JHSS (Journal of Humanities and Social Studies)
https://journal.unpak.ac.id/index.php/jhss
Volume 09, Number 01, Page 259-262
e-ISSN: 2598-120X; p-ISSN: 2598-117X

ADDRESSING THE THREAT OF LOCAL DRONE KAMIKAZES TO STRENGTHEN NATIONAL AIRSPACE DEFENSE AND SECURITY

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Article history: *received 21 April 2025; revised 02 May 2025; accepted 24 May 2025* *DOI: https://doi.org/10.33751/jhss.v9i.11962*

Abstract. he emergence of drone kamikazes as an effective and efficient means of destroying ground targets from the air has been a global concern, especially since Russia's airstrikes on Ukraine in 2022. This technology introduces a new dimension in modern warfare, presenting significant challenges to the defense and security of national airspace. In addition to being effective in destroying targets, the use of drones is also very efficient in terms of the cost of conducting air operations compared to air campaigns using fighter aircraft. Ultimately, drone kamikaze attacks also have the potential to be used in asymmetric attacks, including attacks carried out by insurgent in peacetime. Anticipating this, a new strategic approach is urgently needed to protect national vital objects and secure very important persons (VIPs). The resulting perspective identifies the vulnerability of air defense systems to the swarm tactics and stealth approaches used by drone kamikazes. This paper highlights the importance of integrating advanced technologies, such as artificial intelligence, radar systems and electronic warfare capabilities to effectively detect, intercept, and neutralize drone kamikaze threats , especially those of the fixed-wing drone type . In addition to the technical aspect, the importance of coordinated collaboration between domestic stakeholders and international cooperation to overcome the proliferation of drone technology considering that fixed-wing drone technology can already be produced locally. By adopting a layered air defense strategy, it also offers a holistic approach that includes proactive threat detection, resilient defense systems, and adaptive strategic response and underscores the need for continuous innovation to keep pace with technological developments and drone kamikaze attack tactics in delivering important insights for policymakers, defense strategists, and security professionals in Plan A strong national air defense framework to reduce the risk of kamikaze drone threats , especially domestically made fixed-wing kamikaze drones..

Keywords: kamikaze drones; air defense; airspace security; asymmetric threats; electronic warfare systems; air security policy

I. INTRODUCTION

Rapid advances in unmanned aerial vehicle (UAV) technology, especially fixed-wing kamikaze drones, have presented significant challenges to the defense and security of national airspace. These drones, with their low cost, ease of use, and high destructive capabilities, have been used in a variety of conflicts, demonstrating the potential to disrupt traditional defense mechanisms. The ability of local communities to assemble drones and bombs has raised serious concerns, especially if such individuals join insurgency groups and use their assembled drones to attack national vital objects and VIP security. This threat is increasingly evident along with the ease of access to technology and information that allows the independent creation of armed drones. Its use in asymmetric warfare scenarios underscores the urgency for effective countermeasures, including in peaceful situations where insurgency makes it possible to attack objects of national vital and VIP security.

The main purpose of this paper is to analyze the threats posed by local drone kamikazes and propose strategies to improve the defense and security of national airspace. The study includes an examination of current drone technology , its operational tactics, and exploited vulnerabilities in existing defense systems. In addition, this paper explores the integration of electronic warfare, layered defense strategies, and policy frameworks aimed at reducing the threat of domestically produced kamikaze drones.

Previous research has highlighted the increasing use of drone swarms in modern conflicts, emphasizing the need for more advanced detection and interception technologies. For example, a study by Smith et al. (2020) discusses the effectiveness of electronic warfare in dealing with UAV threats, while Johnson and Lee (2019) explore the implementation of layered defense strategies to improve national security. Furthermore, Davis (2021) discusses the policy framework that is important for regulating the use of drones and developing anti-drone technologies.

In the discussion, this paper aims to answer the following questions: What are the specific threats posed by local drone kamikazes to airspace security and national defense; How electronic warfare and layered defense strategies can be integrated to effectively deal with the threat of these drone kamikazes; What policy framework is needed to support the development and implementation of anti-drone technology.

