

ANALYSIS OF THE AUTHORITY OF THE TNI NAVY HELICOPTER PILOTS IN MARITIME LAW ENFORCEMENT IN INDONESIAN SEA TERRITORIES

Ardy Agustinus Paath ^{a*)}, Agung Pramono ^{a)}, Imam Munajat Nuhartonosuro ^{b)}

^{a)} *Hang Tuah University, East Java, Indonesia*

^{b)} *Sekolah Staf dan Komando Angkatan Laut.*

^{*)}Corresponding Author: ardyapaath@gmail.com

Article history: received 21 May 2025; revised 02 June 2025; accepted 15 July 2025

DOI: <https://doi.org/10.33751/jhss.v9i211801>

Abstract. Indonesia's vast waters make maritime law enforcement an important aspect in maintaining national sovereignty and security. Indonesian Navy (TNI AL) helicopters have a strategic role in maritime surveillance operations with the ability to detect illegal activities faster than patrol boats. However, to date, the authority of helicopter pilots in direct legal intervention is still limited, so that the effectiveness of operations is often hampered. In addition, the lack of coordination with patrol boats, limited fleet size, and minimal support for sophisticated technology are the main obstacles that reduce the efficiency of maritime law enforcement. This study aims to analyze the authority of TNI AL helicopter pilots in maritime law enforcement, identify the obstacles faced, and provide recommendations to improve the effectiveness of maritime operations. The research method used is a qualitative approach, with data collection techniques through in-depth interviews with five respondents, consisting of two TNI AL helicopter pilots, one operational officer, one maritime law expert, and one maritime defense analyst. In addition, operational observations were conducted to understand the real challenges in the field. The results of the study show that helicopter pilots only have a role as a supervisory element without the legal authority to stop or inspect ships. The main obstacles to operational effectiveness are the absence of clear regulations regarding the legal role of helicopter pilots, suboptimal coordination with patrol vessels, limited aerial monitoring technology, and the small number of helicopters in operation. To overcome these problems, regulatory revisions are needed to clarify the authority of helicopter pilots in law enforcement operations, modernization of communication and navigation systems to improve coordination with maritime elements, and the addition of the helicopter fleet to expand the scope of maritime surveillance. With these strategic steps, it is hoped that the effectiveness of maritime law enforcement operations can increase significantly, so that the security and sovereignty of Indonesian waters can be better maintained..

Keyword: *Helicopters, Maritime Law, Operational Coordination, Law Enforcement, TNI AL*

I. INTRODUCTION

Indonesia is the largest archipelagic country in the world with a water area of approximately 3.25 million square kilometers and an Exclusive Economic Zone (EEZ) of approximately 2.7 million square kilometers. This geographical location makes Indonesia face major challenges in securing its maritime territory [1]. In maintaining security and enforcing the law at sea, various agencies have important roles, one of which is the Indonesian Navy (Tentara Nasional Indonesia Angkatan Laut or TNI AL). As part of the TNI AL, helicopter pilots have special authority to support maritime law enforcement operations, both in national defense and in prosecuting violations of the law in Indonesian waters [2]. The authority of TNI AL helicopter pilots in maritime law enforcement is based on various national and international regulations governing maritime defense and security [3]. One of the main legal bases is Law Number 34 of 2004 concerning the Indonesian National Army, which emphasizes that the TNI, including the TNI AL,

has the main task of maintaining state sovereignty and enforcing the law in the national jurisdiction area. In addition, Law Number 17 of 2008 concerning Shipping and various other laws and regulations also serve as the basis for the role of the Indonesian Navy in maritime law enforcement operations [4]. In carrying out their duties, helicopter pilots have the authority to conduct air patrols, monitoring, pursuit, and provide support for sea operations carried out by warships (KRI or Republic of Indonesia Ships) [5]. The role of helicopter pilots in maritime law enforcement is very strategic, especially in dealing with various maritime security threats such as piracy, smuggling, illegal fishing (Illegal, Unreported, and Unregulated Fishing or IUU Fishing), human trafficking, and violations of territorial boundaries by foreign vessels [6]. With the advantages of mobility and wide range, military helicopters are able to detect and intercept suspicious vessels more quickly than warships that have limited speed and maneuverability [7]. In addition, helicopters also function in reconnaissance and surveillance missions, so they can provide real-time information to the

operations command on land or warships located around the incident area [8].

In carrying out their duties, TNI AL helicopter pilots are equipped with various sophisticated technological devices that support operational effectiveness [9]. Several types of helicopters used in maritime law enforcement operations include the AS565 Panther, Bell 412 EP, and EC-725 Caracal, each of which has advantages in patrol missions, surveillance, and search and rescue (SAR) operations [10]. With the presence of radar systems, electro-optical sensors, and tactical communications, helicopter pilots can detect and identify ships suspected of committing violations of the law in Indonesian waters. In addition, helicopters are also capable of carrying out quick landing missions to send special forces (Marines Corps or Kopaska) to take direct action against identified targets [11].

The challenges in implementing the authority of Indonesian Navy helicopter pilots in maritime law enforcement are not few. One of the main challenges is the vast area of Indonesian waters which requires adequate human resources and defense equipment [12]. The limited number of helicopters and supporting infrastructure such as air bases and helicopter carriers are factors that affect the effectiveness of operations [13]. In addition, extreme weather conditions and threats from armed groups or pirates who have sophisticated weapons are also risk factors in maritime operations. Therefore, improving technology and modernizing defense equipment are important aspects in strengthening the role of helicopter pilots in maintaining the security of Indonesian seas [14]. In addition to technical and operational aspects, coordination between agencies is also a key factor in optimizing maritime law enforcement. The Indonesian Navy does not work alone in maintaining the security of waters, but also collaborates with other agencies such as the Maritime Security Agency (Bakamla), the Water and Air Police (Polairud), the Ministry of Maritime Affairs and Fisheries (KKP), and the Directorate General of Customs and Excise. Synergy between these various agencies is essential so that law enforcement operations can run effectively and efficiently. With good coordination, each agency can share intelligence information, conduct joint operations, and optimize the use of available resources [15].

From an international legal perspective, the role of the Indonesian Navy in maritime law enforcement is also in line with various global conventions and agreements, such as the 1982 United Nations Convention on the Law of the Sea (UNCLOS), which is the basis for the rights and obligations of coastal states in managing and securing their maritime territories [16]. UNCLOS regulates various aspects of maritime law, including the rights of states to enforce the law in the Territorial Sea, Contiguous Zone, Exclusive Economic Zone, and Continental Shelf. Indonesian Navy helicopter pilots play a role in upholding state sovereignty at sea by patrolling and taking action against all forms of violations of the law that occur in Indonesia's jurisdiction [17].

The authority of Indonesian Navy helicopter pilots in maritime law enforcement has a very vital role in maintaining the sovereignty and security of Indonesian waters. With the advantages of mobility, technology, and high operational capabilities, helicopters are one of the key elements in supporting maritime operations carried out by the Indonesian

Navy. However, to increase the effectiveness of this role, it is necessary to modernize defense equipment, increase human resource capacity, and strengthen coordination between agencies [18]. With these strategic steps, it is hoped that maritime law enforcement efforts can run more optimally in facing various increasingly complex maritime security challenges in this era of globalization [19]. Indonesia's vast sea area makes it vulnerable to various maritime security threats, such as illegal fishing, drug smuggling, human trafficking, and piracy. In facing these challenges, the Indonesian Navy (TNI AL) has a strategic role in enforcing the law and maintaining national maritime sovereignty. One important element in maritime security operations is the use of helicopters manned by TNI AL pilots. However, the authority of helicopter pilots in law enforcement is still a problem, especially related to legal and operational limitations in the field. Until now, helicopter pilots have played a greater role as monitors and reporters, while direct actions such as stopping and arresting violating vessels are generally carried out by units on warships or other special units.

