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Proposing Evidence-Based Recommendations for Enhancing Malaysia's UAS Regulatory Framework

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ABSTRACT – The expansion of the Unmanned Aircraft System (UAS) industry, along with the growth of commercial unmanned aircraft, urban air mobility vehicles, inspection and hobby drones, calls for a comprehensive regulatory approach. Although the Civil Aviation Authority of Malaysia (CAAM) has made progress in developing regulations for UAS operations, the current rules are inadequate to address the challenges posed by emerging UAS technologies and their unique operational concepts. This study aims to develop a new regulatory framework that employs a risk-based approach to categorize UAS operations in Malaysia. To achieve these objectives, a multifaceted research methodology was used, including an in-depth analysis of international regulatory frameworks and a comprehensive survey to gather necessary data and insights. The proposed framework seeks to address the issues in UAS operation such as safety and security, growth and international alignment; thus, offering a holistic, adaptable, and future-oriented strategy for UAS governance. In summary, the proposed strategy aims to significantly enhance the safety, efficiency, and regulatory compliance of UAS operations while fostering the growth of this emerging air transport sector. The results of this study provide valuable insights for policymakers, regulators, and UAS operators in Malaysia and other countries facing similar regulatory challenges.

KEYWORDS: Unmanned Aircraft System (UAS), Civil Aviation Authority of Malaysia (CAAM), Civil Aviation Regulations (CAR), risk-based approach

1.0 INTRODUCTION

The revolution in Unmanned Aircraft Systems (UAS) technology is transforming modern aviation. These versatile and increasingly accessible aerial platforms have extended beyond their initial uses, impacting industries such as agriculture, infrastructure inspection, emergency response, and urban mobility. The widespread adoption of UAS technologies has ushered in a new era of opportunities while simultaneously presenting a complex set of challenges for regulators. As they navigate the evolving landscape of UAS integration, regulatory bodies worldwide face the daunting task of balancing innovation with safety, commerce with security, and autonomy with accountability. The rapid growth of this disruptive technology has not only changed the skies but also upended traditional regulatory frameworks. Regulations for drones vary across regions, even though the technology and companies operate globally. To make manufacturing more efficient, allow for cross-border drone use, and avoid conflicting rules, it's crucial to address these differences and work towards creating common international standards [1].

In Malaysia, the Civil Aviation Regulations 2016 (CAR 2016) under Civil Aviation Act 1969, represent the country's response to the UAS boom. Although CAR 2016 was a significant step forward, offering a comprehensive framework for UAS operations at the time, it now finds itself at a critical juncture. The swift advancements in UAS technology, driven by developments such as Advanced Air Mobility (AAM), swarm drones, and autonomous UAS operations, have ushered in a transformative era. These innovations are not merely incremental improvements

but quantum leaps in UAS capabilities, unlocking a myriad of new applications. These technological advancements pose significant challenges to the current regulatory infrastructure. The agility and sophistication of AAM vehicles, the coordination challenges posed by swarm drones, and the complexities of autonomous UAS operations challenge existing regulatory norms. A conventional rule-based approach may be inadequate for addressing these emerging complexities that transcend traditional aviation boundaries.

Moreover, the inherently global nature of UAS operations necessitates a nuanced understanding of international best practices. Organizations such as the International Civil Aviation Organization (ICAO), the European Union Aviation Safety Agency (EASA), the Federal Aviation Administration (FAA), various regional Civil Aviation Authorities (CAAs), and the Joint Authorities for Rulemaking on Unmanned Systems (JARUS) have played pivotal roles in shaping the regulatory landscape. Their experiences, insights, and evolving frameworks provide valuable benchmarks and potential models for Malaysia's UAS regulatory development.

Drones are making fast progress in Malaysia. The country's global ranking for drone readiness has jumped from 30th to 21st in just a year. This improvement shows how serious Malaysia is about boosting its drone technology. The drone industry is expected to add RM50.71 billion (USD11.45 billion) to the economy and create 100,000 jobs by 2030 [2].

To help the growing drone industry, the Malaysian government introduced the Malaysia Drone Technology Action Plan 2022-2030 (MDTAP30). This plan aims to make it easier to develop drone technology, establish rules for safe drone use, promote drones in various fields, and improve the skills of local drone businesses [3]. MDTAP30 aims to set up a national system to manage drone traffic, create an online platform for drone registration, promote the use of drones in key industries, and develop skilled drone operators by certifying training organizations. The Malaysian Research Accelerator for Technology and Innovation oversees and manages MDTAP30 [4].