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e-ISSN: 2598-120X; p-ISSN: 2598-117X

In an era of increasingly affordable technology, the ability of local communities to assemble drone kamikazes brings a new dimension in the escalation of threats to the security of national airspace. Drones, originally created as a tool of technological innovation, have turned into effective yet inexpensive weapons in scenarios of asymmetric warfare and insurgency. With easy access to technological components and the abundance of information on the internet, individuals and non-state armed groups can now create threats that are not only deadly, but also difficult to detect by conventional air defense systems.The cases of drone attacks in Yemen, Syria, and Myanmar underscore how local assembly capabilities can be used to launch attacks against objects of national vital and VIP security. In Indonesia, this potential is even more dangerous given the vulnerability to the proliferation of local drone technology without adequate supervision. With domestic insurgencies that may take advantage of this technology, threats to national stability and security are no longer a threat in the future, but a reality that must be anticipated immediately. Facing this situation, a comprehensive strategic approach is needed. Strengthening regulations on drone technology, increasing intelligence capabilities to monitor risky community activities, and developing anti-drone technology are priority steps. In addition, collaboration between agencies, both at the national and international levels, must be increased to limit access to technologies that have the potential to be used for destructive purposes. This paper emphasizes that national airspace security is not just a matter of advanced technology or large investments, but also includes a deep understanding of how local threats can evolve into global risks. With a holistic and innovative approach, the threat of kamikaze drones can be minimized, providing better protection for the country's sovereignty and security.

II. RESEARCH METHODS

This study uses a qualitative approach of secondary data with case study analysis and interview methods to obtain the source of the threat posed and strategies to overcome the threat of local drone kamikaze to the defense and security of national airspace. The data was collected through literature studies, document analysis, and in-depth interviews with defense and security experts.

The collection of supporting data was obtained from secondary data related to drone kamikaze attacks and the results of interviews with air defense experts, security analysts, and policymakers.

Interview Results from Secondary Data

In analyzing empirical data sources, it is necessary to convey the results of in-depth interviews with air defense experts, security analysts, and policymakers related to kamikaze drones that are very important obtained from related secondary data. Here are some relevant speakers, including:

Tangguh Chairil – Lecturer in International Relations at Bina Nusantara University (Binus) who was a resource person in an interview with Kompas about the role of drones in defense.

Prabowo Subianto – Minister of Defense of the Republic of Indonesia (2019-2024 period) who has stated the importance of the Indonesian Air Force having kamikaze drones to strengthen national air defense.

Herlambang Effendy, M.Si – Head of the Center for Research and Development of Defense Equipment (ICECRD) at the Research and Development Agency of the Ministry of Defense (Balitbang Kemhan), who is involved in the development of a prototype of the phase I-II drone kamikaze.

Dirgantara Purnama – President Director of PT AKM Teknologi Nuswantara, a company that collaborates with the Ministry of Defense's Research and Development Agency in the development of drone kamikazes.

Suhendra Yusuf RPN – Director of Technology and Development of PT Dahana (Persero), which developed a kamikaze drone named Rajata and stated that Rajata is ready to compete with the world's kamikaze drones.

Case Study of Drone Attacks on National Vital Objects

In the context of case studies as empirical data, this paper examines several incidents of drone attacks on national vital objects as follows:

Drone Attack on Saudi Aramco Oil Refinery (2019): On September 14, 2019, Saudi Aramco's Abqaiq and Khurais oil refineries were attacked by drones, causing a 5% decline in global oil production. This attack shows the vulnerability of energy infrastructure to drone attacks.

Drone attack on the President of Venezuela (2018): On August 4, 2018, Venezuelan President Nicolás Maduro was the target of a drone attack while giving a speech in Caracas. Although the attack failed, this incident highlights the threat drones pose to VIP security.

Drone Attack on Hmeimim Air Base, Syria (2018): In January 2018, the Russian-operated Hmeimim air base in Syria was attacked by a swarm of drones. This attack was successfully thwarted, but emphasized the need for an effective air defense system against the drone threat.

Drone Strike in Syria: On October 5, 2023, a drone strike targeted a cadet graduation ceremony at a military academy in the Syrian city of Homs, killing at least 100 people and injuring dozens more. These attacks demonstrate the ability of non-state armed groups to use drones to carry out deadly attacks against military and civilian targets.

Drone Attacks by Houthi Groups in Yemen: Houthi groups in Yemen have used assembled drones to attack various strategic targets. On July 19, 2024, a large drone launched by the Houthis managed to reach Tel Aviv, Israel, killing one person. The Israeli military admitted that there was "human error" that caused the drone to not be intercepted by its air defense system.

