

## ANALYSIS OF DEFENSE AND CYBER SECURITY IN AIRSPACE MANAGEMENT IN INDONESIA

Sudarto<sup>1</sup>, Lidia Rina Dyahtaryani<sup>2</sup>, Nanang Trianto<sup>3</sup>

<sup>1</sup>Faculty of Law, Dirgantara Marsekal Suryadarma University

Email : [sudarto@unsurya.ac.id](mailto:sudarto@unsurya.ac.id), [lidia\\_taryani@yahoo.com](mailto:lidia_taryani@yahoo.com), [nanang.trianto@bssn.ac.id](mailto:nanang.trianto@bssn.ac.id)

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### Abstract

Air space management is a crucial aspect in maintaining the sovereignty of a country, including Indonesia. Along with the rapid development of information and communication technology, threats to cyber security are becoming increasingly significant. This research analyzes defense and cyber security efforts in air space management in Indonesia, with a focus on identifying threats, vulnerabilities, and implemented mitigation strategies. Through descriptive-analytical methods, data is collected from various sources, including policy documents. The research results show that although Indonesia has implemented various policies and technologies to improve cyber security, there are still a number of challenges that must be overcome, such as a lack of awareness of cyber threats, limited skilled human resources, and the need for better coordination between relevant institutions. With these steps, it is hoped that cyber security in airspace management can be improved, thereby reducing the risk of attacks and ensuring the safety and efficiency of flight operations in Indonesia.

**Keywords :** Cyber Defense, Cyber Security, Airspace Management

### Abstrak

Pengelolaan ruang udara merupakan aspek krusial dalam mempertahankan kedaulatan suatu negara, termasuk Indonesia. Seiring dengan pesatnya perkembangan teknologi informasi dan komunikasi, ancaman terhadap keamanan siber menjadi semakin signifikan. Penelitian ini menganalisis upaya pertahanan dan keamanan siber dalam pengelolaan ruang udara di Indonesia, dengan fokus pada identifikasi ancaman, kerentanan, serta strategi mitigasi yang diterapkan. Melalui metode deskriptif-analitis, data dikumpulkan dari berbagai sumber, termasuk dokumen kebijakan. Hasil penelitian menunjukkan bahwa meskipun Indonesia telah mengimplementasikan berbagai kebijakan dan teknologi untuk meningkatkan keamanan siber, masih terdapat sejumlah tantangan yang harus diatasi, seperti kurangnya kesadaran akan ancaman siber, keterbatasan sumber daya manusia yang terampil, dan kebutuhan akan koordinasi yang lebih baik antar lembaga terkait. Dengan langkah-langkah ini, diharapkan keamanan siber dalam pengelolaan ruang udara dapat ditingkatkan, sehingga mengurangi risiko serangan dan memastikan keselamatan serta efisiensi operasi penerbangan di Indonesia.

**Kata Kunci :** Pertahanan Siber, Keamanan Siber, Pengelolaan Ruang Udara

## A. INTRODUCTION

All nations, including the Republic of Indonesia, certainly need a sense of security in running their government and providing services to their people. All levels of government and society must work together to support each other in defending the integrity and sovereignty of the country's territory from various threats and disturbances in order to meet these needs. This mission can then be carried out, especially by understanding the meaning of national security. This problem is purposeful to increase the awareness of all citizens of their respective countries so that they are willing to accept responsibility for the security and defense of the Unitary State

of the Republic of Indonesia.<sup>1</sup>

Knowledge and Interaction In various aspects of life today, technology is a basic need for everyone, not only in Indonesia but throughout the world. Current technological advances also have an impact on a country's defense and security. Almost every country in the world has started to develop defense and attack plans using technology, both digital and analog, in line with changes in defense ideas. Currently, almost all technology in the world, both technology used by the wider community and technology limited to security and defense, is digital.<sup>2</sup>

The development of digital technology has had a significant impact on various aspects of life, including the defense and national security sectors. One area that requires special attention is airspace management, which is now increasingly vulnerable to cyber threats. In Indonesia, air space is not only a vital route for air transportation, but also a strategic element in national defense. Therefore, it is important to analyze how cyber defense and security can be implemented effectively in managing air space in Indonesia.

Indonesia's air space covers a wide and strategic area, both in terms of geography and economics. The bodies responsible for managing air space in Indonesia are AirNav Indonesia and the Indonesian Air Force (TNI AU). AirNav Indonesia focuses on civil air navigation services, while the Indonesian Air Force is responsible for monitoring and defending the country's air space.