Despite their important role, studies discussing the involvement of helicopter pilots in maritime law enforcement operations are still very limited. Most previous studies have focused more on the role of patrol ships, legal regulations, and coordination between institutions such as Bakamla, Polairud, and the Indonesian Navy. In fact, helicopters have the advantage of mobility and wider surveillance coverage compared to warships. Without an in-depth study of the operational and legal aspects governing helicopter pilots, the great potential of the air element in supporting maritime law enforcement cannot be optimally utilized. Therefore, this study aims to fill the gap (research gap) by examining the extent to which the authority of helicopter pilots can be expanded to increase the effectiveness of maritime law enforcement operations.

The urgency of this research is increasing considering the increasing threats in Indonesian waters, especially from the activities of foreign ships committing violations of the law. In several cases, the presence of helicopters has been proven to assist in surveillance and provide real-time information to warship units in enforcement operations. However, limited regulations and the lack of integration between air and sea elements often hinder the effectiveness of operations. Considering the importance of real-time intelligence sharing and rapid response to threats at sea, there needs to be an evaluation and strengthening of policies regarding the role and authority of helicopter pilots in maritime operations.

This research not only contributes in academic aspects, but also has the potential to be a reference for policy makers in designing a more comprehensive maritime defense strategy. With clearer regulations, better coordination, and optimization of the use of helicopters in maritime operations, it is hoped that the effectiveness of law enforcement in Indonesian sea areas can increase significantly. In the future, strengthening the synergy between air and sea elements must be a priority in the national maritime security strategy so that Indonesia is able to face increasingly complex threats in the modern geopolitical era.

II. RESEARCH METHOD

This study uses a qualitative approach with a descriptive method to analyze the authority of Indonesian Navy helicopter pilots in maritime law enforcement in Indonesian waters. This approach was chosen because it allows researchers to gain an in-depth understanding of regulations, operational procedures, and the challenges faced by helicopter pilots in carrying out their duties. With this method, research can explore various legal, technical, and strategic aspects related to the role of helicopter pilots in supporting maritime operations. This is in line with research conducted by Bentley [3], which highlights the importance of an in-depth understanding of maritime regulations and operations in Indo-Pacific security. The data sources in this study consist of primary data and secondary data. Primary data were obtained through in-depth interviews with five respondents who have expertise and experience in maritime law enforcement operations, namely two Indonesian Navy helicopter pilots, one Indonesian Navy operational officer, one maritime law expert, and one maritime defense analyst. Secondary data were collected from various literature, including related laws and regulations, Indonesian Navy operational documents, academic journals, and reports from national and international maritime institutions. In academia, research conducted by Shodiq et al. [2] also emphasized the importance of studying maritime legal regulations to understand the legal aspects of maritime security operations.

The data collection technique in this study was carried out through in-depth interviews and documentation studies. Interviews were conducted in a semi-structured manner to explore the perspectives and direct experiences of respondents regarding the authority of helicopter pilots in maritime law enforcement operations. Documentation studies were conducted by reviewing various regulations, operational policies, and previous research reports to enrich the analysis and ensure the validity of the data obtained. This is in line with Mamadlo's research [11], which highlights the importance of documentation studies in examining the legal aspects of military flight operations. With this combination of techniques, research can gain a more comprehensive understanding of the challenges faced in maritime operations.

Data analysis was carried out using the thematic analysis method, where the collected data was categorized into main themes that were relevant to the focus of the research. The analysis process includes data reduction, data presentation, and drawing conclusions. Data obtained from interviews and documentation studies were compared and reviewed in depth to find patterns, relationships, and findings that could contribute to an understanding of the authority of Indonesian Navy helicopter pilots in maritime law enforcement operations. This method is also supported by research by Maharani and Prajuli [9], which emphasizes the importance of thematic-based data analysis in understanding the complexity of military operations and national security.

III. RESULT AND DISCUSSION

This study aims to analyze the authority of Indonesian Navy helicopter pilots in maritime law enforcement in Indonesian

waters. Using a qualitative approach, this study explores the legal, technical, and operational aspects related to the role of helicopter pilots in supporting maritime security. Data were collected through in-depth interviews with five respondents, consisting of two Indonesian Navy helicopter pilots, one Indonesian Navy operational officer, one maritime law expert, and one maritime defense analyst. In addition, a documentation study of regulations, operational policies, and previous research was conducted to enrich the analysis. The data analysis technique used the thematic method, by grouping data based on the main patterns and themes found during the study. The results of this study are expected to provide insight into the challenges, limitations, and recommendations for optimizing the role of helicopters in maritime law enforcement operations, in order to strengthen Indonesia's maritime security strategy.

Table 1. Respondent Characteristics

No	Respondent	Position/Expertise	Background Experience
1	TNI AL Helicopter Pilot 1	Operational Pilot	Experienced in maritime surveillance operations
2	TNI AL Helicopter Pilot 2	Senior Pilot	Has experience in various air missions in sea areas
3	TNI AL Operational Officer	Commander of Maritime Operations Unit	Responsible for planning and implementing sea operations
4	Maritime Law Expert	Academician/Researcher of Maritime Law	Focus on maritime law regulations and policies in Indonesia
5	Maritime Defense Analyst	Observer of Maritime Security Strategy	Experienced in maritime threat analysis and defense strategies

The table above shows the characteristics of respondents selected based on the relevance of their expertise and experience in maritime law enforcement. The combination of practitioners and academics is expected to provide a holistic perspective in understanding the authority of TNI AL helicopter pilots and the challenges faced in field operations.

Table 2. Observation Results

No	Observation Aspect	Findings in the Field
1	The Role of Helicopter Pilots in Maritime Operations	Pilots play a role in aerial surveillance, area mapping, and coordination with warships, but do not have the authority to take direct action against ships suspected of breaking the law.
2	Coordination with Marine Elements	There are communication barriers in joint operations, especially in real-time data sharing between helicopters and patrol ships.
3	Authority in Law Enforcement	Pilots only act as air eyes without the right to stop or intervene directly against lawbreakers at sea.
4	Technology and Support Systems	The surveillance equipment used is still limited, and not all helicopters have a real-time surveillance system to support operations.
5	Operational Challenges	Weather factors, limited flight hours, and the minimal helicopter fleet are the main obstacles to the effectiveness of maritime patrols.

The results of the observations conducted in this study provide an in-depth overview of various aspects that influence the effectiveness of maritime operations involving Indonesian Navy helicopters, especially in law enforcement in Indonesian waters. The findings from this observation indicate that although helicopter pilots have an important role in supporting

maritime surveillance and mapping operations, there are various limitations that hinder the optimization of their functions in law enforcement practices. Indonesian Navy helicopter pilots act as air eyes tasked with detecting and identifying suspicious activities in Indonesian waters. In their operations, they map areas, monitor ship movements, and provide visual information to patrol ships on duty on the sea surface. However, helicopter pilots do not have the authority to intervene directly against ships suspected of committing violations. They can only report their findings to patrol ships or operational commands for further action. This limitation becomes an obstacle in certain situations where quick and direct action from the air can have a more effective impact in preventing violations of maritime law. In terms of coordination with marine elements, the results of the observation indicate that there are still various obstacles that affect the effectiveness of communication between helicopters and patrol ships. One of the main obstacles is the limitation in real-time data sharing, where information obtained from helicopters cannot always be directly transmitted to patrol ships or command centers. This causes delays in decision-making and response to threats at sea. This communication barrier is exacerbated by the limited technological infrastructure that supports interoperability between helicopters and warships. In some cases, helicopter pilots face difficulties in transmitting visual data or coordinates directly to patrol ships, thus slowing down the response to illegal activities detected from the air.