The Malaysian Department of Civil Aviation (DCA) issued guidelines called Aeronautical Information Circular 04/2008 (AIC 04/2008). These rules require all drone operators in Malaysia to follow DCA guidelines and the Civil Aviation Regulations 1996 (CAR 1996) [5]. As a member of the Chicago Convention and the International Civil Aviation Organization (ICAO), Malaysia follows their rules. One of these rules is that drones cannot fly over another country's territory without getting permission first [6].

Minister of Transport brought in new rules called the CAR 2016, which include specific guidelines for drones in Malaysia. One rule, Regulation 140, restricts drones from flying in certain areas and above 400 feet unless they have special permission. It also forbids dropping objects or animals from drones to keep people safe on the ground [7]. Civil Aviation Authority of Malaysia (CAAM) introduced the Authorization to Fly Permit for low-risk drone operations. This permit makes it easier for drone operators doing low-risk activities to follow the rules [8]. CAAM also implemented Civil Aviation Directives focusing on three different aspects of drone operations. The aspects include ensuring the operators maintain high standards of instruction and safety [9], setting guidelines for safe and effective drone use in agriculture [10] and providing a framework for innovative projects requiring unique considerations and exemptions [11].

The formation of the JARUS working group was a pivotal advancement in the regulation of UAS. This group created a categorization framework to delineate the regulatory requirements for different types of UAS and their operations, striking a balance between fostering innovation and ensuring safety [12]. The shift towards pilotless aircraft presents substantial operational and technical challenges, which the aviation industry is actively working to overcome. The ICAO promotes open dialogue and collaboration among Member States, maintaining a repository of varied UAS regulations to facilitate mutual learning and harmonization [13].

ICAO's regulations emphasize UA registration, with weight-based criteria for operational reviews and inspections (Part 101), certification processes for heavier UAs (Part 102) [14], and the role of Approved Aviation Organizations in remote pilot licensing and UA inspections (Part 149) [15]. ICAO also offers Advisory Circulars (ACs) providing insights into UAS operations, including Canada's performance-driven regulatory model (AC 922-001) and guidelines for humanitarian UAS use [16]. European Union (EU) regulations, specifically Regulation EU

2019/947 and Regulation EU 2019/945, provide comprehensive provisions for UAS operations and technical requirements for UAS design and manufacture. These regulations aim to harmonize UAS rules across the EU, covering certification, operator qualifications, and operational limitations [17-18]. In the United States, the FAA's Part 107 governs small UAS (sUAS) operations for commercial purposes, requiring a Remote Pilot Certificate for commercial operators [19].

One pressing challenge is Beyond Visual Line of Sight (BVLOS) operations, which the FAA addresses through pilot programs and industry collaborations [20]. The FAA's UAS Integration Pilot Program accelerates UAS integration into national airspace by allowing state, local, and tribal governments to collaborate with industry partners on innovative solutions [21]. The FAA's Remote Identification (Remote ID) rule, requiring UAS to broadcast identification and location information during flight, enhances airspace awareness and security, particularly in urban environments and BVLOS operations [22].

Having said that, it is essential to undertake a comprehensive reassessment and recalibration of Malaysia's UAS regulatory framework. This research aims to explore these complexities, bridge existing gaps, and develop a strategic pathway. The ultimate goal is to position Malaysia as both a harmonious contributor to global UAS advancements and a proactive leader in innovation and safety within the dynamic UAS landscape.

2.0 METHODOLOGY

The approach used in this study is detailed and multi-faceted, combining different analytical methods to thoroughly examine the topic. It starts with a qualitative review of literature, which involves looking into a variety of articles, research papers, and primary documents related to the subject. The aim is to gather and critically analyze information to identify patterns, challenges, and opportunities. Additionally, the study includes a comparative evaluation of regulations, comparing Malaysia's rules with those of major international aviation organizations. This helps highlight differences, similarities, and best practices, placing Malaysia's regulations in a global context. By merging the qualitative literature review and the comparative regulatory assessment methods, the study offers a comprehensive and insightful perspective on the evolving UAS regulations.

The thorough exploration of literature helps understand the history, current standards, and emerging trends in UAS. Additionally, the study outlines the research questions guiding the investigation. To address these questions, a thorough search was conducted using specific keywords related to the topic. Table 1 lists all the keywords used in this research.

