

Air Defense Strategy in Improving Security Against Airspace Violations in Indonesia

Amrin^{1*}, Suwito², Almuchalif Suryo³

Universitas Pertahanan

Corresponding Author: Amrin amrinminurso@gmail.com

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ABSTRACT

This study aims to evaluate the effectiveness of Indonesia's air defense strategy in addressing increasingly complex modern air threats. Using a qualitative method with a case study approach, data were collected through literature reviews and analysis of strategic documents. The results indicate that air defense effectiveness is strongly influenced by the integration of radar, missile systems, fighter aircraft, and command and control infrastructure. International cooperation and strategic evaluations also play a vital role. The study concludes that enhancing air defense requires sustained technological investment and strengthened regional-global collaboration. These findings offer strategic insights for policymakers and the Indonesian Air Force in developing adaptive and responsive air defense strategies to safeguard national airspace.

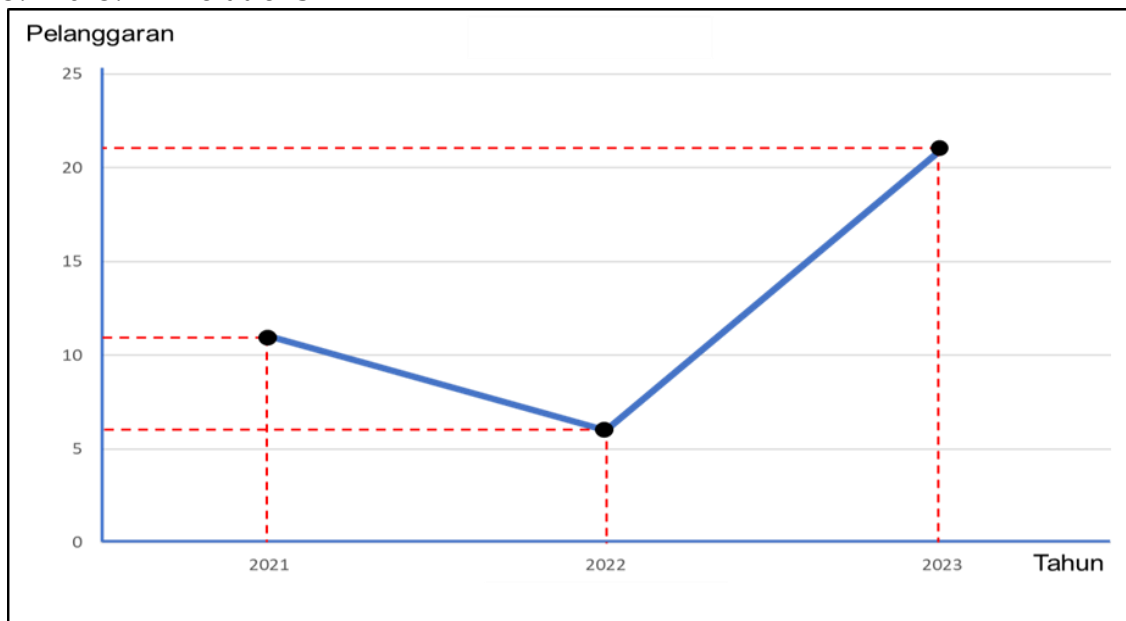
INTRODUCTION

Protection against airspace is an important element in maintain sovereignty country. In Indonesia, which own wide region big and position strategic geography, the threat of airspace violations is a significant challenge for the government and security forces. Such violations can have serious impacts on national stability, including military threats, espionage, and other illegal activities. As an archipelagic country in the form of an archipelago, Indonesia has full sovereignty over its land, sea, and airspace. Indonesian airspace, which covers all over mainland and waters, become issue important Because offers potential benefit Which big However Also accompanied with level vulnerability Which high, making it part of the sovereign territory of the Republic of Indonesia.