The authority in law enforcement is also one of the main aspects observed in this study. Based on the results of observations, helicopter pilots only act as air eyes without having the right to stop or intervene directly against lawbreakers at sea. This is in line with existing regulations, where full authority in maritime law enforcement still lies with patrol ships or special units on the surface of the sea. This limitation of authority poses its own challenges, especially in situations where helicopter pilots detect suspicious activity but cannot take direct action to prevent further violations. In some cases, the pilot may only provide information to a patrol vessel which may be at a considerable distance from the scene of the incident, thus giving the offending vessel time to escape before legal action can be taken.

In terms of technology and supporting systems, the observation results show that the surveillance equipment used in helicopter operations is still limited. Not all helicopters are equipped with real-time surveillance systems that can support maritime surveillance operations effectively. Some helicopters still use manual observation systems that rely on direct vision of the pilot and crew, which of course has limitations in accuracy and monitoring range. In addition, limitations in data transmission technology are also an obstacle, where information collected from the air cannot always be directly transmitted to the command center or patrol ships on the sea surface. The shortcomings in the surveillance and data transmission systems have an impact on the effectiveness of operations, especially in situations where quick decision-making is essential to deal with emerging threats in Indonesia's maritime territory. Operational challenges are also a major factor observed in this study. One of the biggest obstacles in helicopter operations is the weather factor which often affects

flight schedules and the effectiveness of aerial surveillance. Bad weather conditions, such as heavy rain, strong winds, and thick fog, can limit visibility and endanger flight operations. This factor means that helicopter operations cannot always be carried out according to plan, especially in situations where a quick response is needed. In addition to weather factors, limited helicopter flight hours are also a significant challenge. Helicopters have certain operational limits that depend on fuel availability, engine condition, and flight crew readiness. In some cases, these limitations cause operations to be terminated early before detected threats can be fully followed up by patrol elements on the sea surface. The lack of a helicopter fleet is also a major obstacle to the effectiveness of maritime patrols. Currently, the number of helicopters available for maritime surveillance operations is still very limited compared to the vast sea area that must be monitored. With the vast scope of Indonesia's sea area, the need for more helicopters with sophisticated technology is becoming increasingly urgent. However, budget constraints and defense equipment procurement policies are often factors that limit the increase in the number of air fleets in maritime operations. This shortage of helicopters has a direct impact on the effectiveness of operations, where there are many areas that cannot be monitored optimally due to limitations in the number of available air assets. In addition, the lack of support for maintenance and logistics infrastructure for helicopters is also a factor that limits the sustainability of air operations in the long term. Helicopter maintenance requires large resources, both in terms of budget and competent experts, making it a challenge in the daily operations of the Indonesian Navy.

The results of this observation provide a deeper understanding of the challenges faced in the operation of Indonesian Navy helicopters in maritime law enforcement. These findings indicate that although the role of helicopters is very important in monitoring and mapping sea areas, there are various limitations in authority, coordination, technology, and operational support that hinder the effectiveness of the overall operation. Therefore, strategic steps are needed to overcome these challenges, including revising regulations to provide broader authority to helicopter pilots, improving communication and surveillance technology, and modernizing and increasing the number of helicopter fleets to ensure more effective and responsive maritime security. With improvements in these aspects, it is hoped that maritime surveillance and law enforcement operations involving Indonesian Navy helicopters can run more optimally and provide a greater contribution to maintaining the sovereignty of Indonesian sea areas.

Table 3. Interview Results

No	Respondent	Questions	Main Answer
1	TNI AL Helicopter Pilot 1	What is the role of helicopters in maritime law enforcement operations?	Helicopters function as aerial eyes, conducting surveillance, monitoring, and reporting on suspicious activities, but do not have the authority to intervene directly.
2	TNI AL Helicopter Pilot 2	What are the main obstacles in air operations for	Bad weather, fuel constraints, and a small number of helicopters are major challenges, as

No	Respondent	Questions	Main Answer
		maritime law enforcement?	well as the lack of a real-time data sharing system between helicopters and patrol boats.
3	TNI AL Operational Officer	How is the coordination between helicopters and patrol vessels in maritime operations?	Communication is still not optimal, especially in the integration of navigation and information systems that allow for a faster response to threats at sea.
4	Maritime Law Expert	Do helicopter pilots have a legal basis to carry out direct action at sea?	There are no regulations that explicitly give helicopter pilots the legal authority to stop or arrest ships that violate the rules.
5	Maritime Defense Analyst	What are the recommendations for increasing the effectiveness of helicopters in maritime law enforcement operations?	Regulations need to be revised, surveillance technology modernized, and integration between air and sea elements improved to improve operational effectiveness.

The results of interviews with five respondents consisting of two Indonesian Navy helicopter pilots, one Indonesian Navy operational officer, one maritime law expert, and one maritime defense analyst showed that helicopter pilots have a strategic role in maritime surveillance, but there are various limitations in terms of authority, coordination, and technological support that hinder the effectiveness of law enforcement operations at sea.

Based on interviews with Indonesian Navy helicopter pilots, it is known that helicopters are used in maritime operations to conduct surveillance from the air, identify suspicious ships, and provide information to patrol ships below. One of the pilots stated that:

"Helicopters are very effective in detecting ships moving suspiciously in our waters. From the air, we can see illegal activities such as illegal fishing, smuggling, and theft of marine resources faster than patrol ships that are limited by the horizon."

However, although helicopter pilots have the ability to detect violations early, they do not have the authority to take direct action against suspected ships. This was confirmed by another pilot who said:

"We can only monitor and report. If we find a suspicious ship, our job is only to provide coordinates to the patrol ship or base. We do not have the authority to stop or force the ship to stop."

From this statement, it can be concluded that helicopter pilots only act as air eyes without having the authority to intervene directly against lawbreakers at sea. This causes a gap in law enforcement operations, because there is a time lag between the identification of violations and the response from patrol boat units which often take longer to reach the scene.

In an interview with an operational officer of the Indonesian Navy, it was found that coordination between helicopters and patrol boats still has many obstacles, especially in terms of communication and information system integration. He explained that:

"One of the biggest challenges in maritime operations is communication that is not yet fully integrated. Ideally,

helicopters should be able to share data in real time with patrol boats, but in reality, there are still limitations in the communication and navigation systems that we use."

This obstacle makes it so that information collected by helicopters cannot be immediately used for quick action by patrol boats. In some cases, suspected ships have moved locations or even fled before the patrol boat arrives at the location. The officer also added that:

"We still rely on conventional radio communication, which sometimes experiences interference or delays in delivering information. In fact, if we have a more sophisticated system, such as automatic data sharing between helicopters and patrol boats, the response to threats can be much faster."

From this interview, it is clear that the integration of more modern communication and navigation systems is essential to increase the effectiveness of coordination between air and sea elements.

From the perspective of a maritime law expert, it was found that there is no regulation that explicitly gives helicopter pilots legal authority to intervene in maritime law enforcement operations. He explained that:

"Currently, the authority to stop, inspect, and arrest ships is regulated in our maritime law, but this authority is only given to warships and certain units that have legal authority. Helicopters are only considered as supporting elements that function as surveillance tools."

This absence of clear regulations causes a gap in operations, where helicopter pilots have the ability to identify violations early, but do not have the legality to take preventive or repressive action. The legal expert also added:

"If we want to increase the effectiveness of helicopters in maritime operations, we must consider revising regulations that give helicopter pilots a greater role, for example by allowing them to issue warnings or even certain actions in emergency conditions."

This shows that there needs to be legal reform to clarify the role and authority of helicopter pilots in maritime law enforcement, so that they can be more active in prosecuting violators without having to rely entirely on patrol ships. One of the main challenges in the effectiveness of helicopter operations at sea is the lack of advanced technology in surveillance systems and the limited number of helicopter fleets. In an interview with a maritime defense analyst, he stated that:

"The helicopters we currently use are not all equipped with real-time surveillance systems or high-resolution cameras. In fact, if this technology is available, pilots can immediately send visual evidence from the air to the command center or patrol ship."

He also highlighted that the number of helicopters used in maritime operations is still very limited compared to the vastness of Indonesia's sea territory.

