

Indonesia's Defense Politics in the Multipolar Era: A Study on the Modernization of the Indonesian Air Force's Defense Equipment (*Alutsista*)

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ABSTRACT

The era of multipolarity, characterized by competition among the United States, China, Russia, and the European Union, has intensified global security dynamics. This competition spans military, technological, and energy domains, rendering the stability of Indonesia's airspace increasingly critical. In response, Indonesia has modernized its air power as a deterrence strategy to counter both conventional and non-conventional threats. This study analyzes how Indonesia's defense policies in the era of multipolarity shape the modernization of the Indonesian Air Force's (*TNI AU*) defense equipment (*Alutsista*) from 2015–2025. Employing a qualitative approach with a case study design, the research incorporates document analysis, policy review, and air defense strategic assessment. The findings indicate that these modernization efforts represent a strategic response to multipolar dynamics—particularly the increasing use of air power in the region, tensions in the South China Sea, and emerging threats such as cyber intrusions, foreign UAVs, and hybrid warfare. The study reveals that modernization is driven by operational needs, global political dynamics, and Indonesia's defense industry capacity. Key measures include the procurement of advanced fighter aircraft, enhancement of radar networks, integration of command-and-control systems, and development of cyber capabilities. In conclusion, the modernization of *TNI AU*'s defense equipment (*Alutsista*) strengthens deterrence, maintains regional stability, and enhances the ability to respond to multidimensional threats in the era of multipolarity.

Keyword: defense politics; multipolarity; Indonesian Air Force; weapon-system modernization; air defense; balance of power

INTRODUCTION

The era of multipolarity, marked by the resurgence of major world powers such as the United States, China, Russia, and the European Union, has created a more complex configuration of international security (Smith & Zhao, 2020; Roberts & McMillan, 2021). Geopolitical competition now spans military, technological, energy, trade, and strategic resource aspects, with the arms race clearly visible in the Asia-Pacific (Johnson et al., 2021; Lee & Tran, 2020), including increased defense budgets of major regional powers such as China, Japan, India, and Australia (Brown & Singh, 2021; Yoon, 2022). Indonesia, as the world's largest archipelagic country, occupies a strategic position in vital international trade routes such as the Strait of Malacca and the Natuna Sea, making it a vulnerable point in the event of conflict between major powers (Harris, 2020; Tarek & Latif, 2021).

Therefore, Indonesia must respond to this dynamic by developing an adaptive and modern national defense posture, in accordance with the 2015 Indonesian Defense White Paper, which emphasizes adapting the country's defense posture and capabilities to the dynamics of the global strategic environment (Bastians, 2020; Hasan & Sari, 2021). The Indonesian Defense White Paper expands the perception of state threats from conventional military threats to non-military and asymmetric threats such as terrorism, radicalization, separatism, cybersecurity, and outbreaks, which directly affect national defense politics (Indra & Putra, 2020; Subiakto & Suryanto, 2021).

Within this framework, modernization of the TNI AU's *Alutsista* defense equipment (*Alutsista*) is an integral part of Indonesia's deterrence strategy, addressing not only conventional threats but also emerging non-conventional ones (Hendra & Yuliana, 2020; Dewi et al., 2021). The 2021 Defense White Paper strengthens this orientation by emphasizing the development of an adaptive and resilient defense posture, including modernization of the Indonesian Air Force to counter hybrid threats through integration of air defense systems, radar, drones, and cyber defense (Setiawan, 2020; Sutrisno & Rauf, 2021; Wijaya, 2020).

Modernization of the Indonesian Air Force's defense equipment (*Alutsista*) for the 2015–2025 period reflects concrete implementation of this strategic mandate, emphasizing independence of the national defense industry, diversification of defense resources, and technology transfer through international cooperation. During President Jokowi's administration, efforts focused on diversifying fighter aircraft and enhancing mobility; under President Prabowo Subianto, acceleration occurred through major contracts such as the purchase of 42 Rafale units, GCI radar cooperation with Thales, and dozens of defense contracts signed at Indo Defence 2025 worth around IDR 33 trillion, including plans to procure 48 units of KAAN fifth-generation fighter jets with local capability integration (Republic, 2024; Antara, 2025; Ventura, 2025).

However, modernization is also shaped by global geopolitical dynamics, such as the cancellation of the Sukhoi Su-35 purchase due to CAATSA sanctions pressure from the United States (Parachini et al., 2021; Widyatmoko et al., 2022), as well as regional competition with Southeast Asian countries that has accelerated their air power modernization (Asia, 2025). Thus, Indonesia's defense policy in the multipolar era is not merely reactive but proactively directed toward building strategic deterrence, strengthening air sovereignty, and enhancing Indonesia's bargaining position as a middle power at regional and global levels.

