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AIR & SPACE POWER: MARITIME SECURITY

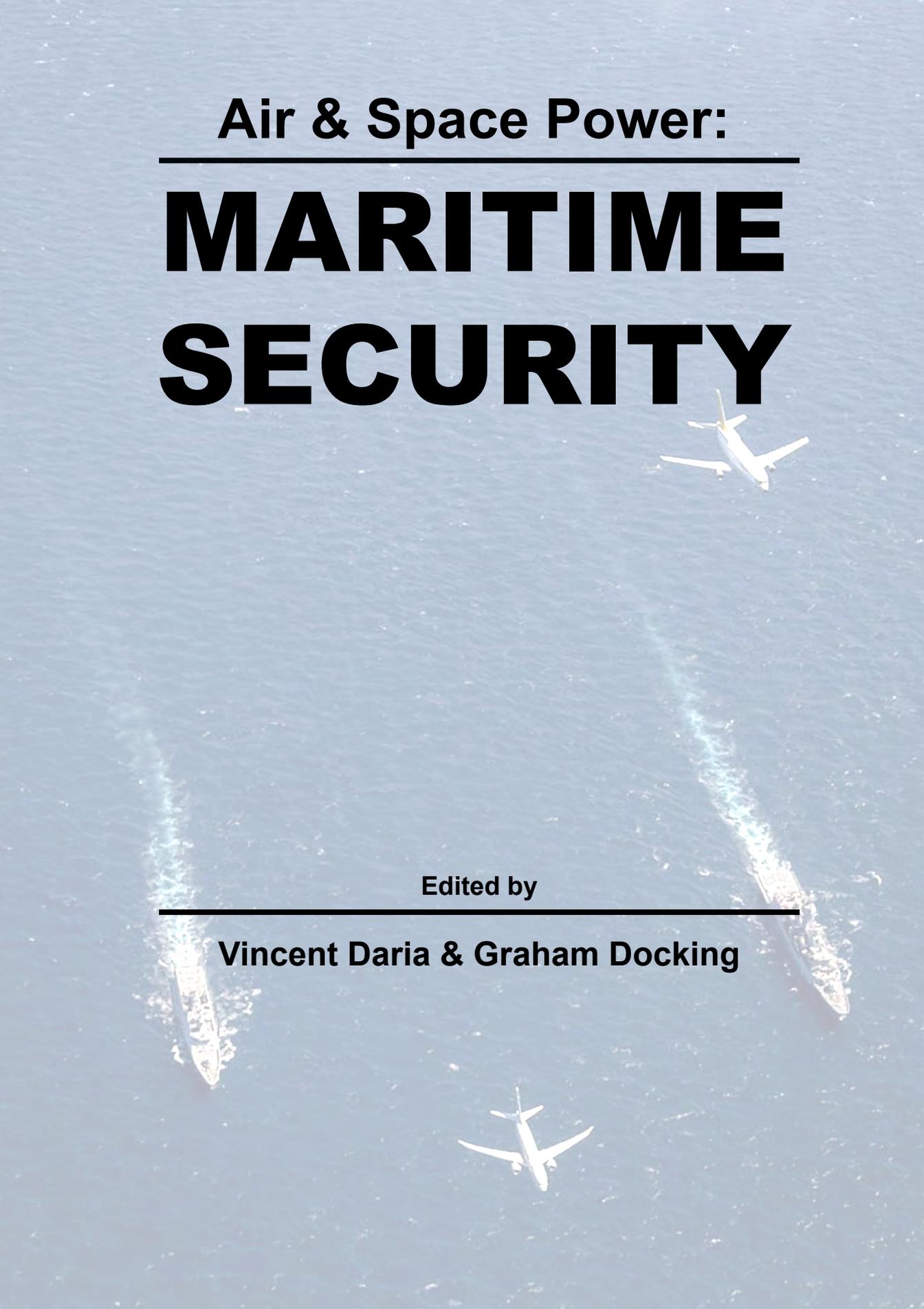
Editors:
Vincent Daria & Graham Docking



**AIR AND SPACE
POWER CENTRE**

Air & Space Power:

MARITIME SECURITY

An aerial photograph of a maritime security operation. Two large, dark-hulled ships are moving in parallel tracks across the blue ocean, leaving white wakes. Two white aircraft are flying in the sky above the ships. The overall scene is captured from a high-angle perspective.

Edited by

Vincent Daria & Graham Docking



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The *Kestrel Papers Series* is a compilation of essays written by a number of young military professionals who have endeavoured to study air and space power and contemplate its further progress into the 21st century. This monograph is a selection of essays by air force officers from ASEAN member states who have participated in the ASEAN–Australia Maritime Security Research Program. They explore the use of air and space power to solve pressing maritime security threats in the region.

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Foreword



I acknowledge the significant effort undertaken by the Air and Space Power Centre (ASPC) in convening the ASEAN–Australia Maritime Security Research Program. The program supports Australia’s Defence Partnership for the Future with ASEAN, which identifies maritime security as a key area of focus. It also aligns with the objectives set out in the 2019 ASEAN Outlook on the Indo-Pacific. It seeks to address shared regional priorities by providing an opportunity to foster stronger military to military relationships and exchange views on maritime security. It also provides a platform to explore security threats to Southeast Asian maritime activities, while promoting the principle of maintaining free and open Indo-Pacific as well as ASEAN-centred solutions to regional issues.

This monograph is a collection of essays by defence scholars who have participated in the research program since 2021. This monograph is published by the ASPC as part of the *Kestrel Papers Series* and holds a special place by offering an opportunity for our visiting defence scholars from ASEAN member states to explore contemporary topics on maritime security in the region.

I highly commend the efforts of our visiting scholars whose papers have been selected for publication here. I also want to acknowledge everyone in the program who has had the courage to write on maritime security challenges and their impact on our region.

Bernard Philip

First Assistant Secretary International Policy

Acknowledgements

We would like to express our sincere gratitude to the reviewers, WGCADR Andrew Rees, MAJ David Cooling and FLTLT Shane Ivimey, who generously dedicated their time and expertise in shaping the chapters. Their insights and constructive feedback have been invaluable. We would also like to thank Kerry Blackburn for the final edits and careful attention to detail that shaped this book to its final form. We are especially grateful for her patience when editing multiple drafts and spotting fine inaccuracies. This project is stronger, more precise and more accessible because of Kerry's contribution. Lastly, we would like to thank Gabrielle Parker and GPCAPT Steven Ferguson who have supported the publication of this book. Thank you for your generosity, professionalism and dedication to the advancement of knowledge.

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1

Enhancing maritime security through air and space power

Vincent Daria

Air and Space Power Centre

Maritime security (MARSEC) is a concept that addresses diverse threats, challenges and opportunities in the maritime domain (Bueger & Edmunds, 2024). It encompasses measures and practices to protect the maritime domain from threats and illegal activities, ensuring safety, security and economic stability. MARSEC involves a wide range of activities, including border protection, law enforcement, and the implementation of security measures for vessels, ports and offshore facilities. The geopolitical region encompassing the Indian and Pacific Oceans (Indo-Pacific) faces a range of MARSEC threats, including territorial disputes, illegal fishing, piracy and transnational crimes. At the centre of the Indo-Pacific are member states of the Association of Southeast Asian Nations (ASEAN) which face these challenges head-on. To address these challenges, ASEAN has established a number of programs for research, dialogue and cooperation (The ASEAN Secretariat, 2023).

Australia is also increasing its maritime partnerships with ASEAN to enhance regional security and prosperity. The ASEAN–Australia MARSEC Research Program seeks to foster people-to-people links and mutual understanding between the Australian Defence Force and defence organisations of state members of ASEAN. The program is designed to contribute to MARSEC debates in Australia, Southeast Asia and across the Indo-Pacific. The research program invites defence officers from ASEAN member states to develop a deeper understanding of the maritime security and strategic challenges confronting their own countries, as well as an appreciation of Australia’s maritime interests and strategy.

Noting that MARSEC is not just a challenge for maritime agencies such as the Coast Guard and Navy, the ASEAN–Australia MARSEC Research Program invites Air Force officers to explore alternative solutions to pressing maritime threats. Air and space power play a crucial role in MARSEC by providing intelligence, surveillance and reconnaissance (ISR) as well as strike capabilities. Air power offers a unique perspective and responsiveness, enabling rapid reactions to threats and improving overall situational awareness at sea (Australian Defence Force, 2023). On the other hand, space power refers to the use of aerospace capabilities and

related technologies for persistent surveillance, communication and navigation to enhance maritime domain awareness (Defence Space Command, 2022). This book is a selection of essays written by Air Force officers from ASEAN member states who have participated in the MARSEC Research Program. They explore innovative solutions to pressing MARSEC threats within the region.

Illegal, unreported and unregulated fishing (IUUF) is a serious MARSEC threat, which refers to fishing activities that violate national and international laws such as fishing without a licence, misreporting of catches, fishing in prohibited areas as well as using illegal fishing gear. IUUF could be mitigated by strengthening monitoring and surveillance as discussed by MAJ Rizky Randiguna of the Indonesian Air Force and GPCAPT Nittapon Srisuk of the Royal Thai Air Force. Randiguna focuses on the Indonesia–Australia maritime boundary and discusses how the Air Forces from the two countries could utilise existing capabilities to enhance MARSEC in the region. Randiguna highlights air power characteristics (speed, range, flexibility, precision and surprise) that can assist the Australian and Indonesian Navies in carrying out MARSEC operations in the region. On the other hand, Nittapon focuses on the European Union’s (EU) sanctions on countries not complying with the EU’s regulatory framework for combating IUUF. Nittapon proposes to enhance Thailand’s efforts to comply with the framework by applying air power for effective monitoring, control and surveillance (MCS) via uncrewed aerial systems (UAS). GPCAPT Virasak Chansriharaj also provides a clearer picture of Thailand’s maritime environment and discusses the advantages of air and space power to enhance ISR. Virasak discusses how the Royal Thai Air Force could expand its UAS force as well as space capabilities to deter or disrupt IUUF and emerging threats of maritime piracy, which could have enormous implications for Thailand.

Maritime piracy encompasses the act of robbery or violence at sea involving hijacking of ships and cargo as well as taking crew as hostages for ransom. Piracy is common in the Straits of Malacca and Singapore (SOMS) as well as in the Sulu-Celebes Seas. LTCOL Bryan Brotonel of the Philippine Air Force discusses the Trilateral Cooperative Arrangement (TCA) between Indonesia, Malaysia and the Philippines, which aims to address the escalating MARSEC threats in the Sulu-Celebes Seas. Bryan identifies challenges of the implementation of the TCA and proposes enhancements through air and space power by utilising the basic features of speed, reach and ubiquity. On the other hand, LTCOL Rahman Fauzi of the Indonesian Air Force investigates past piracy incidents and assesses the effectiveness of previous responses to be able to formulate solutions. He argues that piracy and armed robbery against ships could be managed by understanding the pattern of crimes committed and setting up appropriate mitigating measures.

Drug trafficking is a major challenge in Southeast Asia with broader impacts extending beyond the region with sophisticated distribution channels. In 2024, the illicit manufacture and trafficking of drugs from the Golden Triangle have grown significantly with an average increase of 24% compared to the previous year (United Nations Office on Drugs and Crime, 2025). GPCAPT Chano Tassaró of the Royal Thai Air Force discusses drug cartels in the region and proposes a potential solution using Multi-Domain Operations (MDO) that integrates capabilities from maritime, air, land, cyber and space. Chano argues that drug trafficking cannot be eliminated using only a single force or domain nor from a single state and proposes that a multinational MDO approach could not only solve drug trafficking but also foster cooperation among ASEAN member states.

Protecting sovereignty and territorial integrity enables economic prosperity through accessing maritime resources or facilitating trade. FLTLT Iskandar Firyanata of the Indonesian Air Force argues that space technology can improve the efficacy of Indonesia’s maritime domain awareness. Iskandar discusses the use of space technologies to enhance MARSEC and Indonesia’s

sovereignty. On the other hand, sovereignty issues in disputed areas of the South China Sea have been the focus of attention amidst great power rivalry, of which the Philippines and other ASEAN member states are caught in the middle. CAPT John Leo Romero of the Philippine Air Force discusses challenges in maintaining control of the air over the region due to the Philippines' historical shift in focus from external to internal or domestic operations. The shift is due to the nation's long-term fight against domestic insurgency and the impact of natural disasters. He argues that the Philippines must enhance its capabilities and foster strategic partnerships with Australia and neighbouring countries.

MARSEC is vital in safeguarding global trade routes and maritime resources, particularly in the Indo-Pacific. From combating IUUF and piracy to protecting sovereignty, exploring innovative solutions helps protect the safety and prosperity of maritime trade and resources in the Indo-Pacific.

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2

The role of air power in securing the Indonesia–Australia maritime boundary

Rizky Randiguna
Indonesian Air Force

As neighbours, Australia and Indonesia share territorial maritime borders and play equivalent roles to secure this maritime region. The two countries have operated maritime security patrols to secure their own territorial waters and maritime traffic. Both countries have their respective maritime policies in line with bilateral relations to secure the maritime region. Air power characteristics (speed, range, flexibility, precision and surprise) can assist the Navy in carrying out maritime security operations. Here, I argue that the efforts of the Air Force can significantly improve security in the maritime boundary area between Indonesia and Australia. I will focus on the significant issues of illegal, unreported and unregulated fishing (IUUF) within the Indonesia–Australia water boundary and how the Air Force can utilise air power to enhance maritime security. I will provide subsequent recommendations to optimise and coordinate capabilities between the two countries.

2.1. Introduction

As an island, continent and country positioned between the Indian and Pacific Oceans, Australia relies heavily on international trade to maintain its prosperity and economic stability. Over 99% of Australia's trade transits through the maritime domain, with AUD\$650 billion of trade moving through Australian seaports annually (Ports Australia, 2024). On the one hand, maritime routes that are used as trade routes in the Indian Ocean and the Pacific Ocean have various risks in the form of disturbances in the maritime approach area or sea line of communication which eventually may have direct or indirect consequences for the national economy and national security. On the other hand, by being a nation that does not share a land border with any other nation, Australia puts its attention on a maritime strategy to secure its interests and sovereignty. These geographical conditions make Australia critically dependent on overseas trade

and the maritime environment. It means that Australia should actively protect its national interests, prosperity and security in the maritime domain. This vulnerability and dependence make maritime security a fundamental condition to be implemented and optimised by the Australian Defence Force (ADF).

Indonesia as the biggest archipelago country in the world has an important role in securing its maritime territory. It comprises some 17,500 islands and its total territorial area is ~1.9 million km² (93,000 km² of sea and ~1.8 million km² of land) (Central Intelligence Agency, 2025). Indonesia's status has been recognised worldwide since the United Nations Convention on the Law of the Sea (United Nations, 1982) and Indonesia ratified the convention in 1985. Joko Widodo, then president of the Republic of Indonesia conveyed the vision of the state of Indonesia as 'a global maritime fulcrum' (Witular, 2014). This was officially disclosed to the international community in terms of efforts to realise Indonesia's geostrategy which differs from efforts to utilise Indonesia's maritime assets both strategically and economically.

In realising the ideals of the Indonesian nation as the global maritime fulcrum, President Joko Widodo declared five main pillars: (1) development of Indonesian maritime culture; (2) optimal protection and management of marine resources for the benefit of the people; (3) infrastructure development and maritime connectivity; (4) maritime cooperation through diplomacy; and (5) development of maritime defence forces (Witular, 2014).

The vision of the global maritime fulcrum (GMF) cannot be separated from Indonesia's distinctive geographical conditions. It is the largest archipelagic country in the world and strategically located between the Indian and Pacific Oceans, which are international trade routes and the driving force of the world's economy. Meanwhile, Indonesia's maritime area holds abundant wealth with rich biodiversity and energy resources. However, the strategic position and breadth of Indonesia's maritime area can also create vulnerability to various forms of maritime threat, such as illegal, unreported and unregulated fishing (IUUF), piracy, people smuggling, drug smuggling and others. With this background, Indonesia's identity as a maritime nation is largely determined by how the Indonesian nation protects and secures its maritime territory for national and international interests.

Indonesia and Australia share one of the longest maritime boundaries in the world. Stretching from Christmas Island to the south of Papua Island, within the Torres Strait, this area is close to the north of Australia, and the main sea routes that connect Australia with global trade require roles in maintaining regional security, sovereignty and national interests. There is therefore a need for control, security and stability of the air and sea approach areas both regionally and globally. These conditions require Australia and Indonesia to be proactive in maritime strategy through harmonious collaboration in deploying their sea force and air force capabilities. The Australian Government has strategic defence objectives to shape, deter and respond to attacks or threats to its national interests and to make effective military contributions to support the security of maritime Southeast Asia (Department of Defence, 2020). These objectives require the Australian Defence Force (ADF) to meet the strategic tasks, and the Royal Australian Air Force (RAAF) supports the joint force with core air power roles. Therefore, these conditions mean the RAAF has a major role in controlling air space to enable control of the sea and contribute directly to all other military operations.

Other government agencies also share responsibility for maritime security by carrying out their duties against illegal activities in the maritime domain. Australia's Maritime Border Command (MBC) is enabled by the Australian Border Force (ABF) and the ADF. MBC has the capability to anticipate and respond to identified civil maritime threats by utilising various surface and air assets from the ABF and ADF. Meanwhile, Indonesia's Badan Keamanan Laut (BAKAMLA) is the agency responsible for keeping and maintaining security and safety within

Indonesia's maritime territory. These government agencies carry out their duties by detecting, intercepting and responding to any possible threats within the civil maritime domain. Therefore, the importance of maritime security means support is required from the whole of government to protect respective national interests.

2.2. Shared maritime boundary and bilateral cooperation

Australia and Indonesia are natural maritime partners. The vast maritime shared boundary between Indonesia and Australia stretches more than 2,100 nautical miles. The shared boundary has three separate segments: (1) between Australia, Indonesia and Papua New Guinea; (2) westward from the point where the territorial waters of the two countries touch the western limits of Timor Leste's territorial waters claim in the Indian Ocean; and (3) between the Australian external territory of Christmas Island and the Indonesian island of Java, in the Indian Ocean. Indonesia and Australia have recognised each other's territory based on the geographical location of the sea which is directly adjacent to each other.

The bilateral cooperation between Indonesia and Australia on maritime security is built based on shared interests. To manage this bilateral cooperation, the two countries have solid relations between their Air Forces. For instance, the biennial Exercise Pitch Black is hosted by the RAAF. The Indonesian Air Force (TNI AU) participated in the 2024 exercise by sending F-16 Fighting Falcon aircraft, pilots and crews to RAAF Base Darwin. Australia's participation included the F-35A Lightning, E/A-18G Growler, E-7A Wedgetail and KC-30A Multi Role Tanker in the exercise. The training and integration of the Air Forces in combined air combat operations have a pivotal aim in ensuring the Air Forces' readiness to respond whenever the national government or international security requires it.

Furthermore, in the maritime air patrol capability, RAAF and TNI AU have an annual bilateral exercise, Albatross Ausindo. The exercise conducted by Boeing 737 Maritime Patrol from No. 5 Squadron, TNI AU, and P-8A Poseidon from No. 11 Squadron, RAAF (AP-3C Orion formerly) represented an important opportunity to build on the nations' mutual understanding of interoperability in support of maritime security interests. Ultimately, continuing to work and train together gives benefits to both nations and becomes an understanding partnership for generating and sustaining air power.

2.3. Illegal, unreported and unregulated fishing (IUUF)

As the human population increases, it is directly proportional to the increase in basic human needs, namely food, where fish is one of the staple foods. In Indonesia, the level of national fish consumption increased to more than 1.2 million tons in line with population growth, which reached 1.34% per year. At the global level, the level of fish consumption reaches 19 kg/capita/year, coupled with a global population growth that reaches 1.8% per year. On the other hand, the level of availability of global fisheries resources has a deficit of up to 9-10 million tons per year (Jaelani & Basuki, 2014). This can trigger the emergence of IUUF practices in areas where it is predicted that there are still many fishery resources. Therefore, fish is a commodity that can generate enormous profits for each country and the individual who produces it. This is one of the reasons why fishermen, especially traditional fishermen, are tempted to increase their catches to meet market and economic needs.

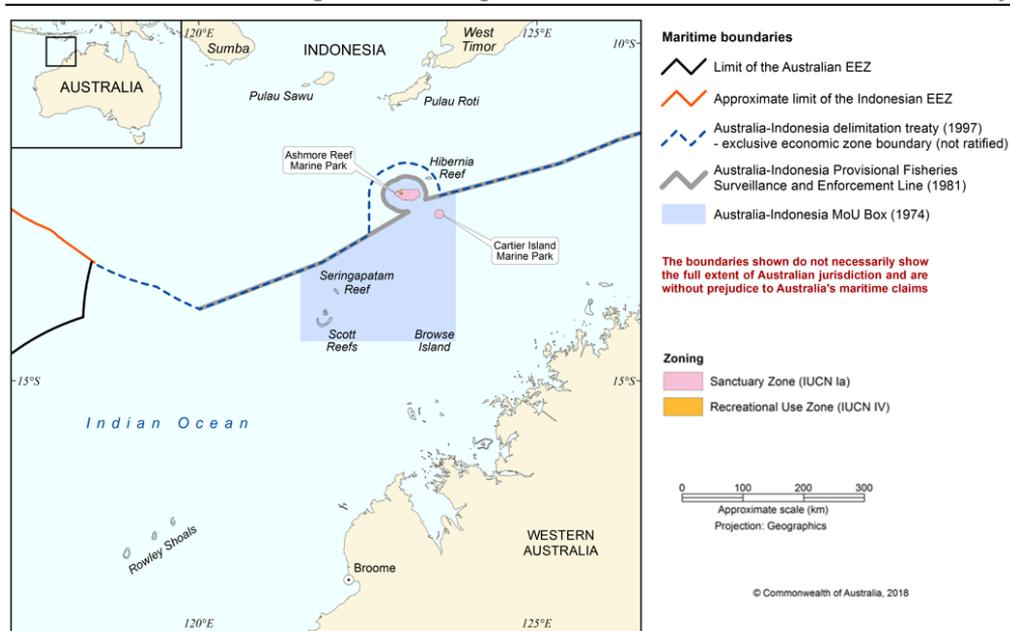


Figure 2.1. Traditional Indonesian Fishing within the MoU Box (Reproduced from Australian Fisheries Management Authority, 2023).

In 1974, a Memorandum of Understanding (MoU) between Australia and Indonesia was signed to allow Indonesian traditional fishermen to operate within Australia's Exclusive Fishing Zone and Continental Shelf also known as the MoU Box as shown in **Figure 2.1** (Australian Fisheries Management Authority, 2023). The MoU stipulated five operational areas: (1) Ashmore Reef (Sand Island); (2) Cartier Reef (Island of Tires); (3) Scott Reef (Datu Island); (4) Reef Filter; and (5) Browse Island Nature Reserve. Traditional Indonesian fishermen are allowed to take fresh water from East Islet and Middle Islet, part of Ashmore Reef (Pulau Pasir). However, Indonesian fishermen are prohibited from fishing and damaging the environment outside the five islands. A large number of traditional fishermen stray within Australia's territory due to lack of knowledge of the territorial boundary and lack of adequate navigation tools such as the Global Positioning System (GPS) and radio communication equipment (HF/VHF frequency).

Illegal fishing has been a challenge within the area. In 2021, illegal fishing by traditional Indonesian fishermen was reported near the Rowley Shoals Marine Park, where they walked on coral reefs, caught sharks and took giant clams (Parke, 2021). The fishermen used destructive methods, such as the use of explosives, to catch fish which can damage the diversity of marine biota. The restrictions during the COVID-19 pandemic were another factor that influenced the increase of illegal fishing due to the reduced frequency of maritime patrols. This has resulted in increased illegal fishing activity in Australia's northern waters reversing the downward trend in recent years. This condition is potentially significant in the damage to and vulnerability of fisheries resources and biosecurity in Australian waters. The loss cost from this activity has reached AUD\$2 billion to AUD\$15 billion annually (Lindley et al, 2019).

In 2017, Australia and Indonesia signed a Plan of Action to implement the Joint Declaration on Maritime Cooperation (Department of Foreign Affairs and Trade, 2017a; Department of Foreign Affairs and Trade, 2017b). The plan sets out focus areas, determined mainly to strengthen maritime security and combat transnational crime committed at sea. The focus areas

include: (1) strengthening cooperation to combat IUUF; (2) sharing information on maritime security; (3) improving maritime safety from environmental threats; (4) strengthening Navy-to-Navy links; (5) building cooperation between maritime civil law enforcement agencies; (6) combating transnational crime; and (7) strengthening education and research cooperation in maritime safety and security. Each country empowers its national defence tools, armed forces and maritime civil agencies as far as possible to realise this Plan of Action. The maritime forces and agencies such as the Australian MBC and the Indonesian BAKAMLA play central roles to secure the maritime environment.

The long water boundary between Indonesia and Australia has become a focus area for maritime security. The focus area is also an international maritime crossing with IUUF operations from actors outside Indonesia and Australia. The region is characterised with high waves and significant weather changes making it difficult for maritime patrol vessels, both Navy and civilian, to carry out their duties. With the large area of operation, a monitoring system with advanced surveillance capabilities that is able to function at high speed and long endurance is needed to cover the entire area. This is in line with the characteristics of air power enabling the Air Forces from both Indonesia and Australia to play a major role to secure the region.

2.4. The role of air power

Air power is a necessary component of national power to ensure the security of the nation, the people and its interests. The effectiveness of air power depends on the complementarity and effectiveness of any one role to another. Within a maritime strategy, the integration of air power effects with those created by sea and land power achieves optimum effectiveness. Effective sea control can be achieved with concurrent control of the air.

Control of the air is a critical requirement for the success of all military operations within a maritime strategy, which is a broad concept that assures the safety and security of the nation through the employment of all elements of national power (Kainikara, 2014). Therefore, the contribution of air power allows the Air Force to run operations in conjunction with other forces that contribute to the defence force for the purpose of attaining national objectives.

Maritime security strategy requires all domains (land, sea and air) to actively protect and control the air and sea approaches. Air Force takes the action with its core role of control of the air by utilising the role of air power. Air power is the total strength of a nation's capability to conduct and influence activities through and from the air to achieve its objectives (Australian Defence Force, 2023). Air power is not exclusive to the air force but also an integral part of navy and army capabilities. The characteristics, environment and applications of air power are common throughout each Service contribution to the air domain.

The basic characteristics of air power are speed, range, flexibility, precision and surprise which can be applied over vast distances and diverse conditions. The operational utility of air power can only be provided by an air force with high capabilities to meet strategic needs. The effectiveness and credibility of the air force are evident with modern technology and skilled personnel to conduct and sustain the full breadth of actions. Therefore, the employment of air power is an ongoing investment across these vast coverage areas to create national sovereignty over the air space, in terms of enhancing maritime security.

The Air Force exploits air power characteristics to ensure that it can perform its role as required by the Government. To be a respected Service in the region, both the Indonesian and Australian Air Forces aim to increase global intelligence surveillance and recognition awareness. Moreover, both forces carry out core and enabling roles to achieve military objectives.

The role of air power enables optimal power effectiveness in maritime security by supporting the Navy.

