



**PUBLIC CONSULTATION PAPER ON
PROPOSED MALAYSIA LOW ALTITUDE ECONOMY FRAMEWORK**

Civil Aviation Authority of Malaysia

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PREFACE

Malaysia stands at the threshold of a new era in aviation and technological development. Advances in unmanned aircraft systems (UAS), Advanced Air Mobility (AAM), artificial intelligence (AI), digital connectivity and autonomous technologies are transforming the way low altitude airspace can be utilised to deliver economic, social and public service benefits. Around the world, governments are developing national strategies to unlock the potential of what is increasingly recognised as the Low Altitude Economy (LAE).

The Civil Aviation Authority of Malaysia (CAAM), as the national aviation regulator and sector development agency, is committed to ensuring that Malaysia is well-positioned to harness these opportunities while maintaining the highest standards of aviation safety, security and public confidence. The development of the Malaysia LAE Framework represents an important step towards establishing a coordinated national approach that enables innovation, supports industry growth and ensures the safe, secure and sustainable integration of emerging low altitude aviation technologies into Malaysia's airspace.

The proposed Malaysia LAE Framework is intended to provide a long-term strategic direction for the development of Malaysia's LAE. It brings together policies relating to aviation safety, operations, digital infrastructure, industry development, innovation, investment and talent, while complementing existing national initiatives such as the Thirteenth Malaysia Plan (RMK-13), the New Industrial Master Plan 2030 (NIMP 2030), the Malaysian Aerospace Industry Blueprint 2030 (MAIB 2030), and the Malaysia Drone Technology Action Plan 2022–2030 (MDTAP30). Rather than replacing these initiatives, the proposed Malaysia LAE Framework seeks to provide an overarching policy architecture that strengthens coordination across government, industry and other stakeholders.

This Public Consultation Paper sets out CAAM's proposed vision, guiding principles, strategic pillars, enabling foundations and implementation roadmap for the Malaysia LAE Framework. The proposals contained in this document are intended to stimulate discussion, gather views and obtain feedback from stakeholders before the Malaysia LAE Framework is finalised.

CAAM recognises that the successful development of the Malaysia's LAE requires close collaboration across government, industry, academia, research institutions, investors, technology developers, professional bodies and the wider public. Stakeholder engagement is therefore essential to ensure that the Malaysia LAE Framework is practical, forward-looking and responsive to the needs of Malaysia's evolving aviation and innovation ecosystem.

CAAM invites all interested parties to review the proposals contained in this consultation paper and to provide constructive feedback on any aspect of the proposed Framework. All submissions received during the consultation period will be carefully considered in refining the Framework before its finalisation.

CAAM appreciates the time, expertise and commitment of all stakeholders in contributing to the development of a safe, innovative and internationally competitive LAE that supports Malaysia's long-term economic growth, technological advancement and regional leadership.

EXECUTIVE SUMMARY

This Public Consultation Paper sets out CAAM's proposed Malaysia LAE Framework and seeks stakeholders' views on the proposed policy and regulatory framework for the safe, secure and sustainable development of Malaysia's LAE.

The consultation covers the key elements of the proposed Framework, including:

- the proposed definition of the Low Altitude Economy;
- the Vision, Mission and Guiding Principles;
- the four Strategic Pillars:
 - Safe Aircraft;
 - Safe Operations;
 - Connected Infrastructure; and
 - Thriving Industry;
- the Enabling Foundations; and
- the proposed Implementation Roadmap.

Together, these proposals provide an integrated framework intended to support the safe integration of emerging aviation technologies, facilitate innovation, strengthen industry development and promote long-term economic growth while maintaining the highest standards of aviation safety and public confidence.

CAAM welcomes views from all interested stakeholders on the proposals contained in this consultation paper. In addition to responding to the specific consultation questions, stakeholders are encouraged to provide comments on any aspect of the proposed Malaysia LAE Framework that may improve its clarity, effectiveness or implementation.

All submissions received during the consultation period will be carefully considered by CAAM in finalising the Malaysia LAE Framework. Feedback received will assist in refining the proposed Malaysia LAE Framework to ensure that it is practical, proportionate, future-ready and responsive to the needs of Malaysia's aviation industry, government agencies, businesses, academia and the wider community.