"With the vast waters that we have, there should be more helicopter fleets for patrols. Currently, the number is still far from ideal, so not all areas can be monitored effectively."

From this interview, it can be concluded that technological modernization and the addition of helicopter fleets are very important to increase the effectiveness of maritime law enforcement operations.

Based on the results of the interview, there are several main recommendations that can be made to increase the role of helicopters in maritime law enforcement operations, namely:

1. Regulation Revision

Revision of regulations in maritime law enforcement operations is an urgency that cannot be ignored. Currently, the authority given to Indonesian Navy helicopter pilots is still limited to monitoring and reporting functions, without the right to directly intervene in violations that occur in Indonesian waters. This is a significant obstacle in maritime law enforcement operations, considering that helicopter pilots are often the first element to identify threats or suspicious activities at sea. With the limited authority available, they can only report their findings to patrol ships or operational commands, which in many cases cannot respond immediately due to the limited distance and travel time of the ship. Therefore, there is a need for a revision of regulations that allow helicopter pilots to have greater authority in law enforcement operations, so that they can act as more than just passive observers in the air. In international law, many countries have adopted policies that give broader authority to air units in maritime law enforcement operations. For example, in a study conducted by Bentley (2023), it was found that countries with high maritime threats have integrated helicopters into their maritime law enforcement strategies, where pilots not only function as observers but also have the right to intervene in certain situations. This model has been implemented in countries with large maritime areas, such as the United States and Australia, where helicopters used by the coast guard and navy have the authority to carry out actions such as stern warnings, seizure of evidence, and in some cases, stopping vessels suspected of violating the law. A study by Fish (2024) also highlighted that the use of helicopters in maritime operations is more effective when they have direct authority to take action against vessels suspected of violating the law, especially in situations that require a high response speed. In Indonesia, this limited authority not only impacts the effectiveness of operations but also has implications for resource efficiency. In many cases, when helicopter pilots identify vessels suspected of violating the law, they must wait for patrol vessels to take further action. This wasted time often provides an opportunity for violating vessels to escape or hide evidence of their crimes. In a study by Mamadlo (2025), it was found that the lack of direct authority for helicopter pilots resulted in a 30% decrease in the effectiveness of maritime law enforcement operations compared to countries that gave their air units broader authority. Therefore, a revision of the regulations that would allow helicopter pilots to take further action, such as giving direct warnings or even stopping the vessel in a manner consistent with international law, could significantly increase the effectiveness and efficiency of operations.

In addition to legal aspects, technical and operational aspects must also be considered in the revision of this regulation. Increased authority for helicopter pilots must be supported by appropriate training and modernization of equipment that allows them to carry out these additional tasks effectively. For example, in a report published by Wu (2024), it was found that countries that give helicopter pilots broader authority in maritime law enforcement operations also invest

significant resources in technology development and training. This includes the use of real-time surveillance systems, encrypted communications, and non-lethal weapons that can be used to stop suspicious vessels without violating human rights norms and international law. Thus, the revision of regulations that give helicopter pilots greater authority must be followed by strategic steps to increase their capacity to carry out these additional tasks professionally and in accordance with applicable legal standards.

From a geopolitical perspective, increasing authority for helicopter pilots in maritime law enforcement operations also has a strategic impact on maintaining the sovereignty of Indonesia's maritime territory. As expressed by Strating (2023), threats in the Asia-Pacific maritime region continue to increase along with the escalation of conflicts and geopolitical competition between major countries. In this situation, Indonesia's ability to respond quickly to maritime threats is a key factor in maintaining the stability and sovereignty of its territory. One way to improve this response is to give broader authority to air units in law enforcement operations, so that threats can be identified and dealt with more quickly before they develop into bigger problems. By giving helicopter pilots the authority to do more than just surveillance, Indonesia can increase its capacity to deal with a variety of maritime threats, from illegal fishing to smuggling and violations of territorial boundaries.

From an economic perspective, increasing the effectiveness of maritime law enforcement operations also contributes to the protection of Indonesia's marine resources. A study by Suharyat (2022) shows that illegal activities in Indonesian waters, such as illegal fishing and human trafficking, cause significant economic losses to the country. By giving helicopter pilots greater authority to act in certain situations, the potential to deal with violations more quickly and effectively can help reduce these losses. For example, if helicopter pilots can immediately give a loud warning to suspicious vessels or even direct patrol vessels to take action more quickly, the chances of violating vessels successfully escaping will be drastically reduced. Therefore, the revision of regulations that allow broader actions for helicopter pilots not only has an impact on the security aspect, but also has a significant economic impact in protecting natural resources and preventing losses due to illegal activities at sea.

In addition, aspects of diplomacy and international relations also need to be considered in the revision of this regulation. As stated in a study by Kraska (2023), countries that have a strong maritime law enforcement system tend to have a better position in international negotiations related to maritime boundaries and regional security. By increasing the role of helicopters in law enforcement operations, Indonesia can strengthen its position in various international forums and demonstrate its commitment to maintaining the stability and security of its maritime region. This step can also increase Indonesia's credibility in international cooperation, especially in ASEAN and the Indo-Pacific, where coordination in maritime security is a major issue that continues to grow.

1. Modernization of Technology

Modernization of technology in maritime law enforcement operations is an urgent need to improve the

effectiveness and efficiency of tasks carried out by Indonesian Navy helicopter pilots. Currently, limitations in communication systems, navigation, and surveillance technology are major obstacles in improving response capabilities to maritime threats. One step that needs to be taken is to adopt real-time surveillance technology that allows helicopter pilots to monitor ship movements directly and accurately. With this system, data obtained from the air can be immediately sent to the nearest command center or patrol ship, allowing faster coordination in taking action against violations of the law at sea. Without direct monitoring technology, information sent by pilots is often delayed or inaccurate, slowing down operational responses and providing loopholes for lawbreakers to avoid prosecution. In addition to real-time surveillance, an automatic data exchange system is also needed that can integrate various elements in maritime operations, including helicopters, warships, command centers, and other security units. In many cases, communication barriers are one of the main factors that hinder the effectiveness of joint operations. A study by Bentley (2023) shows that countries with integrated communication systems have a higher success rate in prosecuting maritime law violations because all units involved can access the same data in real time. With an automatic data exchange system, information on the location of suspicious vessels, their direction of movement, and the surrounding environmental conditions can be continuously updated, allowing for faster and more accurate decision-making.

Ship identification devices are also an important element in the modernization of maritime law enforcement technology. Currently, many ships operating illegally use techniques such as identity forgery, turning off the Automatic Identification System (AIS), or even changing the physical appearance of their ships to avoid detection. With the presence of artificial intelligence (AI)-based identification technology and ship movement pattern recognition, helicopter pilots can more easily identify suspicious vessels even though they try to disguise their identities. A study by Fish (2024) shows that the use of AI in maritime security operations has increased the detection rate of illegal vessels by 40% in several countries that have implemented this system. Therefore, Indonesia needs to adopt similar technology to improve accuracy in identifying and prosecuting illegal vessels.

Technological modernization must also include improvements to the navigation systems used by Indonesian Navy helicopters. Currently, many maritime patrol operations still rely on conventional navigation that has limitations in extreme weather conditions or complex environments. The use of more sophisticated satellite-based navigation systems, such as the Global Navigation Satellite System (GNSS) which has higher accuracy than regular GPS, can help pilots navigate patrol areas more effectively. In a study by Wu (2024), it was found that the use of GNSS technology in maritime military operations increased flight route efficiency by up to 30%, which directly impacted fuel consumption reductions and increased air patrol coverage. In other words, modernizing the navigation system not only improves the operational capabilities of helicopters but also provides efficiency in the use of resources.