Airspace management involves a variety of advanced technologies, including radar, communications systems, and air traffic management systems. All of these technologies are interconnected and depend on digital networks, which makes them vulnerable to cyberattacks.

Currently there is no law in Indonesia that regulates its airspace. The absence of regulations has existed since the country became independent in 1945. To protect Indonesia's airspace, it is very important to implement relevant laws and regulations. Relevance Airspace regulation is not only related to sovereignty issues but also aviation safety, national security, as well as strategic and economic interests.<sup>3</sup>

Without clear rules, Indonesian airspace is vulnerable to violations by foreign aircraft, which could threaten the country's sovereignty. Potential exploitation of air resources by foreign parties, including the use of air space for interests that are detrimental to the country.

The sovereignty and territorial integrity of the Unitary State of the Republic of Indonesia could be threatened if items of a very personal nature and of strategic importance are obtained

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<sup>1</sup> Chotimah, Hidayat Chusnul. "Building national defense and security from cyber threats in Indonesia." *Journal of Diplomacy* 7, no. 4 (2015): 103-123.

<sup>2</sup> Syafi'i, M. H., A. A. Supriyadi, Y. Prihanto, and R. A. G. Gultom. "Defense Science Study in Strategy National Defense to Face Digital Technology Threats in Indonesia." *Journal on Education* 5, no. 2 (2023): 4063-4076.

<sup>3</sup> Hadiswanto Putro, Laksono, Celine Tjandra, and Nursirwan Nursirwan. "Increasing Space Resistance Indonesian Air through Intelligence Analysis." *Journal of National Resilience Strategic Studies* 7, No. 1: 3.

by careless parties. This will be the biggest threat to the country. The TNI is aware of the increasing obstacles in maintaining the sovereignty of the nation and state, especially those related to upholding sovereignty in cyberspace. The TNI Cyber Unit was formed as a cyber organization by considering all potential dangers and considering the current situation. The TNI's vital information infrastructure is increasingly developing and will eventually become the main battlefield, therefore the TNI Cyber Unit was formed in an effort to combat cyber threats and attacks.<sup>4</sup>

## **B. RESEARCH METHODS**

This type of research is normative legal research using a statutory approach method, and conceptual approaches. The type of data in this research is secondary data. The data collection technique used in this research is the library research technique. Data collection tools can be in the form of document studies or library studies or library research to obtain secondary data. This research This is done by collecting relevant materials, including primary, secondary and tertiary legal materials related to the object of study. The method used in this research is a qualitative method, namely by arranging them systematically, connecting them to each other in relation to the problems being studied by applying the provisions of other laws and regulations, paying attention to the hierarchy of laws and ensuring legal certainty, also regarding legislation. applicable laws are implemented by law enforcers.<sup>5</sup> Data analysis was carried out in this research using a qualitative approach.

## **C. RESEARCH RESULTS AND DISCUSSION**

### **The Importance of Air Management**

Indonesia's air space covers a wide and strategic area, both in terms of geography and economics. The bodies responsible for managing air space in Indonesia are AirNav Indonesia and the Indonesian Air Force (TNI AU). AirNav Indonesia focuses on civil air navigation services, while the Indonesian Air Force is responsible for monitoring and defending the country's air space.

Airspace management involves a variety of advanced technologies, including radar, communications systems, and air traffic management systems. All of these technologies are interconnected and depend on digital networks, which makes them vulnerable to cyberattacks.<sup>6</sup>

Indonesia's air space covers a very wide area, including air space over land and sea. Air

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<sup>4</sup> Putra, Ratno Dwi, Supartono Supartono, and D. A. R. Deni. "Cyber Threats from a Defense Perspective Ncountry (Universal Defense System Case Study)." *Asymmetric Warfare (PA)* 4, No. 2 (2018).

<sup>5</sup> Ali, Zainuddin. *Legal research methods*. Sinar Graphics, 2021.