2.5. Maritime air patrol

The Air Force enables control of the air to assist maritime security by primarily conducting ISR and consequently providing commanders and decision makers early warning and information on approaching aircraft and ships or adversarial threats (Armistead, 2002). This role is also a deterrent as it sends a message to adversaries that they are being monitored. The Indonesian Air Force (TNI AU) and the RAAF have created the Wings as the operational elements of Air Command which is made up of squadrons. A squadron is the main tactical element of the Air Force operationally and is responsible for output missions, personnel, aircraft and support functions. Ultimately, the structure of Air Command is organised based on a hierarchical organisation to shape an effective generation of defence capabilities.

Coastal nations exercise sovereignty over their territorial waters and the airspace above. Every sovereign state must control and protect its territory by using all the resources and means it has, including military power. One of the ways to support air sovereignty over its maritime areas is the maritime air patrol (MAP), which is an activity to protect territorial airspace and implement domestic law. MAP missions can be carried out by transport aircraft that can observe and reconnoitre from the air above the object area, above the protected force, above the critical area of the combat zone, or the air defence area.

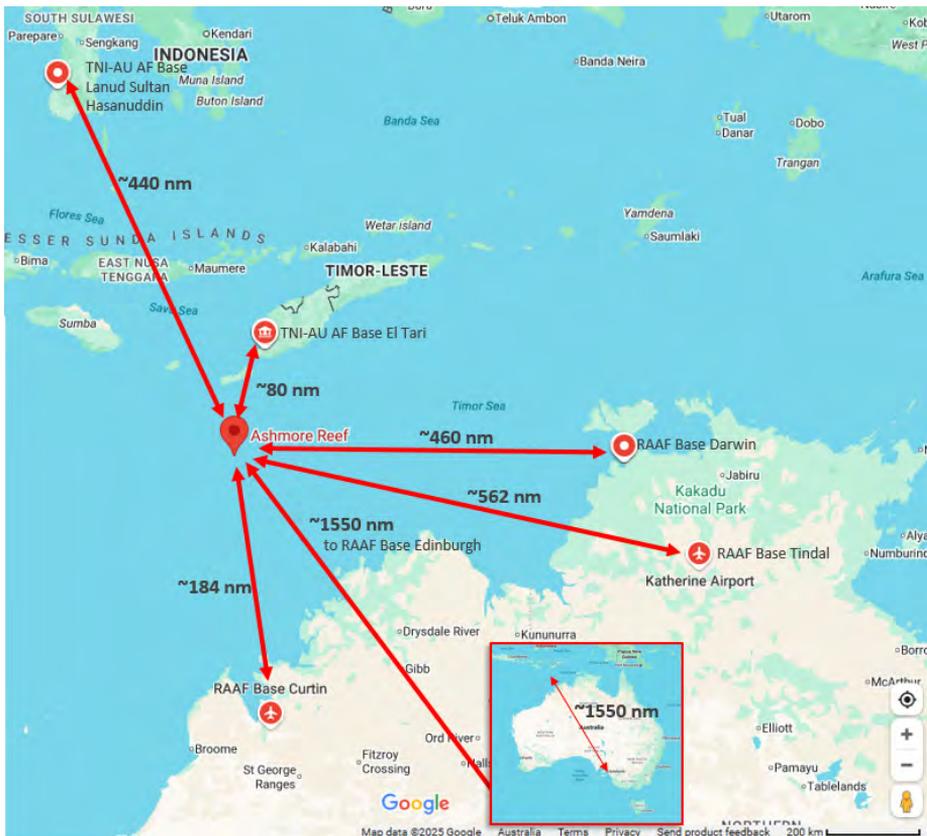


Figure 2.2. RAAF and TNI AU Air Force Bases near the focus area (Adapted from Google, 2025).

The MAP is an effective and responsive action conducted by the Air Force in order to reduce and mitigate the rising number of IUUF occurrences. Moreover, MAP capabilities can cover vast areas especially the IUUF focus area between Australia and Indonesia. Maritime surveillance, patrol and response operations effectively detect, deter and disrupt real and potential civil and military maritime security threats early through both targeted and non-targeted activities. For instance, TNI AU has a No. 5 Squadron below the umbrella of the No. 5 Wing to generate ISR and maritime air patrol missions. To support maritime security in Indonesian waters territory, the Indonesian Air Force operates Boeing B-737 surveillance aircraft. The No. 5 Wing is located at Sultan Hasanudin Air Force Base, Makassar, which is around 440 nm from the focus area as shown in **Figure 2.2**. Maritime patrol aircraft can detect and identify objects suspected of committing threats. Hence, maritime aircraft can be complementary to maritime patrol vessels.

On the other hand, the RAAF has the Surveillance and Response Group (SRG), which provides the ISR capability. The No. 92 Wing is one of the SRG assets that performs the maritime response capability. The No. 92 Wing is the first Maritime Wing of the RAAF and is located in RAAF Base Edinburgh, Adelaide, which is about 1550 nm from the focus area as shown in **Figure 2.2**. Currently, the P-8A Poseidon aircraft is operated by the No. 11 Squadron under the No. 92 Wing. The P-8A aircraft is capable of anti-submarine and ship warfare, maritime surveillance, overland ISR, naval fleet support and survivor supply missions. The P-8A's sensors are also integrated with the Navy making it a fundamental capability of the ADF's future maritime strategy. It is widely acknowledged that Australia has one of the world's most advanced maritime ISR and response capabilities.

2.6. Current and future

Effective maritime security operations are achieved by consistent presence. Hence, conducting MAP operations is needed to secure the Indonesia–Australia vast maritime area. In addition, Australia's Jindalee Operational Radar Network (JORN) provides wide-area surveillance across the sea and air approaches, up to 3,000 km (Allison et al., 2019). The 24/7 JORN operation is used to support air and maritime surveillance efforts. However, maritime objects detected by JORN are limited in size and small wooden vessels cannot be detected. Hence, the Air Force still remains effective for MAP operations. Crewed aircraft could conduct MAP but crew fatigue, finite endurance of the aircraft and risks associated with the human crew could constrain operations. Hence, the Air Force needs a capability to mitigate crewed aircraft constraints.

Uncrewed aerial systems (UAS) could address constraints to MAP operations. The employment of UAS gives the potential design range and significant endurance of the aircraft. Accordingly, the crewed aircraft constraints will be covered by the UAS. However, the application of the UAS must be matched to the task for which the aircraft is expected to be used. In this case, the UAS is utilised to conduct a maritime air patrol operation, which will enhance the air power capability in maritime security.

To modernise Australian maritime surveillance capabilities, Australia has procured Northrop Grumman's MQ-4C Triton. The high-altitude, long-endurance (HALE) uncrewed aerial Triton can fly at altitudes of 50,000 feet for 24 hours straight to fly over 2,000 nm. The system provides high-resolution imagery and real-time video sensors that can assist in detecting, classifying and tracking seagoing vessels across a vast coverage area. With high altitude, long endurance and all weather conditions capabilities, the MQ-4C Triton can generate maritime domain awareness, target acquisition, fisheries protection, oil field monitoring and humanitarian relief, in a report by Doug Shaffer, company vice president of Triton programs (Machi, 2018).

In 2024, the Australian Government announced that the Triton UAS will work in tandem with P-8A Poseidon multi-mission aircraft to cover a wide territorial maritime area and increase interoperability in Australia's region. On the other hand, the Indonesian Government ordered the CH-4B medium-altitude, long-endurance (MALE) UAS to be operated by No. 52 Squadron TNI AU in 2019. The CH-4B has a cruising range of more than 1,000 nm, can fly 24 hours straight and is integrated with the satellite link operation. The MALE UAS has been designed to conduct ISR operations over land and maritime domains, equipped with optic-fit, infrared sensors, laser surveillance and weapon delivery. In fact, Australia and Indonesia have transformed their air power capabilities with current technology systems and weapons to provide their maritime patrol and surveillance capability.

2.6.1 Air bases

The Air Force squadron should be based in strategic and effective locations for effective MAP operations especially with the increase in IUUF violations in the focus area. Hence, squadron bases need to be in strategic locations to maximise Air Force response. In relation to the focus area, the RAAF has three airbases that are located near the focus area. First, the RAAF Base Darwin is located ~460 nm from the focus area as shown in **Figure 2.2**. Second, the RAAF Base Tindal is located ~562 nm from the focus area and is the largest RAAF airbase. Third, RAAF Base Curtin is located ~184 nm from the focus area as shown in **Figure 2.2**.

On the other hand, the TNI AU El Tari airbase is located ~80 nm from the focus area. El Tari airbase located in Kupang could be the option to become the operating base for the Indonesian maritime air patrol squadron. The airbase can provide maximum endurance and optimise the movement of the MAP from the RAAF and TNI AU. Based on the current IUUF situation happening between Australia and Indonesia, the El Tari airbase could be the Forward Operating Base (FOB) for MAP operations. It remains a fact that effective airbase operations require the right locations with adequate base utilities, support personnel and services and be able to provide effective command and control.

2.6.2 Integrated forces

The Air Force plays a prominent role in all other physical domains and is the key to assist freedom of manoeuvre and enhance mobility. Air and maritime integration could enable effective communication, coordination and command and control for MAP operations. For instance, implementation of MAP operations carried out by the Air Force can provide information by Communication link (C-link) to the Navy. Conversely, if a Navy ship or JORN radar detects suspicious objects, such information can be forwarded to the Air Force to carry out aerial ISR and provide more comprehensive data. In addition, engagement with other government agencies such as the MBC and the BAKAMLA working together can secure the focus area. Accordingly, air and maritime integration have to collaborate well before extending to multi-national interoperability.

2.6.3 Joint operation

Combating IUUF within the focus area between Indonesia and Australia could be achieved by joint operations by the two countries. Conducting multiple and coordinated operations simultaneously in and beyond a focus area can achieve maximum effect to secure the maritime environment. In addition, proper management of simultaneous operations in an integrated command and control arrangement carried out in an optimal period and intensity provides an optimal controlling element. Exchanging information and data on violations in the focus area, obtained from each element of the MAP operations of the two countries, makes the space for IUUF violators narrow and leads to paralysis of their movements. Implementing continuous

and alternating MAP operations from crewed and uncrewed aircraft from both countries secures the territorial waters. By combining the Air Forces from two countries in the same theatre, air superiority can secure respective territorial waters from perpetrators of maritime violations.

2.7 Conclusion

The boundary between Indonesia and Australia is recognised as one of the longest water boundaries in the world. Optimal maritime security along this boundary is needed to actively protect national interests, prosperity and sovereignty. However, violations keep occurring, especially IUUF. Apart from the economic loss, the damage caused by IUUF is intolerable. Recently, the number of fishing boat interceptions has significantly increased. Currently, the priority is securing the focus area in the boundary between Australia and Indonesia. This location should be prioritised to control this transnational crime. A good relationship between Indonesia and Australia has been established, and bilateral cooperation and engaging through treaties, especially in maritime domains, is a strong foundation to create joint actions to combat IUUF. Despite current efforts, the vast coverage area is a hindrance to securing the area.

By utilising the role of air power, the Air Forces from both countries could play an important role in creating control of the air across the vast maritime area. Speed, range, flexibility, precision and surprise are air power's unique characteristics that could be provided by the Air Force. ISR is a core air power capability that could enhance maritime security. MAP provides observation and reconnaissance from the air above the focus area. In addition, an advanced aircraft equipped with fully integrated maritime surveillance capabilities could deter and respond to real and potential civil and military security threats.

Consistent presence of maritime security operations could be achieved with UAS with state-of-the-art technology and with minimised risk. The use of MAP aircraft and UAS squadrons should be an effective and fast response to conduct mission operations in the focus area. These are my recommendations to secure the Indonesia–Australia maritime boundary: (1) designate an airbase closest to the theatre zone as the forward operating base to accommodate a MAP squadron; (2) work towards an integrated force between Air Force, Navy and other government maritime agencies across all levels by setting up a robust interoperability between national forces that could extend to multinational interoperability between Australia and Indonesia; and (3) coordinate joint MAP operations by Indonesia and Australia. These recommendations highlight the important role of air power in securing the Indonesia–Australia water boundary.

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3

Air power for combating illegal, unreported and unregulated fishing

Nittapon Srisuk
Royal Thai Air Force

Illegal, unreported and unregulated fishing (IUUF) is a non-traditional security threat that is proliferating globally. Countries trading with the European Union (EU) need to abide by EU's regulatory framework on IUUF and those that do not comply are sanctioned by issuing them with penalty cards. After Thailand was warned with a yellow card for insufficient law-enforcement capabilities to curb IUUF, Bangkok has invested in and improved its monitoring, control and surveillance (MCS) system to curb IUUF. While the MCS has improved the detection and enforcement of IUUF, air power could provide a significant role for MCS through effective intelligence, surveillance and reconnaissance (ISR). Uncrewed aerial systems (UAS) is the ISR platform that has increased in utility to IUUF enforcement. The Thai Armed Forces have acquired UAS capable of covering all of Thailand's Exclusive Economic Zone (EEZ). Combating IUUF also has potential for increased cooperation with ASEAN states. Cooperation could start with bilateral agreements between overlapping or disputed maritime areas and could extend to existing arrangements within ASEAN such as the Malacca Strait Patrol (MSP) and the Trilateral Cooperative Arrangement (TCA).

3.1. Introduction

Due to its wide-reaching impact, illegal, unreported and unregulated fishing (IUUF) is one of the most important issues in global maritime security. In 2001, the concept of IUUF as a security challenge was introduced by the Food and Agriculture Organization in the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (Food and Agriculture Organization of the United Nations [FAO], 2001). IUUF profoundly impacts on the ecological system through overfishing and using destructive fishing gear and practices.

The negative environmental impacts are closely [Linked](#) to socio-cultural impacts in Thailand. IUUF can cause a negative impact in the communities that are heavily dependent on fishing, for example local fishing communities (Daoust, 2021).

In 2010, the European Union (EU) implemented the European Community Council Regulation No.1005/2008 that would sanction the fisheries products from third countries that do not align with that regulation. The regulation emphasised regulated, legal and sustainable fishing practices and required states to effectively enforce their legal requirements. Compliance became a requirement to access the EU market. The European Commission (EC) started dialogue with each fishing state to assess their readiness to meet the condition. By 2021, the EC had established dialogue with more than 60 countries (dialogued states). The dialogue focused on aligning their legal frameworks to the EU regulation and establishing adequate capabilities for IUUF enforcement (Sinkevicius, 2020). Additionally, the ‘card system’ was introduced to identify the readiness of each dialogued state. Three types of cards are used in the card system. The yellow card indicates that a dialogued state has not satisfied the EC in the legal framework and/or enforcement capacities. However, it allows dialogued states to maintain access to the EU market and provides a dialogued state the time to reform its laws and strengthen its enforcement capabilities. The red card follows the yellow and indicates the dialogued state has not sufficiently cooperated with the EC. In contrast, the green card is used to indicate the state has adapted enough to satisfy the EC. By 2022, 27 nation states were affected by this card system.

Figure 3.1 shows the timeline of states that were given warning cards (Popescu, 2022).

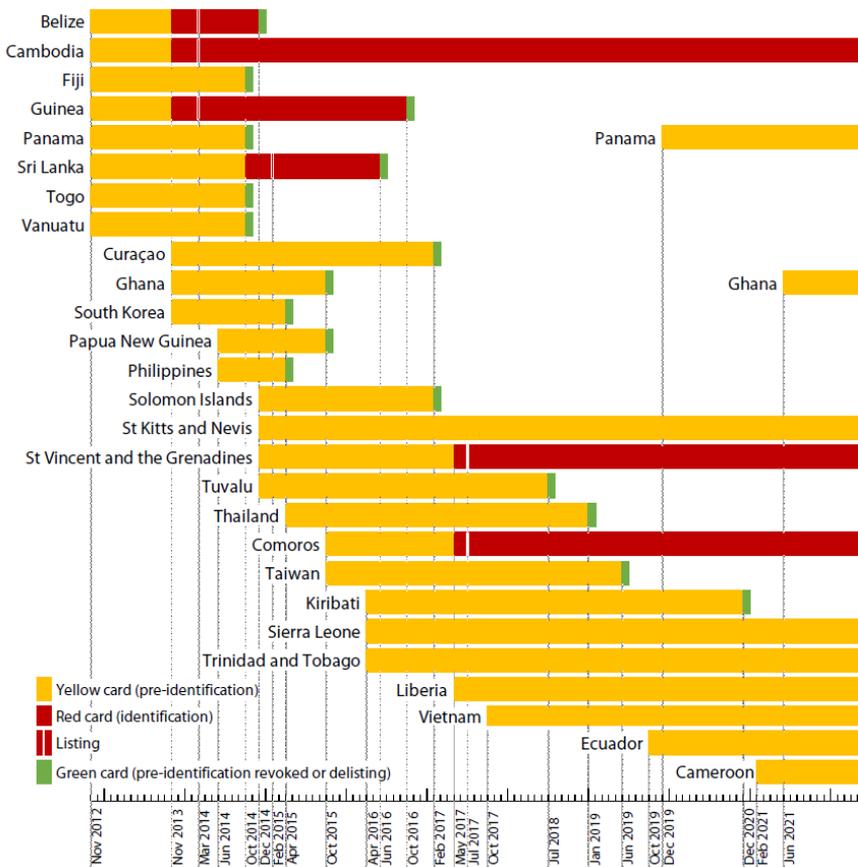


Figure 3.1. Timeline of each country and their card system status (Popescu, 2022).

Some ASEAN states have not been affected by the card system due to different circumstances. For instance, Laos is a land-locked country that would not have a significant impact in the EU's IUUF combating scheme. Since 2011, Indonesia has maintained productive dialogue with the EC and has demonstrated a strong legal and enforcement framework. One visible example includes Indonesia sinking foreign IUUF vessels (Juned et al., 2019). Similar to Indonesia, Malaysia announced its National Plan of Action to prevent, deter and eliminate IUUF.

On the other hand, a number of ASEAN states have been given warning cards by the EU. Cambodia was given the yellow card in 2012 and then was upgraded to a red card in 2013 due to insufficient cooperation with the EC. The Philippines, Thailand and Vietnam were also given yellow cards. While the Philippines only needed one year to implement the required reforms and get a green card, Thailand needed almost four years before they were issued a green card. Vietnam is still in the process of working to satisfy the EC.

The main motivation of any nation to cooperate with the EC is to protect themselves from being sanctioned from the EU market. Thailand shares this motivation and is implementing initiatives to combat IUUF. In 2011, Thailand's exports to the EU were valued at USD\$2.53 billion (Wongrak et al., 2021). However, this dropped to USD\$640 million in 2018, which could be attributed to the time when Thailand was given its yellow card. The reduction in value devastated the domestic fishing industry and supply chains. From 2015 to 2018, the Thai Government invested USD\$94 million into various initiatives, including increasing the number of inspectors and strengthening Thailand's efforts to curb IUUF (Department of Fisheries, 2022).

Complying with the EU's regulatory framework is important to be able to trade with the EU. This work identifies the role of air power for effective intelligence, surveillance and reconnaissance (ISR). Uncrewed aerial systems (UAS) is the ISR platform that has increased in utility to curb IUUF. Combating IUUF also has the potential for increased cooperation with ASEAN states. Cooperation could start with bilateral agreements between overlapping or disputed maritime areas. Moreover, Thailand can also build on existing arrangements such as the Malacca Straits Patrol (MSP) involving Indonesia, Malaysia, Singapore and Thailand and the Trilateral Cooperative Arrangement (TCA) involving Indonesia, Malaysia and the Philippines.

3.2. Thailand's EEZ and fish industry

Thailand's maritime area and EEZ can be accessed from both the east and west side of the country as shown in **Figure 3.2**. On the east side, most of the maritime area is in the Gulf of Thailand that connects to the South China Sea. The EEZ area in the Gulf of Thailand is around 304,000 square kilometres. On the west side, Thailand's maritime area is in the Andaman Sea that connects to the Indian Ocean. This area is approximately 116,280 km². Therefore, Thailand's total EEZ is close to 420,280 km².

Thailand's EEZ overlaps with other countries in three areas. The largest overlapping EEZ area is between Thailand and Cambodia, which is around 34,000 km² in the north-eastern part of the Gulf of Thailand as shown in **Figure 3.2**. The smallest overlapping EEZ area is between Thailand and Malaysia which is approximately 4,000 km² in the south-eastern part of the Gulf of Thailand. The last overlapping EEZ area is a shared area between three nations, Cambodia, Thailand and Vietnam. This area is around 14,000 km² east of the Gulf of Thailand.

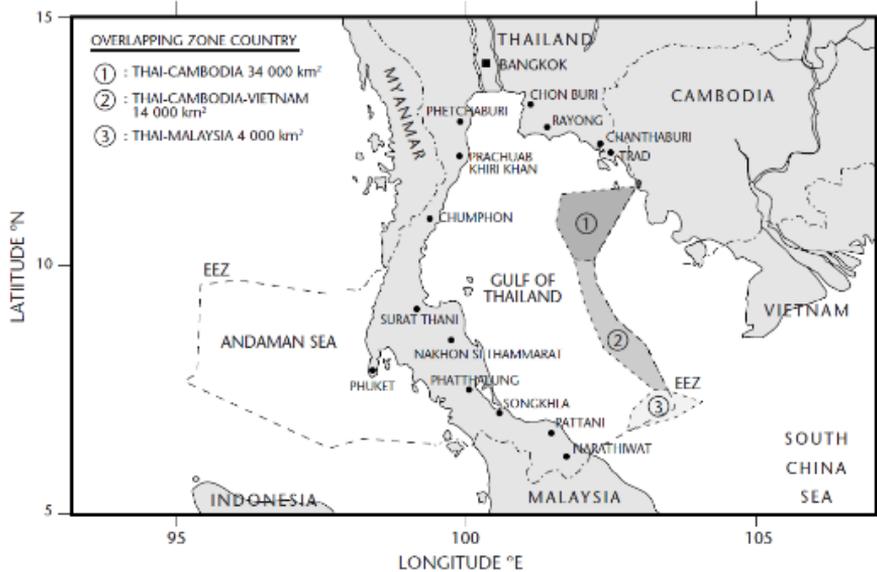


Figure 3.2. Thai EEZ and overlapping areas with Cambodia and Malaysia (Janekitkosol et al., 2003).

In new fisheries law, the ‘coastal area’ was introduced to regulate fishing activities at the provincial level. This provincial coastal area is taken care of by the provincial fishing authority. For example, the provincial fishing authority can consider what kind of fishing gear (except fishing gear prohibited in Royal Ordinance on Fisheries B.E.2558 (2015)) can be used in that provincial coastal area. In addition, only artisan fisheries vessels can fish in the coastal area. Weight is used to decide if a vessel fits that category. If the vessel weight is more than 10-ton gross, it needs to be registered and requires a commercial fishing licence.

3.3. Thailand’s efforts to comply with the EU framework

The Thai Government focused on strengthening its legal framework and improving its enforcement capabilities to satisfy the EC regulation. The legal framework should focus on Thailand reforming its laws and regulations to align with the EC regulation. Enforcement can be strengthened by enhancing detection and enforcement capabilities.

Bangkok has established new fisheries law, both foundational legislation and supporting regulations. The first effort to reform the foundation law was to legislate the Royal Ordinance on Fisheries B.E.2558 (2015), which was implemented shortly after Thailand received its yellow card from the EC. This law has introduced various support measures to regulate the fishing activities in the maritime territory of the kingdom.

These measures include Vessel Registration, where all vessel owners are required to register their vessels through the Maritime Department and install a vessel monitoring system (VMS). Licences are also mandatory and the Thai Government issues two types of fishing licence: commercial and local. The fishing licences are authorised by Thailand’s fishing authority, the Department of Fisheries (DOF). Vessel operators need to report to the authorities for inspection when they are leaving and entering port. All fishing crew needs to register and get inspected by the authorities. The crew needs to carry their registration documents on them at all times especially during inspections. On returning from their fishing expedition, the DOF needs to inspect all catches and issue a catch certificate. Operators must ensure traceability and provide

documentation against all the previously mentioned requirements. The ordinance provides for very high penalties for violators. For example, the IUUF violation fee is up to THB30 million (~AUD\$1.34 million).

Moreover, to efficiently enforce and implement the law and regulations, Thailand has introduced the monitoring, control and surveillance (MCS) system. MCS is defined as ‘the mechanism for implementation of agreed policies, plans or strategies for oceans and fisheries management’ (Flewwelling et al., 2003). ‘Monitoring’ refers to the continuous requirement for measuring fishing effort characteristics and resource yield, while ‘control’ refers to the regulatory conditions under which the exploitation and transport of the resources may be conducted. ‘Surveillance’ refers to the degree and types of observations required to maintain compliance with the regulatory controls imposed on fishing activities. MCS system activities can both enforce and implement the law and regulations but also prevent, deter and eliminate IUUF.

To implement MCS, the Fisheries Monitoring Center (FMC) was established in 2015 to integrate all functions and authorities. The Port Inspection or Port-in Port-out (PIPO) was introduced to inspect vessels, their catch inspection and crew on board. The Royal Thai Navy (RTN) also executes sea inspections accompanied by relevant fishery authorities such as fishing authorities and vessel authorities.

MCS also includes air surveillance, which is provided by both the RTN and Royal Thai Air Force (RTAF). The objective of air patrol is to reduce the workload of sea patrol and also to collect information on and evidence of violation. Air surveillance is the only activity performed by the RTN and RTAF and will be the focus of this study. However, civil authorities need to accompany the patrol unit to do the on-board inspection. VMS also can provide remote surveillance. For example, closed-circuit television (CCTV) is one VMS that commercial fishing vessels need to install.

3.4. Air power contribution to the MCS system

While air surveillance is already part of the MCS, other air power features can be used to tackle traditional security issues and non-traditional security issues. The Royal Australian Air Force (RAAF) recognises that there are six fundamental contributions that air power makes to joint operations: airbase operations, air command and control, counter air, air mobility, air strike and air intelligence, and intelligence, surveillance and reconnaissance (ISR) (Australian Defence Force, 2023).

The most important contribution to combating IUUF using the MCS system is air ISR which is defined as ‘an activity that synchronises and integrates the direction, planning and operation of collection capabilities and processing, exploitation, and dissemination systems’ (Australian Defence Force, 2023). The main platforms for ISR in air and space domains are crewed aircraft, UAS and satellites. All these platforms have different advantages and disadvantages for ISR. This paper will explore UAS further as it is a core part of the Thai Government’s ISR contribution to MCS.

Using UAS can provide a significant role in ISR and is a natural choice to patrol Thailand’s EEZ. UAS can be easier to operate due to the absence of a human pilot and it is able to operate from more austere or remote locations if operated from a launcher rather than runway. UAS have the same benefits of perspective and reach as airborne ISR but without the risk to human life. Also, UAS can be cheaper to acquire and operate than traditional aircraft. UAS can be classified by a number of criteria, with the most common being their range (**Table 3.1**). The types of UAS that can be used for airborne ISR are from the ‘Close Range’ category and above.

Importantly, while UAS has a significant role to play in regional ISR they are under-utilised by ASEANs. This is because a few companies and countries have the resources to dominate the technological development and production of these systems. A potential area for ASEAN collaboration could be on joint ISR production or patrols.

Table 3.1. UAS classification by range (Govorcin et al., 2014).