From the aspect of data and communication security, the use of an encrypted communication system is a must in maritime law enforcement operations. Many operations fail or leak because communications between units are not encrypted, so they can be tapped by irresponsible parties. In a report by Kraska (2023), it was found that many maritime criminal groups use sophisticated technology to monitor law enforcement communications, so that they can anticipate and avoid ongoing operations. By implementing an encrypted communication system, operational information can remain secure and can only be accessed by authorized parties. In addition, the integration of blockchain technology into the operational data management system can also help improve the transparency and security of information collected during maritime patrols.

The impact of technological modernization in maritime law enforcement operations is not only limited to technical and operational aspects, but also has strategic implications in maintaining the sovereignty of Indonesia's maritime territory. As stated by Strating (2023), increasing technological capabilities in maritime operations contributes to increasing Indonesia's bargaining power in dealing with external threats, including in maritime border disputes. By having a more sophisticated monitoring and response system, Indonesia can show that its maritime territory is well managed and ready to face various threats. This also increases Indonesia's credibility in international forums related to maritime security, especially in cooperation with ASEAN countries and other strategic partners.

From an economic perspective, technological modernization in maritime law enforcement also contributes to reducing losses due to illegal activities in Indonesian waters. Illegal fishing, smuggling, and human trafficking are some examples of maritime crimes that cause billions of rupiah in losses each year. A study by Suharyat (2022) shows that improving surveillance technology and rapid response in maritime operations can reduce maritime crime rates by up to 50% in the first five years of implementation. Therefore, investment in technology not only provides benefits in terms of security, but also has a positive impact on the economic sector and the welfare of coastal communities. However, to ensure the success of the implementation of this technological modernization, continuous training is also needed for the personnel involved. The use of advanced technologies such as AI, GNSS, and real-time surveillance requires special skills that must be mastered by helicopter pilots and other supporting personnel. Therefore, training and certification programs for Indonesian Navy personnel must be strengthened to ensure that they can make maximum use of technology. In a study by Mamadlo (2025), it was found that technological modernization that is not accompanied by adequate training can actually reduce operational effectiveness, because personnel do not have sufficient skills to operate the new system optimally.

2. Improving Coordination Between Elements

Improving coordination between elements in maritime law enforcement operations is an important aspect that must be strengthened to ensure effectiveness and efficiency in carrying out tasks. Currently, one of the biggest challenges in maritime operations is limited communication and lack of integration

between various elements, such as Indonesian Navy helicopters and patrol boats. Communication barriers often cause delays in decision-making and responding to threats that arise in Indonesian waters. Therefore, a more solid coordination system is needed by adopting advanced communication technology and improving training and cooperation procedures between units. One of the main solutions in improving coordination is the implementation of a real-time communication system that allows for fast and accurate information exchange between helicopters and patrol boats. This system must be able to integrate data from various sources, including ship radars, air surveillance systems, and command and control centers. In a study conducted by Bentley (2023), it was found that countries that implement a real-time data sharing-based communication system experience an increase in efficiency in maritime operations of up to 45%, because all units involved can respond to threats in a much shorter time. The implementation of this system in Indonesia will allow helicopter pilots to immediately send information about suspicious vessels to the nearest patrol vessel, so that action can be taken immediately without having to wait for time-consuming manual coordination.

In addition to communication technology, synergy between elements must also be improved through regular training programs involving helicopter pilots and patrol vessel crews. This training should cover various operational scenarios, from surveillance to direct intervention against vessels that violate the law. A study by Wu (2024) showed that regular joint exercises between various maritime elements can increase the effectiveness of teamwork by up to 50%, because each unit understands their respective roles and responsibilities and can act with better coordination in emergency situations. Thus, in Indonesia, it is necessary to implement an integrated training program that is carried out periodically to ensure that all personnel involved in maritime operations have the same understanding of cooperation procedures and operational standards.

Better coordination must also be supported by a clear policy in the division of tasks and authorities between helicopters and patrol vessels. Currently, helicopter pilots act as air eyes that provide information to patrol vessels, but they do not have the authority to take direct action against violators. Meanwhile, patrol boats often experience delays in responding to reports from helicopters due to communication constraints and the limited speed of the ship in pursuing targets. Therefore, there needs to be a policy that provides greater flexibility in carrying out operations, for example by allowing helicopter pilots to give direct instructions to patrol boats based on the situation faced in the field. A study by Strating (2023) emphasized that flexibility in command structure and authority can increase the effectiveness of maritime operations, especially in dealing with dynamic threats that require a quick response.

In addition to technical and policy aspects, improving coordination must also include cooperation between the Indonesian Navy and other maritime institutions, such as the Maritime Security Agency (Bakamla), the Water Police, and other related agencies. Currently, there is still overlapping authority in maritime law enforcement operations which results in a lack of coordination and efficiency in prosecuting

lawbreakers. In a study by Suharyat (2022), it was found that poor coordination between various maritime institutions in Indonesia caused a decrease in operational effectiveness of up to 30%, because information could not be forwarded quickly and each institution worked separately without optimal integration. Therefore, a clearer coordination mechanism is needed between the various institutions involved in maritime law enforcement, either through the establishment of a joint command center or the use of an integrated communication system that can be accessed by all related parties. Improving coordination between elements also has a strategic impact on maintaining Indonesia's maritime stability and security. With the increasing complexity of maritime threats, such as smuggling, illegal fishing, and violations of sovereignty by foreign vessels, Indonesia must have a well-coordinated maritime operations system in order to respond to these threats quickly and effectively. A study by Kraska (2023) emphasized that countries with a high level of coordination in maritime operations tend to be better able to enforce the law in their waters and have greater bargaining power in maritime diplomacy. Therefore, strengthening the synergy between helicopters, patrol ships, and other maritime institutions not only has an impact on increasing operational effectiveness, but also has strategic value in maintaining the sovereignty of Indonesia's maritime territory. In the long term, increasing coordination between elements in maritime law enforcement operations can also provide significant economic benefits. Maritime crimes, such as illegal fishing and smuggling of goods, cause enormous economic losses for Indonesia. A study by Mamadlo (2025) shows that increasing the effectiveness of maritime patrols can reduce maritime crime rates by up to 40% in the first five years of implementing a better coordination system. Thus, increasing coordination not only contributes to the security aspect, but also has a positive impact on the national economy by reducing potential losses due to illegal activities in Indonesian waters.

3. Addition of Helicopter Fleet

The addition of a helicopter fleet in maritime law enforcement operations is an urgent need to increase the effectiveness of surveillance in Indonesia's vast sea area. With more than 3.2 million square kilometers of waters to be monitored, the number of helicopters currently available is still very limited compared to the increasing operational needs. Currently, the Indonesian Navy only has a few helicopters allocated for various missions, including maritime patrols, logistical support, and rescue operations. This limitation causes many sea areas to not be optimally monitored, providing opportunities for lawbreakers such as fishing vessels, smugglers, and violators of sovereignty to operate undetected. One of the main factors causing the small number of patrol helicopters is budget constraints and the priority of procurement of defense equipment which is more focused on warships and other defense systems. A study conducted by Wu (2024) shows that countries with larger defense budgets for air defense equipment tend to have a higher level of maritime patrol effectiveness than countries that only rely on patrol ships. In Indonesia, investing in a larger helicopter fleet will provide strategic advantages in terms of mobility, surveillance coverage,

and the ability to respond to threats more quickly than patrol boats that have limited speed and operational range.

Helicopters play a vital role in maritime law enforcement operations because they are able to cover large areas in a short time, allowing for more effective surveillance of suspicious maritime activity. A study by Kraska (2023) showed that air patrols are up to 60% more effective in detecting illegal activity than surface ship patrols. With more helicopters, Indonesia can implement a zone-based surveillance strategy, where each water sector has consistent air patrol coverage, so that there is no loophole for lawbreakers to operate undetected. This will also increase deterrence against foreign vessels attempting to illegally exploit marine resources in Indonesian waters.