In general, violations of national airspace often occur in the form of aerial intrusion by international flights, both civil and military, including drones that enter without official permission (Sinaga et al., 2022). Specifically, these violations include aircraft entering the airspace of other countries without valid permission, violating flight regulations set by local or international authorities, misusing flight routes, carrying prohibited items, violating security and maintenance standards, and not having complete flight documents. The frequent violations of sovereignty by foreign fighter jets crossing Indonesian airspace indicate weaknesses in the supervision and maintenance of national air sovereignty. This reflects the limitations Indonesia in matter defense equipment air, like radar, aircraft combat, and guided missiles, which results in the inability to maintain optimal airspace security.

The data on violations of Indonesian airspace from 2021 to 2023 based on Koopsudnas flight data sources can be seen in the following graph:

1. 2021: 11 violations
2. Year 2022: 6 violations
3. 2023: 21 violations



To overcome these challenges, the Indonesian Air Force needs to develop a comprehensive air defense strategy. This strategy involves increasing the

number of radar units, developing radar technology, and increasing guided missiles and interceptor aircraft. In addition, advanced technology, effective leadership, and quality human resources are important factors in implementing an air defense strategy. Thus, Indonesia can improve security against airspace violations and safeguard national sovereignty more effectively. In recent years, steps such as modernizing defense equipment, improving radar networks, and increasing international cooperation in field defense and security has done. However, challenges remain, particularly in the application of rapidly changing technologies and the need for significant investment. To address these challenges, the Indonesian government urgently needs to develop and implement a comprehensive air defense strategy. This includes strengthening the monitoring and detection system, modernizing the main weapons system, and increasing personnel capacity and collaboration between agencies. With an integrated and technology-based approach, Indonesia can more effectively protect its airspace, maintain sovereignty, and ensure national stability.

This journal aims to analyze the air defense strategies implemented in Indonesia to ensure airspace security is free from threats. airspace violations. It is hoped that the insights generated can provide recommendations for the development of better policies in the future, so that the security of Indonesia's airspace can be optimally maintained, in order to support national stability, and protect state sovereignty.

LITERATURE REVIEW

Framework Theoretical

Theory of Air Sovereignty

The theory of air sovereignty was first proposed by an Italian military figure named Giulio Douhet. Douhet argued that air control is a key element in modern warfare and that control of a country's airspace is essential to winning a conflict and maintaining the country's sovereignty. Douhet's thinking later became the basis for the development of air defense strategies in various countries (Douhet, 2009). In addition, the concept of air sovereignty was first affirmed in the Paris Convention of 1919, and was later strengthened by the Chicago Convention of 1944. In Indonesia, the concept of air sovereignty is regulated in Law No. 1 Year 2009 about Flight, which confirm that region Indonesian air is an integral part of the country's sovereignty. This means that Indonesia has the right to determine who which may and may not use the airspace, including the right to deny or permit foreign flights, as well as the obligation to protect the airspace from external threats. In addition, air sovereignty also includes the responsibility to manage and supervise air traffic, maintain national security, and ensure that the use of airspace is in line with national interests and international law.

Air Defense Theory

Modern air defense theory is not associated with one particular person, but rather developed from contributions of many strategists, military, and engineers throughout the 20th century. However, Hugh Trenchard - A Marshal of the British Air Force played a significant role in the development of the Royal

Air Force (RAF) and the concept of air defense during World Wars I and II (Mahoney, 2018). Air defense theory focuses on protecting a nation's airspace from airborne threats, such as fighter jets, missiles, and drones. This concept has evolved along with the increasing air threats in modern conflicts, where control over airspace has become crucial to maintaining national sovereignty and security. This theory emphasizes the importance of early detection, countermeasures, and interception of threats coming through the air. An effective air defense system usually consists of several elements, including radar for detection early, aircraft combat for interception, as well as missile surface-to-air to shoot down approaching targets. In addition, the integration of air defense systems with modern technologies such as advanced sensors, communication networks, and real-time computing allows for a rapid and effective response to threats. Air defense theory also considers the placement strategy of defense assets to maximize coverage and effectiveness, like placement radar and missiles in strategic locations to protect vital areas such as government centers, military bases, and critical infrastructure. In modern warfare, air defense is a key element in maintaining air superiority. air and protect troops as well as infrastructure from enemy air attacks, thus ensuring the continuity of military operations and national stability.