Table 1: Research keywords

Unmanned Aircraft System	Drone	Unmanned Aerial Vehicle	Regulations	Aviation
Civil Aviation	Civil Aviation Authority	Civil Aviation Directive	Aeronautical	Risk-Based UAS Operation
Airworthiness	Risk Management	UAS Categorization	Enforcement	Risk Assessment
Risk Mitigation	UAS Geo-location	Autonomous	Visual-line-of-sight	Beyond-visual-line-of-sight
Research Methodology	Aerodrome	Data Privacy	Airspace Classification	Remotely Piloted Aircraft System

Based on the research objectives, most information can be sourced from the websites of relevant authorities, such as CAAM, EASA, FAA, JARUS, and ICAO. For example, EASA offers a comprehensive document library containing regulations, type certificates, acceptable means of compliance, and guidance materials for aviation authorities, industry professionals, job applicants, and the media. National civil aviation bodies like CAAM and FAA, along with joint organizations such as JARUS, provide invaluable resources for industry professionals. These online repositories include governing acts for aviation practices, comprehensive regulations for operators and airlines, directives detailing specific aviation-related instructions, circulars guiding regulatory processes, and official notices for streamlined communication from authorities. Such resources are crucial for reinforcing standardized and safe operations within the aviation sector. Additionally, this study leverages established research libraries, including the UiTM Digital Library, Google Scholar, and the IEEE Library, to procure research papers, journals, and publications published within the last 5 to 8 years from the commencement of this research. This time frame was chosen because the UAS industry, along with its regulatory guidelines, is relatively new. Significant technological advancements and the maturation of regulatory requirements have occurred during this period, making it ideal for study and insights. In the final phase of sourcing information, traditional search engines, particularly Google, are used to capture current developments. This approach aims to gather the latest trends, news articles, up-to-date statistics, and pertinent information directly related to the research questions. Using search engines in this way provides a holistic understanding, ensuring the research remains relevant and informed by the most recent advancements and discussions in the field. Table 2 tabulates the online resources employed in the study.

Table 2: Online resources

Organization	Online Resource
Civil Aviation Authority of Malaysia (CAAM)	https://www.caam.gov.my/resources/publications/
International Civil Aviation Organization (ICAO)	https://www.icao.int/publications/Pages/default.aspx
Joint Authorities for Rulemaking On Unmanned Systems (JARUS)	http://jarus-rpas.org/publications/
European Union Aviation Safety Agency (EASA)	https://www.easa.europa.eu/en/home
Federal Aviation Administration (FAA)	https://www.faa.gov/uas/resources/policy_library

3.0 *RESULT AND DISCUSSION*

3.1 Risk Based Approach

Global aviation authorities are tasked with developing balanced standards and criteria for the design, manufacturing, and operational approvals of UAS. These standards must ensure the safe integration of UAS into airspace using non-traditional, performance-oriented regulatory methods. It is expected that UAS will eventually take on roles similar to those of manned aviation. However, the absence of an onboard pilot requires a departure from conventional regulatory methods used for manned aviation. Although the current variety of UAS types is limited, the future is likely to bring greater diversity in their designs, operational environments, and capabilities, necessitating a versatile regulatory approach. A central aspect of this new classification system is the adoption of a risk-based perspective. Key considerations within this framework include potential threats to ground personnel, other airspace users, and critical infrastructure. While aviation authorities primarily focus on these risks, additional concerns such as privacy and security must also be addressed. Figure 1 outlines the risk areas to be considered. Understanding these risks involves assessing the UAS's performance, operational context, and size. For example, a UAS surveying an unpopulated remote area would require different considerations compared to one operating over urban areas.