Name of category	Acronym	Weight [kg]	Range [km]	Flight Altitude [m]	Endurance [hours]
Micro	Micro	<5	<10	250	1
Mini	Mini	25-150	<10	150-300	<2
Close Range	CR	25-150	10-30	3000	2-4
Short-Range	SR	50-250	30-70	3000	3-6
Medium Range	MR	to 1250	70-200	5000	6-10
Medium Range Endurance	MRE	to 1250	>500	8000	10-18
Low Altitude Deep Penetration	LADP	to 350	>250	50-9000	0,5-1
Low Altitude Long Endurance	LALE	<30	>500	3000	>24
Medium Altitude Long Endurance	MALE	to 1500	>500	14 000	24-48

The Royal Thai Army (RTA), Royal Thai Navy (RTN) and Royal Thai Air Force (RTAF) all have UAS in their equipment lists. However, only the RTN and RTAF have participated in air surveillance in combating IUUF. Therefore, only UAS in these two Services will be discussed in this paper.

RTN is the main Service working with various government authorities to combat IUUF. The Thai Maritime Enforcement Command Center (Thai-MECC) was established to make all Thai Government Services and authorities work together. All air and maritime patrols are arranged through the Thai-MECC, which is mainly operated by RTN. The RTN conducts both maritime and air patrols. The RTAF conducts only air patrols. Both Services operate UAS and the specifications are in **Table 3.2**.

Table 3.2. The specification of UAS in RTN and RTAF (Aeronautics Systems, 2023; Boeing, 2025; Elbit Systems, 2025).

	Aerostar	Dominator	Orbiter 3	RQ-21A Blackjack	Hermes 900
Service	RTAF	RTAF	RTN	RTN	RTN (under order)
Endurance (hrs)	12	20	6	16	40
Range (nm)	135	135	27-54	55	540
Cruise Speed - Max Speed (m/ph)	60-100	75-120	Up to 70	60-80	100-119
Category	MR	MR	SR	SR	MALE
Take-off condition	Runway	Runway	Launcher	Launcher	Runway

Only Hermes 900 can cover all of Thailand's EEZ area and would need to be launched from a southern airbase. However, the facilities of the Royal Thai Naval Air Division are mostly located at the U-Tapao airbase that is in the eastern part of Thailand. Short range UAS like RQ-21A and Orbiter 3B can also operate from a naval vessel to extend area coverage. Therefore, Thailand would be best placed to cooperate with other ASEANs to help fully patrol its EEZ. This cooperation could include joint patrols and build on existing ASEAN military cooperation, which will be explained in the next section.

3.5. Other means to curb IUUF

ASEAN has three operating pillars: (1) ASEAN Socio-Cultural Community (ASCC); (2) ASEAN Economic Community (AEC); and (3) ASEAN Political-Security Community (APSC). The APSC was established in 2015 and was the last pillar to be established. Even though it is still in the early stage of enhancing security and stability in the region, the way forward is obvious but with challenges. The challenges include rising geostrategic great power competition, the self-interest of sovereign states and disputed territories, etc (Putra et al., 2019).

The APSC has only established military cooperation on non-traditional security (NTS) threats. Examples of NTS cooperation that have been established include human trafficking and natural disasters. Therefore, IUUF is a major NTS issue on which ASEAN can increase cooperation. The typical military cooperation engagements between ASEANs are mostly bilateral, trilateral or quadrilateral. There are several noteworthy case studies of ASEAN members cooperation on IUUF.

One of the case studies is the Malacca Straits Patrol, which is a quadrilateral arrangement between Thailand, Malaysia, Singapore and Indonesia (also known as MALSINDO). The Malacca Strait Patrol was launched in 2004 and was initially established to combat piracy and sea robbery. Thailand came into this operation as an observer in 2005 and became a full member in 2008. This cooperation can be considered to have had some success due to the decrease in recorded piracy and robbery incidents in the Straits of Malacca and Singapore (Collin, 2016).

Another case study is the Trilateral Cooperative Arrangement (TCA) between Indonesia, the Philippines and Malaysia (also known as INDOMALPHI). It was first established in 2017, a year after an infamous abduction incident, to conduct air and marine patrols in the Sulu Sea to fight transnational crime. Success can be claimed because the number of transnational crimes reported also decreased (Parameswaran, 2019).

The last case study is the ASEAN Solidarity Exercise 2023 (ASEX 2023) which was conducted in September 2023. ASEX 2023 was the first military exercise to include all ASEAN members. Moreover, this exercise still only focused on the NTS issues, which included Humanitarian Assistance and Disaster Relief (HADR), maritime security, search and rescue, medical evacuation and anti-piracy.

Even before the 2010 EU regulation, ASEAN had commenced work on addressing IUUF. The first such cooperation was the Southeast Asian Fisheries Development Center (SEAFDEC) which was founded in 1967. Its objective is ‘to promote and facilitate concerted actions among the Member Countries to ensure the sustainability of fisheries and aquaculture in Southeast Asia’. One tangible success of SEAFDEC is information sharing. SEAFDEC has organised various events to enhance understanding of IUUF as a problem, including facilitating meetings, workshops and training courses (SEAFDEC, 2022). Moreover, in 2016 SEAFDEC announced the ASEAN-SEAFDEC declaration on regional cooperation for combating IUUF and enhancing the competitiveness of ASEAN fish and fishery.

A more recent example of cooperation is the ASEAN Network for Combating IUUF (AN-IUU). Founded as the ASEAN IUU Task Force, the AN-IUU was established in 2019 following agreement from all ASEANs and the EU. The AN-IUU focuses on information sharing and capacity-building and is headquartered in Thailand. Despite this, the AN-IUU is not widely mentioned in international media.

3.6. Conclusion

IUUF is a major maritime security issue, emphasised when the EU launched the implementation of EC Regulation No.1005/2008. EU will sanction fisheries products from the third country that

cannot ensure the products are free from IUUF activities. Thailand and three other countries in ASEAN are affected by the EU card system. The maximum loss in the fisheries market is around USD\$1.9 billion and the average is more than USD\$1 billion.

The EU regulation implementation has been the driving force behind many countries' efforts. If this initiative were to transform into an international mechanism or multinational mechanism, there would be more legal requirements and pressure on each country to cooperate. For example, the International Civil Aviation Organization (ICAO) and the Chicago Convention have become international standards for commercial aviation safety.

IUUF is an area where ASEAN can increase military cooperation. Thailand, like many regional countries, does not have UAS that can easily cover their entire EEZ. A potential area for collaboration is on a regional joint development program for UAS. A model for cooperation is the development of the Eurofighter Typhoon by Germany, Italy, Spain and the United Kingdom. Importantly UAS development, in this case short range or medium range, is not as big and complex a program as the fighter aircraft development program.

Another area for collaboration is conducting joint patrols in the Gulf of Thailand. This potential project could be based on existing multilateral cooperation in ASEAN. There are no joint patrols currently operating in Thailand's EEZ. Moreover, an information sharing system through the AN-IUU is a further area where cooperation could be increased.

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4

Enhancing Thailand's maritime security through air and space power

Virasak Chansriharaj

Royal Thai Air Force

Maritime security in the Southeast Asia region is a primary concern for all countries due to its strategic importance and the significant sea lanes of communication. Modern day piracy has become increasingly sophisticated and prevalent. Hence, the importance of enhancing air and space intelligence, surveillance and reconnaissance (ISR) in maritime security, particularly with uncrewed aerial systems (UAS). Use of air and space power could be advantageous due to their operational effectiveness, cost and reduced risk to personnel and assets. Here, I will provide how the Royal Thai Air Force could expand its UAS force as well as space capabilities to enhance our capability to deter or disrupt the emerging threat of piracy which could have enormous national implications for Thailand.

4.1. Introduction

Maritime security is a term commonly used to classify maritime territorial issues usually related to national security, marine environment, economic development and human security (Bueger & Edmunds, 2017). Klein (2011) stated that maritime security means 'The protection of a state's land and maritime territory, infrastructure, economy, environment and society from certain harmful acts occurring at sea'. Maritime security is concerned with both traditional and non-traditional threats, such as maritime terrorism, piracy, armed robbery at sea, human trafficking, illegal goods and drug trafficking, illegal fishing and marine pollution (McNicholas, 2016).

This article considers piracy, armed robbery and maritime terrorism as potentially the most harmful maritime security threats in the Southeast Asian context and focuses on the potential uncrewed aerial systems (UAS) and space-based assets can offer in combating these threats. It

promotes the role of the Royal Thai Air Force (RTAF) in employing these systems. The study will apply a descriptive-content analysis method in gathering, analysing, interpreting and presenting data, and provide suggestions of possibilities, advantages and disadvantages of using uncrewed aerial systems (UAS) and space-based assets to contribute to maritime security.

Southeast Asia incorporates several international shipping routes. Amongst the most significant is the Strait of Malacca, which connects the Indian Ocean (Andaman Sea) with the Pacific Ocean (South China Sea), with more than 50,000 ships using this strait each year to transport oil from the Middle East to China, Japan and other countries (Raha, 2017).

Thailand's unique maritime environment includes a long coastline on the Pacific Ocean and on the Indian Ocean. Thailand's two seaside areas are the western Andaman Sea (to the Strait of Malacca) and the eastern Gulf of Thailand. Thailand's maritime area is approximately 320,000 square kilometres and consists of internal waters, territorial seas, contiguous zones, continental shelf zones and its Exclusive Economic Zone (EEZ) (Bradford & Herrmann, 2021).

Thailand's maritime environment is a source of political, economic, social, psychological, military, scientific, technological, energy and environmental energy that promotes national security and prosperity (Batstone et al., 2021). The economic importance of Thailand's maritime areas in particular is enormous. Thailand's maritime economy is estimated at around 18 trillion baht per year (data from 2012 and 2014 is forecast at approximately 24 million baht per year according to the Navy's strategic assessment for the next 10 years). The activity that creates the highest value is shipping and, over the next 10 years, Thailand's maritime benefits are forecast to increase (Bradford & Herrmann, 2021).

Thai fisheries are of great value, creating one of the country's important export products. Thai waters have resources such as oil, natural gas and minerals. Thailand's seas and coastal areas have beautiful landscapes, which are tourist attractions with great economic value. Key drivers of Thailand's rapidly developing economy include coastal tourism, fisheries, aquaculture, off-shore oil and gas production, and commercial maritime trade.

Threats to maritime security are a threat to Thailand's national prosperity. In 2015, Thailand adopted the National Maritime Security Plan (2015–2021), in part in response to external pressures from outside the Association of Southeast Asian Nations (ASEAN), which sets out the development and deployment of all national powers, including military Services, to sustainably secure national maritime interests. One of the national objectives stated in the National Security Policy and Plan (2019–2022) is to 'develop the capacity of the state sector, strengthen and promote the roles of all sectors in addressing all forms of security threats' (Office of the National Security Council, 2019).

4.2. Maritime security situation in the Southeast Asia region

Traditional maritime threats in Southeast Asia comprise issues relating to sovereignty, sovereign rights and border governance. These are widespread (Sciascia, 2016) and can be influenced by external states which have maritime interests in the Southeast Asia region. Non-traditional threats include terrorism, piracy, robbery, illegal fishing, slavery and environmental issues. It is piracy and armed robbery that are the most critical security threats in the Southeast Asia region because of their potential impact on trade and commerce (Buzan, 2007).

4.2.1 Piracy and armed robbery

The report by the United Nations General Assembly (2008), *Oceans and the law of the sea*, identified seven specific threats to maritime security, including piracy and armed robbery, maritime terrorism, smuggling, illegal trafficking in persons, illegal fishing and marine

environmental pollution (Raha, 2017). Piracy and armed robbery, and maritime terrorism, were identified as the most dangerous threats to maritime security in the South and Southeast Asia region (Raha, 2017).

In 2015 alone, there were more than 120 reported hijackings and robberies in South and Southeast Asia, making the region the most pirated waters in the world (Subkhi, 2021). Losses due to piracy and armed robbery are estimated at between USD\$4.9 billion and USD\$8.3 billion per year. Other crimes committed at sea include drug trafficking, smuggling, maritime terrorism and human trafficking. The increasing number of incidents in South and Southeast Asia is alarming, making the region a global capital of maritime crime (Subkhi, 2021). Recent reports show that more than half of reported piracy and armed robbery incidents originate from Southeast Asia. Illegal human trafficking and smuggling of illicit goods further widen and deepen the scope of this threat (Raha, 2017).

According to the International Maritime Organization (IMO), there were 330 acts of piracy and armed robbery in 2004. Of all the regions in the world, East Asia (including the Strait of Malacca and the South China Sea) is the most affected.

Piracy is defined under Article 101 of the United Nations Convention on the Law of the Sea (UNCLOS) or, in simple terms, the crime of piracy is the illegal act of violence against life and property at sea with the aim of financial gain through theft of property and demanding ransom to secure the release of hostages. Both the offences of piracy and armed robbery are defined in the same terms in the UNCLOS and the IMO Code. The difference lies in the location of the incident. If the act takes place within territorial waters, it is considered armed robbery, while the same act committed anywhere beyond the jurisdiction of a coastal state is considered piracy (Raha, 2017).

The most affected country in Southeast Asia is Indonesia, which reported 49 piracy attacks in 2016 (McCauley, 2021). Malaysia, Singapore and other countries in the region are also frequently under threat from piracy. This occurs under joint patrols by police and marines from Indonesia, Malaysia and Singapore. Beyond Southeast Asia, piracy is also a concern in Bangladesh and India. In 2016, Bangladesh suffered three piracy attacks, while India accounted for 14 attacks in the same period. According to the UN report, more than half of the world's piracy threats were reported in South and Southeast Asia (United Nations General Assembly, 2008). Between 1995 and 2013, 41% of all global piracy attacks occurred in Southeast Asia, 28% in the Western Indian Ocean, including Somalia, and 18% off the coast of West Africa. Over the past several years, 136 sailors have died in Southeast Asian waters as a result of piracy attacks, twice as many as in the Horn of Africa, where Somalia is located, and more than the deaths and injuries suffered in West Africa combined (McCauley, 2021).

According to a 2010 study by the One Earth Future Foundation, pirate attacks cost the international economy between USD\$7 billion and USD\$12 billion each year. In Asia, the number has increased in recent months, with well-armed and organised criminal groups targeting oil tankers leaving the Straits of Malacca and Singapore and making inroads into the South China Sea, a resource-rich and potentially lucrative area. Most attacks are opportunistic, with 80% of all incidents worldwide occurring on anchored ships, where pirates steal all the equipment, property and cash found on board. These attacks are large-scale and sophisticated attacks on ships at sea, requiring meticulous military coordination and planning (McCauley, 2021).

Given the emerging prevalence of piracy in the South and Southeast Asia regions, a nation like Thailand which is so dependent on its maritime economy is at risk should this trend of piracy be permitted to spread into its adjacent waters. Detecting, identifying and locating piracy threats are essential first stages of preventing their impact on the economy. This paper therefore now turns its attention to the systems which could offer Thailand an advantage in these roles.

4.3. Contemporary air and space power for addressing maritime security threats

4.3.1 Uncrewed aerial systems

For maritime security and surveillance, UAS serve as cameras, capable of capturing images and video from various angles and not limited to a single location (Klimkowska, 2016). A single drone can gather more and better data than multiple cameras placed across a given area. Organisations can use drones to achieve complete awareness when combined with data from stationary cameras. The European Maritime Safety Agency (EMSA) uses drones to assist with border control, pollution monitoring, and detecting illegal activities such as fishing and drug trafficking. Border patrol officers in Arizona have been testing a new, smaller type of drone to support land and sea operations. These devices can use infrared sensors and cameras with facial recognition capabilities to enhance their efforts. In late 2017, Martek Marine established a dedicated aviation division to meet the growing demand for UAS maritime aviation services. Their division will offer a complete range of security and surveillance services for various activities, including illegal pollution detection and monitoring, drug and human trafficking detection, and the prevention of illegal fishing. The company aims to demonstrate how drones have the potential to transform the maritime business by reducing the time, cost and danger of multiple operations, while also improving the value of the data captured.

For maritime security applications, like detection, identification and location of piracy, UAS can be divided into three categories based on mission requirements, flight characteristics and costs: strategic, operational and tactical. At the strategic level, training programs with long-range high-altitude flights can be developed to ensure maritime security on the high seas using UAS such as *Global Hawk*, *Phantom Eye* and *Global Observer* at the strategic level, which covers a broader area of operation. At the operational level, UAS can be used for ISR missions ranging from maritime borders to exclusive economic zones and ground operations. UAS such as *Anka*, *Reaper* and *Heron* can be considered in this context. At the tactical level, fixed-wing UAS such as the *Scan Eagle* and rotary-wing UAS such as the *Camcopter* provide solutions to navies during maritime operations on ships and land. For example, the Italian Navy uses *Camcopter* as a tool for rescue operations for migrants. Therefore, UAS can provide comprehensive and precise data with full-scale video and radar images, which are key for ISR missions and the establishment and protection of Maritime Situational Awareness (MSA), which is part of maritime security goals (Dikmen et al., 2016).

UAS offer the ability to fly sensor payloads over potential threats and detect, identify and locate them so they can be intercepted, prosecuted and prevented or deterred from impacting Thai maritime economic endeavours. The main advantage of UAS over crewed aircraft is their durability and continuity of flight, which are achieved through a number of technologies such as fuel-efficient engines and airframes that can be designed without considering human factors. The space and weight normally allocated to the crew and life support systems on the aircraft can be replaced with a sensor payload or additional fuel to extend the range of the system.

UAS can operate for longer durations because there are no pilots or crew members in the air, experiencing fatigue and hunger or reduced performance when the mission is extended for several hours. NATO member states and about 50 other countries around the world recognise the importance of UAS and have UAS in service or are developing UAS, including Thailand (Oliver, 2016). UAS are more advantageous than crewed aircraft due to their operational efficiency, cost, and risk to personnel and assets in hostile and risky environments. At the same time, having a small fleet of UAS is the best solution for enhancing maritime surveillance. Almost all UAS can be equipped with infrared (IR) or electro-optical (EO) cameras or both.

They can also transmit real-time images to ground operators. For this reason, UAS are a significant force for armed forces with ISR capabilities to detect, disrupt and destroy illegal activities over borders.

UAS can fly for longer durations than crewed aircraft. This provides a great advantage to commanders as they gather information about activities at sea and along their borders and create consistent awareness. Due to the need for systematic interoperability of multiple sensor systems, UAS can contribute significantly to the ISR mission with their wide range of enduring sensors. In terms of cost effectiveness, UAS are still not clearly comparable to some types of crewed aircraft due to the large differences in platform capabilities. However, it is clear that the production of UAS is cheaper than the production of complex aircraft, and the increased survivability and performance (manoeuvrability) are another factor that reduces costs, resulting in a lower cost of UAS than the operation of crewed aircraft in the same role (Dikmen et al., 2016).

UAS represent a different scale and type of technology and are primarily available to the military and government. The US Navy has used this technology to ensure near-constant surveillance of the seas around its base in California and less critical surveillance of the seabed. Sensors on these UAS can identify and monitor ships from miles away and automatically transmit that information to authorities in near real-time. It is a model that could soon become available to commercial enterprises as the technology gets smaller and cheaper.

There are already companies dedicated to providing software for managing these types of systems. These UAS will allow users to protect their assets better and can easily be integrated into existing security teams. It is easy to see the impact UAS have on security and surveillance considerations (Karpowicz, 2019).

Thailand already operates a fleet of UAS and access to space-based surveillance systems. The capabilities are outlined below. These capabilities provide a framework on which to build the doctrine and procedures for anti-piracy and maritime security roles, and on which to develop further systems for increased functionality and capability in these roles.

Part of the RTAF's growing arsenal of ISR aircraft is its fleet of crewed and uncrewed intelligence, surveillance and reconnaissance UAS. In recent years, the role of UAS has increased significantly. The RTAF has upgraded 404 Squadron to its new Wing 3 air base at Watthana Nakhon in eastern Thailand. The new squadron consists of three squadrons: Squadrons 301, 302 and 303. Squadron 301 trains crews using the RV Connex/RTAF-developed U1M tactical UAS based on the company's Sky Scout system. Squadron 302 will partner with Aeronautics Defense Systems Aerostar BP (Royal Thai Air Force, 2019).

Beyond detecting, identifying and locating threats, UAS technology can also provide an important function responding to the aftermath of piracy threats by contributing to maritime search and rescue. UAS equipped with Visual Detection and Ranging (ViDAR) can automatically detect hundreds of large and small objects at sea in various conditions. Small, light and self-contained, ViDAR has dramatically improved the efficiency of maritime operations such as search and rescue and can detect and identify small objects, such as jet skis and buoys. The benefits of this technology are not limited to searching for missing persons; but can also play a role in rescue operations, as happened recently off the east coast of Australia where two boys were caught in large waves, and a flotation device was dropped on them within minutes (Karpowicz, 2019).

Figure 4.1 shows the RTAF U1 UAS, which can fly for 8 hours within an operational radius of 100 km, with the ground control station used for both combat and non-combat operations. The RTAF received three Aeronautics Dominator XP medium altitude long endurance (MALE) UAS in 2021, the first platform to enter service in Thailand. When operational, they act as sensors for the C2 system, which helps speed up the observe, orient, decide, act (OODA)

decision-making process (Boyd, 1996). Armed UAS trials have also been conducted using a modified U1M armed with Thales' FreeFall Lightweight Multi-role Missile (FFLMM) under the U1X program. This program has proven successful, and the RTAF's long-term plan calls for creating an armed UAS fleet, either through domestic development, such as the U1M, or through foreign procurement (Korsakul, 2022).



Figure 4.1. The U1M was the first indigenously developed UAS to be commissioned into the RTAF (Reproduced from RTAF). In total, 17 airframes are now operational with the newly established 301 Squadron.

4.3.2 Satellites

For satellites and space technologies to protect maritime borders, the US military promotes collaborative technology efforts to provide near-real-time global maritime situational awareness to combat everything from illegal fishing and human trafficking to sovereignty threats. This includes a new US Naval Research Laboratory project called Proteus to identify, interrogate and filter vessels at sea based on user-defined criteria and an international Defense Innovation Corps competition called Xview 3 to build machine learning models for locating and distinguishing vessels at sea using synthetic aperture radar. Specifically for the US Navy and US Coast Guard, the US military is also pushing for broader cooperation among allies and partners to apply advanced military technologies, including surveillance satellites, high-resolution radar and data sharing software, to address maritime security challenges (Indo-Pacific Defense Forum, 2022).

The RTAF has launched its first military satellite to enhance the capabilities of the RTAF and play a vital role in the RTAF's defence system. The NAPA 1 and 2 satellites will carry cameras essential to the RTAF's defence system to enhance national security and defence against threats. **Figure 4.2** shows one of the two NAPA 1 satellites, which will work with other existing systems to help the RTAF better handle various operations, including natural disaster relief, wildfire control, natural resource protection and water management (Royal Thai Air Force, 2020). NAPA 1, 2 or RTAF-SAT 1, 2 are Earth observation nanosatellites built for the RTAF, under contract in July 2018 to ISIS of the Netherlands, to deliver a 6U CubeSat Earth observation satellite in orbit. The primary payload is the Gecko Imager from SCS of South Africa, which can image in the RGB band with a ground sampling range of approximately 39

metres from a typical low Earth orbit. There is also a secondary payload, a demonstration model of the TriScape 100 Imager from software developer Simera Sense, with a ground target sampling range of as low as 5 metres from a typical low Earth orbit. The RTAF realises the importance of space technology and gathers knowledge on space security dimensions that are directly related to national security, including military, economic, social and psychological aspects, and is beneficial to the nation in using space as an operational area that can support land, sea and air missions (Nanuam, 2020).



Figure 4.2. The RTAF's first security satellite NAPA 1 was successfully launched into space on 3 September 2020 (Reproduced from Kulu, 2024).

4.4. Implications for Thailand and Southeast Asian countries

The economies of Southeast Asia, and Thailand in particular, are vulnerable to the emerging threat of piracy and maritime terrorism. Advanced technology, such as intelligence, air and space reconnaissance, offers a means to counter these threats.

4.4.1 Technology perspective

The RTAF has developed the capabilities of several UAS systems, which are modern technologies that can be applied in surveillance, information and reconnaissance missions. These can play an essential role in dealing with traditional and non-traditional threats. Therefore, the RTAF has an opportunity to build on this foundation and develop UAS systems to fulfil various roles. Furthermore, cooperation between countries is needed to create security. Each country has different interests and challenges in maintaining security and stability both at the regional and global levels. By cooperating with other countries, countries can support each other, share information, and work together to address various security threats.

The utilisation of joint maritime security operations can be beneficial. Besides being useful in increasing the security of the surrounding area, it also has an impact on the cooperative relations between the two countries and opens up opportunities for cooperation in other fields. Examples include Operation Gannet, the collaboration between Indonesia and Australia, as well as INDOMALPHI (Indonesia, Malaysia and the Philippines) and other activities involving ASEAN countries. With close cooperation, countries can work together to address complex and cross-border security challenges. This collaboration enables coordination, collaboration and sharing of best practices in order to achieve better security collectively. Collaborative goals should include using network-centric operations which share target coordinates and real-time information, [Linking](#) with command and control systems, and sending data directly to relevant agencies on the ground and fighter aircraft.

In terms of space capability, the RTAF has a satellite, the first satellite for space operations of the RTAF. The purpose is to train RTAF personnel to be familiar with the control of the satellite operating system. It was also found that the satellite in the early stages could not fully respond to the operational missions of the RTAF because the images obtained were not clear enough and could not take pictures of the area of interest within 24 hours. Currently, the RTAF uses the NAPA 1 and NAPA 2 satellites, which are equipped with cameras with a resolution of 39 metres and 5 metres, respectively, which have low efficiency in responding to operational missions because space exploration satellites and surveillance satellites should have a resolution better than 0.5 metres to be able to capture images with sufficient resolution to meet the operational needs of the RTAF.

Therefore, the RTAF should cooperate with domestic agencies that have advanced technology related to space affairs and satellites, such as the Geo-Informatics and Space Technology Development Agency, to integrate and exchange space image data with the THEOS-1 satellite, or cooperate with partner countries, such as Australia, to use the satellite to exchange information between each other to maintain maritime security.

4.4.2 Cooperation to enhance the surveillance effect

At present, maritime cooperation in ASEAN is being promoted through frameworks and mechanisms such as the ASEAN Dialogue on Maritime Issues (ASEAN Maritime Forum [AMF]) and the ASEAN Defence Ministers' Meeting (ADMM). However, to combat piracy and armed robbery attacks, including other maritime security threats, organisations such as the National Navy's Information Centre from respective countries within the region and the International Maritime Bureau (IMB), which monitors maritime security worldwide, must improve information sharing, facilitate coordinated patrols, and work with regional governments. Strong cooperation between regional countries, such as the proposed Indo-Pacific Maritime Cooperation (Damayanti, 2019) and frequent joint patrols rather than short periods of exercise and maritime information sharing in the overlapping zone, should be solid and transparent for more effective allocations of time and resources.

4.5. Conclusion

In conclusion, maritime security in the Southeast Asia region is a primary concern for all countries due to its strategic importance and the significant sea lanes of communication. Modern day piracy has become increasingly sophisticated and prevalent. Enhancing air and space intelligence, surveillance and reconnaissance (ISR) in maritime security, particularly with uncrewed aerial systems (UAS) and satellites, should be considered more advantageous than crewed aircraft due to their operational effectiveness, cost and reduced risk to personnel and assets in a hostile environment. The RTAF should expand its uncrewed aircraft system and space

capabilities to provide increasing capability to deter or disrupt the emerging threat of piracy which could have enormous national implications for Thailand should it become widespread in Thailand's adjacent waters.