Air Power

Giulio Douhet was one of the pioneers of Air Power theory. He argued that air power was capable of penetrating defenses. enemies quickly, destroying vital infrastructure, and weakening morale. enemy, so that reduce ability they for continue the war. Douhet also emphasized the importance of strategic bombing of important targets such as weapons factories and communication lines, which aims to weaken the enemy's capabilities in the long term. In addition, Air Power is considered a decisive element in modern warfare because of its flexibility and wide reach, allowing precision strikes and rapid mobilization to conflict areas. This theory has developed along with technological advances, such as fighter jets and drones, which have further increased the effectiveness and efficiency of air operations. In the context of contemporary defense, Air Power not only functions as a means of destruction, but also as a means of surveillance, reconnaissance, and logistics, all of which contribute on strategic and tactical advantages on the battlefield.

Theory Coordination or Cooperation

Theory coordination or Cooperative governance, often associated with Elinor Ostrom, focuses on how communities can manage shared resources effectively without intervention from government or markets. Ostrom, a political scientist, published these findings in her book *Governing the Commons* in 1998. 1990. In theory This, Ostrom emphasize importance rule Which locally agreed upon and active participation of community members in resource management. He identified eight design principles that help communities collaborate, such as clear boundaries, participation in decision-making, and conflict resolution mechanisms. This approach challenges the notion that there are only two ways to manage resources. source power—good through ownership personal or

government management. With this theory, Ostrom paved the way for a new understanding of sustainability and cooperation, showing that local communities can be effective and sustainable managers of their resources.

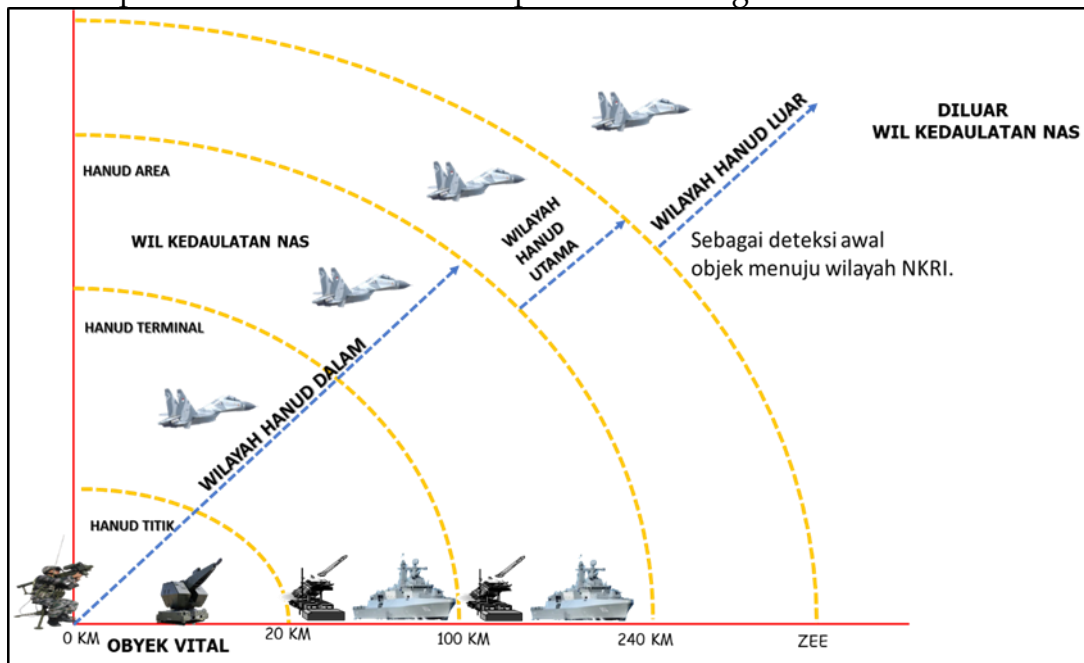
Operation Pattern

Based on Decision Commander Koopsudnas Number Decree/97/VII/2023, The air defense (hanud) operational pattern is divided into three main areas, each of which has a different function and scope.