Drone Strikes in Myanmar: On April 4, 2024, an alliance of opposition groups in Myanmar claimed to have carried out a drone attack targeting two military installations in the capital Naypyidaw. The attack highlights the use of drones by local insurgency groups to attack critical military facilities.

Drone Attack on PT Pertamina RU VI Oil Refinery Balongan, Indonesia (2019): In September 2019, PT Pertamina RU VI Balongan collaborated with the Indonesian Ministry of Defense in the use of anti-drones to protect oil refineries from the threat of drone attacks. This step was taken as a proactive response to the potential threat of drone attacks on national vital objects.

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III. RESULTS AND DISCUSSION

The presence of kamikaze drones as a new threat in air defense strategy has sparked in-depth discussions among defense experts, security analysts, and policymakers. The above cases suggest that individuals or groups with access to drone technology and the ability to assemble bombs can pose a significant threat to national security. The use of assembled drones by insurgency groups allows them to carry out low-cost but high-impact attacks, especially against national vital objects and VIP security. Through interview data and empirical findings from drone attacks on national vital objects, several critical aspects can be identified that emphasize the urgency to present strategic solutions.

The Complexity of the Kamikaze Drone Threat

In an interview with Herlambang Effendy, Head of the Alpalhan Research and Development Center, the threat of kamikaze drones was emphasized as a "game-changer" in asymmetric warfare, namely drones are fast in preparation and effective in destroying targets. These drones, especially fixed-wing ones, have the ability to strike with high precision at low cost, allowing non-state and insurgency actors to take advantage of this technology. This was seen in the 2019 Saudi Aramco attack, in which a swarm of drones halted the operation of two major oil refineries, causing significant global economic losses. The Davis study (2021) supports this, showing that technological advances have made it possible to infiltrate traditional air defenses through stealth tactics.

Technology and Defense Gap

Dirgantara Purnama, Director of PT AKM Teknologi Nuswantara, emphasized that Indonesia has the potential to develop a local drone defense system . However, incidents such as the Hmeimim airbase attack in Syria (2018) show that without advanced radar technology and adequate electronic warfare systems, vulnerabilities remain high. Smith et al. (2020) emphasized the importance of developing radar integration systems, electronic warfare, and artificial intelligence-based detection capabilities to effectively counter drone threats .

The Effectiveness of Electronic Warfare

An interview with Suhendra Yusuf RPN, Technology Director of PT Dahana, highlighted that the kamikaze drone "Rajata" can be a defensive as well as offensive solution. In this context, the layered defense strategy developed by Johnson and Lee (2019) is relevant. The strategy proposes combining electronic warfare systems with ground-based rapid response units to intercept drones before they reach targets.

Policy Framework

From the interview with Prabowo Subianto, the urgency of a technology-based air defense policy is the main highlight. Without comprehensive regulation, proliferasi teknologi drone di pasar lokal dapat memicu risiko bagi keamanan nasional. Studi oleh Davis (2021) mencatat bahwa kerangka kebijakan yang efektif harus mencakup supervision of drone production, budget allocation for the development of anti-drone technology, and international cooperation.

Integration of Findings and Theories

Findings from interviews and drone attacks reinforce the theory that conventional air defenses are no longer adequate in the face of modern drone threats . The asymmetric strategy implemented through drone swarm tactics takes advantage of a gap in traditional radar systems. In addition, the proliferation of local drones, such as those developed by PT Dahana, presents challenges as well as opportunities in building a safe and controlled drone technology ecosystem.

This discussion shows that the threat of kamikaze drones requires a multidimensional response, covering comprehensive technologies, defense strategies, and policies. The integration of insights from in-depth interviews and case studies provides a solid foundation for developing adaptive and resilient air defense protocols.

IV. CONCLUSIONS

The emergence of local drone kamikazes as a real threat to national air defense has introduced a new dimension in asymmetric warfare and airspace security. Through in-depth analysis, both from interviews with experts and case studies of drone attacks, it is clear that the speed of technological adaptation and defense strategies are key to overcoming this threat. Kamikaze drones with low cost and high-precision capabilities have shown significant destructive potential against national vital objects and VIP security.

Vulnerabilities in conventional air defense systems, especially to swarm tactics and stealth approaches, underscore the importance of adopting a layered defense strategy integrated with artificial intelligence technology, electronic warfare, and advanced radar detection. In addition, effective regulation and the development of domestic anti-drone technology should be a priority to limit the proliferation of this technology in the uncontrolled local market..

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