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5

Securing the Sulu-Celebes Seas: air and space power approach

Bryan Brotonef

Philippine Air Force

The Trilateral Cooperative Arrangement (TCA) between Indonesia, Malaysia and the Philippines aims to address escalating maritime security threats in the Sulu-Celebes Seas. The vast region, coupled with limited resources and competing priorities, hampers effective patrol and protection of the maritime region. Moreover, the South China Sea maritime dispute, characterised by overlapping territorial claims and increasing militarisation, diverts priorities and hence presents a significant challenge to the TCA's efforts to address security threats in the Sulu-Celebes Seas. This study analyses the current limitations and proposes enhancements through air and space power. Utilising basic features of air and space power (speed, reach and ubiquity) the TCA could significantly address the limitations in resources in patrolling the region. Moreover, the development of space agencies in Southeast Asian states reflects a growing emphasis on the use of the space domain for civilian applications as well as for national security thus increasing the readiness of these countries to use space-derived services for maritime security. By leveraging intelligence, surveillance and reconnaissance (ISR) capabilities and exploring collaborative space programs with Australia, the TCA can bolster maritime security, improve response times and strengthen regional cooperation.

5.1. Introduction

The Maritime Southeast Asia is considered one of the world's busiest shipping lanes and leads the world in fisheries production due to its biodiverse marine environment. No other maritime region combines this area's geographic and political complexity, making it one of the world's most challenging maritime security environments. This challenge is especially daunting around the Sulu and Celebes Seas, comprising two large bodies of water (~260,000 km² and ~280,000

km² respectively) in the eastern part of Southeast Asia. The Sulu Sea is bounded to the northwest by the Philippine Island of Palawan, to the southeast by the Sulu Archipelago (comprising the islands of Basilan, Jolo and Tawi-Tawi) and in the southwest by the eastern Malaysian state of Sabah. The Celebes Sea is bordered by the Sulu Archipelago and Mindanao in the north, Sabah and the Indonesian province of Kalimantan to the west, and Sulawesi to the south.

The territorial waters of Sulu have strategic, global value due to their use by thousands of oil tankers and merchant ships. The maritime trade routes, which crisscross the two seas, link Indonesia, Malaysia and the Philippines (INDOMALPHI), and are heavily used by international shipping between Australia and Southeast and Northeast Asia. An estimated USD\$40 billion worth of trade passes through the area every year.

However, the trade route through the Sulu Sea faces several threats, such as piracy and hijacking of ships, kidnap for ransom (KFR) as well as territorial violations of maritime boundaries between INDOMALPHI. Maritime crimes are not a new phenomenon in the Sulu-Celebes Seas. Piracy has existed for centuries while other crimes, such as abduction, drug trafficking, human trafficking and arms trafficking, have been reported since World War II. These waters have been renowned for piracy and KFR since the pre-colonial period. Its long history of piracy and armed robbery at sea has given rise to the perception of the Sulu-Celebes Seas as some of the most dangerous maritime regions in the world. Between 1995 and 2013, 41% of the world's piracy occurred in Southeast Asia, with the Sulu-Celebes Seas highlighted to be major hotspots. For decades, a combination of conditions has provided an enabling environment for maritime insecurity to flourish in the Sulu-Celebes Seas. Geography and a combination of the porous and poorly monitored sea boundaries, weak state law enforcement, and the lack of intra-state security cooperation enable outlaws to freely move about and perform crimes such as piracy, sea robbery, smuggling and illegal trafficking.

Post 9/11, terrorism and radical Islamism in the Sulu-Celebes Seas became an area of international concern due to the presence of the Abu Sayyaf Group (ASG) in the Sulu Archipelago (Brey, 2023). Islands in this region have been home to globally recognised terrorist organisations such as the regional affiliates of the Islamic State (IS) and other terrorist groups such as Jemaah Islamiyah and Al-Qaeda. In the early 2000s, ASG committed a series of KFRs in Malaysian and Philippine coastal resorts to generate funds for their activities. The Sulu-Celebes Seas are notoriously known for ASG's KFR operations, which continue to plague the seas due to ASG's asymmetric maritime capabilities. In 2016, a spate of KFRs refocused attention on maritime security in the area where heavily armed ASG operatives attacked three tugboats and abducted 18 crew members (Storey, 2016). Between 2014 and 2019, a total of 85 crew members have been abducted within a spate of 26 KFR incidents in the Sulu-Celebes Seas. Additionally, they often conduct their KFR and piracy in small boats to evade detection from satellite systems and reduce visual exposure to aerial or naval patrols (ReCAAP, 2017). Since the majority of the crew were Indonesians, Jakarta called for greater security cooperation between INDOMALPHI to address the problem.

Besides KFR, ASG has also exploited its asymmetric maritime capabilities to control the influx of terrorist militants as well as manage logistics and funds. While ASG still conducts illicit activities on land, they also rely on maritime crimes, such as hijacking and robbery of cargo ships. In 2004, ASG was responsible for sinking a ferry in Manila Bay killing 116 people. The archipelagic geography has provided shelter and extended the existence of ASG (Brey, 2023). Maritime enforcement agencies face problems locating ASG members as they hop from one island to another to avoid arrest. ASG has also utilised the shallow waters and mangroves of the area to outmanoeuvre the authorities.

To address these complex issues, Indonesia and Malaysia urged the establishment of coordinated naval patrols in the Sulu-Celebes Seas modelled after the success of the Malacca Straits Patrol (MSP) jointly conducted by the armed forces of Indonesia, Malaysia, Singapore and Thailand since 2004. The Philippines agreed to the coordinated naval patrols setting the establishment of the Trilateral Cooperative Arrangement (TCA) in 2016. The three littoral states share common challenges in achieving maritime domain awareness across the complex archipelagic geography and vast waters of the Sulu-Celebes Seas. The wide expanse of the seas, which together cover 540,000 km², can make it difficult to survey, monitor, secure and govern. However, the challenge is not merely a matter of size but also of complexity due to lengthy adjacent coastlines, thousands of large and small islands, shallow waters that prohibit large frigates and mangrove woods. Such complex terrain provides sufficient cover for smugglers and violent non-state actors (VNSAs), which makes it difficult to monitor and sustain state presence in the area (Ariani, 2018). These challenges limit the TCA to be fully effective. Here, I aim to analyse these limitations and propose enhancements through air and space power. I will first discuss the TCA and its challenges. I will then discuss basic features of air and space power and how it could address the challenges faced by the TCA. By leveraging intelligence, surveillance and reconnaissance (ISR) capabilities and exploring collaborative space programs with Australia, the TCA can bolster maritime security, improve response times and strengthen regional cooperation.

5.2. Trilateral Cooperative Arrangement

To protect the strategic environment and maintain national security interests in the Sulu-Celebes Seas, the surrounding countries agree that cooperation is necessary to face the threats. In 2016, INDOMALPHI established the TCA on immediate measures to address security issues in the maritime areas of common concern. The TCA allows the participating countries to respond to the growing security challenges in the Sulu-Celebes Seas. The countries are concerned that the Sulu-Celebes Seas will turn out to be the ‘new Somalia’, due to the increasing activities of ASG in the region. INDOMALPHI highlights the importance of protecting these global shipping highways with a majority of oil shipments using this route.

The TCA aims to provide a mechanism to operationalise immediate measures to address security issues in the maritime areas of common concern and to facilitate further cooperation among the three countries. This cooperation involves coordinated sea patrols, naval and army exercises, designated patrol corridors, intelligence sharing, as well as agreement on the potential sea and air surveillance routes. In addition, the littoral states have also agreed to initiate joint army training for the formation of a joint special task force committed to responding to threats in the maritime region (Amling et al., 2019).

Under the TCA, a Joint Working Group (JWG) was established to formulate, coordinate and implement the cooperative arrangements activities. JWG meetings work towards developing standard operating procedures for maritime patrol and rendering immediate assistance, operating guidelines on information and intelligence sharing, as well as a combined communication plan. The defence leaders also agreed to explore coordinated activities among their armed forces and a trilateral database sharing mechanism. Meetings are held monthly between defence leaders to operationalise the TCA. The three countries also agreed to implement the MSP concept as a model for coordinated naval patrols, combined air patrols, and exchange of information and intelligence.

In 2017, the TCA established a program of trilateral air and maritime patrols to enhance regional security (Storey, 2018). The Trilateral Maritime Patrol (TMP) was inaugurated in Tarakan Naval Base, Indonesia, while the Trilateral Air Patrol (TAP) was inaugurated in Subang

Air Base, Malaysia. The three countries rotate monthly to lead the TAP, and the Maritime Command Centers (MCCs) in Tarakan, Tawau and Bongao monitor the patrols to secure the Sulu-Celebes Seas and surrounding areas.

Following the establishment of the TCA, there has been a sharp decline in maritime piracy and armed robbery incidents in the whole of Southeast Asia between 2014 and 2018. Prior to TCA, Oceans Beyond Piracy reported nearly 200 attacks per year that fell to 129 in 2016 and declined further to 99 in 2017 (ReCAAP, 2017). The number of reported incidents in the Sulu-Celebes Seas declined sharply during 2017. Regional maritime security experts attribute this 50% reduction in incidents to the close coordination among the littoral states brought about by the TCA.

Assessing the efficacy of the TCA is difficult for two reasons: (1) the patrols only began after the attacks had practically ceased; and (2) since the launch of the TMP, little information has been publicly released by the participating countries. However, based on discussions with security experts who are familiar with the situation, the most important contribution of the TMP is improved communication and information exchange among the navies of INDOMALPHI facilitated by the establishment of the MCCs. Furthermore, it is important to note that INDOMALPHI navies do not patrol the area simultaneously, though they occasionally rendezvous near their respective sea boundaries. Combined air patrols have been rare.

5.3. Challenges and remedies

The South China Sea maritime dispute, characterised by overlapping territorial claims and increasing militarisation, presents a significant challenge to the TCA's efforts to address security threats in the Sulu-Celebes Seas. The vastness of the region, coupled with limited resources and competing priorities, hampers the ability of INDOMALPHI members to effectively patrol and protect their maritime interests.

The territorial disputes in the South China Sea divert substantial resources towards naval modernisation and defence. The arms race among claimant states, including Indonesia, Malaysia and the Philippines, diverts attention and funding away from counter-terrorism and counter-piracy initiatives in the Sulu-Celebes Seas. Moreover, the differing geographical characteristics of the South China Sea and Sulu-Celebes Seas hinder the efficient deployment of naval assets, limiting their ability to address threats in both regions simultaneously.

The limited resources available to INDOMALPHI members, including patrol boats, manpower and fuel, further constrain their capacity to effectively patrol the vast Sulu-Celebes Seas (Kulshrestha, 2017). Despite the establishment of the TCA and joint patrols, the lack of sufficient naval and air assets hinders the ability to maintain a continuous presence (Dikmen et al., 2016) and provide adequate maritime domain awareness (Gupta et al., 2013). These factors collectively highlight the competing priorities and resource constraints that impede the TCA's effectiveness in addressing security threats in the region.

To address these challenges, INDOMALPHI has considered logistical remedies such as the makeup of trilateral patrols, be it joint or coordinated. They have also considered prioritising certain threats over less serious threats. They also aimed to optimise standard operating procedures for the patrols and identifying naval capabilities (or limitations) that the three states could offer. There were also suggestions that the TCA could be expanded beyond INDOMALPHI. Brunei, Singapore and Thailand have all been mentioned as potential participants or observers. Brunei and Singapore attended the TMP launch ceremony as observers in June 2017 but neither country has so far contributed naval or air assets. Singapore has offered information-sharing support through the Information Fusion Centre (IFC) at Changi Naval Base (Thomas, 2015).

In 2018, the three defence ministers acknowledged the successes and flagged areas for further progress such as enhancing coordination between MCCs, boosting information sharing, and including land patrols in addition to the air and sea patrols. In 2022, the JWG discussed possible ways to further enhance the cooperation. It was agreed that Concept Papers will be prepared for further discussion among the three countries (Smith, 2014).

In the next few years, Southeast Asia could witness enhanced maritime enforcement efforts in the Sulu-Celebes Seas. There are several projects that the naval forces and civilian maritime enforcement agencies are currently pursuing to address security threats in this area. The naval forces are focusing on expanding their naval weapons systems to include equipment suitable for short-range deployment in the shallow waters as well as ISR systems and crafting of information-sharing initiatives via improved inter-agency coordination. Better research, data collection and dissemination can help create reliable assessment instruments for the success of the TCA. The three countries should take advantage of the increased interest by states beyond the TCA and ASEAN to help in training, information sharing as well as aid in the procurement of assets (such as ISR technologies) that would allow TCA countries to retain control over activities.

Enhancing security cooperation within INDOMALPHI helps overcome distrust and improve communication among militaries in the region. Joint port visits, establishment of sea-lane corridors, periodic joint training and more frequent correspondence between the parties are all desirable. However, policymakers in the region need to be realistic since none of these measures will put an end to terrorism, piracy or KFR in the Sulu-Celebes Seas. As long as there is trade in the region, there will always be people who will exploit security loopholes and unscrupulously benefit.

5.4. The role of air and space power

Utilising basic features of air and space power – speed, reach and ubiquity – could significantly address the limitations of the resource constrained TCA. While the TMP and TAP have had successes with legacy naval vessels and aircraft, air and space power could be further leveraged to protect the relative disadvantages of these legacy craft. One key area where air power’s characteristics could be used is through ISR.

ISR can be divided into three categories in terms of what assets are used to gather information. The first level covers traditional ISR assets such as ground-based and shipborne sensors. The second level covers aerial-based assets. These are very cost-effective because they provide line of sight (LOS) of higher altitudes and their cost is relatively lower. The third level covers space satellites. The most advantageous aspect of these assets is their advanced sensor capability and their relative invulnerability to disruption.

5.4.1 Air power

Aerial-based assets have relative advantages due to their flexibility and rapidness of deployment. It is also difficult to predict their deployment plans and flight patterns, effectively reducing detection and observation. Ground-based and shipborne sensors are disadvantages in terms of range, blind sectors and target tracking particularly in the Sulu-Celebes Seas’ archipelagic environment.

Similarly, satellites, despite being highly effective, are not widespread. They lack the loitering capability of uncrewed aerial systems (UAS) and only pass over the same spot on Earth about once every three days. Furthermore, satellite technology is very expensive in comparison to other assets. But it doesn’t mean that satellites are less effective for ISR: these can still be utilised to complement the ISR products gathered by both first and second-level enablers. Within the context of maritime domain awareness, UAS are considered crucial assets due to their aerial-based ISR capabilities. These enablers offer significant potential in enhancing situational awareness and providing valuable information.

UAS are more advantageous over crewed assets given their operational effectiveness, cost and keeping down the risk of personnel and assets in a hostile environment. A small fleet of uncrewed aerial systems is the ideal solution for increasing the effectiveness of aerial maritime surveillance. UAS could provide real-time intelligence to combat illegal activity along the sea borders and open seas. UAS can carry infrared (IR) and/or electro-optical (EO) cameras and could transmit real-time images to the ground operators. Hence, UAS is deemed as a force multiplier for naval forces with their ISR capacities for detecting, disrupting and dismantling unlawful activities over borders.

UAS are highly desired to support Maritime Situational Awareness (MSA). UAS can fly longer hours than any crewed aircraft. This provides a great advantage to navy commanders while gathering information about activities on sea and along borders and building a coherent MSA. Given the requirement of collaborating a large number of sensor systems systematically, UAS made a great contribution to ISR architecture with their endurance sensor diversity.

The use of UAS can be divided into three categories by taking into consideration various factors such as mission requirements, flight characteristics and cost. These categories are the strategic level, operational level and tactical level. At the strategic level, navies can use high altitude long endurance (HALE) programs to ensure maritime security on high seas by using UAS. For instance, *Global Hawk* (Northrop Grumman), *Phantom Eye* (Boeing) and *Global Observer* (AeroVironment) are used at the strategic level, which covers broader area operations. At the operational level, navies can use UAS for ISR missions from sea borders to exclusive economic zones and ground-based operations. The UAS such as *Anka* (Turkish Air Force), *Reaper* (General Atomics) and *Heron* (Israel Aerospace Industries) can be considered within this context. As for the tactical level, fixed-wing UAS like *ScanEagle* (Boeing) and rotary-wing UAS like *Camcopter* (Schiebel) provide a solution for navies during their maritime operations both from ships and lands. As an example, the Italian Navy used a *Camcopter* UAS as a tool for its immigrant rescue operations. Hence, UAS provides a range of solutions for obtaining necessary information for ISR missions and MSA. At present, UAS can play a complementary role for navies to establish Maritime Situational Awareness.

The range of categories of UAS could be used for national security, paramilitary and wartime missions. It provides for over the horizon targeting (OTHT) and increases the scanning area, time over target and mission flexibility. It also serves in real-time battle damage assessment. During peacetime, it aids in preventing seaborne hostile intruders, protects the country's rights and interests in the Economic Exclusive Zone (EEZ), and supports Search and Rescue operations. **Figure 5.1** shows an example for a potential Philippine-based UAS launched from a command and control centre from a major city in the south of the Philippines. Its range allows for protecting national security, protecting the EEZs and could cover threats in the Sulu-Celebes Seas.

5.4.2 Space power

Like air power, space power offers unique value through characteristics such as global perspective, reach and adaptability (Defence Space Command, 2022). Global perspective describes the greater field of view and extended horizon of the operational environment obtained under a platform's orbital altitude. **Figure 5.2** shows this perspective from a satellite that could take a snapshot of a 40,000 km² area within the Sulu-Celebes Seas. Perspective describes the way a force physically views the operational environment and a broad perspective enables an understanding of seemingly separate events on the surface, increasing awareness and enabling better-informed decision making (Australian Defence Force, 2023). On the other hand, reach is the distance over which a military capability or system can contribute to desired effects. Satellites can generate data and transmit them over long distances allowing coverage of desired areas particularly in remote areas of the Sulu-Celebes Seas. Lastly, adaptability is the ability of space systems to alter functionality in anticipation

of, or response to, changes to missions, threats and natural environments, either by flexible design, internal adjustment or planned functional modification. It is a space power characteristic based on the flexibility of the payload, spacecraft software, constellation configuration, link, ground or user segment. Moreover, it is the adaptability of space capabilities that allows space power to be employed across a variety of military and whole-of-government missions and efforts. This is the characteristic that underpins the joint-by-nature utility of space power and the space domain.

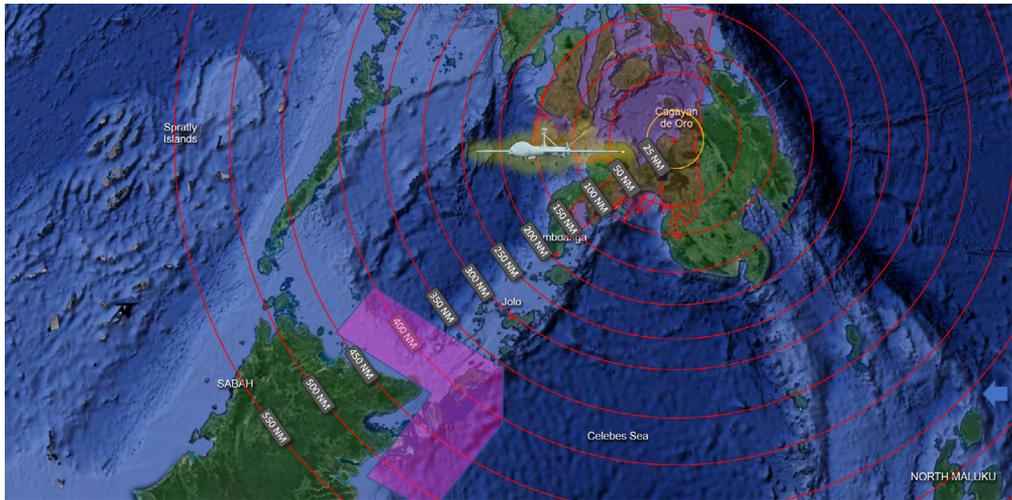


Figure 5.1. An example for a potential Philippine-based UAS launched from a command and control centre for protecting national security and protecting the EEZs, and its range could cover threats in the Sulu-Celebes Seas (Source: Google, 2025).

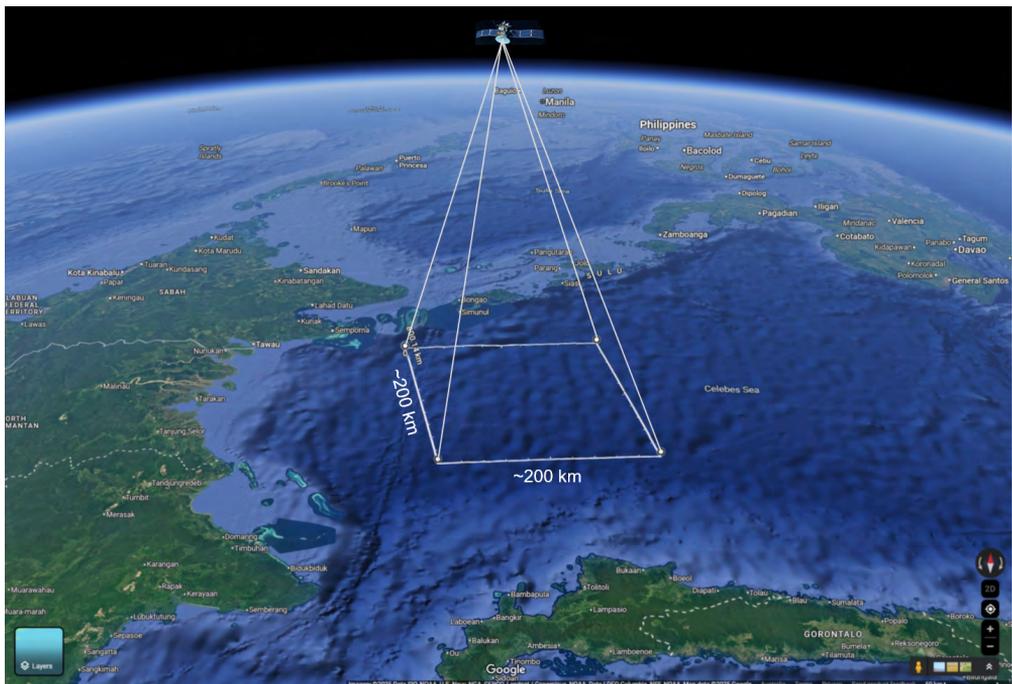


Figure 5.2. Global perspective provided by a satellite that could take a snapshot of a 40,000 km² area within the Sulu-Celebes Seas (Source: Google, 2025).

The broad perspective attainable through the space domain provides a field of view for ISR systems that cannot be matched by other physical domains. This advantage in perspective is further enhanced by exploiting other characteristics of the space domain such as reach. Space-based intelligence collection synchronises and integrates sensors, assets and systems for gathering data and information on an object or in an area of interest on a persistent, event-driven or scheduled basis. Moreover, the characteristics of global perspective and reach achieved through satellites support beyond visual range communications.

ISR is a continuing function carried out through all domains as part of a whole-of-government enterprise (Defence Space Command, 2022). Effective space-based ISR enables decision superiority over an adversary concerning the operational use of the space domain, providing the analysis of available information required to enable commanders and operators to make better-informed decisions at a tempo faster than the adversary does. Space-based ISR contributions synchronise and integrate the planning and operation of sensors, assets and systems in direct support of current and future operations. Space-based ISR contributions to the joint force can come from space or terrestrial-based systems and can include visual and electronic observation.

Space services also include satellite communications (SATCOM), which can provide timely, rapid and reliable transportation of data across the range of military operations in support of decision-making especially in the Sulu-Celebes Seas. Relaying of ISR information via SATCOM could include voice and data point-to-point communications, broadcast communications, long-haul communication links, protected strategic communications, and machine-to-machine interfaces.

Furthermore, space enables operations in other domains to be expeditionary, connected, informed, efficient and lethal. Space systems operating in the space domain may have segments in all of the domains – space segment (space domain), link segment (cyber domain), ground segment (land and cyber domains) and user segments (in all of the domains). Similar to the aim of the ADF, the TCA should also pursue a joint force that can achieve the highest level of interoperability across all operational domains.

5.5. INDOMALPHI space readiness

The development of space agencies in Southeast Asia highlights an increasing focus on space science, technology applications and national security. In Indonesia, the Research Organization for Space and Aeronautics (Organisasi Riset Penerbangan dan Antariksa, ORPA) (ORPA, 2023), operating under the National Research and Innovation Agency (2019), assumed the responsibilities of the former National Institute of Aeronautics and Space (Lembaga Penerbangan dan Antariksa Nasional, LAPAN) in 2021. Established in 1963, LAPAN was tasked with civilian and military aerospace research, satellite management, and the development of sounding rockets and small orbital launch systems.

Malaysia streamlined its space research endeavors in 2019 by consolidating the Malaysian Remote Sensing Agency (ARSM) and the National Space Agency (ANGKASA) into a single entity, the Malaysian Space Agency (MYSA). Established in 2002, ANGKASA had previously played a crucial role in space policy formulation and regulatory oversight. MYSA's formation aligns with Malaysia's National Space Policy, with the objective of utilising space technology to advance the nation's economic, social and security goals (International Astronautical Federation, 2020).

The Philippine Space Agency (PhilSA) serves as the central authority for space science and technology applications, actively collaborating with various national security institutions. It partners with the National Coast Watch (NCW) Center and the Department of National Defense (DND) to bolster maritime security and enhance domain awareness. PhilSA further supports

the Armed Forces of the Philippines (AFP) through the development of satellite data products and by conducting capacity-building initiatives, which include training in artificial intelligence (AI) for automated object detection. Additionally, PhilSA and the DND are joint participants in the 2021-2030 Decadal Survey, a collaborative effort aimed at addressing critical defence challenges through advancements in space technology (PhilSA, 2021).

INDOMALPHI have increased their readiness for space-derived services. Their future application for enhancing maritime security is encouraging and these countries could soon develop space as a major defence capability. A collaborative space program by major stakeholders in the Indo-Pacific such as ASEAN and Australia could potentially boost defence cooperation and enhance maritime security in the region.

5.6. Conclusion

The increasing maritime security challenges in the Sulu-Celebes Seas have led to the establishment of the Trilateral Cooperative Arrangement (TCA). This paper analysed the gaps and challenges to propose enhancements of the TCA via an air and space power approach. I discussed the relevant maritime security issues and the efficacy of the TCA to maintain maritime security and covered the challenges confronting the TCA implementation. I then provided the pathway to enhance the TCA by utilising the advantages of air and space power, especially in terms of intelligence, surveillance and reconnaissance (ISR) to complement the need for acquiring real-time information for immediate and rapid response. Towards the end, I investigated the different strategic mechanisms and tools that INDOMALPHI can collaborate with each other as well as with Australia for venturing into a common space program for the TCA.

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Please download the digital version of the monograph from <http://doi.org/10.58930/isbn9781925062601> to access references with hyperlinks.

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6

Indonesia's role to secure the ASEAN maritime gateway

Rahman Fauzi

Indonesian Air Force

Maritime piracy is a significant challenge particularly in the Straits of Malacca and Singapore (SOMS). Indonesia, a coastal state and a crucial stakeholder of the SOMS, is actively combating maritime piracy in the region including the Riau Archipelago, which are considered hotspots for sea robbery incidents. The Indonesian Government's proactive tactics and cooperative efforts are essential elements of the larger regional and global maritime security environment as it navigates the obstacles posed by piracy. However, Indonesia's efforts to combat maritime piracy in the SOMS are beset with numerous difficulties. By investigating past incidents and assessing the effectiveness of previous responses, a foundation is laid for evaluating the current scenario. Piracy and armed robbery against ships could be managed in the SOMS by understanding the pattern of crimes committed and designing appropriate mitigating measures.