The inner air defense area includes three categories, namely point air defense which operates within a range of 0-20 km to protect vital strategic objects, such as military bases and important installations. Furthermore, terminal air defense which covers a distance of 20-100 km aims to protect aircraft landing and departure areas, as well as prevent threats from the air. Finally, area air defense which covers a range of 100-240 km serves to maintain air sovereignty in a wider area, ensuring effective surveillance of potential threats.

Outside the inner air defense area, there is a main air defense area that operates within a distance of 240 km to the Exclusive Economic Zone (EEZ) boundary, functioning as an additional shield to protect national interests. In addition, the outer air defense area covers areas outside the EEZ boundary, which focuses on supervision and detection early to threat Which more Far from border country Which is detection beginning object Which leading to territory of the Republic of Indonesia. This division creates a comprehensive and integrated defense system, supporting preparedness in facing various potential air threats.

Pattern Operation Defense Air can depict as following:



Draft Base Air Defense

Air defense is a vital element in protecting national sovereignty, involving the detection, identification, and response to threats in Indonesian airspace. Its effectiveness depends on the integration of key components: radar systems, fighter aircraft, air defense missiles, and command and control systems.

Radar plays a critical role in early threat detection. Although the Indonesian Air Force has made significant improvements in radar technology and network integration, challenges remain in coverage due to Indonesia's vast geography and the rise of stealth technology. Continuous development and integration of radar with other systems are essential. Fighter aircraft serve as the frontline intercept force. The TNI AU operates advanced jets such as the F-16, Su-27/30, and T-50i, supported by pilot training and modernization plans including the acquisition of Rafale and F-15EX. However, limited fleet size and vast territorial coverage require ongoing improvements in readiness and response speed.

Air defense missiles complement radar and aircraft capabilities. The TNI AU operates air-to-air and air-to-ground missiles such as AIM-120, AIM-9, and AGM-65. Despite modernization challenges, these systems are crucial in ensuring air superiority and defense capability. The command-and-control system acts as the operational brain, integrating all elements to enable real-time decision-making and coordination. While the system is effective, interoperability and modernization remain priorities for future development.

Finally, effective air defense requires multi-agency integration. Cooperation between military branches and civilian sectors enhances response capacity, especially against emerging threats like drones and hypersonic weapons. Ongoing innovation and joint coordination are key to maintaining Indonesia's airspace sovereignty.

METHODOLOGY

In this writing, the author uses "Qualitative, Quantitative, and R&D Research Methods" (Sugiyono, 2015). Sugiyono stated that qualitative methods are methods used to study and research the conditions of objects and subjects that are natural, where researchers act as the main instrument in the investigation, discovery, description, and explanation of phenomena. This method was chosen because the author requires in-depth research on the problems found in the field, so that qualitative methods are considered the most appropriate to answer the formulation of the problems that have been determined.

This study uses a qualitative method because the subject and object of the study require in-depth data mining as well as exploration and presentation of data in accordance with the topic that has been determined. The approach used is descriptive analysis, which involves literature studies to collect and explain information from various source, including book, Internet, data historical, and evaluation. Descriptive analysis is an important phase in qualitative methods, which help describe and summarize data so that certain patterns can emerge (Moleong, 2017:7).

RESEARCH RESULT

Technology in Defense Air

The use of advanced technology is essential in modern air defense strategies, given the increasingly complex threats that countries around the world must face. Technology plays a key role in ensuring that threats can be

detected, identified and responded to quickly and accurately. One of the main technologies used in air defense is radar, which plays a vital role in detecting aircraft or other objects entering a country's airspace. Modern radars (Cherniakov, 2008) have the ability to detect objects with high accuracy and at wide range, allowing air defense systems to respond to potential threats before they approach protected targets.