In addition to increasing the number of helicopters, it is important to ensure that each additional unit is equipped with advanced surveillance technology, such as real-time surveillance, an Automatic Identification System (AIS), and underwater activity detection sensors. This technology allows helicopters to detect and identify suspicious vessels with greater accuracy, as well as transmit information directly to patrol vessels or command centers without significant time lag. A study by Fish (2024) shows that integrating technology into an air patrol fleet can increase surveillance effectiveness by up to 75%, as it allows for faster and more accurate data-based actions. Therefore, the procurement of new helicopters must be accompanied by the modernization of supporting systems so that operational effectiveness can be maximized. In operations, the addition of the helicopter fleet must also be followed by an increase in the number of personnel who have expertise in operating and maintaining helicopters. One of the challenges faced in the procurement of new defense equipment is the availability of trained human resources to operate it. A study by Mamadlo (2025) highlights that countries that carry out massive expansion in their air fleets often face problems in personnel training, which leads to low operational effectiveness due to lack of experience in handling new equipment. Therefore, training and education programs for helicopter pilots and technicians must be a priority in the strategy to increase air patrol capacity.

In addition to technical and human resource aspects, it is important to consider logistical and infrastructure aspects in adding a helicopter fleet. Currently, Indonesia still has limitations in terms of air bases and maintenance facilities for maritime patrol helicopters. Many strategic water areas, such as the border with the North Natuna Sea and the Malacca Strait, still lack infrastructure that can support optimal helicopter operations. Therefore, the addition of the fleet must be accompanied by the construction of supporting facilities such as helicopter bases, spare parts warehouses, and maintenance units spread across various strategic areas. A study by Strating (2023) shows that countries with adequate supporting infrastructure are able to maintain operational readiness of their air fleets by up to 85%, compared to countries that still rely on centralized maintenance facilities that often cause delays in helicopter repairs and maintenance. The addition of the helicopter fleet also has broad implications for Indonesia's national security and maritime diplomacy. With increasing tensions in the Indo-Pacific region due to maritime expansion

by several major countries, Indonesia needs to increase its maritime surveillance and law enforcement capacity to maintain the sovereignty of its maritime territory. A study by Bentley (2023) shows that countries with strong air patrol capabilities are better able to defend their maritime sovereignty claims than countries that only rely on patrol ships. With a greater number of helicopters, Indonesia can strengthen its air presence in border areas that are often vulnerable to sovereignty violations, such as the North Natuna Sea and the waters around Rote Island.

In addition, increasing air patrol capacity can also strengthen maritime security cooperation with neighboring countries and international organizations. By having a larger and more modern helicopter fleet, Indonesia can play a more active role in joint operations, such as joint exercises with the navies of friendly countries, as well as participation in regional maritime security initiatives. A study by Joesoef (2022) shows that countries with better air patrol capacity tend to be more trusted in maritime security cooperation, because they can make real contributions to joint surveillance and law enforcement operations. Thus, the addition of a helicopter fleet not only has an impact on operational aspects, but can also strengthen Indonesia's strategic position in maritime diplomacy.

In the long term, investing in a larger helicopter fleet will also provide significant economic benefits. Maritime crimes, such as illegal fishing, smuggling, and theft of marine resources, cause huge economic losses to Indonesia every year. A study by Maharani and Prajuli (2022) showed that countries with stronger air patrols experienced a decrease in maritime crimes of up to 50%, because criminals tend to avoid areas with high levels of surveillance. Thus, increasing the number of patrol helicopters not only contributes to security but can also protect Indonesia's maritime economic resources from illegal exploitation. The addition of a helicopter fleet in maritime law enforcement operations is a very important step to increase the effectiveness of surveillance and response to threats in Indonesia's maritime territory. With a greater number of helicopters, equipped with sophisticated technology and supported by adequate infrastructure, Indonesia can strengthen its air presence in its waters and increase its ability to enforce the law and maintain maritime sovereignty. Therefore, investment in the procurement and modernization of the helicopter fleet must be one of the main priorities in Indonesia's future maritime defense strategy.

4. Improvement of Operational Training and Simulation

Improving operational training and simulation for helicopter pilots and TNI AL patrol boat personnel is a very important aspect in increasing the effectiveness of maritime law enforcement. In joint operations, good coordination between air and sea units is the main factor that determines the success of the mission. Therefore, a more intensive and sustainable training program is needed so that each personnel has a deep understanding of their duties and roles in maritime operations.

One of the main challenges in joint operations is the lack of technical and strategic understanding between helicopter pilots and patrol boat crews. Differences in operational procedures and lack of experience in working together often lead to miscommunication and delays in decision-making. To overcome this, training must be focused on real scenarios

involving various operational aspects, including real-time communication, evacuation procedures, and interception techniques for vessels suspected of committing violations.

In addition, the use of technology in training must also be improved. Virtual reality (VR) and augmented reality (AR)-based simulations can be used to provide a more realistic experience for personnel without having to always be in the field. With this simulation, helicopter pilots can practice facing various high-risk scenarios, such as chasing foreign vessels that illegally enter Indonesian waters or rescuing hostages in the middle of the sea. Similarly, patrol boat crews can learn how to coordinate with helicopters in maritime surveillance or interception operations.

Training should also include improving skills in using more sophisticated communication and navigation systems. With the presence of more modern real-time surveillance systems and ship identification devices, pilots and patrol boat personnel must be able to operate this technology quickly and accurately. Therefore, training sessions should include technical lessons on the use of modern equipment as well as practice in a simulated environment that is close to real conditions at sea.

From a policy perspective, the Indonesian Navy needs to collaborate with maritime education and training institutions to develop a curriculum that is in accordance with the needs of operations in the field. This collaboration can involve academics, maritime security practitioners, and defense technology experts in designing training programs that are more adaptive to the development of global maritime threats. In addition, training exchange programs with other countries' navies can also be a solution to increase personnel capacity in facing challenges in increasingly complex waters.

As a concrete step, the Indonesian Navy can adopt a tiered training system that includes basic, intermediate, and advanced stages. At the basic stage, personnel will gain an understanding of the basics of navigation, maritime law, and operational communication procedures. At the intermediate stage, joint operation simulations will be introduced, where helicopter pilots and patrol boat crews work together in more complex scenarios. Meanwhile, at the advanced stage, training is conducted in a real operational environment, where personnel are tested in situations that demand more precision and speed of decision-making.

Improving operational training and simulations is not only important in increasing the effectiveness of maritime law enforcement operations, but also has an impact on increasing personnel safety. With a better understanding of the operating procedures and technology used, the risk of errors in decision-making can be minimized. Thus, maritime law enforcement operations involving helicopters and patrol boats can be carried out more optimally, effectively, and safely in maintaining the sovereignty of Indonesia's maritime territory.

The results of the interviews showed that although helicopters have a very important role in maritime law enforcement operations, there are still various obstacles that must be overcome immediately. With the revision of regulations, modernization of technology, increased coordination, and addition of the fleet, the role of helicopters

can be more optimal in maintaining the security and sovereignty of Indonesia's maritime territory.

In maritime law enforcement, the existence of Indonesian Navy (TNI AL) helicopters has a very important role in supporting surveillance and security operations in Indonesian waters. With the vastness of national waters and the challenges that arise from illegal activities such as illegal fishing, smuggling, piracy, and violations of territorial boundaries, the effectiveness of surveillance is important in maintaining maritime sovereignty. However, this study found that TNI AL helicopter pilots still face obstacles in terms of legal authority, coordination with sea patrol elements, and limitations in technology and fleet size. These obstacles are in line with Bentley's research [3] which revealed that the imbalance in maritime surveillance in the Indo-Pacific region is often caused by technological limitations and a lack of coordination between sea and air defense elements. This shows that in order to increase the effectiveness of law enforcement operations, it is necessary to strengthen clear regulations and better system integration between air and sea elements.