<sup>6</sup> Kusumaningrum, Adi, and Vishnu Virgiaswara Putra. *Air law: Indonesia's interests in airspace national*. Brawijaya University Press, 2019.

space management involves various important aspects, including:

- a. National Security: Supervise and control flights to prevent threats from abroad and maintain airspace sovereignty.
- b. Aviation Safety: Ensuring civil and military aviation occurs safely and efficiently.
- c. Economy: Maximizing the use of air space for efficient flight routes to support the national economy.<sup>7</sup>

### **Cyber Defense Arrangements in Air Space Management**

#### 1. Law 3 of 2002 on National Defense

National defense aims to maintain and protect the sovereignty of the country, the territorial integrity of the Unitary State of the Republic of Indonesia, and the safety of the entire nation from all forms of threats. What is meant by threat is every business and activity, both domestic and foreign, which is deemed to endanger the sovereignty of the state, the territorial integrity of the state, and the safety of the entire nation. In this context, threats must be interpreted as not only physical, but also non-physical, especially cyber threats in cyberspace.

#### 2. Law 34 of 2004 concerning the TNI

The main task of the TNI is to uphold state sovereignty, defend the territorial integrity of the Unitary State of the Republic of Indonesia which is based on Pancasila and the 1945 Constitution of the Republic of Indonesia, and protect the entire nation and all of Indonesia's bloodshed from threats and disturbances to the integrity of the nation and state.

The Air Force is in charge of:

- a. Carry out TNI air force duties in the defense sector;
- b. Enforce the law and maintain security in the airspace of national jurisdiction in accordance with the provisions of national law and ratified international law;

#### 3. Minister of Defense Regulation Number 82 of 2014 concerning Cyber Defense.

The regulation states that the Ministry of Defense and the Indonesian National Army have two interests in cyber defense. First, to secure all electronic systems and information networks in the environment. Second, supporting cyber security coordination in other sectors as needed. Paying attention to these two interests, it is necessary to anticipate the need for cyber defense which covers all aspects including security aspects in air space.<sup>8</sup>

### **Cyber Threats Can Influence and Be Influenced by Airspace Management**

According to **Michael D Mc Donnell and Terry L Sayers** Types of cyber threats can be grouped into three:

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<sup>7</sup> Dahuri, Rokhimin. "Spatial management of coastal and marine areas is in line with the implementation of autonomy area." *Mimbar: Social and Development Journal* 17, no. 2 (2001): 139-171.

<sup>8</sup> Lidia Rina. Cyber Defense In PRU Unsurja. *Solar Elements Seminar*, 2024.

a. Hardware threats

Threats caused by the installation of certain equipment whose function is to run a system so that it can disrupt the network system or other hardware

b. Software threats

Threats caused by the entry of certain software that can damage or manipulate information systems

c. Data/information threats

Threats caused by the dissemination of certain data/information aimed at certain interests, such as information warfare or propaganda activities.<sup>9</sup>

### **Cybersecurity Challenges in Airspace Management**

Cybersecurity in airspace management faces various complex challenges, including:

a. Cyber Attacks: Threats from cyber attacks that can disrupt navigation, communications and flight control systems. These attacks can take the form of malware, ransomware, or DDoS (Distributed Denial of Service) attacks that can cripple critical systems.

b. Data Loss: Risk of loss or theft of sensitive data that could compromise national security. Flight data, flight plans, and passenger information are some examples of data that is very important and needs to be protected.

c. System Vulnerabilities: Vulnerabilities in the information and communications technology infrastructure used in airspace management. Outdated or out-of-date systems can be easy targets for cyber attackers.

d. Technological Complexity: Air space management uses various complex and integrated technological systems. Any component of this technology can become a weak point if not properly secured.<sup>10</sup>

### **Implementation of Advanced Technology in Airspace Management**

a. Use of Artificial Intelligence (AI): AI can be used to monitor and analyze data in real-time, helping to detect potential cyber threats more quickly and accurately.

b. Blockchain: Blockchain technology can be used to improve data security in airspace management. By using blockchain, data can be recorded securely and transparently, thereby minimizing the risk of data manipulation.

c. Internet of Things (IoT): The application of IoT in airspace management enables the integration of various devices and systems, thereby increasing operational efficiency.

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<sup>9</sup> Manafe, Christo Febi Cahya, Sapto Priyanto, and Imam Subandi. "Implementation of the National Security Concept In Efforts to Face Cyber Threats in Indonesia." *Nusantara: Journal of Social Sciences* 10, No. 4 (2023): 2063-2073.

<sup>10</sup> Arianto, Adi Rio, and Gesti Anggraini. "Building Indonesia's national cyber defense and security is useful facing global cyber threats through the Indonesia security incident response team on internet infrastructure (Privacy ID)." *Journal of Defense and National Defense* 9, no. 1 (2019): 13-30.