Radar operates (Murpratama, 2019) by emitting electromagnetic waves which are then reflected back by the object being detected. encountered. These reflections are then interpreted to determine the location, speed, and direction of the object. Radar technology has evolved significantly since its introduction, with recent innovations allowing for faster and more accurate detection. Modern radar systems can detect aircraft flying at low altitudes or those using stealth techniques to avoid detection. In addition, radar can identify a wide range of threats, from fighter jets to ballistic missiles, providing invaluable data to air defense operators. Surface-to-air missiles are also a component important from defense air. Missile This designed for destroy enemy aircraft or missiles before they reach their targets. There are different types of surface-to-air missiles, ranging from short-range systems used to protect critical installations to long-range systems used to capable of targeting threats from hundreds of kilometers away. Surface-to-air missile technology continues to evolve, with improvements in speed, accuracy, and maneuverability. Modern systems such as the US-made Patriot or the Russian-made S-400 have the ability to track and target multiple threats at once, providing a strong layer of protection against air attacks.

Integration between these technologies is key to a successful air defense strategy. Radar systems, and surface-to-air missiles must work together in an integrated network to provide a rapid and effective response to threats. Command and control systems also play a critical role in coordinating these components, ensuring that information from the radar can be used to direct missiles to the correct targets. In the command center, operators use data received from the various sources to make informed decisions. on how to respond to emerging threats. The use of advanced technology (Grahadi et al., 2018) in air defense also involves international cooperation. Many countries work together in developing and sharing air defense technology to deal with common threats. For example, NATO has an integrated air defense system involving its various member countries, ensuring that air threats can be met with a coordinated and effective response. This cooperation also allows countries to share the costs of developing new technologies and improve interoperability between their air defense systems.

Overall, advanced technology plays a very important role in strategy defense air modern. With use radar, and surface-to-air missiles, and other technologies, countries can ensure that they Ready to face threat air Which increasingly complex and diverse. Integration between these various technological components, supported by an effective command and control system, is key to ensuring that air defense can operate with maximum efficiency and effectiveness. By continuing to develop and implement new technologies,

countries can stay at the forefront of maintaining their nation's air security and sovereignty.

Cooperation And Coordination Between Institution.

Cooperation and coordination between institutions are key elements in implementing an effective air defense strategy (Sumantri et al., 2023). In the modern context, threats to a country's air sovereignty come not only from enemy fighter jets, but also from increasingly complex forms of attacks such as drones, ballistic missiles, and cyber attacks. Effectiveness air defense very depends on good coordination between the air force, navy, and other security agencies. In Indonesia, the role of Indonesian National Armed Forces Force Air as end spear in defense air is vital, but cooperation with the Maritime Security Agency, Police, and other institutions is also key to increasing the effectiveness of the overall air defense strategy.

The Indonesian Air Force, as the main component in air defense, has responsibility for operating fighter aircraft, radar systems, and air defense missiles. However, complex and varied threats require cross-sectoral collaboration involving various agencies. For example, the Maritime Security Agency (Bakamla) plays an important role in monitoring and supervising Indonesian waters, which are often track for threat air. Cooperation between Indonesian National Armed Forces Force Air and Bakamla ensures that approaching threats can be detected early and responded to quickly, both by sea and air.

In addition, the Indonesian National Police (Polri) plays an important role in supporting air defense strategies. The POLRI can provide useful intelligence on potential domestic threats, such as terrorist groups or other non-state actors who may be planning attacks on strategic facilities or assets. Cooperation between the Indonesian Air Force and the POLRI allows for a fast and accurate exchange of information, so that responses to threats can be carried out more effectively. The POLRI can also play a role in securing the area around air defense facilities, ensuring that there is no interference or sabotage that could hamper defense operations. Other institutions such as the Meteorology, Climatology, and Geophysics Agency (BMKG) also play a role in supporting air defense by providing information weather Which accurate and latest. Condition weather can greatly affect flight operations and the effectiveness of radar systems (A. Putri et al., 2017). With timely weather information, the Indonesian Air Force can plan missions better and reduce the risks associated with adverse weather conditions.