6.1. Introduction

Maritime piracy, an age-old threat, has resurged as a significant challenge in contemporary times, with the Straits of Malacca and Singapore (SOMS) emerging as a hotspot for such illicit activities. The narrow passage connecting the Indian Ocean to the South China Sea is pivotal in global trade, making it a strategic yet vulnerable region. The SOMS, one of the busiest and most crucial waterways in the world, facilitates the transportation of a substantial portion of global trade. However, its strategic importance is coupled with inherent risks as the narrowness of the strait and its complex geography provide favourable conditions for piracy.

The SOMS has witnessed a recurring pattern of piracy and armed robbery against ships (ARAS), with various factors contributing to its persistence. As a critical coastal state bordering the SOMS, Indonesia plays a central role in mitigating the threats posed by maritime piracy. The Indonesian waters and the Riau Archipelago are identified as notorious hotspots for sea

robbery incidents, accounting for more than one-third of such reported incidents worldwide (Edwards, 2022). This issue extends beyond Indonesia's borders, affecting regional security and international trade. As maritime piracy continues to impact trade routes and jeopardise the safety of seafarers, the response of the Indonesian Government needs to be analysed.

Before the 1990s, the SOMS had a relatively low incidence rate but this trend changed during the political and economic transformation that led to the 1997 East Asian financial crisis and the collapse of the Suharto regime in 1998. State control over criminal actors was undermined because of rivalries and turf conflicts sparked by the police and military's division into autonomous agencies (Daxecker & Frécon, 2020). Piracy incidents in the SOMS have fluctuated, with periods of heightened activity followed by relative calm conditions. The International Chamber of Commerce (ICC) annual reports contain information from 1991 to 2019, when there was an increase in incidents between 1998 and 2003 and another between 2006 and 2011 (Pardo, 2021).

In 2023, the ICC International Maritime Bureau (IMB) (2023) reported 120 incidents of armed robbery and maritime piracy against ships, which is an increase from 115 incidents in 2022. Incidents include hijacking, assault and holding the crew hostage prompting the IMB to advise caution regarding crew safety. A detailed analysis of these trends reveals the dynamic nature of the threat, influenced by factors such as economic conditions, regional stability and law enforcement efforts. Understanding the current statistical landscape sets the stage for a nuanced exploration of the factors contributing to the ebb and flow of piracy.

Beyond the immediate threat to seafarers and vessels, piracy has far-reaching consequences for maritime trade and regional security. The SOMS's strategic position as a critical transit route for oil, gas and other commodities magnifies the impact of piracy on global trade. Piracy disrupts trade and imposes a substantial financial burden as indicated by a reduction of 2.3% in trade along routes between China and Europe (Sandkamp et al., 2022). The interconnected nature of the maritime industry means that disruptions in the SOMS reverberate across international markets. Additionally, the psychological impact on shipping companies and seafarers must be considered, influencing route planning and operational decisions.

The SOMS is a vital conduit for global trade but its strategic significance is accompanied by an ongoing challenge – maritime piracy. However, the nuanced background of piracy sheds light on the historical occurrences of piracy and the evolution of illicit activities in the region. By studying past incidents and assessing the effectiveness of previous responses, a foundation can be laid to evaluate the current situation. Statistical analysis of past incidents offers insights into the frequency, nature and severity of attacks, providing a basis for evaluating the effectiveness of counter-piracy measures. By understanding the pattern of crimes committed and reasons behind the area's vulnerability, appropriate strategies and mitigation mechanisms can be designed to combat piracy and ARAS in the SOMS. Mitigation strategies include the role of uncrewed aerial systems (UAS) and joint operations centres (JOCs).

6.2. Challenges in securing the SOMS

As Indonesia navigates the challenges of piracy, its proactive strategies and collaborative endeavours become crucial components of the broader regional and international maritime security landscape. Many challenges confront Indonesia's efforts to counter maritime piracy in the SOMS. Regional cooperation remains a key challenge, as the SOMS involves multiple littoral states with diverse interests. The essential aspect is that the states must demonstrate the utmost dedication to maritime security cooperation, as with all security partnerships. Interstate cooperation entails a certain level of concession by associated states and relinquishing a certain

degree of autonomy. However, implementing cooperative agreements that undercut the crucial interests of states or violate sovereignty sensibilities poses significant challenges to achieving practical regional cooperation and coordination (Ali, 2015).

Differences in legal frameworks, institutional capacities and historical tensions can hinder seamless collaboration. The Malacca Straits Patrol (MSP) is a comprehensive framework comprising many collaborative initiatives, including the Malacca Straits Sea Patrol (MSSP), the 'Eyes-in-the-Sky' Combined Maritime Air Patrols, and the Intelligence Exchange Group (Singapore Ministry of Defence, 2015). These initiatives aim to enhance coordination among coastal states, but the diversity of political landscapes poses ongoing challenges. Navigating diplomatic sensitivities and aligning disparate maritime strategies require adept diplomatic negotiations.

Moreover, socio-economic factors such as poverty and unemployment contribute to the allure of piracy for local communities, necessitating a comprehensive approach that addresses both security and development. Poverty partly fostered piracy by drawing quick returns for cheap risk. The 1997 economic crisis worsened financial conditions for millions of coastal people, many of whom struggled to make a living from local fishing (Baird, 2012). The government's challenge lies in formulating comprehensive strategies that enhance maritime security and promote sustainable socio-economic development. Initiatives such as job creation, education and community engagement are integral to a holistic approach.

Pirates operating in the SOMS are remarkably well equipped and able to adapt to changing circumstances. Pirates rely on speedboats outfitted with satellite navigation and communication systems and equipped with automatic guns, armour-piercing missiles and rockets. The evolution of their tactics and the use of advanced technologies present ongoing challenges for Indonesia's counter-piracy efforts. Modern piracy has some new aspects that distinguish it from previous piratical incidents. The core act of the crime remains the same, but the circumstances in which it occurs have altered substantially. This is primarily due to changes in pirates' abilities, weaponry and techniques, and the development of new approaches to combat the threat. In recent times, popular piracy methods have generally been limited to the abduction and hijacking of ships and cargo. However, in other situations, ships are plundered of their valuables in brief raids (Hassan & Hasan, 2017).

6.3. Combating piracy and ARAS

Article 101 of the 1982 United Nations Convention on the Law of the Sea (UNCLOS) defines piracy as any act of assault, detention or depredation carried out for private purposes by the crew or passengers of a private ship or aircraft in international waters. This act is directed against another vessel, individuals or belongings on board, and vessels, individuals or belongings outside the authority of any nation. On the other hand, the International Maritime Organisation (IMO) Assembly Resolution A.1025(26) defines ARAS as unlawful actions or deliberate facilitation of violence or detention, targeting a vessel or individuals or assets on board, within territorial waters, archipelagic waters and the territorial sea of a state, excluding acts of piracy carried out for personal gain (ICC International Maritime Bureau, 2023).

As a critical coastal state bordering the SOMS, Indonesia has been at the forefront of efforts to combat maritime piracy. The Indonesian Government has two distinct approaches to implement a maritime security strategy: (1) a robust endeavour to enhance maritime defence and law enforcement to safeguard the maritime territory and its natural resources; and (2) centres on maritime diplomacy and negotiation. Both approaches aim to enhance Indonesia's standing as a global maritime axis and are intricately [Linked](#) to education, specifically within the maritime domain.

The soft approach emphasises maritime diplomacy and negotiation. Indonesia can enhance its global maritime influence and engage the younger generation in maritime diplomacy and negotiation by fostering stronger alliances with nations interested in Indonesian waters (Prasetyo et al., 2023). Indonesia's proactive efforts are evident with the establishment of specialised anti-piracy units, collaborations with international partners, and enhancement of legal frameworks and jurisdiction over piracy-related crimes. Assessing the strengths and limitations of these measures provides a holistic view of Indonesia's role in securing the SOMS. Enhancing the efficiency and effectiveness of maritime law enforcement structures also enhances other facets of maritime governance, such as port management. Maritime law enforcement is crucial in strengthening and promoting maritime governance, explicitly focusing on maritime security. Legislative reforms, such as enacting specific anti-piracy laws, provide the legal basis for prosecuting offenders (Laksmana, 2022).

Indonesia's commitment to combating piracy is also evident in its maritime policies, which extend beyond punitive measures. The Indonesian Government, specifically the Maritime Security Agency (BAKAMLA), disseminates maritime-related information to the public. This information can be accessible through the Indonesia Maritime Information Center (IMIC). The establishment of this centre adds to the existing international maritime agencies, such as the Information Fusion Centre (IFC) in Singapore and the International Maritime Bureau (IMB) in Malaysia (Nirmala & Long, 2020). Integrated approaches that combine legal deterrence with socio-economic development initiatives contribute to a holistic strategy.

The IMIC has been established to respond swiftly to incidents, demonstrating the government's commitment to maintaining a visible and proactive presence in the strait. The objective of the IMIC is to consolidate all data and information about Indonesian seas utilising the Voluntary Community Report (VCR) pioneered by the IFC in 2010. This platform will undeniably be advantageous for numerous individuals since it allows the maritime community to directly report any occurrences that disrupt marine safety or abnormal behaviour at sea. The first stage involves collecting data from diverse sources, including live information, online media news and other relevant channels. The second stage entails the gathering of information. The validation process involves verifying the accuracy of the acquired information through coordination with appropriate stakeholders.

Furthermore, bringing Indonesia-centric development to life is one of the government's primary goals: to advance Indonesia, fortify its unity and raise its standard of living. To better serve the people outside of Java Island, the government has been working to put this idea of equitable development into practice. This includes distributing progress equitably across all regions of Indonesia, including the most remote ones (Antara, 2024).

The efficacy of these initiatives is assessed by examining their impact on deterring piracy and ensuring a rapid response to emerging threats. Additionally, collaboration with international partners is explored to augment Indonesia's maritime capabilities and intelligence-sharing efforts. Recognising the transnational nature of maritime piracy, Indonesia actively engages in collaborative initiatives with neighbouring countries and international organisations. Bilateral and multilateral partnerships aim to enhance information-sharing, joint patrols and coordinated responses to piracy threats.

6.4. Pattern of piracy and ARAS in the SOMS

Piracy and ARAS in the SOMS have significant causal effects on maritime security, economic stability and human welfare. This analysis explores the causal relationships between piracy incidents and their impacts on stakeholders and sectors from 2022 to 2024. The process of

reporting incidents in Asia is based on the guidelines provided by the International Maritime Organization (2009). In 2004, the Regional Cooperation Agreement on Combating Piracy and Armed Robbery against Ships in Asia (ReCAAP) was formed (ReCAAP, 2023a). ReCAAP distributes incident information to maritime authorities and law enforcement organisations. The incident reporting process keeps the existing procedures for reporting occurrences the same. Although not obligatory, shipowners, ship operators and shipping firms are strongly advised to promptly report any ‘actual’ or ‘attempted’ occurrences of piracy and ARAS.

Table 6.1. Summary of piracy and ARAS incidents within Asia and the SOMS from 2022 to 2024. Cases and locations taken from the annual reports of ReCAAP (2022; 2023b; 2024). Incidents within anchorages of Belawan and Dumai along the Malacca Strait have been added to the SOMS Total. Note that incidents from both anchorages are listed separately from SOMS incidents in the ReCAAP annual reports.

Year	Malacca Strait	Singapore Strait (SS)	SOMS Total	$\frac{SS}{SOMS}$ %	Asia Total	$\frac{SOMS}{Asia}$ %
2022	3	55	58	94.8%	84	69.0%
2023	13	58	71	81.7%	100	71.0%
2024	9	61	70	87.1%	107	65.4%

Table 6.1 shows the summary of piracy and ARAS cases in 2022–2024, where over 65% of the cases in Asia occurred in the SOMS. In 2022, there were 58 cases reported in the SOMS with 3 cases in the Malacca Strait near the Belawan Anchorage, Indonesia, and 55 cases in the Singapore Strait (ReCAAP, 2022), as shown in **Figure 6.1a**. In 2023, a total of 67 incidents were reported where 9 incidents occurred in the Malacca Strait and 58 in the Singapore Strait (ReCAAP, 2023b). Four cases occurred in the Dumai Anchorage and 5 cases in the Belawan Anchorage, as shown in **Figure 6.1b**. In 2024, 71 occurrences were reported in the SOMS with 10 cases in the Malacca Strait and 61 in the Singapore Strait (ReCAAP, 2024). From 2022 to 2024, over 80% of cases in the SOMS occurred in the Singapore Strait.

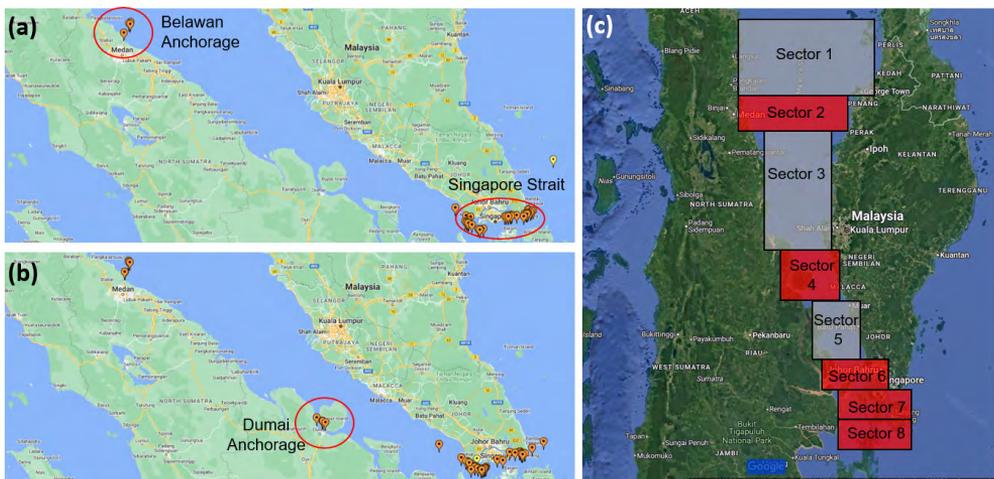


Figure 6.1. Piracy and ARAS cases located in the Belawan Anchorage, Dumai Anchorage and Singapore Strait in (a) 2022 and (b) 2023. (c) SOMS sectors according to probability of piracy and ARAS incidents. Cases and locations adapted from ReCAAP Annual Reports, 2022; 2023. (Google, 2025).

Incidents of piracy and ARAS can be linked to two primary causes: (1) poverty in specific geographical regions; and (2) congested shipping lanes. The prevalence of poverty and lack

of economic opportunities in specific geographical areas are socio-economic factors that may compel people to resort to piracy within their vicinity. Piracy assaults are also more likely to occur in regions with congested shipping lanes and inadequate law enforcement presence due to their location. While the socio-economic factor is fading due to developments in Southeast Asia and an increase in living standards, the second cause persists due to the lack of deterrence and ease to commit the crime.

From the data, the most probable locations of piracy and ARAS within the last three years can be inferred. **Figure 6.1c** shows how the SOMS can be divided into sectors with Sector 1 in the west side of the Malacca Strait running to the east region for Sector 6, while Sectors 7 and 8 are within the Singapore Strait. Sectors 7 and 8 are the most heavily trafficked areas for trading and have the highest probability of occurrence. Ships passing through these sectors move sluggishly and often remain moored. While there are two nearby maritime forces in this sector, the Indonesian Maritime Security Agency in Batam and the Singapore Marine Police, incidents of piracy and ARAS have persistently occurred. For most of the incidents, the vessel itself is not affected but instances of pilfering of goods have been reported. Offenders typically aim for a range of items within the ship but are restrained by the quick response of nearby authorities following the activation of the vessel’s alarm system.

Sector 2 (Belawan Anchorage) and Sector 4 (Dumai Anchorage) have lower probability but the second most prevalence of piracy and ARAS in the SOMS. Most vessels cruise constantly at this location and it is difficult for culprits to board ships traveling at such speed. However, there are few anchored ships within this sector, which are susceptible to piracy or ARAS. The impact for incidents in this sector is higher due to the extended response time for authorities as well as the large gap between detection and action. The offender can execute significantly more criminal activities, such as abducting the entire crew, pocketing a substantial portion of the ship’s cargo and demanding a ransom directly from the ship’s owner.

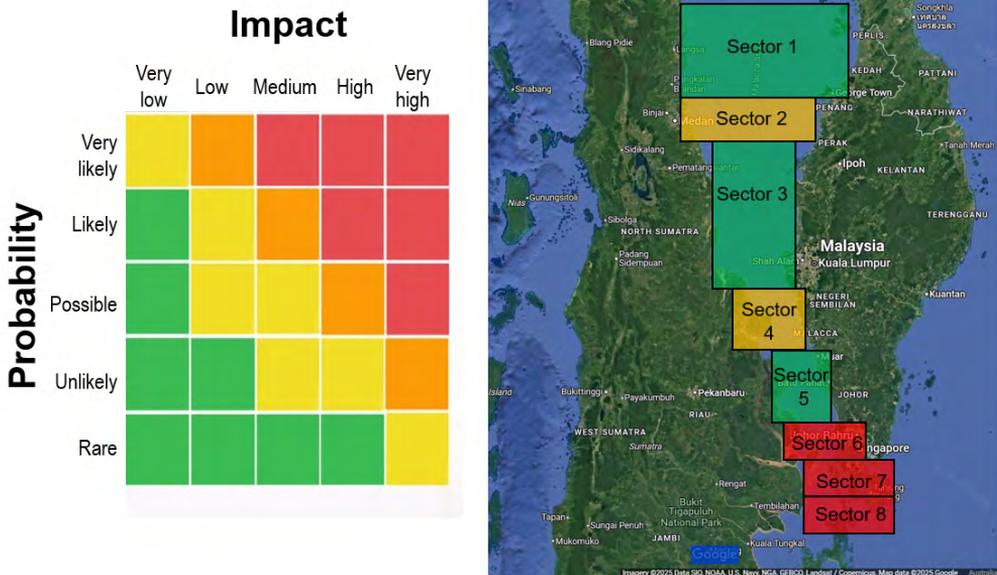


Figure 6.2. (Left) Risk mapping; (Right) Pattern of piracy and ARAS in the SOMS. (Google, 2025).

Figure 6.2 (Left) shows how risk is assessed by considering the impact and probability of occurrence. Low-impact events with very likely probabilities can have a higher risk than medium-impact events with rare probabilities because the frequency of occurrence significantly

influences the overall risk. Even though the individual impact of the low-impact event might be minimal, the high likelihood of occurrence means that, over time, the cumulative effects can be substantial. In contrast, while medium-impact events with rare probabilities may have more severe consequences individually, their infrequent occurrence reduces the overall risk. Thus, the combination of impact and likelihood determines the level of risk associated with an event. **Figure 6.2** (Right) shows the risk assessment of the various sectors along the SOMS for cases analysed between 2022 and 2024.

Ships that lack adequate security measures, such as low-quality surveillance systems, are more vulnerable to pirate attacks. Such security weakness makes it easier for pirates to board the ship, take control and steal valuable cargo. Real-time surveillance gaps in the SOMS hinder early detection of pirate threats, particularly during the night or adverse weather conditions. Despite the crew's prompt activation of the distress signal, the lack of real-time surveillance in the SOMS means the vessel could only detect the approaching pirate boat once it was nearby, reducing its response options and increasing vulnerability. The Global Maritime Distress and Safety System (GMDSS) enables vessels to communicate distress signals to maritime authorities and nearby ships (Federal Communications Commission, 2023). However, it lacks real-time surveillance capabilities to detect and deter pirate attacks pre-emptively. Vessels equipped solely with GMDSS rely on reactive responses, leaving them vulnerable to surprise attacks by pirates.

Vessels lacking additional security protocols such as armed guards, citadels or secure fencing are more susceptible to piracy incidents. Ships lack dedicated security personnel or physical barriers to deter pirate attacks, leaving the vessel and its crew vulnerable to boarding and hijacking attempts in the open waters of the SOMS, heightening vulnerability during night-time boarding attempts. The absence of armed guards or physical barriers on board the ships leaves the crew defenceless against pirate attacks, making the vessel an easy target for boarding and hijacking.

In addition, maritime security agencies have a limited response time during the attack. Despite its effectiveness in coordinating search and rescue operations, GMDSS response times can vary depending on factors such as communication congestion and the proximity of rescue assets. Vessels under pirate attack require immediate assistance, and distress signal processing or response coordination delays can exacerbate the situation. Communication delays during night-time or adverse weather conditions prolong the crew's exposure to pirate threats, increasing the risk of casualties and vessel seizure. Delays in distress signal processing and response coordination are exacerbated by the congested maritime traffic in the SOMS.

6.5. Counter piracy concept and recommendation

As Indonesia continues its commitment to counter maritime piracy in the SOMS, this section delves into the prospects of securing this vital waterway. It explores evolving challenges, potential strategies for sustained success, and the broader outlook on the maritime security landscape in the region. The future promises continued advancements in maritime security technologies that can bolster Indonesia's capabilities in countering piracy. Integrating anti-piracy capabilities into the GMDSS and UAS and establishing a Joint Operations Centre (JOC) present opportunities to enhance situational awareness and response capabilities.

By investing in cutting-edge technologies, Indonesia can strengthen its ability to detect, monitor and respond to piracy incidents in real time. The GMDSS can be designed to incorporate anti-piracy capabilities, enabling vessels to serve as early warning systems. These features include real-time threat detection algorithms and automated distress signal activation. These measures will prevent pirates from deactivating distress signals, preventing hijackers

from invading. Authorisation protocols will ensure that only recognised authorities can deactivate distress signals. Advanced authentication mechanisms will prevent unauthorised access. GMDSS systems can be integrated seamlessly with broader maritime security networks, enhancing coordination and collaboration. They could also be equipped with autonomous response capabilities, complementing existing protocols. However, international standards and regulations are needed to ensure compliance across maritime jurisdictions.

UAS are increasingly being embraced due to their cost-effectiveness and extensive capabilities in enabling timely situational awareness for many applications, such as fire protection, emergency medical services, hazardous materials intervention and specialised rescue operations (Hardy, 2025). With infrared imaging, UAS can detect heat signatures of approaching vessels, enabling nighttime surveillance and detecting pirate activity. They provide real-time monitoring, quick deployment and cost-effective alternatives to human-crewed aircraft or satellite surveillance. Indonesia actively engages in international collaboration to enhance security measures, focusing on the transnational nature of maritime piracy in the SOMS.

Multilateral cooperation, such as the establishment of a Joint Operations Centre (JOC), contributes to regional stability and security by addressing shared security challenges. The JOC could be a crucial hub for maritime security in the SOMS to coordinate anti-piracy efforts among ASEAN member states. The JOC could monitor maritime activities, analyse real-time intelligence and provide timely threat assessments to vessels operating in the region. The JOC could integrate data from various sources, including surveillance systems, vessel tracking databases and intelligence networks to provide comprehensive maritime domain awareness in the SOMS.

In a piracy incident, the JOC could facilitate a coordinated response by orchestrating search and rescue operations, coordinate law enforcement actions, and deploy maritime assets to intercept and apprehend pirate groups. Streamlining communication and coordination protocols ensures swift and effective responses to piracy threats, minimising the risk to vessels and crew. The JOC could optimise the allocation of resources, including naval patrols, aerial surveillance assets and response vessels, based on real-time threat assessments and operational requirements. Pooled resources and coordinated joint patrols/responses maximise the efficiency and effectiveness of maritime security operations in the SOMS. It also promotes capacity-building initiatives and facilitates information sharing among ASEAN member states to strengthen maritime security capabilities and enhance cooperation in combating piracy. Most importantly, the JOC could foster collaboration and mutual assistance among regional naval stakeholders through joint training exercises, workshops and knowledge-sharing initiatives.

The JOC is a communication hub, enabling seamless coordination between vessels, maritime authorities and security forces. It facilitates rapid dissemination of distress signals, emergency alerts and operational directives through dedicated communication channels and protocols, ensuring swift and effective responses to piracy incidents. It also coordinates deploying resources, including naval patrols, aerial surveillance assets and response vessels, to deter and intercept pirate activity in the SOMS. Optimising resource allocation based on real-time threat assessments and operational requirements enhances anti-piracy operations' effectiveness and maximises maritime traffic protection. In the event of a piracy incident, the JOC serves as a crisis management centre, orchestrating search and rescue operations, coordinating law enforcement actions, and providing support to affected vessels and crew members. Through rapid decision-making and coordinated action, the JOC minimises the impact of piracy incidents and ensures the safety and security of maritime navigation in the SOMS.

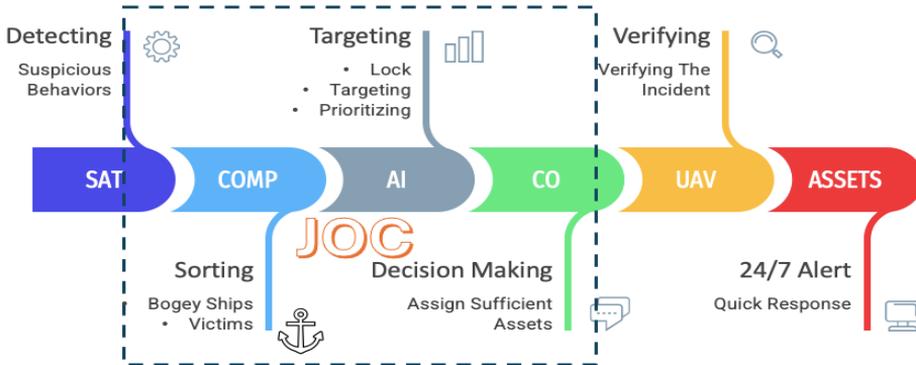


Figure 6.3. Proposed maritime security concept to combat piracy and ARAS in the SOMS.

Figure 6.3 is a proposed maritime security concept involving systems using artificial intelligence (AI) that could aid in the decision-making process to combat piracy and ARAS in the SOMS. AI can identify multiple vessels exhibiting suspicious behaviour by utilising real-time data from satellite imagery, tracking maritime traffic and examining historical piracy patterns. AI algorithms could process real-time data streams from satellite imagery, maritime traffic monitoring systems and on-board sensors. This data is then analysed to identify vessels at risk of piracy and prioritise interventions based on various factors, including threat level and proximity to critical infrastructure.

The JOC's dedicated analysts and operators team monitors the situation, interprets the AI-generated insights and coordinates deployment strategies. Moreover, autonomous UAS equipped with surveillance capabilities can be dispatched to gather visual intelligence and provide real-time situational awareness to decision-makers. The seamless integration of AI technology with human expertise ensures a coordinated and effective response to protect maritime traffic in the SOMS. In the JOC responding to piracy incidents in the Singapore Strait, a variety of UAS are deployed. UAS can be equipped with high-resolution cameras to capture detailed imagery of the maritime environment, allowing analysts in the JOC to identify and track suspicious vessels. Infrared imaging capabilities enable UAS to detect heat signatures, aiding in identifying potential threats even in low visibility conditions or during nighttime operations.

The system prioritises cases based on various factors, such as the proximity to populated areas, the type of cargo being transported, and the potential threat level posed by each vessel. AI algorithms analyse the data to determine the most critical situations requiring immediate intervention. Meanwhile, autonomous UAS with surveillance cameras and sensors are deployed to the identified locations, providing live feeds to command centres. AI algorithms process the visual data to confirm armed pirates' presence and assess each vessel's threat level.