However, this also calls for increased security measures to protect IoT devices from cyberattacks.<sup>11</sup>

## **Digital Transformation in Airspace Management**

With the adoption of advanced technologies such as satellites, radar, navigation systems and digital communication systems, air space management has undergone a major transformation the last few decades. This provides operational efficiency and allows for denser air traffic.

Nowadays, the use of air space has expanded to more specific air areas, for example the use of "subspace" (near space) for the use of High Altitude Platforms (HAPS).

Cyber defense is vital in protecting air space management infrastructure from threats to cyber attacks that could endanger aviation safety.<sup>12</sup>

## **Cyber Defense and Security Strategy**

To face cyber threats, a comprehensive and integrated defense and security strategy is needed. Some steps that can be taken include:

- a. Enhanced Network Security: Ensure all networks used in airspace management have strong security protocols, including data encryption and advanced firewalls.
- b. Training and Awareness: Provide training to personnel on cyber threats and how to address them. Awareness of the importance of cyber security must be instilled at all levels of the organization.
- c. Monitoring and Detection: Use real-time threat monitoring and detection systems to quickly identify and respond to cyber attacks.
- d. Collaboration: Building cooperation between AirNav Indonesia, the Indonesian Air Force, and other related institutions, including international institutions, to share information and cyber defense strategies.
- e. Policy Development: The government needs to develop policies that support cyber security, including regulations that set security standards for airspace management systems.<sup>13</sup>

## **Draft Law on Air Space Management (RUU PRU)**

### **Article 39**

(1) Indonesian subspace as intended in Article 33 paragraph (1) letter f is a certain air area

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<sup>11</sup> Bhaskara, Wahyu Wira, and M. Arif Sulaiman. "Analysis of the Use of Multi-Constellation Gns Technology In Air Navigation Systems." *Journal of Aerospace Management* 17, no. 1 (2024): 29-38.

<sup>12</sup> Supardam, Dhian, and Rifqi Raza Bunahri. "Factors Influencing Innovation in the Sector Aviation: Human Resource Capabilities, Technological Advancements, and Clean Energy Prominence." *Journal AND Information Systems Management economy* 4, no. 4 (2023): 740-747.

<sup>13</sup> Mahendra, Yustika Citra, and Ni Komang Desy Setiawati Arya Pinatih. "Cyber Security Management

located between the maximum height limit for civil flights to the highest limit of air space.

- (2) The Indonesian Subspace as intended in paragraph (1) is used to place Indonesian Civil Air Vehicles, Indonesian State Air Vehicles, Foreign Country Air Vehicles, and/or Foreign Civil Air Vehicles for national interests.

#### Article 23

Utilization of air space management for national interests must be supported by mastery and development of air technology that is integrated with other technologies.

#### Article 24

- (1) The control and development of aviation technology as referred to in Article 23 is carried out based on the development of:
  - a. Aircraft technology;
  - b. Air Vehicle technology;
  - c. satellite application technology for aviation navigation purposes;
  - d. rocket launcher technology for aviation;
  - e. information and communication technology; and/or other technology.
- (2) Mastery and development of air technology as intended in paragraph (1) can be carried out through cooperation between stakeholders at the national and international levels in accordance with the provisions of statutory regulations.

### **D. CONCLUSION**

Air space management in Indonesia requires serious attention to cyber defense and security. With increasingly complex challenges, a comprehensive and integrated strategy is needed to protect these systems from cyber threats. Through strict monitoring, strong data protection, continuous training and international cooperation, Indonesia can improve cyber security in managing its air space, maintaining the sovereignty, safety and efficiency of aviation in its territory.

### **E. SUGGESTIONS**

To improve cyber security in managing air space in Indonesia, the government needs to update regulations and develop special policies in the aviation sector. Regular training and certification of personnel is essential, as well as the adoption of advanced technologies such as AI and ML for threat detection and response. Collaboration with educational institutions and international cooperation will increase preparedness and response against cyber attacks. Strengthening the Security Operations Center (SOC) and carrying out routine attack simulations

are also needed. In addition, awareness and education campaigns about data security for the public and workers in the aviation sector will increase awareness of cyber threats. Implementation of these measures will strengthen cyber security and ensure safety and efficiency in aviation operations in Indonesia.

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