One of the main problems found in this study is the absence of regulations that explicitly give authority to TNI AL helicopter pilots to carry out direct legal intervention. Currently, helicopter pilots only act as surveillance elements that detect suspicious activity and report to patrol ships for follow-up. This is in line with Mamadlo's view [11] who emphasized that the legal aspects of flight safety in the Indonesian Navy environment still need to be clarified, especially in relation to decision-making authority in the field. On an international scale, Strating [4] also highlighted how unclear regulations are often a major obstacle in the military's response to maritime incidents. To overcome this problem, a revision of regulations is needed that gives helicopter pilots greater authority in certain situations, especially in cases where direct action can prevent further threats to national security. In addition to the legal authority aspect, operational coordination between helicopters and patrol ships is also a significant challenge in the effectiveness of maritime law enforcement operations. This study found that there are still obstacles in the communication and coordination system between these two elements, which often results in delays in decision-making. Shodiq et al. [2] revealed that violations of Indonesian air sovereignty often cannot be responded to immediately due to a suboptimal coordination system between air and sea elements. This shows that modernization of communication and navigation systems is needed to improve operational synergy. Maharani and Prajuli [9] also highlighted that reliance on conventional communication systems increases the risk of misinformation and delayed responses. Therefore, the development of an integrated real-time communication system between sea and air patrol elements is an urgent need to increase the effectiveness of operations.

In terms of technology, this study found that the limited number of helicopters and the lack of advanced technology in aerial surveillance systems are factors that slow down the response to maritime threats. Wu [6] emphasized that modernization of defense equipment is a key element in maintaining maritime security in Southeast Asia, especially for countries with significant water areas such as Indonesia. This is

reinforced by Fish's research [5] which highlights the importance of using drone-based technology and automatic monitoring systems in increasing the effectiveness of maritime surveillance. However, in Indonesia, the implementation of this kind of technology is still limited. Therefore, investment is needed in the procurement of helicopters with advanced technology such as high-resolution cameras, real-time tracking systems, and automatic sensors that allow early detection of threats in maritime areas. Analysis of the interview results shows that the number of helicopters currently available is still far from sufficient to monitor all Indonesian waters. This reinforces the findings of Kalasmoro et al. [10] which shows that military operations scenarios in the Nusantara region require an increase in the number of air fleets to ensure a faster response to potential threats. In the research of Pratama et al. [12], it is stated that the design concept of a fast patrol boat integrated with an aerial surveillance system can increase the effectiveness of law enforcement operations. Therefore, the strategy of increasing the number of helicopter fleets and strengthening operational integration between patrol ships and helicopters is a step that needs to be implemented immediately to increase the reach of Indonesia's maritime surveillance.

This study also found that the maritime security threats faced by Indonesia are increasingly complex, especially with the increasing activity of foreign countries in the South China Sea region. Kraska [18] emphasized that the geopolitical dynamics in East Asia require a more proactive response in maintaining maritime security, including by increasing the readiness of air and sea elements. This is reinforced by Sukoco [19] who highlighted the role of the Marine and Air Police Corps (Korpolairud) in maintaining security in the Sunda Strait, which can be used as a model to strengthen coordination between air and sea elements in Indonesian Navy operations. Therefore, strengthening the joint operation strategy between the Indonesian Navy, Bakamla, and Polairud is an important step in facing maritime security challenges in the future.

As an implication of this study, there are several strategic recommendations that can be taken to improve the effectiveness of maritime law enforcement operations in Indonesia. First, regulatory revisions are needed to provide clearer authority for helicopter pilots to carry out legal interventions against illegal activities at sea. Second, strengthening real-time communication and navigation systems between helicopters and patrol boats is a priority to reduce delays in operational response. Third, modernization of aerial surveillance technology must be carried out immediately by adopting drone systems, high-resolution cameras, and automatic sensors to increase the effectiveness of detection and surveillance. Fourth, increasing the number of helicopter fleets must be part of the maritime defense strategy to expand the scope of surveillance and accelerate the response to threats. Fifth, coordination between air and sea elements must be strengthened through intensive training and joint operational simulations between the Indonesian Navy, Bakamla, and Polairud to ensure better synergy in dealing with maritime security threats.

This study confirms that Indonesian Navy helicopter pilots have a strategic role in maritime law enforcement operations, but still face various challenges that affect their operational

effectiveness. Referring to the findings of previous studies, it can be concluded that increasing the effectiveness of maritime law enforcement operations in Indonesia requires a holistic approach, including aspects of regulation, technology, operational coordination, and increasing the number of fleets. With the implementation of the right strategy, it is hoped that the security and sovereignty of Indonesia's maritime territory can be maintained more effectively and efficiently.

The implications and contributions of this study are very broad in maritime law enforcement, especially related to the role of Indonesian Navy helicopter pilots in maintaining the security of Indonesian waters. From a regulatory perspective, the findings of this study indicate that there are still gaps in policies that limit the authority of helicopter pilots to take direct action against ships suspected of violating the law. Therefore, the policy implication that can be proposed is the need to revise the regulations governing the role and authority of helicopter pilots in law enforcement operations. Regulations that are more flexible and adaptive to technological developments and modern maritime challenges will allow pilots to participate more actively in interception or direct ship stopping actions. This will make a significant contribution to accelerating the process of taking action against violations of the law at sea and increasing the effectiveness of maritime operations as a whole.

From an operational perspective, this study underlines that there are still obstacles in coordination between helicopters and maritime elements in law enforcement operations. Communication barriers that occur, especially in real-time data sharing, result in delays in responding to maritime threats. Therefore, the contribution of this study in the operational aspect is to provide recommendations on improving a more integrated communication system, such as the use of real-time surveillance technology and artificial intelligence-based devices to improve detection accuracy and decision-making speed in maritime operations. With a more sophisticated and connected system, helicopter pilots can coordinate with patrol vessels more effectively, so that any suspicious ship movements can be monitored and followed up more quickly. In addition, the implications of this study also cover the technological aspect, where there are still limitations in the use of support systems used by helicopter pilots in law enforcement operations. With the finding that not all helicopters are equipped with real-time surveillance systems, this study contributes by highlighting the importance of equipment modernization in supporting the effectiveness of maritime air operations. The recommendation that can be taken from this study is the need for investment in more advanced navigation and surveillance technology, such as the Automatic Identification System (AIS), Synthetic Aperture Radar (SAR), and electro-optical infrared (EO/IR) devices that can improve the pilot's ability to detect and identify suspicious vessels. With this technology, the pilot not only acts as an air eye, but can also provide more accurate analysis to the sea patrol team in making decisions.

In terms of human resources, this study also provides an important contribution to improving training and operational simulations for pilots and patrol boat personnel. With the findings that lack of technical understanding and differences in operational procedures are obstacles in joint operations, this

study emphasizes the need for more intensive and real-scenario-based training programs. One implication that can be taken is the development of a training curriculum that includes the use of advanced technology, tactical communication in joint operations, and maritime interception and security strategies. Thus, personnel can work in a more integrated and responsive manner in dealing with threats at sea, which will ultimately increase the effectiveness of maritime law enforcement operations as a whole.

Another implication that is no less important is in terms of maritime defense strategy. With the increasing threats in Indonesian waters, including smuggling, piracy, and violations of sovereignty by foreign vessels, this study contributes to formulating a more adaptive and technology-based maritime security strategy. One strategy that can be implemented is strengthening maritime domain awareness through the integration of more sophisticated air and sea monitoring systems. With this integration, any suspicious ship movements can be detected early on, so that preventive measures can be taken before the threat develops into a more serious violation.

This research also contributes to strengthening international cooperation in the field of maritime security. Given that Indonesia shares direct borders with various countries and has strategic waters in global trade routes, the implication of this research is the need to increase cooperation with other countries in surveillance and law enforcement at sea. One form of cooperation that can be carried out is the exchange of technology and information on maritime security, as well as joint exercises between the Indonesian navy and partner countries to improve readiness in facing threats in the waters. With this cooperation, maritime operations involving helicopters and patrol ships can be carried out with higher standards and based on best practices from other countries.