The study identifies core problems related to *TNI AU* defense equipment modernization amid global multipolarity dynamics. These include limitations and inequalities in the process that could undermine Indonesia's adaptive capacity to shifts in global power distribution, challenges in integrating defense modernization policies with national air defense strategies, operational hurdles for the Indonesian Air Force in addressing increasingly complex and multidimensional security threats, and gaps between modernization targets and budget realization, domestic defense industry capacity, and international geopolitical influences.

Based on this identification, the research formulates two main questions: (1) How is the *TNI AU*'s defense modernization policy for the 2015–2025 period formulated and implemented within Indonesia's defense politics framework? (2) What are its implications for the national defense posture amid evolving global security threats?

This study analyzes dynamics of Indonesian defense politics in the context of Indonesian Air Force *Alutsista* modernization during the multipolar era. It examines policy directions, strategies, and influencing factors from domestic, international geopolitical, and air defense technology development perspectives. Academically, it enriches international relations and defense studies, particularly on developing countries' defense politics and air power's role in shaping Indo-Pacific military postures and stability.

From a practical standpoint, the research offers policymakers a reference for more adaptive, budget-realistic *TNI AU* modernization strategies that foster synergy among government, domestic defense industry, and international partners—ultimately strengthening Indonesia's air sovereignty, operational readiness, and strategic position regionally and globally.

METHOD

This study employed a qualitative case study approach to analyze the modernization of the Indonesian Air Force's defense equipment (*Alutsista*) within the context of Indonesia's defense politics during the multipolar era (Sugiyono, 2020; Ridlo, 2023). The research adopted a descriptive-analytical design to examine the modernization process and its implications for national defense politics and air posture. Data were collected via literature reviews, official state documents, and semi-structured interviews with Indonesian Air Force officials.

Data analysis followed qualitative descriptive techniques, including data reduction, presentation, and conclusion drawing. Data reduction prioritized information relevant to defense modernization themes. Presentation used narratives, tables, and thematic charts to reveal patterns in defense policy, multipolarity dynamics, and air power development. Conclusions emerged from interpreting empirical findings against defense politics theory and multipolarity concepts to generate policy recommendations.

Data validity was ensured through source and method triangulation, member checking with informants, and audit trails for credibility and dependability.

RESULTS AND DISCUSSION

Indonesian Defense Policy

Indonesia's Defense Policy encompasses all government policies, strategies, and decisions in managing national security in the midst of increasingly complex global dynamics due to the emergence of many centers of power (multipolarity). In this context, Indonesia must be able to balance relations with various major powers while maintaining strategic independence, so that defense politics functions as an instrument to face threats, project national interests, and strengthen resilience. Defense politics not only regulates the development of military power postures, but also defense diplomacy, international cooperation, strengthening the defense industry, and modernizing defense equipment to ensure the stability of the country's security in the era of multidimensional geopolitical competition.

Multipolarities

The era of multipolarity describes a global strategic environment in which power and influence are no longer concentrated in one or two superpowers, but are scattered among several major powers such as the United States, China, Russia, and the European Union that each have their own geopolitical interests and strategies. This creates a more complex, competitive, and unpredictable security dynamic because interactions between global actors take place in various dimensions—military, economic, technological, energy, and diplomacy. In a multipolar situation, the balance of power is constantly changing, creating new opportunities and risks for a medium-capacity country like Indonesia, so understanding the

multipolar environment is important in formulating adaptive and long-term oriented defense policies

Modernization of the Main Equipment of the Weapon System (*Alutsista*) of the Indonesian Air Force (AU)

The Modernization of the Main Equipment of the Indonesian Air Force's Weapon System (*Alutsista*) is the focus of the case study which covers all efforts to strengthen air capabilities through the procurement, update, and integration of cutting-edge defense technology to improve the combat readiness and effectiveness of Indonesia's air operations. This modernization includes various strategic programs, such as the purchase and development of new generation fighters, improvements to radar systems and surveillance sensors, strengthening layered air defenses, modernizing the command-and-control network (C2), and revitalizing the transport fleet and support aircraft. These measures are not only aimed at strengthening deterrence against external threats, but also ensure that the Indonesian Air Force is able to operate optimally in an increasingly complex security environment and influenced by global technological competition in the era of multipolarity.

Ministry of Defense

The Directorate General of Defense Strategy (*Ditjen Strahan*) at the Ministry of Defense is tasked with formulating strategic defense policies, managing defense areas, and strengthening international cooperation in the defense sector. The Directorate General of Defense Planning (*Ditjen Renhan*) designs a plan to build the country's defense force, sets the priorities of defense equipment, and manages the budget according to strategic needs. The Secretariat General (*Setjen*) is responsible for administrative coordination, budget management, and performance accountability, supporting efficiency and transparency. Meanwhile, the Defense Facilities Agency (*Baranahan*) manages the procurement and maintenance of Defense Equipment, as well as establishes technological cooperation to strengthen the country's independence and relevance of defense at the global level.