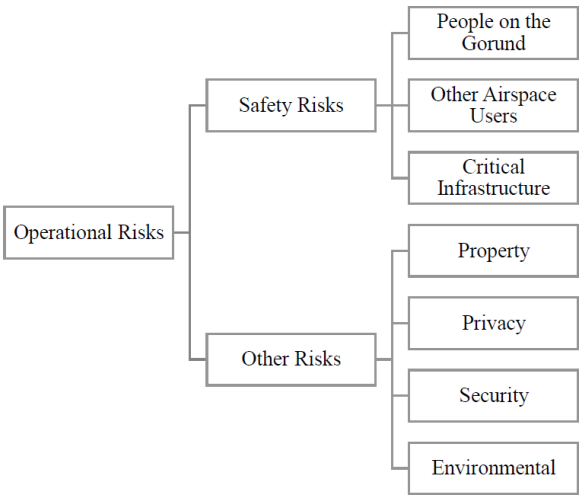

Figure 1: UAS risk considerations

Safety, as defined by ICAO, is the condition in which risks associated with aviation activities, whether related to or directly supporting the operation of aircraft, are reduced and controlled to an acceptable level. Safety hazards linked to UAS operations can be categorized based on the potential impact on individuals on the ground, other airspace users, and critical infrastructure.

The JARUS identifies the primary safety risk associated with UAS operations as harm to people on the ground. In the event of an incident, victims may include participants who are directly or indirectly involved, as well as individuals not associated with the UAS operation. Injuries or fatalities may result from a direct impact of the aircraft, its components, or its payload, including post-crash threats such as explosions or fires. Additionally, UAS can cause indirect harm; for example, a low-flying drone could distract a motorist, potentially leading to an accident. While both intentional and accidental harms are concerning, safety risks specifically pertain to unintentional incidents, with deliberate harms classified as security risks.

JARUS also highlights significant safety concerns regarding the potential harm to or compromise of vital infrastructure. Such infrastructure includes assets essential to society's functioning, such as systems for electricity generation and distribution, communication channels, food and water supply, industries like mining, and energy resource management, including oil platforms and nuclear power stations. Additionally, it covers all modes of a country's transportation networks, from terrestrial to maritime and aerial. Before issuing operational permits, it is crucial to assess UAS operations for potential hazards they might pose to these critical structures, with impacts evaluated at the national level.

Other risks linked to UAS operations include property damage, privacy concerns, security issues, and environmental impacts. Although these are important for regulatory bodies to assess, they are not the primary focus of this classification system due to the challenges in reaching a unanimous consensus given cultural differences. UAS can cause property damage due to system malfunctions or operator errors. To ensure compliance with regulations, authorities might set rules such as limiting flights over private property or mandating insurance coverage for UAS operations involving property areas.

UAS present distinct privacy risks due to their small size, remote operation capabilities, and advanced recording technologies. Many small UAS are equipped with cameras or video recorders that can store or transmit footage, offering new surveillance methods that can compromise individual or group privacy. Essentially, UAS can challenge conventional notions of privacy by accessing spaces designed for seclusion. Privacy infringements can be mitigated through regulatory measures such as operational restrictions, design limitations, or even complete bans in extreme cases. However, due to widely varying cultural perceptions of privacy, this aspect is not a primary factor in the new categorization framework.

Security concerns related to UAS operations revolve around intentional malicious actions by those involved directly or indirectly with UAS, as well as by uninvolved individuals. Risks include motives for intentional harm, such as a pilot deliberately causing a crash to injure people or damage property, causing distractions, or transporting harmful substances. There is also the threat of third-party interference, such as cyber-attacks that compromise UAS control, potentially leading to the drone's misuse. Despite the importance of these concerns, the varied cultural perspectives on security mean they are not a primary focus in the upcoming categorization framework.

UAS operations can also lead to environmental concerns, impacting both living organisms and their surroundings through factors such as emissions, waste, and noise. These concerns might be localized, such as preserving delicate areas like national parks or residential zones from noise or emissions, or broader, requiring countries to implement strategies to control widespread environmental impacts. Potential mitigation measures include airspace limitations or design modifications to reduce noise or emissions. However, due to diverse environmental priorities across different countries, environmental factors are not incorporated into the UAS operations categorization.

3.2 UAS Operational Category Development

When devising categories for regulatory involvement in the UAS sector, it is essential to take a balanced approach focused on the unaddressed risks of the intended operation. By using the Concept of Operations method and thoroughly understanding the implications of UAS activities, one can determine the necessary level of regulatory engagement to ensure safety. Some low-complexity systems operating in low-risk environments might require minimal to no oversight. However, certain operations may not clearly fit under minimal supervision or full regulatory control. To address this, a three-tiered categorization for UAS has been established. Accurately evaluating the risks is crucial to correctly categorize an aircraft operation. Once appropriate regulatory oversight is applied, the remaining risk for all UAS operations should be acceptably minimal.
Figure 2 depicts the UAS risk management framework for operational risks, specifically focusing on aviation risks. These risks are initially assessed as low, medium, or high, corresponding to categories A (Open), B (Specific), and C (Certified). Mitigation measures for each category involve varying degrees of operational limitations, approvals, and certifications, including type design and pilot certificates. The goal is to reduce the unmitigated risk to an acceptable level, ensuring safety and regulatory compliance.