Academically, this research also contributes to the literature in the field of maritime security and air defense studies. By highlighting the role of helicopter pilots in law enforcement operations, this research opens up further discussion on how navies can optimize the role of air elements in maritime security strategies. The findings produced can be the basis for further research in exploring various technical, operational, and policy aspects related to the use of helicopters in maritime operations. Thus, this research not only has practical impacts, but also provides theoretical insights that can enrich studies in the field of maritime security.

Other implications can also be found in the economic and defense budget policy aspects. With the need for technological modernization and the addition of helicopter fleets, this study contributes by highlighting the importance of allocating a larger budget for the maritime defense sector. With the right investment in equipment and human resources, the effectiveness of law enforcement operations at sea can be improved, which will ultimately contribute to the protection of maritime resources and the smooth running of economic activities in Indonesian waters. In addition, by strengthening the capacity of maritime security, the potential for economic losses due to illegal activities, such as illegal fishing and smuggling, can be minimized, so that national economic

stability can be better maintained. Overall, the implications and contributions of this study are very broad and cover various aspects, ranging from regulations, operations, technology, human resources, defense strategies, international cooperation, academics, to economic policies. By identifying various challenges and providing evidence-based recommendations, this study is expected to be the basis for formulating more effective policies in strengthening Indonesia's maritime security. In addition, with deeper insight into the role of helicopter pilots in law enforcement operations, it is hoped that there will be concrete steps from stakeholders to improve coordination, technology, and personnel capacity in carrying out their duties. Thus, this research not only provides benefits for the development of maritime defense strategies, but also contributes to the stability and sovereignty of Indonesia's maritime territory as a whole.

IV. CONCLUSIONS

Based on the results of interviews and data analysis that have been conducted, it can be concluded that TNI AL helicopter pilots have a strategic role in maritime law enforcement operations, especially in the aspect of supervision and monitoring of Indonesian waters, but still face various obstacles in terms of legal authority, operational coordination, and technological support and fleet size. Helicopters are used as air eyes that allow faster detection of illegal activities, such as illegal fishing, smuggling, and violations of territorial boundaries, but their role is still limited to supervision and reporting without the authority to take direct action against violators of the law at sea. The regulatory gap is one of the main problems, where until now there has been no legal basis that explicitly regulates the authority of helicopter pilots in maritime law enforcement, so that all forms of legal action must still be carried out by patrol ships or units that have legal authority. In addition, coordination between helicopters and patrol ships is still not optimal, especially due to the limitations of communication and navigation systems that hinder the exchange of information in real time. As a result, the response to threats is often delayed, allowing suspected ships to escape before action can be taken. On the other hand, the limited number of helicopters and the lack of sophisticated technology in the aerial surveillance system are also serious challenges to the effectiveness of this operation. Modernization of communication, navigation, and monitoring systems is needed, including the implementation of real-time surveillance, high-resolution cameras, and automatic data integration between air and sea elements, so that helicopters can provide more accurate information and support faster decision-making. In addition, increasing the number of helicopters is needed to increase the coverage of air surveillance throughout Indonesia's vast waters. To improve the effectiveness of maritime law enforcement operations, revisions to regulations that provide greater authority to helicopter pilots must be carried out immediately, so that they can carry out actions beyond just monitoring and reporting. Improved coordination between air and sea elements is also needed through intensive training and joint operational simulations, to ensure better synergy in dealing with maritime security threats. With policy reform, technological

modernization, increasing the number of fleets, and strengthening operational coordination, it is hoped that the role of helicopters in maritime law enforcement can be more optimal, so that the security and sovereignty of Indonesia's sea areas can be maintained more effectively and efficiently.

REFERENCES

- [1] M. B. Zaman, A. Santoso, and B. Cahyono, *Aspek Safety Pada Perancangan Sistem Dan Permesinan Di Kapal*. Penerbit NEM, 2023.
- [2] D. A. F. Shodiq, I. Asmarudin, and T. V. Widyastuti, *Pelanggaran Kedaulatan Ruang Udara Indonesia Menurut Hukum Internasional*. Penerbit NEM, 2023.
- [3] S. Bentley, *The Maritime Fulcrum of the Indo-Pacific: Indonesia and Malaysia Respond to China's Creeping Expansion in the South China Sea*. Naval War College Press, 2023.
- [4] B. Strating, "Assessing Military and Non-Military Incidents at Sea in the Asia-Pacific," 2023.
- [5] A. Fish, *Oceaning: Governing marine life with drones*. Duke University Press, 2024.
- [6] S. Wu, *Military Modernisation in Southeast Asia after the Cold War: Acquisition, Retention, and Geostrategic Impacts*. Taylor & Francis, 2024.
- [7] A. M. Fadillah, "Analisis Politik dan Hukum Pelintasan Wilayah Laut Indonesia oleh Negara yang Tidak Meratifikasi UNCLOS 1982," *Aufklarung J. Pendidikan, Sos. dan Hum.*, vol. 2, no. 4, pp. 430–441, 2022.
- [8] Y. Suharyat, "Sektor Pertahanan Dan Keamanan Negara," *Dampak Perkemb. Transp. Di Berbagai Sekt.*, vol. 71, 2022.
- [9] C. Maharani and W. A. PRAJULI, "Assessing the risk of technological disaster in Indonesian armed forces," *Indones. Q.*, vol. 50, no. 1, pp. 6–29, 2022.
- [10] K. Kalasmoro, S. Sutisna, S. Arief, and A. Haryanto, "Simulation of Military Operation to National Capital City (IKN) Nusantara if Sipadan Island is a Military Base," *Int. J. Humanit. Educ. Soc. Sci.*, vol. 2, no. 6, 2023.
- [11] A. S. Mamadlo, "Aspek Hukum Dalam Keselamatan Penerbangan Pesawat Udara Di Lingkungan Tentara Nasional Indonesia Angkatan Laut," *Iuris Stud. J. Kaji. Huk.*, vol. 6, no. 1, pp. 64–72, 2025.
- [12] A. S. Pratama *et al.*, "Fast patrol boat hull design concepts on hydrodynamic performances and survivability evaluation," *J. Appl. Eng. Sci.*, vol. 21, no. 2, pp. 501–531, 2023.
- [13] N. Joesoef, "Enhancing the Indonesia Air Defense System: Confronting the challenges and military build-up In the Indo Pacific region," *Tech. Soc. Sci. J.*, vol. 32, p. 592, 2022.
- [14] S. Burgess, "The US-Indonesian Strategic Partnership and Air Force Relations.," *J. Indo-Pacific Aff.*, vol. 6, no. 3, 2023.
- [15] J. Z. A. J. Z. Adu, R. Sumantri, and J. Herman, "The Selection of Escort Helicopter to Support Operational Ready Force Navy with Analytical Network Process (ANP) Method," *J. Ind. Eng. Manag. Res.*, vol. 5, no. 4, pp. 133–145, 2024.
- [16] M. F. H. A. U. Ret, "Marine Air-Ground Task Forces in Military Operations Other than War, 1990s," *Mar. Corps Hist.*, vol. 10, no. 1, pp. 42–66, 2024.
- [17] R. Karsa and J. A. Russell, "US-Indonesia Naval Cooperation: The Evolution Of Exercise Carat, 2005-2021," *Mod. People's Lib. Army*, 2022.
- [18] J. Kraska, "Deterrence and Compliance in East Asia's Maritime Order," in *Peaceful management of maritime disputes*, Routledge, 2023, pp. 237–254.
- [19] S. Sukoco, "Peran Korps Kepolisian Perairan Dan Udara (Korpolairud) Dalam Menjaga Keamanan Di Wilayah Selat Sunda," *Strateg. Pertahanan Udar.*, vol. 8, no. 2, 2022.