CAAM appreciates the valuable contributions of all stakeholders and looks forward to continued collaboration in shaping a safe, innovative and sustainable LAE for Malaysia.

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LIST OF ACRONYMS

Acronym	Meaning
AAM	Advanced Air Mobility
AI	Artificial Intelligence
ATF	Authorisation to Fly
ATM	Air Traffic Management
BVLOS	Beyond Visual Line of Sight
C2	Command and Control
CAAM	Civil Aviation Authority of Malaysia
ConOps	Concept of Operations
EVLOS	Extended Visual Line of Sight
eVTOL	Electric Vertical Take-off and Landing
LAE	Low Altitude Economy
MCMC	Malaysian Communications and Multimedia Commission
MRO	Maintenance, Repair and Overhaul
MRANTI	Malaysian Research Accelerator for Technology and Innovation
MTOM	Maximum Take-off Mass
NACSA	National Cyber Security Agency
RPTO	Remote Pilot Training Organisation
SMS	Safety Management System
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System
UASTM	Unmanned Aircraft System Traffic Management
VLOS	Visual Line of Sight

SECTION 1: INTRODUCTION

1.1 INTRODUCTION

The Low Altitude Economy (LAE) is emerging as a new domain of economic activity enabled by the safe and efficient use of low altitude airspace. Powered by advances in UAS, AAM, autonomous technologies and digital aviation, the LAE has the potential to transform a wide range of sectors, including logistics, agriculture, infrastructure inspection, emergency response, environmental monitoring and future passenger mobility.

The successful development of the LAE requires more than the deployment of new aircrafts. It depends on an integrated ecosystem comprising proportionate regulation, modern airspace management, digital infrastructure, industry capability, skilled talent and effective collaboration across government, industry and academia. Many countries are therefore adopting national strategies to coordinate these elements and create an enabling environment for innovation while safeguarding aviation safety, security and public confidence.

This consultation paper presents CAAM's proposed Malaysia LAE Framework, which aims to provide a strategic policy architecture for the development of the LAE in Malaysia. The proposed Malaysia LAE Framework is organised around four Strategic Pillars, Safe Aircraft, Safe Operations, Connected Infrastructure and Thriving Industry, supported by five cross-cutting Enabling Foundations and a phased implementation roadmap.

The purpose of this consultation is to seek views from stakeholders on the proposed Malaysia LAE Framework before it is finalised. Throughout this paper, CAAM invites comments on the proposed policy directions, regulatory approaches and implementation priorities to ensure that the proposed Malaysia LAE Framework reflects the needs of Malaysia's aviation sector, industry and wider economy.

1.2 MALAYSIA'S PROGRESS TOWARDS THE LOW ALTITUDE ECONOMY

Malaysia's journey towards the LAE has evolved progressively over the past decade through the establishment of regulatory frameworks, operational capabilities, digital infrastructure and strategic partnerships. While the term "Low Altitude Economy" has only recently emerged as a national policy concept, many of the regulatory, operational and institutional foundations required to support such an ecosystem have already been established.

As the national aviation regulator and sector development agency, the CAAM has played a central role in enabling the safe integration of UAS into Malaysian airspace. Through progressive regulatory reforms, operational oversight, technological innovation and collaboration with government agencies, industry and international organisations, Malaysia has moved beyond the initial regulation of drone operations towards developing the foundations of a broader low altitude aviation ecosystem.

1.2.1 Regulatory Framework

Over the past decade, Malaysia has progressively established a comprehensive regulatory framework to support the safe integration of UAS into the national aviation system. Malaysia established the legal foundation for UAS operations through the Civil Aviation Regulations 2016 (CAR 2016). Regulations 140 to 144 of CAR 2016 provide the statutory basis for regulating unmanned aircraft (UA) operations in Malaysia and empower CAAM to oversee their safe, secure and efficient operation.