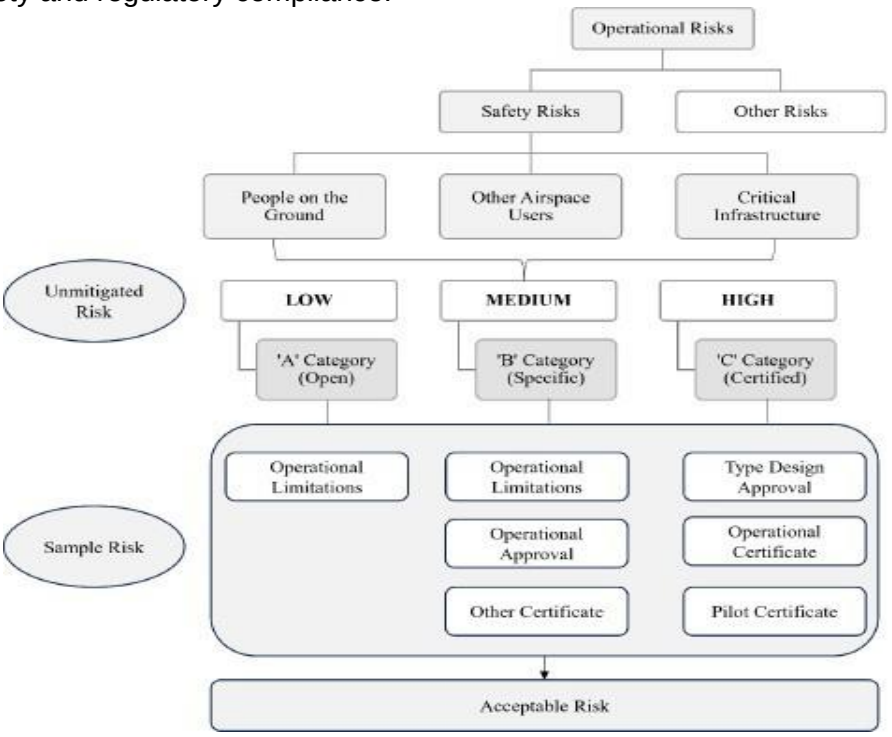

Figure 2: UAS Operational Categorization

3.2.1 Categorization Rationale

Categorization introduces a practical perspective to the risk-based approach. Ideally, each UAS operation would be evaluated individually, with regulatory involvement aligned to the specific unaddressed risks. However, for operations with minimal inherent risks, this method could burden both operators and aviation regulators with the extensive task of creating and approving risk assessments. Conversely, for operations with significant inherent risks, increasing regulatory involvement beyond current standards for manned commercial flights might not effectively control those risks.

A three-tier system addresses these challenges at both the low and high-risk extremes while maintaining risk-based principles across all operations, as illustrated in Figure 3. Defining and establishing precise thresholds for regulatory involvement can be challenging. Operations that fall near the boundary between two categories, based on their perceived unaddressed risks, will often challenge the assumptions of those categories. As UAS operations evolve, it is crucial to reassess and potentially adjust these category boundaries.

