prevented through intensive training and the formation of rapid reaction units. Potential threats in the form of interstate conflict or conventional warfare also require preparedness through collaboration across all branches of the Indonesian National Armed Forces (TNI) in large-scale simulations. Technologies such as AI (Artificial Intelligence) in air defense reflect the transformation of defense science to become more dynamic, keeping pace with developments in non-traditional threats. For example, the use of AI for real-time radar data detection and management is a crucial element in addressing hybrid threats, such as cyberattacks on defense systems.

In terms of external roles, according to the Indonesian Defense White Paper, cooperation with neighboring countries reflects a defense diplomacy approach that supports regional stability and national security. Joint international exercises such as Cope West and Pitch Black not only increase interoperability but also strengthen strategic relationships that can act as a deterrent to potential threats from other countries. In the context of Barry Buzan's theory of traditional and non-traditional security, regional threats such as arms races or air security infiltration can be addressed through traditional (military cooperation) and non-traditional (security diplomacy) approaches. The Indonesian Air Force's role in security diplomacy in the Southeast Asian region demonstrates that air defense also functions as a political instrument to create a zone of regional stability. For example, the Indonesian Air Force's efforts to engage in negotiations on no-fly zones or air route alignment reflect the aspect of defense as a tool to strengthen Indonesia's position on the international stage, as is done by countries such as the United States. The Indonesian Air Force's participation in international negotiations related to airspace security reflects the essence of national security as a function. According to the National Resilience Council, this not only safeguards border airspace from external threats, but also ensures the protection of civilians as part of human security. Based on Law Number 3 of 2002 concerning National Defense, defense is defined as efforts to safeguard sovereignty, territorial integrity, and national safety from various threats. The Indonesian Air Force's efforts to strengthen Jakarta's air defense align with the concept of total defense that involves all components of the nation. From an ontological perspective, the need to maintain sovereignty and territorial integrity through the development of defense infrastructure and the modernization of defense equipment is the formal object of defense science. Epistemologically, this is reflected in the utilization of cutting-edge technology and the integration of defense systems that are able to adapt to the dynamics of threats. Meanwhile, from an axiological perspective, this strengthening aims to realize national security as a foundation for achieving state goals. Thus, the Indonesian Air Force's role in strengthening Jakarta's air defense is not only limited to the military domain, but also involves non-military aspects

through cross-sector collaboration. This emphasizes that national defense is a shared responsibility that requires synergy between military forces and civilian elements. In this context, border areas not only serve as physical protection zones against air sovereignty violations, but also as a first line of defense against drone threats, which are asymmetrical, stealthy, and difficult to track conventionally. The characteristics of modern drones—such as their small size, low-flying capabilities, and minimal radar signature—make them highly effective at penetrating air defenses in areas lacking sophisticated detection systems. Therefore, border air defense systems must be developed with a multi-layered approach, combining conventional radar, passive radar, electro-optics, and Artificial Intelligence (AI) technology capable of automatically detecting unusual movement patterns.

The deployment of advanced radar and Counter-Unmanned Aerial Systems (C-UAS) at vulnerable border points is crucial to counter potential drone infiltration from neighboring countries or non-state groups. This step must be followed by the deployment of Indonesian Air Force (TNI AU) tactical anti-drone units equipped with electromagnetic weapons, GPS jammers, and interceptor drones to quickly neutralize threats before they enter vital national airspace. As the frontline zone, successful detection and interception at the border will determine the effectiveness of protecting the nation's center of gravity, the capital. Furthermore, to address the complexity of this threat, the Indonesian Air Force (TNI AU) needs to develop a network-centric air defense system that integrates various sensors, commands, and combat units in border areas into a unified Kohanudnas platform. This system enables a faster, more accurate, and more coordinated response to the movement of foreign drones or unidentified unmanned aerial vehicles, both in the context of reconnaissance and direct attacks. By making border areas the main focal point in its early warning and first line of defense strategy, Indonesia can build an air defense posture that is not only reactive, but also proactive and resilient to drone threats in the era of modern warfare.

Study of the Global C-UAS System

The rapid development of drone technology over the past two decades has transformed the landscape of modern warfare. Drones now function not only as reconnaissance vehicles but also as precision strike platforms with low operational costs. This phenomenon has prompted various countries to develop Counter-Unmanned Aerial Systems (C-UAS), namely air defense systems designed to detect, track, identify, and neutralize drone threats. In general, modern C-UAS combine radar technology, electro-optical sensors, radio frequency jammers, artificial intelligence (AI), and kinetic and non-kinetic weapons systems within a single, integrated operational framework.[31] The United States is one of the most advanced countries in C-UAS development. Through its Integrated Air and Missile Defense (IAMD) strategy, the Pentagon emphasizes the integration of sensors, radars, and C-UAS units into the national defense network. Systems such as the Drone Defender and the AN/TPQ-53 radar have proven effective in detecting and disabling small, low-profile drones. Furthermore, the United States is also developing the concept of networked C-UAS, where C-UAS units can connect with each other and share data in real time to counter the increasingly prevalent threat of drone swarms on the battlefield.[32]