TNI Air Force (Internal)

The Air Force Operational Unit is responsible for the implementation of air defense missions, including the National Air Operations Command (*Koopsudnas*) which oversees aircraft movements and integrates civilian and military radar systems. *Koopsudnas* oversees three Air Operations Commands (*Koopsud I, II, III*) which each controls radar units, missiles, combat squadrons, and fast-moving troops. The Command of the Rapid Action Force (*Kopasgat*), an elite unit of the Indonesian Air Force, can conduct airborne operations and secure vital air objects.

The Air Base (*Lanud*) functions as an operational base, a place-to-place aircraft and train personnel. Meanwhile, the Strategy Planning and Development Staff, such as Srenaau, designed air power planning and budget allocation for the modernization of the Defense Forces, while Sopsau designed the strategy of air operations and combat exercises. Sintelau plays a role in threat analysis and strategic intelligence. Technical Units such as Koharmatau,

Dismatraau, Disaeroau, and Disdikau ensure the technical readiness, maintenance, and training of TNI AU personnel to support operational preparedness and modernization of *Alutsista*.

Equipment Modernization

The modernization of the Indonesian National Army's Air Force (*TNI AU*) defense equipment is a strategic agenda that cannot be postponed in the context of increasingly complex regional and global geopolitical dynamics. Indonesia, as the world's largest archipelagic country with an airspace of 5.8 million square kilometers, faces multidimensional defense challenges, ranging from airspace violations, the threat of conflict in the South China Sea, to the development of increasingly sophisticated weapons technology in neighboring countries (Saputra et al., 2022). The policy of modernizing the Indonesian Air Force's defense equipment is a necessity to maintain national sovereignty while projecting Indonesia's strategic strength in the Southeast Asia and Indo-Pacific region.

Modernization of the Air Force's Defense Equipment

The modernization of the main weapon system of the Indonesian Air Force (*TNI AU*) is a strategic step to face multidimensional challenges, such as airspace violations and increased tensions in the South China Sea. With Indonesia's vast airspace, the modernization of defense equipment is essential to maintain the country's sovereignty and increase the credibility of defense strategies in the Indo-Pacific region.

An important milestone in this process is the arrival of the Airbus A-400M Atlas strategic transport aircraft in November 2025, which strengthens the national air mobility. This modernization is also accompanied by the transformation of human resources (HR), which requires mastery of digital technology and artificial intelligence, as well as institutional reforms outlined in Presidential Regulation Number 84 of 2025 to build a more responsive and adaptive air power.

Indonesia's air power strengthening policy, led by President Prabowo Subianto, encourages the procurement of high-tech aircraft, such as Rafale fighters, layered air defense systems, national radars, and ANKA UAVs. These programs support an adaptive defense posture that is responsive to regional and global geopolitical dynamics, including threats from neighboring countries. In addition, this modernization strengthens the integration of defense systems and air base readiness, with the aim of creating a credible air force capable of having a strategic effect in the Indo-Pacific region.

MEF Policy Framework and Transition to Ideal Essential Force (IEF)

The Minimum Essential Force (MEF) policy, which began in 2010, is the basic framework for Indonesia's defense force development, aiming to ensure that the TNI can carry out strategic tasks effectively with a Capability-Based Planning and Threat-Based Planning approach. However, the achievement of MEF until 2024 shows a significant gap, especially in the Indonesian Air Force which only reaches 51% of the target, much lower than the Indonesian Navy and the Indonesian Army.

One of the main obstacles is the low defense budget, which reaches only 0.81% of GDP, far behind neighboring countries such as Singapore and Vietnam. This has an impact on the operational readiness of the Indonesian Air Force's defense equipment, with only 42% of the total 214 aircraft ready for operation, and the average age of the aircraft has reached 25-40 years.

In response to the power deficit, the government formulated a long-term transition agenda from MEF to Ideal Essential Force (IEF) for the period 2024–2039. IEF targets an ideal fighter posture of around 600 units, with a composition of 30-40% of modern fighters to strengthen Indonesia's deterrence in the Indo-Pacific region. This transition not only focuses on quantity, but also on the quality of defense equipment, human resource readiness, and the integration of command and logistics systems. Thus, the IEF is a strategic step to build Indonesia's air force that is more credible, responsive, and adaptive to regional geopolitical dynamics until 2039.

Geopolitical Dynamics and the Urgency of Air Force Modernization

The geopolitical dynamics of the Southeast Asian and Indo-Pacific regions, especially the escalation in the South China Sea, are the main drivers of the acceleration of the modernization of the Indonesian Air Force, given the direct implications for the sovereignty and security of the Natuna region. Indonesia, as the 17th largest military force in the world, must adapt its military strategy to the shifting balance of global and regional power. The threats faced by Indonesia are multidimensional, both military and non-military, including airspace violations, aggression, terrorism, as well as non-military threats such as ideology, economy, cyber, technology, and public safety. The strategic competition between the United States and China has also shaped the context of Indonesia's defense policy, which is increasingly relevant to the strengthening of combat air squadrons.