Building upon this legislative framework, CAAM has continuously strengthened the regulatory regime to accommodate increasingly diverse UAS operations. Since the establishment of the dedicated UAS Unit in 2021, CAAM has introduced a series of Civil Aviation Directives (CADs) covering key areas of unmanned aviation, including:

- CAD 6011 Part I – Remote Pilot Training Organisation (RPTO);
- CAD 6011 Part II – Agricultural UAS Operations; and
- CAD 6011 Part V – Special UAS Projects (SUP).

These directives provide regulatory requirements for RPTOs, specialised agricultural operations and higher-risk UAS activities, while providing greater regulatory certainty for industry and supporting the safe adoption of emerging technologies.

Complementing the regulatory framework, CAAM has established a competency-based certification system comprising approved RPTOs, the Remote Pilot Certificate of Competency – Basic (RCoC-B), specialised competency modules for Extended Visual Line of Sight (EVLOS) and agricultural operations, and the Remote Pilot Certificate of Competency – Agriculture Light (RCoC-AL) for private agricultural drone operators. These initiatives ensure that UAS operations are supported by competent personnel operating within an appropriate regulatory framework.

Collectively, these initiatives demonstrate Malaysia's transition from regulating individual drone operations towards a comprehensive, risk-based regulatory ecosystem capable of supporting increasingly advanced UAS operations while maintaining the highest standards of aviation safety.

1.2.2 Operational Growth and Industry Adoption

Malaysia has experienced significant growth in UAS operations across commercial, industrial and public sector applications. Between 2020 and 2025, the number of Authorisations to Fly (ATF) issued by CAAM has increased from **252** from 2020 to **1,217 in 2025**, reflecting the rapid expansion of UAS applications across agriculture, logistics, utilities, infrastructure inspection, public safety and other sectors of the economy.

To support this growth, CAAM has approved six RPTOs, which have collectively produced more than **6,600 certified remote pilots** under nationally recognised competency standards. This growing pool of qualified personnel provides an important foundation for the continued expansion of Malaysia's low altitude aviation sector.

CAAM has also established structured approval mechanisms to enable increasingly sophisticated operations. These include the UAS Aerial Work Certificate (UAWC), Specific

Operations Risk Assessment (SORA), Pre-Defined Risk Assessment (PDRA) and Swarm Operations Approval (SOA), which support activities such as Beyond Visual Line of Sight (BVLOS) operations, agricultural applications, research and development, infrastructure inspection, cargo delivery trials and coordinated multi-aircraft operations under appropriate regulatory oversight.

The continued growth in operational approvals reflects increasing confidence in Malaysia's regulatory framework and demonstrates the expanding role of UAS technologies across multiple sectors of the economy.

1.2.3 Airspace Management and Digital Infrastructure

Recognising that the future growth of the LAE depends on more than aircraft regulation alone, CAAM has also commenced the development of enabling airspace management and digital infrastructure.

Key initiatives include the development of segregated UAS airspace, new operational approval mechanisms for lower-risk operations, enhanced digital operational tracking capabilities and the implementation of a national UAS Traffic Management (UASTM) ecosystem to facilitate the safe, efficient and scalable integration of UA within Malaysian airspace. These initiatives are designed to support increasing traffic density while maintaining the highest standards of aviation safety and operational efficiency.

Together, these developments represent an important step towards establishing the digital infrastructure necessary to support routine commercial UAS operations and future autonomous aviation services.

1.2.4 Preparing for Advanced Air Mobility (AAM)

Malaysia has also begun preparing for the introduction of AAM, recognising its potential to transform cargo logistics, passenger transport and other future aviation services.

CAAM has established the AAM Technical Working Group, organised the Malaysia LAE Forum, developed Malaysia's draft AAM Concept of Operations (ConOps), prepared guidance for regulatory sandbox activities and initiated the development of a national AAM roadmap. These initiatives provide an important foundation for the future integration of electric vertical take-off and landing (eVTOL) aircraft and other advanced aviation technologies into Malaysian airspace.