Security forces, including naval units, coast guard and law enforcement agencies, collaborate closely with the AI system. They rely on the AI's assessments and recommendations to coordinate their response efforts effectively. Security forces are then dispatched to intercept and neutralise the pirates, guided by the AI's recommendations on the order of priority. Through coordinated efforts facilitated by AI, maritime authorities swiftly respond to multiple piracy incidents in the Singapore Strait, ensuring the safety of ships and crew navigating the busy waterway.

6.6. Conclusion

The journey through the complexities of maritime piracy in the SOMS and Indonesia's response has illuminated a multifaceted landscape shaped by historical, socio-economic and geopolitical factors. Indonesia's commitment to countering maritime piracy in the SOMS has yielded notable achievements. The nation has proactively addressed piracy threats through legal reforms, naval initiatives, and collaboration with regional and international partners. The SOMS sea patrols exemplify successful regional collaboration, and advancements in maritime surveillance technologies have contributed to enhanced situational awareness. These efforts underscore the resilience and adaptability of Indonesia's response, reflecting a multifaceted strategy that combines legal, military and socio-economic dimensions. The progress provides a foundation for future endeavours to secure the SOMS. Despite commendable achievements, challenges persist in securing the SOMS. Regional cooperation remains complex, necessitating diplomatic finesse and strategic alignment among coastal states. Socio-economic vulnerabilities continue to fuel piracy, requiring sustained efforts in holistic development. Technological advancements in piracy tactics and the potential impact of global shifts pose ongoing challenges. Tackling these multifaceted issues demands ongoing dedication, adaptability and international collaboration.

The prospects of securing the SOMS are anchored in several vital considerations. Technological advancements, including UAS and AI, offer promising tools to enhance maritime security. Strengthening regional cooperation, adaptive legal frameworks and engagement in global governance initiatives are pivotal for a resilient and interconnected security architecture. Anticipating and mitigating future challenges requires continuous assessment, flexibility and innovation.

The interconnected nature of maritime security underscores the need for collaborative, comprehensive and forward-looking strategies. As Indonesia navigates the path forward in securing the SOMS, several recommendations can be made to attain a resilient security posture: (1) continuous investment in technological capabilities; (2) strengthened regional cooperation; and (3) global engagement. Good governance initiatives will fortify Indonesia's position in ensuring the security of this vital maritime passage. The lessons learned and recommendations offered provide a roadmap for sustaining the security of the SOMS and contributing to broader global maritime stability.

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7

Multi-Domain Operations for countering drug trafficking in Southeast Asia

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Royal Thai Air Force

Drug trafficking is a major challenge in the Southeast Asia region and has been for a long time. The United Nations Office on Drugs and Crime (UNODC) stated that there was a huge increase in drug trafficking in the region, especially in synthetic drugs such as methamphetamine, in the past few years (UNODC Regional Office for Southeast Asia and the Pacific, 2023). While the COVID-19 pandemic appeared to have prohibited drug trafficking, the number of narcotics movements has continued to rise (Son, 2021). This issue affects many countries in the region with some of these drugs delivered to countries within the region and beyond through various channels. In addition, drug trafficking cannot be eliminated by using only one force and from only one country. Therefore, to address this challenge, it has to be done with a pragmatic multi-domain approach as well as fostering cooperation among stakeholders.

7.1. Introduction

The synthetic drugs market in Southeast Asia is diversifying (UNODC Regional Office for Southeast Asia and the Pacific, 2023). Methamphetamine has been produced and trafficked in the region in high volumes and the production of ketamine and other synthetic drugs has expanded. In this regard, the main drugs in the market have changed from traditional drugs such as heroin and opium to modern narcotics since the demand for these has been greater and they have been easier to traffick into the territory. Statistics show that 71% of 169 tons of methamphetamine was captured in 2020 primarily in five countries around the Mekong River (Cambodia, Laos, Myanmar, Thailand and Vietnam). This is 20% more than in the past decade (UNODC Regional Office for Southeast Asia and the Pacific, 2023). Nevertheless, drug trafficking issues cause many problems in the region, including in Australia, both direct and indirect such as economic issues and social problems.

Although there are many efforts such as the Joint Declaration for a Drug-Free ASEAN (ASEAN Secretariat, n.d.) and the ASEAN–Australia Counter Trafficking Program (Department of Foreign Affairs and Trade, 2023) to tackle the issue of drug trafficking in the area, problems continue to emerge. Drugs syndicates have developed their approach and tactics to smuggling drugs and to conduct their activities. For example, they use online spaces for drug trading or various social media platforms for promoting their illegal activities. Modern equipment such as drones has been employed for delivering drugs in the area of the Golden Triangle, a notorious area of drug trafficking in Southeast Asia (Doyle, 2023).

All this data indicates that drug trafficking activities cannot be tackled with the conventional approach since there is evidence that modern equipment and methods have been used by the traffickers. The need for a new approach to eliminate the consequences of drug trafficking is crucial. Multi-Domain Operations (MDO) is the new concept that is already implemented in some military entities such as United States (US) forces and NATO to enhance military capacity when combating threats in the modern environment.

This research aims to apply this approach to tackle the issue in the region. Drugs can be delivered through different channels such as land, maritime and air and all these channels are part of the domains in MDO. As such, a new approach like MDO may be a possible solution for securing the ASEAN maritime security sector against drug trafficking.

7.2. Multi-Domain Operations (MDO)

The need for MDO is stated in the US Department of Defense (DoD) National Defense Strategy: to ‘compete in this complex and contested security environment, the US must be prepared to operate across a full spectrum of conflict, across multiple domains at once’ (Nettis, 2020). As such, the objective of MDO must be concerned with creating complex and simultaneous problems for the enemy. In addition, the MDO concept seeks to harmonise effects among the domains of land, maritime, air, cyber and space at the tactical, operational and strategic levels which would lead to several problems for the enemy. These activities in each domain are synchronised with non-military activities and enable the Alliance to create desired outcomes at the right time and place (NATO, 2023).

There are three main elements in MDO. There will be consultation among stakeholders such as at the national policy level, national armed forces and external stake holders to establish objectives and the desired outcome of operations. After this stage, this information will pass to all five domains (land, maritime, air, cyber and space) which are the core factors in the operation. The activities across five domains need to be synchronised and orchestrated to attain lethal and non-lethal effects in the engagement environment. Then once activities across the five domains are executed, the consequent effect is the target of operations in three dimensions (virtual, cognitive and physical). Ideally, activities across all domains should be harmonised and synchronised to achieve the objectives of the operation, such as to disrupt enemy cohesion and anti-access/area denial (A2/AD) on the enemy’s side. If one domain from the enemy’s side has been disrupted, continuation of the operation cannot be achieved and collapses as a result. However, in the real situation, each domain has its weaknesses and limitations. MDO needs to consider how to eliminate the limitations of each domain and how to offset that by using other domains to achieve a desired outcome.

7.2.1 Analysis of each domain characteristics

This research uses a SWOT analysis to analyse characteristics and how to bridge the gap between each domain. The result of the SWOT analysis is shown in **Table 7.1**. The strengths of land domain are that it is flexible to respond to combat situations and it is the main domain

to enable the other four domains. However, it requires a long time to set up and is limited by human capabilities. To offset the limitations of this domain, in the context of countering drug trafficking activities in the Mekong River, maritime patrolling and virtual force (cyber and space) will compensate its limitations on intelligence missions. In addition, air domain will support land operations by using its resources on close air support operations.

Maritime domain has an advantage on the length of force deployment which is capable of a long and continuous mission. The weaknesses of this domain are similar to land domain: the time to build up troops to be ready for a mission; and the speed of ships or vessels, which are considerably slower and limit the range and operating time of a mission. To mitigate its limitations, space and cyber domains assist maritime domain to enhance a capability of command and control (C2).

For air domain, it has fast aircraft and is agile which enables this force to reach the target on time or in advance. The problem in applying MDO in the ASEAN region is that there are many types of aircraft in terms of utility. These aircraft also have different technology which in some cases is not compatible with new technology which require updated data links. Weather is another factor that limits the operation. However, using a virtual domain for enhancing the quality of command and control (C2) and anti-access/area denial (A2/AD) is a possible solution to overcome the weakness.

This research combined cyber and space domains into one aspect for analysing by the SWOT method because not all countries in ASEAN have both cyber and space domains. Therefore, these two domains can be joined as one domain. Since the virtual domain is flexible to use and takes a short time to be ready, sharing of information among the stakeholders in this context can be easily done for enhancing situational awareness in the MDO. In the area that the signal for operating satellites is weak, land domain can be deployed for extending the range of operations. However, virtual domain among ASEAN countries is not fully implemented since it requires a hefty budget. Therefore, cooperation and agreement to eliminate the drug trafficking issue in Southeast Asian countries is the key factor for integrating virtual force in MDO.

Table 7.1. Characteristics of each domain using SWOT analysis.

Domain	Strengths	Weaknesses	Opportunities	Threats	Alternate Domain
Land	<ul style="list-style-type: none"> Response flexibility Ability to influence the air, sea, space and cyber domains. 	<ul style="list-style-type: none"> Readiness of troops takes time Human limitations 	<ul style="list-style-type: none"> Cooperation with land forces within ASEAN 	<ul style="list-style-type: none"> Use of weapons from drug cartels 	<ul style="list-style-type: none"> Maritime patrol Air domain for CAS Virtual force for ISR
Maritime	<ul style="list-style-type: none"> Capacity for long missions 	<ul style="list-style-type: none"> Requires long time to set up and reset Slow (speed) 	<ul style="list-style-type: none"> There are existing frameworks within ASEAN 	<ul style="list-style-type: none"> New tactics and modern equipment from drug dealer's side 	<ul style="list-style-type: none"> Virtual force for C2
Air	<ul style="list-style-type: none"> Speed Agility 	<ul style="list-style-type: none"> Requires high-speed data Link Different types of aircraft within the region 	<ul style="list-style-type: none"> Enhanced ISR capabilities Air littoral 	<ul style="list-style-type: none"> Ground-based AAA 	<ul style="list-style-type: none"> Virtual domain for C2 and A2/AD Land & space domain when weather is not suitable for operations
Virtual: cyber & space	<ul style="list-style-type: none"> Requires short time to set up and reset Flexible to use 	<ul style="list-style-type: none"> State-of-art technology Compatibility among ASEAN 	<ul style="list-style-type: none"> Information and technology sharing 	<ul style="list-style-type: none"> Cyber-attack on systems using data obtained from satellites 	<ul style="list-style-type: none"> Land domain to enhance range of communication

7.3. Applying MDO to counter drug trafficking

This research used drug trafficking movement in the Golden Triangle, a notorious area for this drugs issue, as a possible scenario to apply MDO. For a better understanding of the level of drug trafficking organisation, the organisation structure of drug trafficking is shown in **Figure 7.1**.

The overview of the organisation of drug trafficking consists of three levels. The primary level is the core organisation which is the origin of the drug trafficking network. This level operates the activities internationally and is highly centralised. The drugs cartels around the Mekong River fall into this level. They organise and manage all activities in the business from production to delivery. The next level is the secondary organisations which have multiple tasks to operate the business such as money laundering, regional distribution and transportation. There are some sub organisations from the drug cartels in the core level around the Mekong River, especially in the Golden Triangle. The last level in drug trafficking organisations are local organisations or dealers who execute the distribution of drugs on a local basis (Howard, 1994). The MDO should aim to focus on both the primary and secondary levels to counter, rather than emphasise, the low level since MDO requires modern technology and a substantial budget.

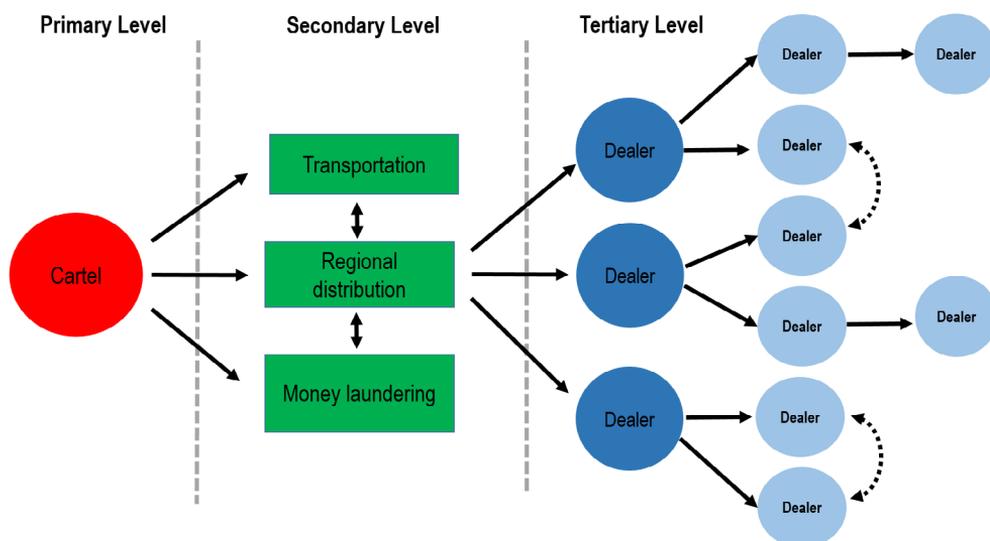


Figure 7.1. Drug trafficking organisation structure (Adapted from Howard, 1994).

When applying MDO in this scenario, the situation should be as follows:

- Cyber domain detects activities and movements on social platforms or the dark web from drugs cartels, then disrupts it by using cyber performance and distributes this information to other domains.
- Space domain detects the use of certain frequencies that drug trafficking units are engaged in, then supports other domains by securing communication and providing updated information from satellite images around the area. Apparently not all countries in this area have a space domain, in which case countries that already have this resource available, such as Thailand and Singapore, may utilise their assets for supporting the mission. However, this has to be done through a diplomatic channel or a mutual agreement as part of the first MDO elements.
- With regard to the information provided by both cyber and space domains, air domain will conduct air patrolling along the target zone for close air support

missions, as well as standing by for a search and rescue (SAR) mission if needed. In addition, depending on available assets, this domain may integrate uncrewed aerial systems (UAS) or drones to enhance the capacity to patrol beyond normal conditions such as in high terrain. UAS can fall into both air domain and space domain depending on performance. This research focuses on how to bridge the gap between each domain to tackle drug trafficking issues regardless of performance.

- With land domain, especially the force deployed around the Mekong River, land forces need to be ready for deployment for drug seizing operations since physical workforces and sometimes weapons are required to enforce the law in these situations. In the meantime, land domain is the prime domain for enabling and supporting other domains from land such as a ground-based satellite for space domain and an air-ground radio station for communication among the five domains to enhance the capability of intelligence, surveillance and reconnaissance (ISR) missions in Southeast Asia.
- For maritime domain, available resources such as river patrol vessels have to operate along the Mekong River and in the meantime receive information across other domains on the movement of drug trafficking activities to reduce the time to approach the target. This domain also supports air domain on search and rescue (SAR) missions if required.

In addition to the scenario above, the domain that detected activities and needs to identify the target, whether it is a legitimate or false target, should have a capability to send that information to a decision maker who can authorise the next step of the operation. Therefore, MDO is a suitable approach since the concept improves the command and control system (C2) together with activities across five domains for sharing information.

There are many military exercises in the ASEAN region, and Australia has participated in some, that foster cooperation among the countries. As a result, this coordination experience may enable the mission to be conducted smoothly at the operation level. However, with exercises focused on utilising conventional forces (land, maritime and air) to combat the new threats posed by drugs cartels around the Golden Triangle, MDO still needs some time for ASEAN countries to fully understand and comply.

7.4. Assessment tools

Following the hypothetical scenario in Section 3, it is important to evaluate the effectiveness of MDO as a practical approach for securing maritime security in the region, especially how well MDO works to counter drug trafficking in the Southeast Asian maritime zone. However, it is difficult to conduct a military experiment since it requires a substantial budget. Wargaming has long been an approach for military testing and to speculate an outcome of war. This approach is suitable for supporting military decision-making since it is a cost-effective method (Kainikara, 2008). The complexity of drug trafficking in the region is challenging for accurate wargaming and thus there is a need to conduct war games which assist decision makers to understand the environment and make decisions in accordance with ongoing situations. Therefore, this research used the method of wargaming to speculate and evaluate the effectiveness of MDO in countering drug trafficking in this area. Nonetheless, the research did not comply with a full-scale wargaming process since it is time consuming. This research used only a reflection process to evaluate the course of action when using MDO from four perspectives: technology, operational effectiveness, network and joint interoperability. These perspectives are called Line of Effort (LoE) which, 'in the context of planning, [is] using the purpose (cause and effect) to

focus efforts toward establishing operational and strategic conditions by *Linking* multiple tasks and missions' (US Department of Defense, 2021).

Drawing on LoE when using a wargaming approach to assess the effectiveness of MDO, the results are as follows:

7.4.1 LoE-1: Technology

What is the technological readiness of ASEAN countries for Multi-Domain Operations for countering drug trafficking around the Mekong River?

It is a fact that some countries in the region have not enough assets or resources to conduct MDO. However, Thailand, in the region, already possesses all five domains and is ready to support others to tackle the issue.

Is virtual force such as cyber and space effective or compatible enough in the ASEAN region to be deployed in a specific area such as the Golden Triangle?

In this context, basic infrastructure such as internet connection is implemented to cover most of the area in the ASEAN region. Consequently, it is sufficient to support cyber and space missions in that specific area when the nature of the region does not require on-site equipment. Both cyber and space domains may operate somewhere beyond the region which can be assumed is effective enough to conduct operations to counter drug trafficking.

7.4.2 LoE-2: Operational effectiveness

Is it worth developing MDO to use in countering drug trafficking in a small area such as the Golden Triangle?

According to the available resources among ASEAN countries, not all countries have a virtual force both space and cyber. A project to establish a new force would be costly and take time to implement. However, once it has been developed, it would not only help that country to enhance its capability to counter drug trafficking but would also support other missions in civilian sectors such as humanitarian aid operations during disasters. Therefore, it is worth implementing MDO in the region.

Is Southeast Asia ready to use MDO for enhancing maritime security capacity in the region?

Since it is a new approach, this region needs some time to incorporate this strategy. There are various doctrines in the region which are influenced by different ideologies. Although technology is already implemented and sufficient to conduct MDO in the region, different ideologies may lead to misunderstanding among countries in MDO.

7.4.3 LoE-3: Network

Do we have a reliable network among ASEAN countries to support MDO in countering drug trafficking?

The effectiveness of MDO relies on a good quality network for improving situational awareness and to understand the ongoing situation in real time. There is an effort to establish a reliable network for communication in the region, such as the ASEAN Communication Master Plan (ASEAN Secretariat, 2019) but the success of this plan is still an ongoing process. However, since MDO for seizing drug activities in a small area in the region such as in the Golden Triangle may not require a full-scale or great reliability of network, it may be presumed that the region has a practical network that could be used for MDO on this issue.

What capacity should be developed or acquired for better quality of network, especially for integrating in the ASEAN maritime zone?

Since the ASEAN maritime area is a large area approximately 2 million square kilometres (ASEAN Secretariat, n.d.), some countries need to improve their network capabilities such as satellite and data links to cover their maritime area of responsibility. In the context of countering drug trafficking, activities in the maritime zone may detect and deter if a network capacity is sufficient to cover all their responsible area. Consequently, space domain is a key factor on which to focus and emphasise the need.

7.4.4 LoE-4: Joint interoperability

Are there any constraints that affect operations, especially in the Mekong River?

The area around the Mekong River comprises many countries with different official non-English languages. Therefore, language barriers have to be addressed when implementing MDO in the region, specifically during a multi-national operation. National culture may be another constraint for MDO in Southeast Asia since there are different ideologies among ASEAN countries, which hinders cooperation.

How can MDO eliminate problems during joint operations, both small and large scale, in the ASEAN maritime region?

The objectives of MDO are to improve situational awareness in the combat or non-combat environment, enhance abilities to direct forces across domains, and facilitate rapid decision-making. In dealing with drug trafficking activities in the ASEAN region, regardless of the size of operations, MDO helps eliminate problems that might occur during operations by reducing the time for making a decision using the high speed of a command and control (C2) system. In addition, MDO makes it more flexible to change a plan or consider alternative options by utilising cyber and space domains. However, the resources that will be deployed depend on the size of the operation, whether it should be full scale or rely on some forces according to the economy of force principle.

7.5. Conclusion

Although the drug trafficking problem in the Southeast Asia region is not completely eliminated, the approach of Multi-Domain Operations is not mature enough to be used in ASEAN since it is quite a new strategy. However, it is possible to implement MDO in some countries that already have all five domains. Activities among domains enhance the capability of situational awareness and the ability to command and control across domains. Furthermore, MDO facilitates quick decision-making for high level officers which reduces the time to respond as a result. Therefore, this approach is an effective method in dealing with a diversifying method of drug trafficking in this area. The research intended to use the Golden Triangle to demonstrate an idea of how to apply MDO in a real situation. When activities among five domains are synchronised and orchestrated, an outcome of drug trafficking seizing operations will likely be as expected. However, it needs emphasis on both the primary level which is a core component of drug trafficking organisations and the secondary level such as money laundering units and transnational agents rather than focusing on drugs dealers. MDO should aim to eliminate the presence of drugs cartels and deter a supply of narcotics to illegal markets in the ASEAN region and Australia. Hence, combining with the aforementioned information, an MDO approach in this region may need time to be synchronised among ASEAN countries' assets and resources since different countries follow different doctrines. In addition, the emergence of new domains such as cyber and space requires a large sum of money to implement since they depend on modern technology. Consequently, finance is another factor to be considered in implementing MDO to solve this issue.

However, in terms of finance, it is beneficial in the long term for each country since threats always develop in dynamic and approach to pose dangerous effects. In the case of drug trafficking activities, dealers use cyber to promote and organise crime; it is complex to use only conventional approaches to eliminate their activities. Also in the Southeast Asia region, although the GDP in some countries is low, drug trafficking activities use new technologies and take advantage of modern equipment for their business. Cooperation among ASEAN countries will enhance the effectiveness of countering drug trafficking operations in the region. Accordingly, MDO is another suitable option for governments to allocate budgets for improving the capability of military forces especially by considering establishing virtual forces such as cyber and space to tackle drug trafficking.

The challenge in this region of using MDO involves contributing factors such as language barriers, willingness of cooperation and the available resources of each country. Since there are many different official languages in Southeast Asia, English has to be a means of verbal communication in the area. However, there may be difficulty in understanding each other because of different cultures and perceptions. Some countries are more prone to compromise rather than lead, while other countries seem to be more direct about command and control to achieve their objectives. This also leads to the level of willingness of cooperation in the ASEAN region. Although drug trafficking issues in the region influence other problems both direct and indirect such as social issues and unnecessary use of the government budget, the level of cooperation to solve this problem is not sufficient. Each country prioritises this problem at a different level because of other ongoing domestic issues. Thus, drug trafficking issues may be placed at the low level and MDO may remain to be considered since the government needs to focus on more important problems.

In addition to this data, available assets to establish and implement MDO in ASEAN countries may be hindered by limited budgets and resources. Since MDO requires activities across five domains, it is apparent that some countries do not have all domains that are necessary to tackle drug trafficking activities within the region. It is obvious that it requires modern technology and some time to adapt to the new concept. However, if there is a willingness to cooperate among the region, this might offset difficulties by using other available forces among Southeast Asia countries. In this case, Australia may participate in operations since drug trafficking in this region will eventually reach a market in Australia. Cooperation between Australia and ASEAN countries is already established and needs to be continued since Australia also lists narcotics trafficking as a top priority issue to be eliminated (Department of Foreign Affairs and Trade, 2023). Furthermore, trust is also a key factor in building honest cooperation among stakeholders. Every country in the region, including Australia, should have a clear objective towards countering drug trafficking.

Lastly, there is a cultural challenge influenced by multi-domain integration (Kainikara, 2008) not only among ASEAN countries and Australia, but within the five domains in particular countries. Conventional forces such as land, maritime and air might take time to integrate with the new domains such as cyber and space as the cyber and space domains operate in a fast-paced environment unlike other domains such as land and maritime. This may trigger conflicts between operators among all domains and needs to be addressed for an effective result from a mission. Operational MDO needs to be able to minimise the problems caused by cultural challenges to enhance the maritime security sector's capacity to counter drug trafficking in the ASEAN region.

Drug trafficking activities also transform to fit in with the new environment and to avoid counter-drug trafficking strategies. A new approach to counter drug trafficking especially in the ASEAN region is crucial since the issue contributes to various problems in the region including in Australia. Multi-Domain Operations is a concept developed to deal with new threats that

keep emerging in the modern world. Although this issue seems to be difficult to completely eliminate, successful integration and synchronisation among available domains through excellent cooperation in the region will reduce the impact of drug trafficking in the ASEAN region as a result of using MDO effectively.

The concept of Multi-Domain Operations facilitates rapid decision making. Therefore, it might apply to operations that are not war-related or deployment in a battlefield but still require a military force to operate a mission. This kind of situation may refer to military operations other than war (MOOTW). MDO provides more flexibility to change a plan or consider alternative options since it has capabilities from cyber and space domains to support the decision-making process. For example, MDO may apply to a humanitarian assistance and disaster relief (HADR) mission which in this context is sometimes caused by military operations on countering drug trafficking that lead to collateral damage. MDO assists decision makers through clear command and control and improves situational awareness. Hence, cooperation among ASEAN countries on a mission will be effective and contribute to improved outcomes from the operation.

A further recommendation from this research is wargaming that can be used to identify the weakest domain, depending on the situation. There are some examples from other forces such as US forces and NATO that already implement MDO in their current missions. However, these examples may not be sufficient to analyse the weakest force and use them as lessons learned. To simulate an outcome of a mission requires a lot of time and money. Consequently, wargaming is a practical process for speculating and analysing an outcome of a mission since it does not require a large sum of money. However, it should be done carefully without any bias and conflicts in order to achieve a useful expected outcome of the mission to prepare a force accordingly.

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8

The role of space technologies in enhancing Indonesia's maritime security

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Indonesian Air Force

Indonesia's territory is mostly sea. Maritime security is an important issue for protecting sovereignty and territorial integrity and for enabling economic prosperity through accessing maritime resources or facilitating trade. Securing Indonesia's maritime environment could prevent and address criminal threats including terrorism, piracy, smuggling and illegal fishing. Here, I will explore the use of space technology to assist Indonesia in addressing the limitation of its current approach to maritime security. I argue that space technology can provide the potential to significantly improve the effectiveness and efficiency of Indonesia's maritime security awareness, which will greatly benefit Indonesia's security and prosperity and make Indonesia 'king of our seas'. I will discuss the use of space technology from the perspective of Indonesia as a state with substantial territorial waters, and its potential to enhance maritime security and sovereignty.

8.1. Introduction

'We must become kings in our seas' proclaimed Indonesian President Joko Widodo during the launch of Indonesia's global maritime fulcrum (GMF) in 2014 (Farisa & Erdianto, 2021). He also declared the importance of maritime security to Indonesia and committed Indonesia to a renewed focus on its maritime territorial boundaries.

Maritime security is an important issue for all countries, whether for protecting the state's sovereignty and territorial integrity or for enabling economic prosperity through accessing maritime resources or facilitating trade. For the Indonesian state, whose territory is mostly sea, sovereignty and prosperity also depend on preventing and addressing criminal threats in the maritime environment. These criminal maritime threats include terrorism, piracy, smuggling and illegal fishing.