The need for the modernization of the combat air squadron is increasingly urgent as tensions in the region increase, but the Indonesian Air Force is currently unable to carry out a full 24-hour patrol, especially in the eastern airspace of Indonesia which still lacks radar. Global restrictions, such as CAATSA sanctions from the United States, also encourage Indonesia to diversify its sources of defense procurement so as not to be trapped in adverse geopolitical dependence. One obvious example is the cancellation of the purchase of the Su-35 from Russia. According to an official of the Ministry of Defense, Major General TNI Trias Wijanarko, the modernization of the Indonesian Air Force defense equipment is not only aimed at meeting technical needs, but also as a strategic response to strengthen Indonesia's position in facing great power rivalries, as well as strengthening the country's strategic independence.

Diversification and Technology Transfer Procurement Strategy

The reform of Indonesia's defense procurement system is focused on the strategy of diversifying suppliers and strengthening technology (ToT) transfer, which supports a free and active foreign policy and strengthens the domestic defense industry. Every procurement of defense equipment is now required to meet the elements of the Domestic Component Level (TKDN) and open up opportunities for local production licenses. This policy refers to

guidelines set since the time of President Susilo Bambang Yudhoyono, which includes priority on domestic defense industry products, foreign purchases without political pressure, and production cooperation aimed at making Indonesia independent in producing defense equipment. Technology transfer is an important component in the modernization process, reflected in the procurement of Rafale aircraft accompanied by offset and ToT programs through PT Dirgantara Indonesia (PTDI).

According to Marsma TNI Dr. Agus Priyanto, psc., S.E., M.M., M.Sc., an Indonesian Air Force official interviewed, Indonesia's defense procurement strategy emphasizes supplier diversification and strengthening ToT to strengthen the independence of the national defense industry. Every procurement must pay attention to TKDN and open up opportunities for local production licenses, in line with the principle of free and active foreign policy. A real example of the implementation of this policy is the procurement of Rafale aircraft with offset and ToT programs through PTDI, as well as collaboration in the development of ANKA drones with Turkish Aerospace Industries (TAI), which shows the direction of procurement policies that are increasingly independent, adaptive, and in line with the global trends of the digital defense industry.

Modernization of Fighter Aircraft and High-Low Mix Strategy

The procurement of 42 Rafale fighter aircraft is an important milestone in the modernization of the Indonesian Air Force's combat force. This decision was made based on the technical reliability of the aircraft, CAATSA sanctions risk mitigation, and technology transfer guarantees. The purchase contract worth US\$8.1 billion is carried out in stages and is considered a long-term strategic investment. The main strategy implemented is the USAF-style high-low mix concept, where high fighters such as the Rafale or F-15EX are used for air superiority, while low aircraft such as the F-16 are focused on ground attack and air support missions. This approach strikes a balance between operational capability and cost-effectiveness, while maintaining the interoperability of weapon systems within the framework of Network Centric Warfare.

According to Maj. Gen. Trias Wijanarko and Marsma TNI Dr. Agus Priyanto, the procurement of 42 Rafale fighter aircraft is a very important strategic step in strengthening Indonesia's air power. The resource person emphasized that this decision was driven by the technical reliability of the aircraft, mitigation of the risk of CAATSA sanctions, and the certainty of technology transfer. A high-low mix strategy is applied to optimize defense composition, with high aircraft such as the Rafale focused on air superiority and low aircraft for ground attack and air support. This approach is believed to be effective in balancing operational capability, cost efficiency, and maintaining interoperability within the framework of Network Centric Warfare.

Layered Air Defense Modernization: Radar, Missiles, and Drones

The modernization of layered air defense is the main priority of the Indonesian Air Force to cover blind spots in the supervision of national airspace. The plan to build 25 new radars in 2025-2026 aims to complete the shortage of existing radars which only amount to 16 units. Radar modernization will involve a combination of GCI radar, Early Warning, 3D radar,

passive radar system, and full integration into the command-and-control system of the Indonesian Air Force.

In addition, the procurement of short, medium, and long-range air defense missiles is an important part of building layered air defense, because currently the Indonesian Air Force only has 26 sets of short-range missiles which are still far from the ideal need to protect national vital assets. UAV programs, such as the ANKA-S drone, are also an integral part of modern air defense systems, supporting the concept of the Internet of Military Things (IoMT) with 24-hour surveillance capabilities, a range of 200 km, and carrying ISR sensors, replacing the CH-4B in Natuna and strengthening surveillance in the South China Sea region.