1.2.5 Strategic Partnerships and Ecosystem Development

The successful development of the LAE requires close collaboration across government, industry, academia and the wider innovation ecosystem. Recognising this, CAAM has established strategic relationships with key stakeholders, including the Malaysian Communications and Multimedia Commission (MCMC), SIRIM Berhad, Futurise Sdn. Bhd., the National Security Council (MKN), and other relevant ministries and agencies to address the cross-sectoral policy, regulatory and technical issues associated with the development of the LAE.

To further strengthen coordination and stakeholder engagement, CAAM has established the **Jawatankuasa UAS (JAKUAS)** as a platform for inter-agency collaboration, organised the **Malaysia Low Altitude Economy Forum** to facilitate dialogue and knowledge sharing, and undertaken continuous engagement with industry, academia and international partners to support regulatory development and innovation.

These initiatives have enhanced regulatory readiness, strengthened institutional coordination and fostered a shared understanding of the opportunities and challenges associated with the LAE. More importantly, they have established the collaborative foundations necessary to support a whole-of-nation approach to the safe, secure and sustainable development of Malaysia's LAE.

1.2.5 Malaysia Low Altitude Economy Forum 2026

As Malaysia's low altitude ecosystem continues to evolve, CAAM recognises the importance of developing a shared national vision for the sector. This led to the organisation of the inaugural Malaysia Low Altitude Economy Forum 2026 (the Forum) on 24 June 2026, which served as a key milestone in bringing together more than 400 participants from federal and state governments, regulatory authorities, industry, academia, investors, technology providers and international organisations to shape the future direction of Malaysia's LAE. The Forum established a common understanding of the opportunities, challenges and policy priorities associated with developing the LAE, while reinforcing the importance of a coordinated, whole-of-nation approach to its future development.

The Forum was structured around four thematic sessions, each examining a key dimension of the LAE ecosystem. The first session, "Shaping Malaysia's Low Altitude Economy: Building a National LAE Strategy", explored the strategic direction for positioning Malaysia as a regional LAE hub. Discussions highlighted Malaysia's comparative advantages, including its aerospace manufacturing capabilities, digital infrastructure, telecommunications ecosystem, investment potential and regulatory readiness, while emphasising the need for a coordinated national strategy supported by strong governance and cross-sector collaboration. The second session, "Cultivating Future LAE Ecosystem through Academic Innovation and Experimental Drone Systems", focused on the critical role of universities, research institutions and innovation ecosystems in advancing unmanned aircraft technologies, strengthening research and development, nurturing future talent and accelerating the commercialisation of locally developed technologies and solutions.

The third session, "Use Cases Driving Value: Refinery, Public Safety, Agriculture and Surveying", showcased practical applications of unmanned aircraft systems across a range of sectors, demonstrating how drones are already delivering tangible benefits in industrial inspection, emergency response, public safety, precision agriculture, geospatial surveying and other commercial applications. The discussions illustrated the significant economic and operational value that could be unlocked through wider adoption of low altitude aviation technologies. The fourth session, "AAM & UAS: Global Trends Shaping the Future of Aviation", examined emerging international developments in AAM, including eVTOL aircraft, vertiport infrastructure, UASTM, digital airspace integration and evolving regulatory approaches. International experts shared experiences and best practices, highlighting the importance of progressive regulation, integrated

planning and international collaboration in preparing Malaysia for the next generation of aviation services.

Collectively, the Forum reinforced a broad consensus that Malaysia possesses many of the key capabilities required to become a regional leader in the LAE. Participants agreed that unlocking this potential will require an integrated national ecosystem supported by enabling regulation, coordinated governance, modern digital and physical infrastructure, cybersecurity, research and innovation, talent development, investment facilitation and close collaboration among government, industry, academia and international partners. The insights generated through the Forum have directly informed the development of the proposed Malaysia LAE Framework, providing an important foundation for the policy directions, strategic pillars and implementation priorities presented in this Public Consultation Paper. A summary of the Forum proceedings and key discussions is provided in **Appendix B** for reference.

1.2.6 Building the Foundations of Malaysia's LAE

Collectively, these achievements demonstrate that Malaysia has already established many of the essential building blocks required to support the LAE. A robust regulatory framework, growing operational experience, expanding digital infrastructure, competent workforce and strong institutional partnerships provide a solid foundation for the next phase of development.