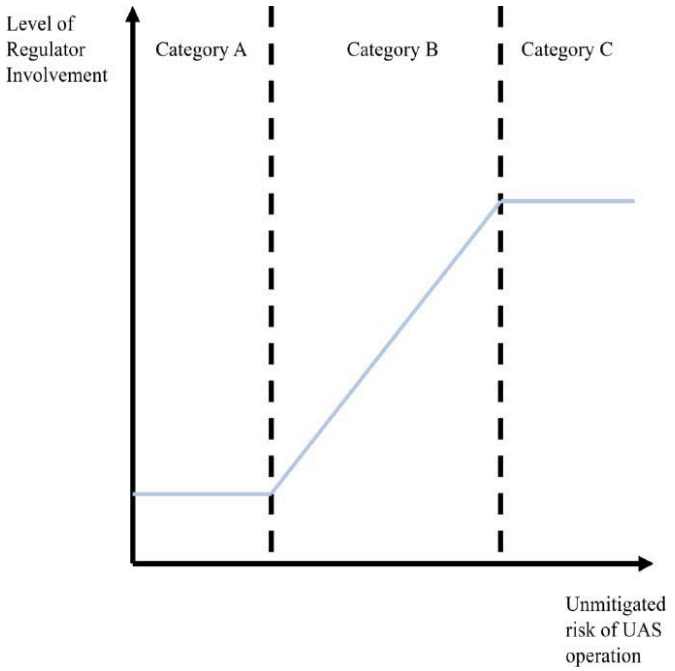

Figure 3: Regulator Involvement Based on Operational Risk

3.2.2 Risk Management

Regulations should only permit UAS operations that pose an acceptable risk to individuals on the ground, other airspace users, and vital infrastructure. It is important to understand that "acceptable risk" does not imply the absence of risk. The level of regulatory oversight, determined by the UAS operational category, along with other previously discussed mitigations, should ensure that the inherent safety risk is reduced to a low risk level. This lower-level risk can be defined as a safety goal for all operational categories.

3.2.3 Enforceability of UAS Regulation

When developing UAS regulations, it is crucial to consider their enforcement. Traditional enforcers such as aviation safety inspectors will continue to play a vital role, leveraging their expertise to ensure safety and compliance, particularly in scenarios where UAS pose significant risks to manned aircraft. However, with the increasing use of UAS driven by factors like affordability and ease of use, there is a growing need for new enforcement methods and personnel.

Local law enforcement agencies, which may lack a background in aviation regulations, may be tasked to assist in enforcement efforts. While they provide broader coverage compared to traditional inspectors, their limited familiarity with aviation regulations presents challenges. This can result in potential misinterpretations of regulations and inconsistencies in enforcement practices. Therefore, when integrating these non-traditional enforcement bodies, it is essential for authorities to establish clear and easily understandable regulations. This ensures that violations can be promptly and accurately identified and addressed.

3.3 UAS Operational Categorization By ICAO

At the request of its Member States, ICAO undertook the development of a regulatory framework for UAS operating outside the IFR International arena. This initiative involved a comprehensive review of existing UAS regulations across different countries. The goal was to identify commonalities and best practices that align with the ICAO aviation framework and can be universally adopted. As a result of this effort, ICAO introduced the ICAO Model UAS Regulations, categorized specifically as Parts 101, 102, and 149. These model regulations, accompanied by ACs, serve as a standardized blueprint for Member States to either adopt or enhance their current UAS regulations. They are designed to be dynamic documents that evolve alongside industry advancements, providing regulators with internationally harmonized guidelines based on the latest developments. The model regulations integrate elements from existing UAS regulations in countries such as Vanuatu, New Zealand, Australia, Canada, and the United States, incorporating customary practices from other Member States to ensure inclusivity and comprehensiveness.

3.4 UAS Operational Categorization By EASA

Regulation (EU) 2019/947 has brought significant advancements to the regulation of UAS operations, categorizing them into three distinct categories: 'open', 'specific', and 'certified'. Each category imposes varying levels of operational prerequisites and regulatory oversight.
The 'open' category provides a relatively unrestricted operational environment for UAS operators. Operators under this category can initiate operations without prior operational authorization, aiming to streamline operations deemed to pose lower risks and reduce bureaucratic hurdles. In contrast, the 'specific' category introduces regulatory oversight where UAS operations require operational authorization. This can be obtained through either compliance with Article 12 provisions or alignment with Article 16 directives. Additionally, in specified scenarios outlined in Article 5(5), operators must make formal declarations. This category strikes a balance between flexibility and regulatory control, accommodating operations with moderate risk levels.

The 'certified' category is the most stringent, involving a comprehensive certification process for both the UAS and its operator. The UAS must adhere to certification standards defined in Delegated Regulation (EU) 2019/945, while operators may also need certification. Operations involving remote pilots necessitate pilot licensing, ensuring robust oversight and safety measures for complex and potentially high-risk UAS operations. These categories under Regulation (EU) 2019/947 aim to ensure safety while accommodating the diverse operational needs of UAS, reflecting a nuanced approach to regulatory management in the evolving field of unmanned aviation.