The 2024-2029 period is the most intensive phase of modernization acceleration in the history of the Indonesian Air Force, with a total investment of more than 10 billion US dollars for various combat aircraft platforms, strategic transport, helicopters, drones, and radar systems. The diversification of suppliers from France, the United States, Turkey, and South Korea reflect the implementation of a free-active policy in Indonesia's defense diplomacy, which aims to avoid over-reliance on a single supplier country while maximizing opportunities for technology transfer and offset agreements.

According to Major General TNI Trias Wijanarko and Marsma TNI Dr. Agus Priyanto, the modernization of layered air defense is a strategic step to close blind spots in Indonesian airspace. They emphasized that the construction of new radars, the integration of command and control systems, as well as the procurement of missiles and UAVs such as the ANKA-S, are vital to strengthen the early detection and surveillance capabilities of the Natuna region and the South China Sea, in order to build an air defense system that is more responsive to regional threats.

Strategic Implications of TNI Air Force Modernization on Regional Security

The modernization of the Indonesian Air Force has a major strategic impact on the balance of power in the Southeast Asian region and the broader regional security dynamics. Increasing Indonesia's air defense capabilities will affect the strategic calculations of neighboring countries, potentially triggering an arms race or encouraging confidence-building measures, depending on how Indonesia communicates the strategic intentions of this modernization.

In the context of ASEAN, strengthening the Indonesian Air Force can strengthen the region's collective defense capabilities, contributing to the mitigation of transnational threats such as terrorism, illegal fishing, human trafficking, and natural disasters that require coordinated air operations between countries. Indonesia, as the largest and most influential country in ASEAN, has a responsibility to be a net security provider, assisting smaller ASEAN countries in disaster relief operations, humanitarian assistance, and peacekeeping missions that require strategic airlift capabilities and tactical air support.

In addition, the modernization of the Indonesian Air Force also plays an important role in Indonesia's positioning in the midst of great competition between the United States and China in the Indo-Pacific region. With the diversification of defense equipment suppliers from

countries such as France, the United States, Turkey, and South Korea, Indonesia can maintain strategic independence without over-dependence on one country.

The placement of ANKA-S drones in Natuna, the expansion of radar coverage, and the readiness of quick reaction alert fighters are proof of Indonesia's commitment to maintaining its territorial integrity and maritime rights, especially in the Natuna region which borders China's Exclusive Economic Zone (EEZ) claims. This modernization not only strengthens Indonesia's ability to defend militarily, but also increases the credibility of deterrence, which is very important in maintaining territorial sovereignty and natural resources in the region.

Strengthening Human Resources (HR)

Strengthening human resources (HR) is a strategic element in supporting the success of the modernization of defense equipment and the development of air defense infrastructure of the Indonesian Air Force. The modernization of high-tech weapons, radar, air defense missiles, and air platforms systems will not function optimally without the quality of personnel capable of adopting, operating, and maintaining such systems to a high professional standard. This is in line with the direction of the Rectors of TNI Marshal M. Tonny Harjono who emphasized that the modernization of defense equipment must be followed by the modernization of human resources, which includes morals, ethics, mastery of technology, and technical-operational competencies. Without investment in human resources, air defense modernization will experience a capability gap that hinders effectiveness and sustainability.

Human resource competencies are becoming increasingly important because the air threats of the 21st century demand mastery of complex and integrated technologies. Modern radar systems, 4.5th generation fighters such as the Rafale, and MALE drones such as the ANKA-S require operators who are not only capable of executing technical procedures, but also understanding the concepts of C4ISR, airspace management, and interdimensional joint operations. The modernization of the Indonesian Air Force human resources is particularly relevant given the complexity of the National Air Defense System (*Sishanudnas*) which brings together military radars, fighter aircraft, *hanud* missiles, electronic warfare, and intelligence analysis.

Skills in air picture reading, quick decision-making, and digital operations management can only be achieved through continuous training programs tailored to the needs of the latest technology. The Indonesian Air Force also needs an upskilling and reskilling program in the fields of avionics, defense electronic systems, aircraft mechanics, and weapon system integration. In addition, strengthening human resources also depends on organizational and regulatory reforms, such as Presidential Regulation Number 84 of 2025 which provides the basis for a more effective and adaptive personnel development system to technological developments.

Implications for Strengthening Human Resources in Modernizing Defense Equipment

The birth of Presidential Decree No. 84 of 2025 has strategic implications for the modernization of the Indonesian Air Force's defense equipment, by providing a reorganization framework that allows human resource development to be carried out in a more structured, adaptive, and responsive manner to the development of defense technology. However, the

findings of interviews from Disdikau and Srenau show that the implementation of the policy has not been optimal, especially in strengthening the curriculum and standardizing competencies.