Nevertheless, these initiatives have largely evolved independently in response to specific operational and regulatory needs. As unmanned aviation technologies continue to mature and AAM moves closer to commercial deployment, there is a growing need for a coordinated national framework that aligns aviation regulation, infrastructure development, industry growth, digital innovation, investment and talent development under a common strategic direction.

The proposed Malaysia LAE Framework seeks to fulfil this role by providing an overarching national framework that builds upon Malaysia's existing strengths, enhances coordination across government and industry, and positions Malaysia to become Southeast Asia's key hub for the LAE.

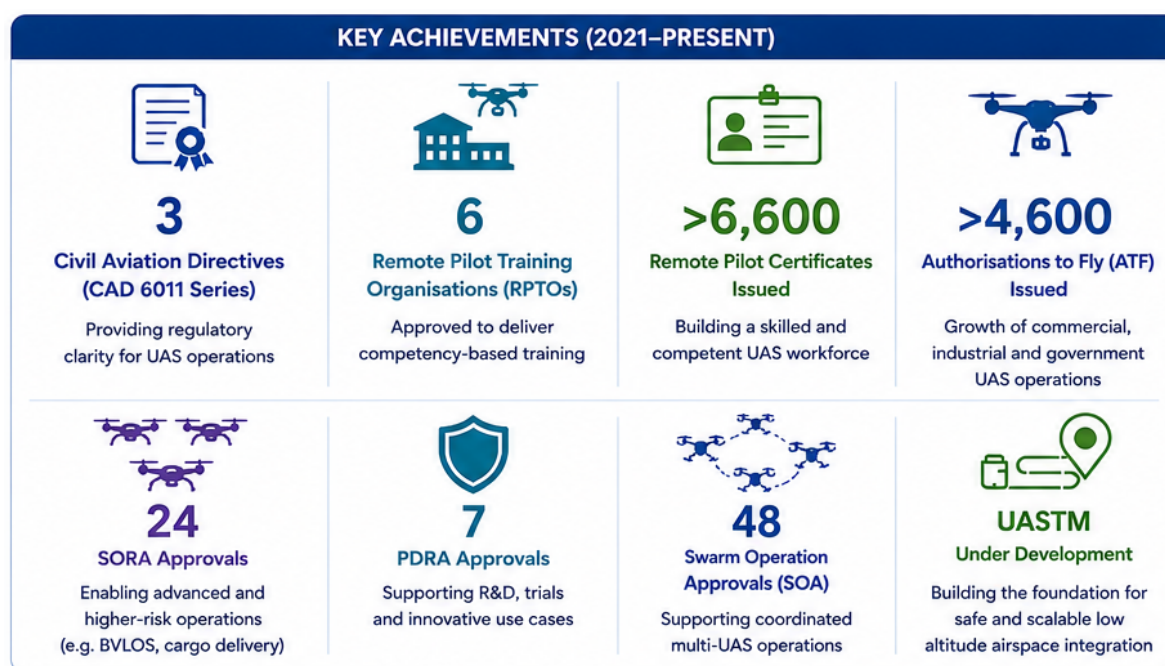


Figure 1: Key Achievements (2021 – present)

1.3 GLOBAL TRENDS

The LAE is rapidly emerging as one of the next major frontiers of the global digital and aviation economy. Driven by advances in UAS, autonomous technologies, AI, electric propulsion, advanced communications, and digital airspace management, countries around the world are investing heavily in policies and infrastructure to unlock new economic opportunities in low altitude airspace.

Unlike conventional aviation, the LAE potentially extends beyond just a basic mode of transportation. It encompasses logistics, agriculture, infrastructure inspection, emergency response, environmental monitoring, public safety, smart cities, advanced manufacturing, and future passenger mobility. As a result, governments increasingly regard low altitude airspace as a strategic national asset that supports both economic growth and national resilience.

Global market projections demonstrate the scale of this opportunity. The commercial drone market alone is expected to reach approximately **USD 57.8 billion by 2030¹**, driven by increasing adoption across logistics, agriculture, energy, public safety and infrastructure inspection. Asia-Pacific is expected to remain the fastest-growing regional market owing to rapid urbanisation, manufacturing capability and supportive government policies.