Currently, Indonesia mainly relies on air and sea maritime patrols to monitor and respond to security threats in the maritime environment. While these are useful means of surveillance and response, patrols have limitations in terms of coverage area and time on target, as well as the availability of patrol resources. This means that the effectiveness of the current forms of maritime patrolling is limited by the availability and reach of patrolling air and sea craft and must be prioritised.

This paper will explore the use of space technology as one way to assist Indonesia to address the limitations of its current approach to maritime security. I argue that space technology provides the potential to significantly improve the effectiveness and efficiency of Indonesia's maritime security awareness, which will greatly benefit Indonesia's security and prosperity and make Indonesia 'king of our seas'. I will discuss the use of space technology from the perspective of Indonesia as a state with substantial territorial waters, and its potential to enhance maritime security and sovereignty.

This paper is divided into four sections. The first section will explain how Indonesia's geographical location as a strategic crossroads of global trade and its maritime environment offers potential but also presents challenges which can significantly impact the country's economy, society and environment. The second section looks at Indonesia's current strategy for addressing maritime security, including relevant agencies and their roles. The third section explores the potential use of satellites for Indonesia and specifically their application in implementing maritime area security. The fourth section proposes opportunities for Indonesia to use satellite technology in providing capabilities to contribute to maritime area security.

8.2. Indonesia's maritime environment

Indonesia is the largest archipelagic country in the world and is located in Southeast Asia. It stretches from Sabang to Merauke, with some 17,500 islands. Indonesia's total territorial area is ~1.9 million km², of which 93,000 km² is sea and ~1.8 million km² of land (Central Intelligence Agency, 2025). The Indonesian islands are located between the Asian continent and the Australian continent, and between the Indian and Pacific Oceans. Thus, geographically the territory of Indonesia is a crossroads of lands and seas and is globally central. This is significant for Indonesia's place in the international system, its security, climate and economy.

Indonesia is strategically situated at the intersection of world economic activity and trade between industrialised countries and developing countries. Indonesia shares land borders with three countries: Malaysia, Papua New Guinea and Timor Leste. Indonesia also has sea borders with other countries: Singapore, the Philippines, Vietnam and Australia. An advantage of Indonesia's geographical location is its position between two continents and two oceans, making it a crossroad for global air and sea traffic. However, the marine sector presents challenges for Indonesia. These challenges include piracy, sea and armed robbery, weapons and ammunition smuggling, illegal fishing, pollution, and disposal of hazardous and toxic waste. The importance of the sea to Indonesia's economy, society and environment also presents as a significant challenge. This is discussed below.

Indonesia has abundant marine resources in its expansive maritime territory especially in the fisheries sector. Indonesia's rich biodiversity offers great opportunities for the development and utilisation of various types of fish, shrimp, shellfish and other marine species. In 2021 Indonesia's fishery production reached 21.8 million tons (SEAFDEC, 2022). Oceans are vital for Indonesia's prosperity. The World Bank, in *Oceans for Prosperity: Reforms for a Blue Economy in Indonesia*, notes that the fishing industry is worth over USD\$27 billion, supports employment for 7 million people and generates substantial economic benefits (World Bank,

2021). Indonesia's abundant marine resources and geographically strategic position provide a solid foundation for development and utilisation of the marine sector. By sustainably using these resources, Indonesia can open vast economic growth potential, create job opportunities and strengthen its position in international trade.

8.3. Maritime security threats faced by Indonesia

Maritime security is related to economic development, and the oceans were always of vital economic importance (Bueger, 2015). Indonesia's geographic location and as an archipelagic country provide advantages in terms of access to export markets and international trade. Most of Indonesia's trade is carried by sea and fishing is a significant industry.

Indonesia's complex maritime environment has a range of security threats. Indonesia's strategic location can pose vulnerabilities in terms of maritime defence and security. Key maritime security issues facing Indonesia include illegal, unreported and unregulated fishing (IUUF), human trafficking, illegal arrivals, smuggling and piracy. These issues are shared with Indonesia's neighbouring countries, which also face the challenge of trying to deal with illegal activities. Indonesia's Destructive Fishing Watch (DFW) assesses that Indonesia's seas are currently used extensively for criminal acts and the country is highly vulnerable to maritime crime (Liputan News, 2021).

The main maritime crime affecting Indonesia is IUUF which costs Indonesia an estimated USD\$4 billion per year (Leonardo & Deeb, 2022). In 2021, the Ministry of Marine Affairs and Fisheries (KKP) detained 135 fishing boats for IUUF, including 88 Indonesian boats and 47 illegal foreign fishing boats.

Indonesia is a major hub for drug trafficking in Southeast Asia, notably through the tactic of throwing packages containing contraband and buoys into the sea. In 2022, authorities found 179 kg of cocaine in packages floating near Merak port on Java island (Associated Press, 2022). Illegal maritime activities pose various threats to Indonesia and its neighbouring countries, including economic, criminal and security problems. These illegal activities not only harm Indonesia and neighbouring countries but also perpetuate criminal networks that threaten regional security.

The Malacca Strait is a major location for piracy and robbery in Indonesian territorial waters. This strategic waterway that connects the Indian and Pacific Oceans has been the site of many maritime crimes. Pirates take advantage of the narrow lanes and heavy sea traffic in the strait to carry out their illegal activities. In April 2022, the International Chamber of Commerce published a report on piracy and armed robbery against ships: this noted that, of the 37 incidents recorded worldwide in the first three months of 2022, 41% occurred in Southeast Asian waters, especially in the Singapore Strait, Malacca Strait and Indonesian waters (Anh, 2022). Piracy in the Malacca Strait is an indirect threat to the economy and a direct threat to crew members and cargo integrity which is why it is a major concern for marine stakeholders. To reduce risk and maintain a safe maritime environment, efforts to address these issues and ensure safe transit through the area require coordinated and collaborative activities with relevant stakeholders.

8.3.1 Indonesia's current maritime security capability

Indonesia has been active in addressing maritime threats and increasing its capacity to continue to do so. The GMF outlines the policy priorities for Indonesia's maritime security including a focus on ensuring maritime security both domestically and with regional partners. Current initiatives include carrying out joint exercises with regional and international partners, progressing regional cooperation, establishing a maritime task force, increasing the capacity of law enforcement agencies, and ratification of laws (Morris & Paoli, 2018). Indonesia and many of

its maritime neighbours actively conduct maritime patrols in and around national and shared waters. This activity is intended to create a deterrent effect against criminal actors, as well as to enhance situational awareness and respond to specific maritime threats. Shared patrols increase the capacity of Indonesia and its neighbours to counter threats, and recognise the importance of protecting marine resources, ensuring security and promoting regional stability in the maritime area. Typically, shared short-range air and sea patrols are scheduled as well as conducted in response to specific intelligence-led tasks, such as during particular fishing seasons or from knowledge of smuggling operations. Coordinated air patrols have been carried out by Indonesia, Singapore and Malaysia, which in practice respect the boundaries of each other's territories and follow agreed procedures. In addition, since 2018 Indonesia and Australia have carried out joint patrols under Operation Gannet (Australian Fisheries Management Authority, 2021).

Maritime patrols are considered the most effective approach to address maritime crime but are limited in range, scope and duration. Patrols are also affected by weather, and patrols by each nation are typically limited to respective national boundaries unless they are part of a combined operation. The number, type and duration of tasks vary between different countries and depend on patrol resources available and competing priorities. There are still many gaps for crimes to occur in Indonesian territorial waters.

8.3.2 Indonesia's maritime security agencies

Maritime security in Indonesia is carried out by several authorities. Indonesia has 13 marine stakeholder agencies. Of these, seven agencies have a sea patrol task force while the remaining six agencies have no sea patrol capability. Law enforcement agencies that have a patrol task force at sea are the TNI-AL (Navy), POLRI–Directorate of Water Police, Dirjen Hubla–Ministry of Transportation, PSDKP–Ministry of Maritime Affairs and Fisheries Directorate General, Ministry of Finance–Directorate General of Customs and Excise, BAKAMLA (Maritime Security Agency), and the Task Force for the Eradication of Illegal Fishing (Satgas 115). These seven law enforcement agencies carry out patrols related to maritime security in a sectoral manner in accordance with their authority based on their respective laws and regulations, and in accordance with their priorities at the time and available resources. This number of agencies and the vast area of water that must be managed require cooperation to be built between related institutions.

BAKAMLA is the Indonesian maritime security agency. It works closely with the Indonesian Sea and Coast Guard (KPLP), which handles law enforcement and prosecution of maritime crimes. Prior to the formation of BAKAMLA, integration efforts between marine institutions were realised by the establishment of the Coordinating Board for Security in the Sea (BAKORKAMLA) through Presidential Regulation No. 81 of 2005. In addition, TNI-AL (Navy) is responsible for maintaining the defence and security of Indonesian waters, fighting threats and potential attacks that disturb the stability of the country, and maintaining and developing facilities and tools that support maritime security operations. By working together, these authorities leverage their respective duties, capabilities and knowledge to address a wide range of maritime crime targets. They share information, intelligence and expertise to support the enforcement of laws, prevention of crime and prosecution of maritime violators, thereby helping maintain the security and integrity of Indonesian waters. The main tasks mandated to BAKAMLA include coordinating all operational security activities at sea, addressing violations of law at sea, and organising cooperation with neighbouring countries with the aim of optimising the power and benefits of security operations at sea (Iswardhana et al., 2021). The interaction between these institutions is still limited to the exchange of maritime information; however, this information contributes to determining activities in the respective institutions.

Indonesia is increasing efforts to combat maritime crime and maintain the security of state waters through cooperation and coordination with related institutions.

8.4. Cooperation with other parties

Indonesia participates in a range of collaborative maritime security activities with Association of Southeast Asian Nations (ASEAN) partners and with its largest maritime boundary neighbour, Australia. The Indonesian government has a policy for international cooperation in defence based on the principles of mutual respect, trust and benefits: this is also the case with maritime security cooperation. Indonesia takes part in a number of ASEAN's maritime security efforts. Indonesia works with other ASEAN members, particularly Malaysia, Singapore, the Philippines and Vietnam, to preserve marine security in agreed areas. An important forum for discussion and information sharing on maritime security problems is the ASEAN Maritime Forum (AMF). Indonesia and Australia coordinate joint maritime patrols in northern Australian waters, and the two countries have a long-standing cooperation in combating various forms of civil maritime security threats, including the annual joint activity Operation Gannet. This international cooperation in maritime security helps Indonesia increase its capacity to deal with complex maritime threats that cross national borders. Collaboration with partner nations strengthens regional and global cooperation frameworks to maintain maritime security and stability in the region.

International cooperation provides an opportunity to create mutual security. International collaboration enables the pooling of resources, experience and intelligence to successfully confront transnational threats through information sharing, joint patrols and coordinated responses. To deal with security challenges related to maritime areas that cross national borders, Indonesia took action together with Malaysia and the Philippines by starting a trilateral maritime patrol cooperation activity, INDOMALPHI (Guiang, 2018). This is an effective example of a cooperative security approach, where the three countries do not need to deal alone with the criminal threat in their territory, and surveillance and response is greatly enhanced. Dewitt (1994) argues that the concept of cooperative security is flexible, and can draw upon the benefits of bilateral agreements, contribute to regional security, and allow for the expansion of multilateral cooperation through ad hoc, informal and flexible processes. While activities such as the INDOMALPHI patrols enhance interoperability, they are limited in time and space and only occur on occasion. Information and communications are limited by different national systems and problems in sharing classified information. Building security between countries is, however, possible through international cooperation within the scope of maritime security. By working together states can solve problems and increase maritime security.

8.5. Using satellites in maritime security surveillance

Surveillance aims to gather information about an object, its characteristics and the way it acts in a given environment. Steps to achieve this goal may involve the following phases: detection (determining the presence and location of an object); classification (determining the type or class of the detected object); determination (individualising objects among recognised classes, usually without relying on prior information); recognition (matching detected objects with certain predetermined objects); and verification (confirming the existence or geographic position of an object) (Bosilca, 2016).

Surveillance of maritime threats in Indonesia is mostly undertaken by air and sea patrols by various Indonesian agencies. However, it is supplemented by satellite technology in important ways. Satellite technology supports the integration of multiple data sources, such as Automatic Identification System (AIS) data, maritime surveillance radar and satellite imagery.

The contributions made by satellites to maritime surveillance include providing better visibility over a larger area for a greater period and without the transit times needed by planes and seagoing vessels. Satellites are less affected by the weather: once deployed they are available for continued use. They can also operate at any time day and night; for example, a satellite can send data updates every two hours and have superior ability to send accurate and updated data. In carrying out its operations, the satellite is not limited by the territorial area of a country.

Further incorporation of satellite technology could provide even great efficiencies for surveillance by Indonesia’s maritime security agencies, and greater effectiveness in the range and duration of surveillance activities. The Capella-2 satellite, developed by San Francisco-based Capella Space, demonstrates a satellite capability which could further enhance Indonesia’s maritime security. This system uses synthetic aperture radar (SAR) technology to obtain super-sharp photos for use by military, environmental, energy and law enforcement sources (Grad, 2020). The experience of other countries shows that satellites can address some of the limitations of Indonesia’s current approach to air and sea patrols in the maritime environment.

8.5.1 Indonesia’s space capability

Indonesia has played a more active role in satellite technology as evidenced by its hosting the 29th Asia-Pacific Regional Space Agency Forum in 2023. Indonesia’s role in space activities includes participation in international forums, space technology development, regional cooperation and the use of space technology for national interests.

In 2021 then Deputy Minister of Defense M. Herindra stated that ‘Based on the concept of national defense, satellite systems are an important part of strengthening national defense, especially in building self-reliance’. Indonesia has a growing space and satellite industry, and it is timely to look at how this can be used to enhance maritime security. For 50 years the National Aeronautics and Space Institute (LAPAN) was the main government agency responsible for Indonesia’s space activities. LAPAN, founded in 1963, plays an important role in advancing the country’s space capabilities. It carries out research, development and utilisation of space science and technology for various applications. In 2021, LAPAN transitioned to the National Research and Innovation Agency (BRIN) with the aim of increasing the organisation’s focus on research, innovation and technology development in various fields, including in the space sector. BRIN is also charged with responsibility to coordinate research and innovation in Indonesia and collaborate with various research institutions and industries to achieve development goals (Paralegal.ID, 2022). In Indonesia, remote sensing and GIS technology are currently used extensively. Data from remote sensing has been used by many public and private organisations for a variety of purposes. Low-resolution to high-resolution satellite data are both required for remote sensing. With the establishment of BRIN and its broader collaborative remit, Indonesia is opening up opportunities in the development of space technology. (See **Table 8.1**)

Table 8.1. Table of Operational Indonesian Satellites (Sources: Kelas Pintar, 2022; Arief, 2019).

No.	Name	Operator	Type	Functions
1	Telkom-1	PT. Telkom	Telecommunication	Telecommunications Provider
2	Telkom-2	PT. Telkom	Telecommunication	Telecommunications Provider
3	IndoStar-II	ProtoStar	Telecommunication	Telecommunications Provider
4	Palapa-D	PT. Indosat Tbk	Telecommunication	Telecommunications Provider
5	BRIsat	Bank BRI Tbk	Banking Services	Improvement of banking services
6	Lapan A2	BRIN, IPB	Observation	Earth situation monitoring, disaster mitigation
7	Lapan A1	Lapan, TU-Berlin	Observation	Earth situation monitoring, disaster mitigation

8.5.2 Cost-benefit analysis of maritime patrol and satellite technology

The construction and launch of satellites and the operation and maintenance of maritime aircraft patrol and boats and their personnel are significant investments. Developing and maintaining advanced technologies such as satellites and maritime patrol vessels involves high costs to ensure optimum reliability, safety and performance. These costs cover development, acquisition, testing, rollout, routine maintenance, repairs and technology upgrades. Despite the costs, it is important to consider the long-term benefits that can be obtained in terms of security, protection of marine resources and wider economic impact. According to data released by the US Department of the Navy, the cost of operating a maritime surveillance aircraft, namely the P-8A Poseidon per hour, is ~AUD\$45,600 (USD\$29,900) excluding the cost of purchasing an aircraft unit (Swagel, 2021). The total cost to Indonesia can be estimated by looking at the cost per hour, per aircraft, length of time and the sea area that must be covered. Hence, the total cost of using maritime patrol aircraft in a year amounts to AUD\$286M (AUD\$45,600/hour X 3 sorties/week X 4 hours/sortie X 52 weeks).

On the other hand, the cost of operating an imagery satellite is around AUD\$45M including the spacecraft bus cost with an operating period of 10-15 years (Foreman, et al., 2016). To calculate the average annual cost of using satellites over a 15-year period, we divide AUD\$45M by 15 years, amounting to ~AUD\$3M. This comparison between cost and effectiveness shows that despite a high initial outlay, the use of satellite surveillance has an advantage over patrol aircraft over a 15-year period. A satellite also has wider daily coverage compared to a maritime patrol aircraft.

8.5.3 Cost saving alternatives

Alternative ways can be used to realise space technology that make it possible for Indonesia to access satellite capability. Countries can cooperate in the construction and operation of satellites. This involves sharing costs, resources and technical expertise as well as leveraging existing expertise and infrastructure in other countries. Alternatively, by accessing the service through a subscription or usage-based payment from a satellite service provider, satellite costs can be reduced. Cooperation with countries that have expertise and experience in satellite production can help Indonesia acquire the necessary knowledge and skills to employ satellites in maritime surveillance roles. Partner countries can provide technical training, guidance and technology transfer to strengthen Indonesia's capabilities in satellite production and employment.

In the space sector, Indonesia and Australia have collaborated on several satellite missions. Indonesia has launched the LAPAN A2/Orari and LAPAN A3/IPB communication satellites, and Australia has launched the UNSW-EC0 CubeSat satellite (Nugraha & Nugraha, 2022). The development of space technology, earth observation and communications benefit from this cooperation.

In addition, Indonesia and Australia share knowledge and experience in the space sector through training programs and workshops. The goal is to increase the capacity of human resources in the space sector so that the two countries can support each other in the development and utilisation of space technology.

8.6. Conclusion

Satellite utilisation plays a significant role in supporting the monitoring of Indonesia's maritime areas, particularly in overseeing maritime traffic, addressing border threats, and identifying and controlling illegal activities at sea. The proposed satellite capability will further enhance the

precision and range of maritime surveillance, enabling more accurate identification and faster response to potential threats, while maintaining the sensitivity of strategic information.

In this way, satellite capability will serve as a crucial element in safeguarding maritime security and national sovereignty in Indonesian waters on an ongoing basis. Satellite technology provides broad area coverage, raises awareness in the maritime domain, facilitates more effective communication and coordination, supports search and rescue operations, enables security monitoring, and strengthens border surveillance in protecting maritime infrastructure. This capability contributes to safeguarding Indonesia's vast maritime territory, promoting safe and sustainable maritime activities.

Satellites provide important capabilities that contribute significantly to monitoring and safeguarding the maritime domain. By leveraging satellite-based systems, countries can effectively address various challenges related to maritime security, including surveillance, piracy, illegal fishing and smuggling. By combining satellite-derived datasets, maritime patrol agencies can comprehensively understand maritime activity, identify patterns and detect anomalies.

There are a number of steps that could be taken by Indonesia to realise the potential benefits of increased satellite coverage:

- increase investment in technology development to build infrastructure, equipment and personnel through collaboration with relevant stakeholders, including government agencies, research institutions and private sector partners, to develop and implement a new satellite system which fits Indonesia's maritime security needs;
- integrate satellite data into existing maritime security platforms to provide real-time situational awareness and improve response times;
- establish cooperative relationships with developed nations that successfully operate space technologies as well as neighbouring countries with space organisations;
- actively participate in international forums and agreements related to maritime security, facilitating cooperation, information sharing and information exchange;
- promote understanding of the value of space technology towards the goal of maintaining ocean security and educate the public about the importance of maritime security.

To emphasise the significance of satellite operations in enhancing maritime security, the Indonesian Government can actively participate in regional discussions like ASEAN or special dialogues with neighboring nations like Australia. Indonesia has the ability to effectively address maritime threats by encouraging the integration of satellite-based monitoring and communication systems into regional initiatives for maritime security. By focusing on these areas, Indonesia can leverage the benefits of satellite technology to strengthen its maritime security capabilities in the vast Indonesian archipelago.

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9

Optimising air power for securing the Philippine maritime environment

John Leo Romero

Philippine Air Force

Air power plays a critical role in securing the maritime region west of the Philippines, which is a region of immense importance due to its abundant resources and strategic location. However, the Philippine Air Force (PAF) faces a multitude of challenges in optimising its air power to secure the region due to a historical shift in focus from external to internal operations, primarily due to the nation's long-term fight against insurgency and the impact of natural disasters. To overcome these challenges and protect its interests, the Philippines must foster strategic partnerships through its Security Cooperation and Engagement strategy. As the country continues its efforts to develop armed forces, the Philippines can leverage capacity-building activities, such as joint maritime patrols, joint military exercises, and information and intelligence sharing, particularly with like-minded nations such as Australia and other neighbouring countries.

9.1. Introduction

In the context of this maritime expanse, air power emerges as a critical factor in safeguarding the Philippines' interests and addressing the numerous challenges it faces. The South China Sea, often regarded as one of the most important shipping lanes in the world, plays a pivotal role in facilitating global trade. Roughly 80% of global trade by volume and 70% by value relies on maritime transportation and, of that volume, 60% of maritime trade passes through Asia, with the South China Sea carrying an estimated one-third of global shipping (Schrag, 2017). The Philippines' location at the crossroads of international maritime trade routes that converge and pass through the South China Sea and key straits like the Straits of Malacca, Lombok and Makassar sets its maritime interests up either against or in favour of other countries (Batongbacal, 2021). In this multifaceted scenario, air power assumes a pivotal role.

The maritime region located on the western side of the Philippines includes critical areas such as Panatag (Scarborough) Shoal, the Kalayaan Island Group and portions of the Spratly Islands. The island group is within the Exclusive Economic Zone (EEZ) and extended continental shelf (ECS) of the Philippines. To emphasise its significance and assert sovereign rights, the Philippines officially designated this area as the 'West Philippine Sea' in 2012 as an administrative order by then Philippine President Benigno Aquino (Ubac, 2012).

The maritime region is known as a hotspot and a centre of marine biodiversity. It also holds significant reserves of oil, gas and minerals, as well as some of the largest fisheries in the world (Jenner & Thuy, 2016). The South China Sea accounts for 12% of the world's annual fish catch, worth USD\$21 billion (Ladrangan & Gandia, 2021). The Kalayaan Islands is one of the highly important fishing grounds in the Philippines, contributing to about 20% of the country's annual commercial fisheries production (Arceo et al., 2020). Its annual fish yield is estimated to be 5 million tons, supporting thousands of Filipino fishermen's everyday living and livelihood (Ladrangan & Gandia, 2021). The disputed Reed Bank, located within the Spratly Islands, is believed to house significant energy reserves. According to a 2013 report from the United States Energy Information Administration (EIA), the Reed Bank may contain as much as 5.4 billion barrels of oil and 55.1 trillion cubic feet of natural gas. Additionally, the region is thought to be abundant in methane hydrates, as highlighted by Carpio (2017). These methane hydrates, considered a potential energy source of the future, have the capacity to sustain an economy as large as that of China for up to 130 years.

The United Nations Convention on the Law of the Sea (UNCLOS) stands as a foundational document for addressing maritime disputes among its member states. While a significant number of countries, including China, have ratified UNCLOS, China's adherence to its provisions has been selective. This selectivity has led to conflicting actions and territorial claims in the South China Sea, sparking security concerns and heightening tensions with neighbouring countries, with the Philippines being particularly affected. In 2016, an international tribunal in The Hague delivered a landmark ruling that China lacks any legal basis for asserting historical rights over the majority of the South China Sea (The Republic of the Philippines v. The People's Republic of China, 2016). Despite this ruling, China continues to expand its influence within the region. Over the past two decades, China has seized control of numerous reefs and atolls in the South China Sea. During this period, it has undertaken extensive construction of military facilities, including runways and ports. These actions have presented significant challenges, not only to the sovereign and fishing rights of the Philippines but also to the delicate marine ecosystem in this heavily contested and resource-rich region (Magramo, 2023).

National Defense Strategy

Considering the Philippines' significant geographical position in the region, maritime domain awareness (MDA) holds immense importance. Concurrently, its defence capability particularly in the air domain should progress in tandem with the enhancement of MDA as indicated in the current Philippines' National Defense Strategy (NDS). An analysis of the NDS by Galang (2019) highlighted that, being a small power, the country cannot rely solely on its capabilities. It was also emphasised that small powers operate within narrower margins, necessitating the expansion of their diplomatic options. Consequently, it becomes imperative for the Philippines to bolster its Maritime and Air Defense (MarAd) and Security Cooperation and Engagements (SCE) with other like-minded nations in the region.

Hence, this research aims to assess the Philippines' air power capability in securing its maritime environment. Additionally, it will explore the potential contributions of like-minded nations in the region to enhance the maritime security in the maritime region west of the

Philippines, examining its implications for regional peace and stability. Specifically, it answers the following questions:

1. What is the role of Philippine air power in contributing to maritime security?
2. What are the key challenges faced by the Philippine Air Force in enhancing its air power capability?
3. How can Australia and neighbouring countries contribute to optimise Philippine air power in maritime security?

9.2. Air power in maritime security

Within this regional context, air power emerges as a critical linchpin for both the Philippines and its partners like Australia. In the contemporary complex maritime security environment, nations frequently aim to preserve peace and stability in their maritime domains without the use of force. The Philippine constitution, in particular, has a policy of renouncing war as an instrument of national policy. However, as stated by Greenway and Sipes (2018), the maritime domain is a place that, if left unguarded, could harbour illegal entities who intend to bypass laws, disrupt already precarious trade routes and harm our national security.

Furthermore, the interconnection of air power's role in achieving control of the air and enabling concurrent maritime operations should not be understated. As Kainikara (2014) highlights, effective sea control is contingent upon concurrent control of the air. This synergy is acknowledged in the Australian Air Force doctrine, which underscores the contribution of air power to national power (Boroš & Csengeri, 2021). Such concurrent capabilities can significantly mitigate the challenges posed by the intricate and expansive maritime operating environment (Kainikara, 2014).

Moreover, recognising the multifaceted nature of air power is pivotal. Traditionally seen as a military instrument, it can also serve as a formidable deterrent force as underscored by the Philippines' Defense Department (Mangosing, 2020). This aligns with the concept of maintaining a minimum credible defence posture to prevent bullying and secure national interests. In essence, it reinforces the idea that a favourable air situation is a fundamental requirement for successful maritime operations (Hallion, 1999).

9.3. Philippine air power: history and challenges

As we delve into the challenges faced by Philippine air power within the context of maritime security, it is essential to recognise the versatile contributions it makes. Kainikara (2014) highlights that Air Force fulfills numerous roles in the pursuit of military objectives, with the integration of air power's effects alongside sea and land power being pivotal for optimal effectiveness. Among these roles, control of the air, strike capabilities, mobility, and intelligence, surveillance and reconnaissance (ISR) all assume critical significance in deterring potential threats and safeguarding the nation's interests.

Despite these critical roles, the Philippines faces unique challenges that impede the modernisation and enhancement of its air power capabilities, limiting its full potential in maritime security and air defence.

9.3.1 Control of the air

In the history of Southeast Asian militaries, the Philippine Air Force (PAF) stands as a symbol of determination and a nation's fight for sovereignty. Formally established in the aftermath of World War II, the PAF quickly rose to prominence, becoming one of the region's most

formidable air forces. However, this ascent was not without turbulence, and the subsequent decades witnessed challenges that reshaped its course (Philippine Air Force, 1997).