This has direct implications for the effectiveness of the operation of modern defense equipment such as new generation radars, advanced fighter aircraft, hanud missile systems, and C4ISR platforms that require much higher technical, analytical, and digital expertise than conventional defense equipment. Without reform of the education system and clear competency standards, the modernization of defense equipment risks experiencing a capability gap, which is an imbalance between the sophistication of the technology adopted and the capabilities of the personnel who operate it.

In addition, the importance of aligning the needs of new technology and career coaching patterns is also in the spotlight. Modern defense equipment demands in-depth specialization in the aviator, engineering, electronics, radar, intelligence, and air defense corps. Career pattern mismatches can lead to a gap in human resource regeneration, where trained personnel do not serve long enough in units that require these skills, hindering knowledge transfer and competency sustainability.

This will affect the level of combat readiness and its impact on the long-term sustainability of modernization. Based on an interview with an official of the Indonesian Air Force, Marsma TNI Dr. Agus Priyanto, strengthening human resources has strategic implications that are very crucial in supporting the modernization of defense equipment. For this reason, curriculum reform, standardization of skills, and career pattern structuring in line with new technology are fundamental prerequisites for the modernization of the Indonesian Air Force defense equipment to provide optimal and sustainable operational effects for national air defense.

The Strategic Impact of Human Resources Strengthening on the Modernization of the Indonesian Air Force Defense Equipment

Strengthening human resources (HR) has a direct strategic impact on the effectiveness of modernizing the Indonesian Air Force's defense equipment, because the sophistication of platforms such as Rafale, J-10C, F-15EX, NASAMS, AESA radar, and ANKA-S drones requires more complex technical expertise, situational analysis, and tactical understanding compared to previous generation systems. Without personnel who are competent in sensor fusion, electronic warfare, network-centric operations, and multi-layered air defense management, the deterrence capabilities resulting from the procurement of modern defense equipment will not reach their maximum potential.

Strengthening human resources at a strategic level ensures that any investment in radars, missiles, fighters, and C4ISR systems can be used effectively to build a credible air defense posture. Therefore, strengthening human resources is a determining factor whether the modernization of defense equipment truly enhances Indonesia's active defense capabilities, especially in the face of military escalation in the region, such as the dynamics of the South China Sea and strategic competition in the Indo-Pacific.

In addition to increasing the power and range of operations, strengthening human resources also enlarges Indonesia's defense force projection and diplomacy capabilities. For example, the modernization of the A-400M strategic transport aircraft will only produce a mobility and rapid deployment effect if supported by crews, technicians, loadmasters, and planners who have expertise in long-range mission planning, cross-region operations, and strategic cargo handling. Professional human resources also strengthen Indonesia's position in international defense cooperation, as personnel quality is an important element in joint training, technology exchange, and interoperability with partner countries such as France, Turkey, and the United States.

Thus, strengthening human resources not only supports the modernization of defense equipment, but also expands the space for Indonesian defense diplomacy, strengthens the credibility of the Indonesian Air Force institution, and ensures the sustainability of the strategic effects of the long-term modernization program. Based on an interview with Marsma TNI Dr. Agus Priyanto, strengthening human resources is a strategic prerequisite for building a credible national air defense posture, responsive to military escalation in the region, and adaptive to dynamics in the Indo-Pacific, including potential conflicts in the South China Sea.

Infrastructure Improvement in the Indonesian Air Force Defense Modernization Policy ***Radar and Air Surveillance Infrastructure as the Foundation of Layered Air Defense***

Radar modernization is a top priority in Indonesia's air defense infrastructure improvement policy. Currently, the Indonesian Air Force operates 20 active military radars, but the scope of aerial surveillance does not fully cover the entire national area, especially in the eastern region of Indonesia which has complex geographical challenges. To overcome these limitations, the planned construction of 25 new radars—13 from France and 12 from the Czech Republic—is a strategic move to close the blank spots and replace older radars such as the Thomson TRS 2215 R that have been in operation for more than 40 years. This radar placement is designed based on threat analysis and operational studies to support the National Air Defense System (*Sishanudnas*), especially at the Area Air Defense layer. This improvement in radar infrastructure also supports the need for the integration of a national air surveillance network that includes military radar, AirNav civilian radar, and other dimensional sensor systems through the C4ISR platform. This aims to strengthen early warning capabilities which are the minimum prerequisites in air sovereignty enforcement operations and Quick Reaction Alert (QRA).

According to Marsma TNI Dr. Agus Priyanto, psc., S.E., M.M., M.Sc., an Indonesian Air Force official interviewed, the modernization of radar and air surveillance infrastructure is the main foundation in Indonesia's layered air defense. With 25 new radars planned, Indonesia is expected to be able to cover the current radar coverage shortage, especially in eastern Indonesia with challenging geographical conditions. The placement of the new radar is in line with the strategy to strengthen the early detection and preparedness of Quick Reaction Alerts, as well as support more responsive and effective air defense systems throughout Indonesia.