Israel, a country frequently facing drone threats from non-state groups, relies on a modified Iron Dome system and a specialized Drone Dome system. The Drone Dome combines an RPS-42 radar, electro-optical sensors, and an RF jammer to quickly neutralize threats. Furthermore, Israel is developing laser-based directed energy weapons believed to be capable of destroying small drones at a low operational cost, providing a more efficient long-term solution than conventional missiles. This innovation demonstrates that responding to drone threats requires more than just kinetic systems, but also disruptive technologies that can reduce the cost of combat.[33] Russia and China are also developing C-UAS approaches with different characteristics. Russia relies on the Repellent-1 system and the Krasukha-4 jammer to disrupt GPS navigation, and utilizes the Pantsir-S1 to counter drone threats in Ukraine. However, their effectiveness remains limited against small drones with low radar profiles.[34]Meanwhile, China is placing greater emphasis on multi-

[31]Gettinger, Dan, & Michel, Arthur Holland. (2015). Counter-Drone Systems. Center for the Study of Drones at Bard College.
[32]US Department of Defense. (2022). Counter-Unmanned Aircraft Systems Strategy 2022. Washington, DC.
[33]Shapir, Yiftah Shapir. (2021). “Israel's Air Defense Systems and the Challenge of Drones.” INSS Strategic Assessment, Vol. 24, no. 2.
[34]Watling, Jack, & Reynolds, Nick. (2022). Operation Z: The Death Throes of an Imperial Delusion. Royal United Services Institute (RUSI).

layered systems such as the Silent Hunter and the LW-30 Laser Defense Weapon, as well as AI-powered interceptor drones that can be used to counter drone swarm attacks. This aligns with China's intelligent warfare doctrine, which emphasizes the integration of AI into military operations.[35] In Europe, NATO member states are developing modular C-UAS that can be used in both military and civilian contexts. The UK uses the AUDS (Anti-UAV Defense System) system that combines Ku-band radar, thermal cameras, and RF jammers, while Germany is developing the HPEM Sky Shield system that uses high-energy electromagnetic pulses to disable drones. This trend shows that C-UAS are not only being developed to counter military threats, but also to protect vital civilian infrastructure such as airports, power plants, and government centers. Thus, there are several main trends in global C-UAS development, namely: (1) multi-sensor integration, (2) multi-layered systems based on hard-kill and soft-kill, (3) utilization of AI and machine learning, (4) integration in the concept of network-centric warfare, and (5) implementation of dual-use applications for both military and civilian purposes.[36]

Conclusion and Suggestions

This research confirms that strengthening the national air defense system in Jakarta has strategic significance in maintaining the integrity and sovereignty of the Unitary State of the Republic of Indonesia, particularly in protecting the capital city as its center of gravity. The asymmetrical threat of drones and other unmanned aerial vehicles—cheap, precise, difficult to detect, and low-cost—demands an adaptive, integrated, and technology-based defense response. From the perspective of ontology, epistemology, and axiology of defense science, the need for advanced radars, strategic air bases, defense equipment modernization, and the integration of network-centric warfare reflect a real effort to ensure Indonesia's air sovereignty, particularly in the capital region. International comparative studies also show that the global trend in Counter-Unmanned Aerial Systems (C-UAS) is moving towards multi-sensor integration, layered defense systems (both hard-kill and soft-kill), and the use of Artificial Intelligence (AI). Therefore, strengthening Jakarta's air defense system is not only an operational necessity but also a strategic instrument for building national deterrence and stability.

The following recommendations are divided into Long, Medium and Long Term which are given based on the results of the analysis above, namely:

Short-term

1. Improving the Indonesian Air Force's preparedness through joint inter-service exercises with drone threat simulations in the Jakarta area.
2. Deploying conventional radar, passive radar, and tactical anti-drone units (portable C-UAS, GPS jammers, drone interceptors) in areas around vital objects in the capital.
3. Raising public awareness in Jakarta through national defense programs, air safety education, and emergency response training.

Medium Term

1. Implementing modernization of air defense equipment, including medium-range missiles, new generation fighter jets, and reconnaissance drones.
2. Building over-the-horizon radar installations to strengthen early detection systems.
3. Implementing a network-centric warfare air defense system that is directly connected to Kohanudnas.

Long-term

1. Integrating artificial intelligence (AI) and machine learning into command and control systems to accelerate drone swarm threat analysis.
2. Developing the domestic defense industry to be able to independently produce radars, C-UAS systems, and combat drones.

[35]Kania, Elsa. (2018). Battlefield Singularity: Artificial Intelligence, Military Revolution, and China's Future Military Power. Center for a New American Security (CNAS).
[36]European Defense Agency. (2020). Countering Unmanned Aerial Systems: European Approaches and Challenges. Brussels: EDA.

3. Strengthening defense diplomacy through regional forums such as ASEAN as well as international exercises (e.g. Pitch Black, Cope West) to enhance interoperability and strategic trust.

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