During the post-World War II era, the PAF received crucial support from the United States, particularly through the Truman Doctrine, which aimed to bolster allies and satellite states in Asia with military aid. This support included much-needed aircraft and equipment, providing a foundation for the early development of the PAF (Hellström, 1998).

On 1 July 1947, a significant milestone occurred when the Philippine Army Air Corps (PAAC) was reorganised and officially became the Philippine Air Force. This transformation marked its inclusion as one of the three separate major commands of the Armed Forces of the Philippines (AFP) Regular Force (Filipinas Heritage Library, n.d.).

The early years of the PAF were characterised by the extensive use of the North American P-51 Mustang fighter planes with numerous units delivered over the years. However, this abundance of aircraft sometimes outpaced the availability of trained pilots (Hellström, 1998).

The PAF's transition to jet aircraft in the mid-1950s, including aircraft like the Lockheed T-33 Shooting Star and North American F-86D/F Sabre, significantly boosted its capabilities and reputation. It became a prominent air force in Southeast Asia for about three decades and actively participated in international missions, such as assisting the United Nations in neutralising airborne secessionists in the Congo in the early 1960s. This history highlights the PAF's ability and willingness to engage in global operations (Hellström, 1998).

The 1960s marked a period of substantial progress for the PAF, with the activation of an extensive radar system and the introduction of supersonic Northrop F-5A/B Freedom Fighter. These achievements placed the PAF at the forefront of air forces in the Southeast Asia region. The acquisition of these supersonic jets is aimed at replacing the ageing F-86 Sabre in the air defence role (Philippine Air Force, 1997).

To supplement its capabilities, the PAF acquired retired US Navy F-8H Crusader aircraft in the mid-1970s. These aircraft played a crucial role in protecting the Philippine maritime environment and its islands, contributing to the country's territorial defence. The regular flights conducted during this time served as a clear assertion of the country's sovereignty.

The political instability of the Philippines during the 1980s, which subsequently led to the fall of the President Ferdinand Marcos regime played a significant role in changing the political equation and redefining the allocation of resources in the country. This instability had a particularly substantial impact on defence spending, especially within Air Force, focusing on external defence.

The Philippines made a significant move in 1991 by severing its military reliance on the United States, leading to the need for a credible national defence capability. This decision marked a turning point in the country's defence strategy. It was also during that time that Exercise Cope Thunder was halted due to the volcanic eruption of Mount Pinatubo. This annual exercise is designed to provide multilateral fighter training and improve the interoperability of the Philippine Air Force with other air forces.

In the mid-1990s, the PAF started using Italian-made S-211 trainer jets for air defence. These planes couldn't be modified for interception missions as they were designed for training and surveillance, not combat. Many problems with their functionality emerged, raising doubts about their safety and suitability for Philippine air defence (De Castro & Lohman, 2012).

Regrettably, as noted by De Castro and Lohman (2012), the PAF, which had been the most advanced air force in Southeast Asia during the 1960s, had transformed into the region's weakest by the early 2000s. Its meagre aircraft fleet, remnants from the Vietnam War, primarily consisted of outdated F-5 Freedom Fighters and OV-10 Bronco reconnaissance planes. During its

peak in the early 1980s, the PAF could deploy nearly 50 interceptors, including F-5 A/B and F-8 Crusaders, and could effectively challenge any aircraft entering the country's airspace without permission. However, in 2005, the AFP leadership made the decision to retire the remaining F-5 A/B fighters, effectively eroding the country's external defence capabilities (Cervantes & Sapnu, 2005).

The significance of control of the air became strikingly apparent in May 2011 when the PAF reported a Chinese fighter aircraft intrusion into Philippine airspace (De Castro & Lohman, 2012). This incursion transpired during a routine air patrol in the Kalayaan Island. General Eduardo Oban Jr, the AFP chief at the time, emphasised that these air patrols aimed to safeguard the nation's territorial integrity and its maritime resources, particularly against those who violated the country's maritime laws (Laude, 2011). Military sources disclosed that two PAF reconnaissance planes were buzzed by Chinese MIG-29 Fulcrums over the Reed Bank Basin where the Philippine Government, in partnership with foreign investors, was conducting ongoing oil explorations (Calica, 2011). This incident underscored the critical importance of maintaining air control for the Philippines, not merely for defence but also for safeguarding sovereign rights and resources in a complex and contested maritime region.

The PAF's capability received a significant boost with the acquisition of 12 Korea Aerospace Industries (KAI) FA-50PH Lead-in Fighter Trainers from South Korea in 2015. However, it is evident that the need for a new multirole combat capability is a longer-term requirement, aligning with the PAF's aim not only to enhance its air territory defence but also to reinforce its role in safeguarding the Philippines' maritime interests across the vast expanse of the country's EEZ (Nath et al., 2024).

9.3.2 Strike and ISR

In the context of maritime security, the ability to deter potential threats hinges on the capability to exert substantial influence on potential adversaries. The Air Force plays a pivotal role in this regard as its ISR and strike capabilities serve as potent tools to convey the message that adversaries are under surveillance and can be swiftly and effectively targeted if necessary (Kainikara, 2014). Singapore, recognising its vulnerability as a tiny state made a deliberate choice to develop an Air Force with an aggressive strike capability. The intent of such a posture was to send a powerful message to potential aggressors – if attacked, Singapore would respond with force (Stephens, 1997).

This approach underscores the critical importance of having a credible air power to secure maritime interests, thereby enhancing deterrence against potential threats. However, for nations like the Philippines, maintaining such a focused approach can be challenging. The Philippines faces a unique situation with divided attention between external defence and internal security operations, creating a complex environment where resource allocation and strategic prioritisation become paramount. This situation coincided with the previous decision of the Defense Department reallocating military resources to internal security operations, driven by the belief that there was 'no immediate external security threat to the Philippines' (De Castro & Lohman, 2012).

The Philippines has been plagued by terrorism for a long time, and this has shaped the history of the entire country (Brey, 2023). When the Philippines obtained its independence from the United States in 1946, the Philippine government recorded the first terrorist attack in the country in 1949 (Banlaoi, 2018). Since then, numerous terrorist groups have emerged in the country, and they continue to pose security and peace challenges. They have long been able to take advantage of the Philippines' porous borders and internal transit routes due to the country's complex and varied maritime environment, combined with its limited and inconsistent maritime and border security (Brey, 2023). In fact, the Philippines has consistently ranked

near the top of the list of countries associated with terrorism according to the Global Terrorism Index. As a result, the AFP intensified its focus on internal security which led to the redirection of military materiel and limited financial resources originally intended for territorial defence towards internal security operations. Additionally, a significant portion of the budget allocated for AFP modernisation was reallocated to cover personnel costs and support combat operations against insurgent groups (De Castro & Lohman, 2012).

Although the country has seen a significant decrease in terrorism in recent years, it remains among the top in Southeast Asia, next to Myanmar. In recent years, the terrorism situation in the Philippines has worsened, eroding confidence in the country's security. One of the most notable examples of this is the Marawi siege in which the PAF played a pivotal role. During this crisis, the country had to deploy its air assets, which were primarily dedicated to performing day and night strikes as well as ISR missions, contributing significantly to the liberation of the town.

To some extent, addressing these challenges on its own remains complex for the Philippines. Partner nations like Australia have provided training, weapons, equipment and specialist capabilities, such as surveillance flights (Knight & Theodorakis, 2019). This experience underscores the expectation that the Philippines may continue to rely on its air assets in internal operations, given the persistent threat of terrorist attacks by local extremist groups, despite the government's declaration of 'full liberation' from the Islamic State in October 2017 (Banlaoi, 2018). Additionally, Mindanao remains a possible location for future conflict and is central to counter-terrorism efforts in the Asia-Pacific (Knight & Theodorakis, 2019).

Meanwhile, the prolonged counter-insurgency conflict had far-reaching consequences for the PAF, including the loss of human lives, misalignment of strategic priorities, rapid depletion of limited resources and a gradual erosion of its capacity for external defence (De Castro & Lohman, 2012). These challenges have further complicated the PAF's role in maritime security and external defence, given the divided attention between internal security operations and external defence responsibilities.

9.3.3 Air mobility

In an archipelagic nation like the Philippines, air mobility enables swift deployment of personnel and equipment, which is especially crucial in vast maritime areas where conventional transportation is slow. This capability becomes particularly vital in emerging situations that require rapid force projection to maintain security in these maritime areas (Kainikara, 2014). Therefore, air mobility's speed and unpredictability, particularly in maritime settings, can be a war-winning capability and a deterrent, effectively restricting the adversary's courses of action.

However, fully harnessing this capability poses a significant challenge for the Philippines, primarily because of its geographical position and other critical factors. According to the 2022 World Risk Report (Atwii et al., 2022), the country ranks first among 193 nations worldwide in terms of exposure and vulnerability to disaster risks. Comprising more than 7,600 islands, and the home of 24 active volcanoes, the Philippines is frequently beset by earthquakes due to its location in the Pacific Ring of Fire.

In addition, the country lies in the path of typhoons sweeping west towards East Asia from the expanses of the Pacific, making it highly susceptible to natural disasters. The Philippines, being tropical and highly exposed to typhoon pathways, has been projected to be one of the most vulnerable countries to climate change (Anttila-Hughes & Hsiang, 2012). Climate change is expected to exacerbate extreme events such as heavy rainfall during typhoons, as seen in the case of Typhoon Ketsana in 2009, which adversely affected Metro Manila and adjacent areas, and Typhoons Chan-hom (in 2009) and Haiyan (in 2013), causing significant damage to infrastructure and livelihoods in the Visayas and Mindanao regions (Mangahas, 2013). During

these challenging times, the Australian Government provided invaluable support by deploying two transport aircraft to deliver humanitarian assistance in the aftermath of Typhoon Haiyan.

In this context, given the archipelagic nature of the Philippines, where the vast expanse of islands amplifies the challenges of conventional transportation, the country relies on the indispensable contribution of transport aircraft and helicopters playing vital roles in humanitarian assistance and disaster relief (HADR) missions (Yeo, 2022). This multitude of roles that Air Force performs poses one of the key challenges for the Philippines in optimising its air mobility capabilities. Balancing these priorities, the country strives to ensure the safety and security of its citizens in times of crisis while meeting its maritime security needs.

9.4. AFP's efforts in maritime and air defence and security cooperation engagement

To address these complex challenges, the PAF formulated a strategy to enhance its air defence capability under Republic Act (RA) 7898, signed into law in 1995 as the legal foundation for the AFP Modernization Program. This act enables the PAF to develop its air power capability by acquiring multirole aircraft, air munitions, avionics, point and area defence missile systems, maritime patrol and surveillance equipment, early warning and control systems, and capabilities for strategic and battlefield airlift, including limited ground attack support for ground forces. These acquisitions aim to enhance the nation's capabilities in both internal and external operations, particularly in maritime and air defence.

The multifaceted challenges faced by the Armed Forces of the Philippines, particularly the Air Force, have shaped the nation's security posture, necessitating strategic prioritisation, international partnership and resource management. As discussed earlier in the nation's National Defense Strategy, these key challenges in the Philippines' air power have hindered the accomplishment of Maritime and Air Defense (MarAd), leading to the prioritisation of Security and Stability (SS) or Internal Security Operations and HADR. Therefore, due to its current limited capability, the Philippine Air Force must leverage all possible capacity-building activities available with like-minded countries like Australia to meet the country's demand in maritime and air defence while developing its own capability from acquiring these new assets.

9.4.1 Philippines and Australia partnership

Considering these challenges and the Philippines' strategic position in the region, the role of air power takes on greater significance. As we explore the potential contributions of countries like Australia, it becomes evident that strengthening partnerships and enhancing defence capabilities in both air and maritime domains are essential for safeguarding the Philippines' interests. Australia's commonality with the Philippines in addressing maritime and security issues entails Australia actively engaging with the Armed Forces of the Philippines and the Department of National Defense. Notably, a significant portion of critical maritime and shipping routes connecting Australia and China pass through the Sulu Sea within the Philippine Archipelago. This geographical fact emphasises the importance of Australia nurturing and reinforcing its connections with the Philippines (Abayon, 2021).

In the 2017 Foreign Policy White Paper (FPWP), the Department of Foreign Affairs and Trade (2017) highlights the growing importance of ASEAN countries collectively surpassing the US as Australia's second-most significant trade partner. This underscores ASEAN's role as a cornerstone of regional prosperity. The Philippines, as a member of ASEAN, holds a vital geopolitical position in the Indo-Pacific region due to its strategic location bridging the Americas, Oceania and Asia. It serves as a crucial link between Southeast Asia and Northeast Asia (Abayon, 2021).

Like Australia, the Philippines is a maritime nation with extensive coastlines and borders. Thus, it should possess adequate capabilities to fulfill its mandated task of safeguarding the country's extensive maritime borders and ensuring security against even the most remote possibility of external aggression (De Castro & Lohman, 2012). In order to fully maximise and secure the maritime resources, areas and activities of the Philippines, it would need to rethink and establish an archipelagic and maritime strategy approach. Such strategy, to be more effective, needs not only to involve the instrumentalities of the Philippine Government but the nation as a whole (Palma, 2009). The military instrument of national power will always be used as part of whole-of-government efforts. It follows that air power must be thought of in terms of how it can contribute to the joint force for the purpose of attaining national objectives (Australian Defence Force, 2023).

The Philippines' deepening defence relationship with Australia is a most relevant and timely development, given its focus on maritime security (Abayon, 2021). Moreover, the framework in which maritime security cooperation takes place is made up of several key agreements: the 1995 Memorandum of Understanding (MoU) on Cooperative Defence Activities; the Philippines-Australia Status of Visiting Forces Agreement (SOFVA), signed in 2007, which was ratified and came into force in 2012; the 2015 Comprehensive Partnership declaration; the 2021 Philippine-Australia Mutual Logistics Support Arrangement (MLSA); and the 2023 Joint Declaration of Strategic Partnership. Furthermore, within this framework, several maritime security initiatives have developed, alongside Australian Defence Force and AFP major services (Hall, 2019).

Being one of the most significant partners in the region, the recent Philippine-Australia Joint Declaration of elevating the relation of both countries from Comprehensive to Strategic Partnership will expand cooperation in various significant areas especially in maritime matters. Item number 13 under Defence and Security Cooperation states that:

As maritime nations, we reaffirm the importance of maritime safety and security, freedom of navigation and overflight and other lawful uses of the seas in accordance with UNCLOS. To this end, we will strengthen bilateral and regional cooperation between maritime policy-making, administration, security and law enforcement agencies through dialogue and coordination, practical engagement, and capacity-building activities. We will plan bilateral joint patrols in the South China Sea and in areas of mutual interest to support regional peace and stability.

In recent years, the AFP has maximised the existing frameworks between the two countries' respective major Services, focusing on capacity-building activities, particularly within the Navy and Army. Both major Services routinely engage in combined exercises with their ADF counterparts, aiming to enhance their capabilities as they acquire new assets. However, the PAF's interactions with the RAAF have primarily centred around dialogues, personnel exchanges and visits, with only limited involvement in joint military exercises. This limitation primarily stems from resource constraints, which also impact the PAF's operations both externally and internally.

Nevertheless, as the PAF progresses in developing its capabilities, especially in territorial defence, the potential for its active participation in combined exercises with the RAAF becomes increasingly evident. In preparation for forthcoming acquisitions and upgrades, the PAF should leverage its existing capabilities and assets to improve its interoperability within combined operations. This commitment aligns with the Philippines' Defense Secretary's emphasis on the pivotal role of joint exercises in enhancing the country's maritime domain awareness. Thus, the PAF, with its established history of collaboration with other air forces, must continue to

demonstrate its dedication to addressing shared concerns within maritime areas of interest (Dava, 2023).

As the Philippines continues its long-standing fight against terrorism and insurgency, several PAF assets have been dedicated to their original role in external defence. ISR assets, including some of the transport aircraft, have been increasingly employed to enhance maritime domain awareness. Collaboration with the RAAF offers the potential for combined efforts in areas of mutual interest, especially in conducting joint patrols, together with respective navies, within the South China Sea. This collaboration is made feasible through the MLSA, which provides the necessary logistical support during coordinated operations.

On the other hand, joint and combined exercises have emerged as a pivotal avenue for the Philippines to enhance its air power capabilities and contribute to maritime security. Exercise Alon, as part of the 2023 Indo-Pacific Endeavor (IPE), primarily focused on joint bilateral amphibious operations but also included complex air scenarios. The RAAF, with its F-35A Lightning II and E-7A Wedgetail aircraft, played a critical role during the exercise by providing situational awareness and supporting ground forces with their weapons capabilities (Leca, 2023). While the PAF did not participate in this specific exercise, it highlights the potential benefits of including the PAF in such endeavours as their involvement could further emphasise the pivotal role of air power, especially within a vast maritime and archipelagic setting.

Additionally, the Philippines and Australia share strong alliances with the United States. Each of these nations shares a commitment to the international rules-based system, including freedom of navigation and overflight (Abayon, 2021). This common alignment with the US underscores the potential for greater collaboration with the participation of RAAF in future combined air and surface exercises like Balikatan and Cope Thunder. This collaboration can be further solidified through the utilisation of additional military bases under the Enhanced Defense Cooperation Agreement (EDCA), opening new operational opportunities for strengthened partnerships and security.

Balikatan, which translates to ‘shoulder to shoulder,’ is an annual training exercise between the AFP and US military forces. While the ADF has actively participated in multiple complex scenarios, its primary focus has traditionally been on ground forces. In contrast, the RAAF, which has previously participated as observers, could enhance the exercise by becoming active participants and bringing its combat, transport and ISR air assets to support the AFP in transitioning from internal operations to external defence, emphasising the critical role of air power, particularly in counterair and maritime operations.

In addition, Exercise Cope Thunder, which took place in the Philippines until its conclusion in 1991 due to the volcanic eruption of Mount Pinatubo, is a Pacific Air Forces (PACAF)-sponsored exercise designed to provide each aircrew with essential mission experience, thereby increasing their chances of survival in combat environments (PACAF, 2023). Originally a multilateral exercise, its revival could serve as a pathway to invite partners and allies in the region, including Southeast Asian nations with mutual interests in the South China Sea. This initiative aligns with PACAF’s strategic priorities of reinforcing allies and partners by increasing security capacity through enhanced integration and interoperability.

One of PAF’s current objectives is to actively participate in Exercise Pitch Black in Australia. It is a biennial event and is considered the most significant tactical air activity conducted in the region (Nepomuceno, 2022). In the past, the PAF only sent observers and Air Battle Managers to this exercise. However, the PAF now aims for a more substantial involvement by deploying its FA-50PH light combat aircraft. This move is intended to prepare its aircrew for multinational exercises, with a particular focus on large force employment scenarios, showcasing the PAF’s commitment to enhancing its air power capabilities.

Participation of the PAF in these multinational exercises not only enhances interoperability with partners and allies but also plays a crucial role in projecting air power and maritime security for the Philippines. As one of the key findings in the study conducted by Kuo and Blankenship (2020), Joint Military Exercises, in general, do not escalate conflict and, when conducted with allies, they even reduce the probability of conflict escalation. These actions serve to communicate a nation's commitment to its defence and deterrence posture.

9.4.2 Philippines and ASEAN

In addition, cooperation among Southeast Asian nations is of paramount importance for the Philippines, given its archipelagic nature and the need to combat transnational crimes and terrorist threats effectively. The Sulu-Celebes Seas remain a central concern for terrorism in Southeast Asia. Its challenging archipelagic terrain provides an advantage to insurgent groups, such as the Abu Sayyaf Group (ASG), which exploit the region's geography for kidnap for ransom (KFR) tactics and smuggling foreign fighters into Mindanao.

Recognising these shared security concerns, a Trilateral Cooperative Arrangement (TCA) was established in 2016 among the Philippines, Malaysia and Indonesia as an immediate measure to address the increasing security challenges arising from lawless activities. Cooperation among these nations extends to intelligence and information sharing, which plays a crucial role in preventing security incidents within their respective territories (Da Costa, 2023). Addressing these non-traditional threats also contributes to addressing traditional threats, particularly disputes in the South China Sea, as eliminating this focus for the PAF can free up its assets to concentrate on external defence operations.

9.5. Conclusion

The role of air power in ensuring maritime security in this complex and contested area, particularly in the maritime region west of the Philippines, cannot be overstated. However, the challenges posed by long-term insurgencies and the constant threat of natural disasters have placed limitations on the Philippines' ability to modernise its Armed Forces, especially the Air Force.

As the country continues to develop its Armed Forces by acquiring new assets, the Philippines must seek to strengthen its strategic partnerships, especially with like-minded nations such as Australia and other neighbouring countries. By leveraging these partnerships and collaborations, the country can maximise its existing assets, thus enhancing its interoperability with regional partners and projecting a formidable deterrent posture as the nation continues to develop its air power capabilities.

This paper has underscored the critical importance of Philippine air power in securing its maritime environment as a vital element of its national defence strategy. The key challenges have significantly contributed to the historical shift in focus of its Air Force from external to internal operations. By addressing these challenges, forging strong partnerships and collaborations, and actively participating in multinational capacity-building activities, the Philippines can ensure its sovereignty, protect its maritime interests, and contribute to regional peace and stability.

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10

Conclusion: A new era in maritime security

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As we stand at the precipice of a new era in maritime security, the waters of Southeast Asia and the Indo-Pacific region tell a story of unprecedented challenges and extraordinary opportunities. The convergence of technological innovations, evolving security threats and shifting geopolitical dynamics has created a complex maritime landscape that demands not merely adaptation but transformation in how nations approach their sovereign waters and shared seas.

The scholars emerging from the ASEAN–Australia Maritime Security Research Program are witnessing this transformation from inside their respective defence forces. These practitioners bring fresh eyes to the challenges that have confounded policymakers for decades with little progress made over the years. Nittapon Srisuk explained how his country’s approach to illegal fishing was completely rebuilt after the European Union’s (EU) yellow card warning. The threat to a billion-dollar seafood export industry accomplished what years of diplomatic pressure could not. Thailand invested heavily in surveillance technology, rebuilt its enforcement infrastructure from the ground up and created a monitoring system that other nations can now study and replicate. However, criminal networks studied every change and adapted within months. The surveillance systems that seemed revolutionary a few years ago now face countermeasures from criminals who share information across borders faster than governments share intelligence. This emphasises the need for continuous development, where capabilities and policies need constant review. What works today is not guaranteed tomorrow. Thailand’s initial success against its EU yellow card demonstrates this perfectly. As Nittapon Srisuk recommended in his research, changes to current practices must strengthen both policies and their practical implementation through closer collaboration between government agencies and military forces.

This book explored how air power is changing our understanding of maritime security. However, few people grasp just how fundamentally, although air power alone is not the panacea. Speed makes the difference between intercepting a drug shipment and watching it vanish outside of territorial waters, but criminal networks have learned to exploit the gaps between domains. Bryan Brotonel’s paper provided insights into the benefits of how uncrewed aerial systems cover vast distances, yet criminals discover blind spots where air, sea and space surveillance overlap imperfectly. While real-time satellite tracking creates impressive

situational awareness, criminals often operate in the areas between nations where coordination remains fractured by competing priorities, cultural misunderstandings or capability gaps. Rizky Randiguna also demonstrated how Australia and Indonesia, two very capable nations, struggle with criminal adaptation. Both countries patrol their maritime boundaries, but criminal networks exploit jurisdictional gaps and timing windows with precision. They have turned our sovereignty into their advantage, disappearing across territorial boundaries while enforcement agencies are left to deal with diplomatic protocols that criminals simply ignore.

Multi-Domain Operations (Plevnik & Vuk, 2025) promised integration across air, space, cyber, land and sea domains, but cultural challenges runs deeper than technical coordination. Traditional military services protect their institutional interests, reluctant to change, while the cyber domain thinks in milliseconds and the space domain in orbital cycles. Criminals don't face these challenges or cultural barriers. They simply adopt whatever approach works the fastest, regardless of ethical considerations or due processes. Will our democratic institutions ever prove agile enough to keep pace with criminal innovation? Or are we just building impressive capabilities that arrive too late or fail to achieve what we need them to do?

Similarly, the Golden Triangle's methamphetamine networks adapted to pandemic restrictions faster than most governments adapted to remote work (Son, 2021). Criminal organisations restructured their supply chains, adopted new technologies and maintained operations, while enforcement agencies struggled with travel restrictions, reduced patrols and continually changing and impractical guidelines throughout the pandemic. Criminals learned that resilience matters more than individual operations, which is a lesson government agencies are only beginning to grapple with. This reality shapes how we must think about future cooperation and operations. Australia's partnerships with ASEAN states create opportunities for capability sharing, but criminals already share capabilities and without the diplomatic overhead that slows government cooperation. The ASEAN-Australia Maritime Security Research Program scholars are discovering that trust building between nations takes years while criminal networks establish trust through shared risks and profits.

Moreover, environmental changes will accelerate these challenges in ways we are only beginning to comprehend. Climate change is affecting ocean temperatures, which in turn alter fish migration patterns. Consequently, traditional fishing grounds are becoming less productive, pushing people towards illegal activities. Criminal networks are already positioning themselves to exploit these pressures while our enforcement mechanisms remain focused on current threats rather than emerging vulnerabilities. The question isn't whether we can build better surveillance systems or establish more cooperation agreements. Criminal networks will adapt to both. The question is whether we can create decision-making processes that match the speed of criminal innovation while maintaining oversight that legitimises our authority and ethical principles. Can our bureaucracies designed for stability operate at the pace that maritime security now requires?

Regional understanding and cooperation through the ASEAN-Australia Maritime Security Research Program offer hope, but only if we acknowledge uncomfortable truths about our limitations. Formal agreements and capability sharing matter less than cultural willingness to prioritise collective security over national prerogatives. The Indonesia-Australia maritime boundary could become a test case for this kind of cooperation, but success requires both nations to accept that sovereignty means less when criminals ignore borders entirely (Albanese & Subianto, 2025). The practitioners in this book and emerging from the program are researching, defining and recommending solutions to challenges that have the potential to shape maritime security for decades. They could focus their recommendations on building impressive national capabilities that ultimately criminals will learn to evade. However, in an effort to develop meaningful maritime security measures, the scholars are experimenting with cooperation models

that sacrifice some autonomy for greater collective effectiveness. Their research could help determine whether democratic institutions can conduct maritime security effectively within their territorial borders, which are often viewed by criminal networks as ungoverned and filled with opportunities.

Looking ahead, the winners in maritime security won't necessarily be those with the most advanced technology or the largest budgets. If that were the case, then global superpowers would not have maritime security issues. The winners will be those who can adapt the fastest while maintaining legitimacy, cooperate meaningfully while preserving sovereignty, and think systematically about problems that criminals approach opportunistically. While technology and capabilities undoubtedly play a significant role in maritime security, it is people who ultimately determine the outcome. The relationships being forged through the research program represent more than an academic attempt to resolve maritime issues. It is a meaningful way to understand regional maritime security issues, build cultural awareness and provide long-lasting relationships that will create the foundation for a better tomorrow. As the Director of Sea Power Centre, Australia, CAPT Alastair Cooper, first told me when I joined the ASEAN–Australia Maritime Security Research Program, the ocean is there to connect us rather than to divide us. This is true, however, only if we can learn to navigate it as skilfully as those who currently exploit our weaknesses and hesitation.

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