3.5 Low-Risk UAS Operational Categorization for Malaysia Proposal

The regulations proposed in Tables 3 and 4 aim to achieve a balance between fostering innovation and ensuring safety in low-risk UAS operations within Malaysia. They are tailored to address the specific requirements and risks inherent to this category of UAS operations, prioritizing public safety and privacy. Furthermore, these regulations are aligned with international best practices and standards, considering Malaysia's distinct geographical and operational considerations.

Table 3: Proposed Low-Risk UAS Regulations for Malaysia

Regulation Subject	Description
UAS Operations Divided into Subcategory (JARUS Model like)	Introduce subcategories A1, A2, and A3 for low-risk UAS operations to address varying risks and operational requirements, like the EASA Open Category subcategories.
UAS Classification (EASA Model-like)	UAS will be classified into categories based on their maximum takeoff weight (MTOM) and specific criteria for each class: Class C0: UAS with MTOM below 250 grams. Class C1: UAS with MTOM between 250 grams and 900 grams. Class C2: UAS with MTOM between 900 grams and 4 kilograms. Class C3: UAS with MTOM between 4 kilograms and 25 kilograms. Class C4: UAS with MTOM above 25 kilograms
Remote Pilot Competency and Training (EASA Model-like)	Remote pilots must possess a certificate of remote pilot competency, demonstrating a basic understanding of UAS instructions and safety guidelines
UAS Geographical Zone (EASA Model-like)	Implement geographical zones for low-risk UAS operations, designating areas within which UAS can operate with reduced restrictions and safety measures, mirroring the approach adopted by the European Union Aviation Safety Agency (EASA) in Malaysia.
Operator and Aircraft Registration (ICAO Model-like)	Require the registration of both UAS operators and their aircraft, following the principles proposed by the International Civil Aviation Organization (ICAO) model regulations

Table 3: Proposed Low-Risk UAS Regulations for Malaysia

Subcategory	Operational Area and Safety Distances	Remote Pilot Competency and Training	UAS Classification
A1	a. Avoid flying over uninvolved persons b. Safety distance as close as 5 meters in certain conditions	a. Certificate of remote pilot competency b. Basic knowledge of UAS instructions	Class C0 and C1
A2	a. Avoid flying over uninvolved persons b. Minimum safety distance of at least 30 meters	a. Certificate of remote pilot competency b. Specific training and exams	Class C2
A3	a. Operations in areas with no uninvolved persons at risk b. Minimum safety distance of at least 150 meters from specific areas	a. Certificate of remote pilot competency b. Specific training and exams	MTOM < 25 kg (private-built)

CONCLUSION

New regulatory framework that employs a risk-based approach to categorize UAS operations in Malaysia has been developed successfully based on international regulatory boards. The objective was aimed to propose evidence-based recommendations for enhancing Malaysia's UAS regulatory framework. These recommendations specifically addressed the adoption of risk-based approaches, integration of emerging UAS technologies, and alignment of Malaysian regulations with globally recognized best practices. This objective has been fulfilled through actionable insights and recommendations outlined in the research.

The proposed regulations for low-risk UAS operations in Malaysia mark a significant advancement towards achieving the dissertation's objectives. These regulations are crafted to meet the specific needs and challenges associated with low-risk UAS operations in Malaysia, while prioritizing safety, privacy, and international alignment. Key components of the proposed regulations include:

i. Subcategory Categorization: Introducing subcategories A1, A2, and A3 similar to EASA's Open Category subcategories, tailored to address varying risks and operational requirements.

ii. UAS Classification: Classifying UAS based on maximum takeoff weight (MTOM) in line with international norms, ensuring regulations are proportional to the size and capabilities of the UAS.

iii. Remote Pilot Competency and Training: Mandating remote pilots to hold a certificate of remote pilot competency and possess fundamental knowledge of UAS operations to enhance safety and professionalism.

iv. UAS Geographical Zones: Establishing geographical zones for low-risk UAS operations, akin to the EASA model, providing flexibility and safety within designated areas.

v. Operator and Aircraft Registration: Adhering to ICAO principles for operator and aircraft registration to bolster traceability and accountability in UAS operations.

By proposing these regulations, the study effectively addresses the need for a tailored and balanced approach to UAS regulation in Malaysia, catering to the country's unique operational landscape. These regulations also uphold international best practices and standards, contributing to the safe and responsible integration of UAS into Malaysia's airspace. The study provides valuable insights to guide Malaysia's future developments in UAS regulations, positioning the nation at the forefront of UAS regulatory advancements.

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