Inter-agency coordination also includes aspects such as joint exercises, personnel exchanges, and integration of technology systems. Joint exercises between the Indonesian Air Force, Navy, and other security agencies help improve interoperability and a common understanding of standard operating procedures. These exercises also allow for the identification and improvement of weaknesses in the overall air defense system.

Integration of technology systems is another important aspect of inter-agency cooperation. Integrated command and control systems allow agencies to share

information in real time, increasing awareness. situational and response to threat. For example, data from system the Indonesian Air Force radar can be integrated with data from Bakamla patrol vessels, creating a more comprehensive picture of the situation in the air and at sea. Advanced communication technology also allows for more effective coordination between the various units involved in air defense operations.

International cooperation is also an important part of the strategy air defense. Indonesia can learn from the experiences and technologies of other countries, and participate in international military exercises to improve capabilities and knowledge. For example, cooperation with neighboring countries in ASEAN can strengthen regional security and create mechanisms for rapid response to common threats. This cooperation can also include joint technology development, intelligence exchange, and logistical support. In the digital era, cooperation also includes cyber defense (E. Putri et al., 2023). Modern air defense systems rely heavily on computer networks and digital communications that are vulnerable to cyber attacks. Therefore, cooperation with the National Cyber and Crypto Agency (BSSN) is very important to protect critical infrastructure and ensure that the air defense system is not disrupted by cyber attacks. BSSN can provide cyber protection, threat detection, and response to cyber incidents that can affect air defense operations.

In conclusion, cooperation and coordination between institutions are the keys to success in air defense strategy. The Indonesian Air Force, as the spearhead of air defense, cannot work alone. Collaboration with Bakamla, Polri, BMKG, BSSN, and other institutions ensures that threats can be detected more beginning, analyzed with accurate, and responded to with fast and effective. Joint exercises, personnel exchanges, technology system integration, and international cooperation all contribute to the strength and reliability of defense. air Indonesia. With approach Which coordinated and collaborative, Indonesia can face various threat air with better and maintain national sovereignty and security.

Challenge And Strategy Defense Air in Indonesia.

Indonesia, as country archipelago the biggest in world with more from 17,000 islands spread along the equator, facing unique challenges in defending its airspace. The vastness of the airspace which must be monitored and maintained to be one of the main challenges faced by the Indonesian Air Force and other defense agencies. According to Wiryawan (2018), the main challenges faced by Indonesia in defending its airspace include several important aspects such as the vastness of the airspace that must be monitored, budget constraints, and the need to continue to follow increasingly rapid technological developments (Ika Primayanti et al., 2020). These challenges require appropriate and effective strategies to ensure that Indonesia's air security and sovereignty are maintained.

The vastness of Indonesia's airspace makes it a major challenge in air defense. This vast area not only covers land but also vast waters, thus requiring a comprehensive and integrated surveillance system. The existing radar network

must be able to cover the entire region, from Sabang to Merauke, to detect and identify threats coming from various directions. In addition, the diverse geographical conditions, ranging from high mountains to deep oceans, add complexity to the placement and operation of radar systems and other air defense weapons systems. To overcome this challenge, Indonesia needs to expand and improve its radar network and integrate it with other monitoring systems, such as satellites and surveillance aircraft.

Budget constraints are also a significant obstacle in the development and maintenance of advanced air defense systems. defense Which limited often time make Indonesia must choosing priorities in modernizing defense equipment and developing defense infrastructure. However, efforts to allocate the budget efficiently are very important in order to maximize existing resources. One strategy implemented is to gradually modernize defense equipment, by prioritizing the procurement and improvement of weapons systems and technologies that have a significant impact on air defense capabilities.