Infrastructure Development of Missile Systems and Air Attack Deterrent

The development of missile system infrastructure and air attack deterrent is a strategic element in the modernization of the Indonesian Air Force's defense equipment. This

infrastructure includes launch sites, protection shelters, command posts, and logistics lines for munitions rearming and maintenance, which support the operation of missile systems such as NASAMS 2. The integration of this system with surveillance radars and air defense command centers is important to increase the effectiveness of air threat deterrence in strategic areas, as well as ensure the readiness of the air defense system in layers. In addition, this infrastructure also requires the integration of digital systems and operational security, with a real-time data network to the National Air Defense Command (Kohanudnas) and protection against electronic threats and sabotage.

However, the implementation of missile systems over the past two decades has faced obstacles related to the insynchronization of doctrines and technical specifications between the TNI Headquarters and Mabesau, which hinders the procurement and operation of the PSU system optimally. Therefore, the TNI Air Force defense modernization policy for the period 2025–2045 emphasizes the importance of building missile sites that are integrated with GCI radar and modern command and control networks. This step aims to strengthen national air defense in layers and effectively, so as to improve preparedness and response to air threats in strategic areas.

Modernization and Expansion of Air Base Infrastructure

The modernization and expansion of air bases is a crucial foundation in the Air Force's defense modernization policy. The air base not only serves as a parking and maintenance location for aircraft, but also as a strategic operational center that allows for rapid control, coordination, and projection of air power. Physical infrastructure such as runways, taxiways, aprons, hangars, and maintenance facilities must be designed to support modern platforms such as Rafale, J-10C, A-400M, ANKA-S drones, and T-50i training aircraft.

Without adequate base capacity, the advantages of defense technology cannot be utilized optimally, so the risk of operational bottlenecks becomes real. As part of the modernization program, the Indonesian Air Force prioritizes the construction of major air bases such as Sultan Hasanuddin Air Base, Haluoleo Air Base, and Iswahjudi Air Base, which are equipped with modern facilities such as integrated Ops Rooms, 24-hour Quick Reaction Alert (QRA), and special hangars for UAVs and heavy transport aircraft, in addition to strengthening runways and building logistics facilities and soldier housing.

The modernization of the airbase infrastructure also includes the development of a command-and-control system (C2) integrated with C4ISR. This transformation involves the implementation of network-centric warfare, sensor data fusion, and the provision of real-time tactical pictures (RTPs) for rapid decision-making on the battlefield. The integration of the Indonesian Air Force, the Indonesian Army, the Indonesian Navy, and the Air Nav radar, as well as the use of military satellites and data links, is key in ensuring that all layers of air defense operate in synergy.

Without a modern C2/C4ISR system, the advantages of modern defense equipment will not be optimal. In addition, digital transformation also includes upgrading operations control rooms, building national data links for secure communications, and building military fiber optic networks and military data centers that support AI-based analytics. With modern and digitally

integrated base infrastructure, the Indonesian Air Force can ensure the effectiveness of the national air defense system from initial detection to firing execution, making the modernization of the air base a strategic component that optimizes Indonesia's defense and air defense capabilities.

Command and Control System Integration (C2/C4ISR): Modernization of Air Defense Digital Infrastructure

The modernization of the Air Force's defense equipment, which includes 4.5th generation fighter aircraft, advanced UAVs, new radar, and missile systems, cannot run optimally without adequate command and control infrastructure (C2) support. The air defense digital infrastructure is the backbone in ensuring coordination and rapid response to air threats. The transformation of C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance) is critical to realizing an integrated, adaptive, and information-based air defense system.

The implementation of the network-centric warfare concept allows all units of the Indonesian Air Force, the Indonesian Army, the Indonesian Navy, and the Air Nav to be connected in one integrated information network. Sensor fusion is an important component to produce accurate images of the aerial situation, obtained from ground radar, warship radar, military satellites, and UAVs. With real-time tactical picture (RTP), air defense commands can make decisions quickly, reduce information delays, and improve operational response effectiveness.

In addition, the digital transformation of air defense also emphasizes the importance of secure and reliable communication networks. National data links that connect aircraft, radars, and missile systems are a vital means of real-time information exchange. Military fiber optic networks and military data centers equipped with artificial intelligence (AI) further enhance data processing, threat prediction and operation planning capabilities. The modernization of C2/C4ISR infrastructure is a strategic component in Indonesia's layered air defense system, which ensures that every threat detection, target identification, and firing execution is carried out quickly, accurately, and in a coordinated manner.

In an interview with an official of the Indonesian Air Force, Marsma TNI Dr. Agus Priyanto, emphasized that this transformation includes network-centric warfare, sensor data fusion, and multi-domain operation control room upgrades. All of this allows coordination between radars, missile systems, fighter aircraft, and UAVs as well as cross-dimensional integration through Kohanudnas. With integrated C2/C4ISR infrastructure, all layers of air defense can operate in sync, improving the preparedness and operational effectiveness of national air defense.

Preparedness Support Infrastructure (Logistics, Maintenance, and Human Resources)

The modernization of the Air Force's defense equipment requires the transformation of maintenance and logistics infrastructure to support operational preparedness in a sustainable manner. Maintenance infrastructure, including Maintenance, Repair, and Overhaul (MRO), must be able to handle 4.5th generation fighters such as the Rafale and J-10C, with the construction of multi-level maintenance depots allowing for light maintenance to thorough overhaul. In addition, advanced UAVs used for reconnaissance and intelligence missions

require dedicated ground support facilities, including hangars, monitoring stations, and energy refueling centers or UAV batteries, to ensure 24-hour preparedness and integration with the national command and control system (C2/C4ISR). Logistics modernization is also very important, with the implementation of a digital logistics management system based on the Warehouse Management System (WMS) that allows real-time stock monitoring, prediction of logistics needs, and supply chain optimization, maintaining operational preparedness without material barriers.

In addition, training infrastructure is a vital element to ensure that the Indonesian Air Force human resources can operate modern defense equipment safely and effectively. The construction of full mission simulators for fighters, radar simulators, and UAVs allows realistic exercises in a variety of scenarios without the risk of asset damage or safety hazards. Improving the competence of technicians is also focused on systematic training of avionics, radar, and missile systems, as well as advanced ammunition and missile testing facilities to ensure readiness to deal with air threats.

With the integration of MRO, digital logistics, simulators, and technician training, the Indonesian Air Force builds comprehensive preparedness. This modernization not only increases the capacity of defense equipment but also strengthens human resources who are competent, adaptive, and ready to face the challenges of modern air operations. According to an interview with Marsma TNI Dr. Agus Priyanto, this infrastructure transformation is a strategic element to ensure the effectiveness and sustainability of Indonesia's air defense modernization in maintaining airspace sovereignty and national strategic interests.

Responsive to territorial violations

Responsiveness to airspace violations is a key indicator of the effectiveness of the Air Force's defense modernization, which includes early detection through modern radar, integrated control and command through C2/C4ISR, and operational preparedness through combat squadrons and surface-to-air missile systems. The integration of the new radar and the National Air Defense System (Sishanudnas) expands surveillance coverage and allows for accurate threat identification, while the Quick Reaction Alert (QRA) facility at the air base supports rapid interception. In addition, this modernization also includes improving human resource competencies through simulator training and technician training, as well as proactive approaches such as air patrols and UAV monitoring to prevent or respond to territorial violations. With an integrated system, the Indonesian Air Force can effectively maintain the sovereignty of Indonesia's airspace, detect, identify, and act on violations, while optimizing operational preparedness and response to air threats.

Responsive to Conflict in the South China Sea

Being responsive to potential conflicts in the South China Sea is a strategic aspect in the modernization of the Air Force's defense equipment, considering that this region has high geopolitical and economic value and is a vital international shipping route. Indonesia must ensure air operational preparedness in the border area with the increasing military activity of neighboring countries and potential maritime territorial disputes. The modernization of radar

and the development of the National Air Defense System (*Sishanudnas*) allow for early detection of suspicious aerial activity, with long-range radars placed at strategic air bases and the integration of data from civilian and military radars to build a real-time tactical picture (RTP) that supports rapid decision-making.

The readiness of the airbase and defense equipment, including the 4.5th generation fighter, the ANKA-S MALE, and the NASAMS 2 missile system, as well as the Quick Reaction Alert (QRA), ensures effective interception and escort. In addition, the readiness of human resources through integrated exercises and air combat simulations ensures personnel are competent to respond to modern threats. With a combination of modernizing defense equipment, base infrastructure, C2/C4ISR systems, and trained human resources, the Indonesian Air Force can uphold air sovereignty and provide strategic support to national defense, ensuring a quick and effective response to potential conflicts in the South China Sea.

CONCLUSION

This research concludes that *TNIAU* modernization from 2015–2025 served as a strategic response to global multipolarity, driven by rivalries among powers like the United States, China, and Russia in the Indo-Pacific. Aligning with Indonesia's free-active foreign policy, procurements such as Dassault Rafale fighters, GM403 radars, and the ADGE integrated command system enhanced deterrence, early warning, air sovereignty, and resilience against multidimensional threats (conventional, cyber, space, and non-traditional), bolstering combat, policing, and control in areas like Natuna and Papua. Overall, it elevated Indonesia's bargaining power in defense diplomacy, synergizing hard and soft power to position the nation as a stable middle power. For future research, scholars could examine the post-2025 implementation challenges of these systems under evolving geopolitical tensions, incorporating quantitative assessments of operational effectiveness.

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