In addition, the need to continue to follow technological developments is also a challenge that cannot be ignored. Technological developments in the military field, especially in air defense systems, are taking place very quickly. Technology new like radar with ability detection Which more tall, more sophisticated air defense missile systems, and the latest generation of fighter jets require significant investment and technical know-how. Therefore, Indonesia needs to continue to update and improve its technological capabilities to remain relevant and effective in facing increasingly complex threats. Training and education programs for military personnel, as well as cooperation with research and technology development institutions, are an important part of this strategy.

International cooperation is also a key element in air defense strategy. Indonesia. Cooperation with countries neighbor and international partners can help Indonesia improve its defense capabilities the air (Manafe, 2019). Cooperation This Can covering various form, such as exercise military together, exchange information intelligence, And joint technology development. For example, Indonesia can cooperate with ASEAN countries for create mechanism supervision air Which integrated in Southeast Asia region. Joint military exercises also help improve interoperability between the Indonesian air force and other countries' air forces, so that they can respond to common threats more effectively.

Radar network enhancement is also a major focus in Indonesia's air defense strategy. A strong and integrated radar network enables early detection of threats coming from the air. Radar development and enhancement is carried out by adopting the latest technology that is able to detect objects at a greater distance and with higher accuracy. In addition, integration between ground radars, maritime radars, and other air surveillance systems helps create a more comprehensive situational picture, thus allowing a response which is faster and more precise against threats.

Modernization of defense equipment (Pertwi & Sari, 2022), including the procurement of new fighter aircraft, air defense missile systems, and surveillance

aircraft, is also part important from strategy defense air Indonesia. Aircraft new generation fighters with more advanced maneuverability and weaponry provide tactical advantages in facing air threats. More modern air defense missile systems are able to provide better protection against enemy missile and aircraft attacks. All these efforts aim to create a layered and integrated air defense system, capable of facing various types of threats.

Overall, the challenges in defending Indonesia's airspace are very complex and require a comprehensive strategic approach. By addressing these challenges through modernization of defense equipment, upgrading radar networks, and increasing international cooperation, Indonesia can significantly improve its air defense capabilities. Cooperation And coordination the good one between various agencies and institutions, both at the level of national and international, become key in ensure that air defense strategy can run effectively and efficiently. By continuing to innovate and adapt to technological developments, Indonesia can maintain its sovereignty and air security from increasingly complex threats in the future.

Studies Case and Strategy Evaluation

Cases and evaluations of air defense strategies in various countries show how important it is to adapt and update in the face of evolving threats. Case studies in the United States show that the integration of advanced technologies and cooperation between agencies are key elements in maintaining airspace security (Ganau et al., 2023). The United States, with its advanced technological capabilities, has developed a comprehensive air defense system, involving various components such as advanced radars, the latest generation of fighter jets, and highly accurate missile defense systems. This system relies not only on its own technological strength, but also on close coordination between various agencies such as the Air Force, Army, Navy, and other intelligence and national security agencies.

In American Union, Wrong One example success from integration technology sophisticated is a land and sea-based missile defense system known as Name Aegis (Zinger & Krill, 1997). System Aegis, which operated by The US Navy, is capable of detecting and neutralizing ballistic missile threats from very long ranges. The SPY-1 Radar technology that is part of this system can track more than 100 targets simultaneously, providing very fast and accurate detection and response capabilities. Integration with satellites and advanced command and control systems allows for efficient coordination between units spread across multiple locations, creating a solid layer of defense against missile attacks.

In Indonesia, an evaluation of the air defense strategy shows that although there have been efforts to improve air defense capabilities, there are still several aspects that need to be improved. One of the main challenges is the budget constraints that hamper the procurement of and comprehensive modernization of defense equipment. However, efforts to increase investment in technology and personnel training continue. Indonesia has a very large airspace and complex geographical conditions, so it requires an air defense system that can reach the entire region. One of the steps taken is to increase the radar network throughout

Indonesia. This radar is not only intended to detect aircraft entering without permission, but also to monitor heavy air traffic. This effort is expected to improve early detection capabilities and provide sufficient time for the Indonesian Air Force to respond to any threats that arise.

One thing that needs to be considered in evaluating Indonesia's air defense strategy is the importance of continuous personnel training. Advanced technology requires skilled and knowledgeable operators. Therefore, training and education programs for military personnel must continue to be improved. This includes technical training on the use of modern defense equipment, as well as tactical training to deal with various threat scenarios.

Apart from training, Indonesia also needs to adopt new technologies. can increase the effectiveness of air defense. For example, the use of Unmanned aerial vehicles (drones) for surveillance and reconnaissance (Dr. Deepak Sonker et al., 2023) can provide valuable information about the situation in the airspace. Drones can operate at altitudes that are difficult for conventional aircraft to reach and can be equipped with various sensors that sophisticated. Integration of this technology with existing command and control systems can increase ability detection and response to threat.

The evaluation also shows that Indonesia needs to increase domestic manufacturing and research capacity to reduce dependence on defense equipment imports. The development of the domestic defense industry (Ramadhan, 2019) can provide benefits in terms of independence and sustainability of supply. In addition, it can also encourage innovation and development of technology that suits Indonesia's specific needs. Thus, the air defense strategy can be adjusted to the geographical conditions and threats faced.

In general, overall, studies case and evaluation strategy defense air (Han et al., 2023) shows that both advanced technology and inter-agency cooperation play a very important role in maintaining airspace security. In the United States, technology integration and inter-agency coordination have proven effective in creating a strong air defense system. In Indonesia, despite challenges in terms of budget and the vast area to be monitored, increased investment in technology and personnel training, as well as international cooperation, can significantly improve air defense capabilities. Continuous evaluation and adaptation to technological developments and new threats are key to maintaining Indonesia's air security and sovereignty.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

1. The Importance of Air Defense Strategy. Air defense strategy is essential to maintain the security of Indonesia's airspace, especially as the largest archipelagic country with more than 17,000 islands.
2. Advanced Radar System Development. The use of modern radars, including AESA technology, is a key element. This technology offers high-accuracy detection and tracking of aerial objects, expanding detection coverage, and accelerating response to threats.
3. Integration Platform Defense Air. Integration various platform such as radar, fighter jets, air defense missiles, and command and control systems create a

formidable air defense and enable rapid response and efficient coordination to threats.

4. Human Resource Management. Human resource management is critical. Rigorous recruitment and selection processes ensure that personnel have the necessary qualifications and commitment. Continuous training and development enhance skills and operational readiness.
5. Performance Evaluation and Assessment. Regular performance evaluation and assessment is essential to assess personnel performance and identify areas for improvement, in order to enhance the effectiveness and efficiency of air defense operations.

Recommendation

1. The need to strengthen the Radar System and Air Monitoring by improving Radar infrastructure and integrating Radar systems.
2. The need to increase the modernization of Alutsista (Main Weapons System Equipment) by modernizing the fighter aircraft fleet with the latest technology to increase interception capabilities and prevent airspace violations and provide air defense systems such as surface-to-air missile (SAM) systems.
3. The need for Human Resources development by conducting routine training for Air Force personnel in operating new systems and efficient detection and response techniques.
4. The need to improve coordination between the air force, navy and other related institutions in responding in an integrated manner to airspace violations.

ADVANCED RESEARCH

Future research should focus on designing a comprehensive air defense capability development model that integrates advanced technology, human capital optimization, and strategic interoperability. This includes exploring the application of cutting-edge radar technologies such as AESA, AI-based threat detection, and the integration of multi-layered defense platforms including SAM systems and next-generation fighter jets. Research should also examine effective human resource development frameworks tailored for air defense operations, emphasizing adaptive training, skill specialization, and simulation-based readiness programs. Additionally, studies on performance monitoring systems using real-time data analytics could provide insights for continuous improvement. Such research would contribute significantly to enhancing Indonesia's adaptive and resilient air defense architecture in response to evolving aerial threats.

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