At the same time, AAM, comprising eVTOL aircraft, autonomous cargo aircraft and future passenger air mobility services, is progressing from demonstration to commercial deployment. While long-term forecasts vary significantly, studies by the World Economic Forum indicate that AAM could generate **up to USD 38 billion in economic opportunities by 2040²** across manufacturing, infrastructure, traffic management and associated services as commercial deployment accelerates.

The global policy landscape is also evolving rapidly.

In the **United States**, the Federal Aviation Administration (FAA) has progressively developed regulatory pathways for drone integration through initiatives such as the BEYOND Programme, UASTM operational evaluations and proposed BVLOS regulations. These initiatives aim to enable routine commercial drone operations while maintaining aviation safety, with increasing emphasis on digital airspace management and scalable approvals. Recent regulatory reforms are expected to accelerate commercial drone delivery and other advanced operations.

Within the **European Union**, the European Union Aviation Safety Agency (EASA) has established one of the world's most comprehensive regulatory frameworks through the **U-space Regulations³**, providing harmonised rules for drone operations, digital flight authorisation, network identification, traffic information services and interoperable UASTM services across Member States.

Singapore has similarly recognised the strategic importance of the LAE. The Government has identified drones and eVTOL aircraft as technologies capable of enhancing productivity, logistics,

¹ <https://accesspartnership.com/opinion/lifting-off-capturing-aseans-low-altitude-economy/>

² https://reports.weforum.org/docs/WEF_Deployment_Pathways_Advanced_Air_Mobility_2025.pdf

³ <https://www.easa.europa.eu/en/regulations/u-space>

emergency response and urban mobility, while progressively developing regulatory frameworks, operational testbeds and industry partnerships to support commercial deployment⁴.

Perhaps the most ambitious example is **China**, where the LAE has been elevated to a national strategic industry. China's Civil Aviation Administration projects the sector to grow to approximately **2 trillion yuan (around USD 280 billion) by 2030**⁵, supported by extensive investment in drone manufacturing, infrastructure, autonomous logistics, air mobility and supporting digital ecosystems.

These international developments demonstrate that global competition is no longer centred solely on aircraft manufacturing. Countries are increasingly competing to establish enabling regulatory frameworks, digital infrastructure, skilled talent, manufacturing capability and innovation ecosystems that together support large-scale commercial operations.

1.4 MALAYSIA'S CURRENT POSITION

Malaysia enters the next phase of LAE development from a position of considerable strength. In addition to the regulatory and operational capabilities already established by CAAM, the country benefits from a series of complementary national policies and industrial strategies that support aerospace, digital transformation and innovation.

At the national level, the **Thirteenth Malaysia Plan (RMK-13), 2026–2030** identifies aerospace as one of Malaysia's strategic high-growth industries and emphasises the need to accelerate economic transformation through advanced manufacturing, digitalisation, innovation and emerging technologies. RMK-13 highlights opportunities in unmanned aerial vehicles (UAVs), AAM, sustainable aviation technologies and next-generation aerospace capabilities as part of Malaysia's aspiration to strengthen industrial competitiveness and move further up the global value chain. These priorities reinforce the importance of developing a coordinated ecosystem that enables the safe and sustainable growth of low altitude aviation while supporting broader national economic objectives.

Supporting this national agenda is the **New Industrial Master Plan 2030 (NIMP 2030)**, which identifies the aerospace industry as one of Malaysia's strategic industries for future growth. NIMP 2030 seeks to strengthen advanced manufacturing capabilities, accelerate technology adoption, promote innovation-driven industries and deepen participation in global value chains. These strategic directions provide an important industrial foundation for the development of the LAE, particularly in areas such as advanced manufacturing, electronics, autonomous systems, precision engineering and digital technologies.

The **Malaysian Aerospace Industry Blueprint 2030 (MAIB 2030)** further strengthens this foundation by providing a dedicated long-term strategy for the aerospace sector. The MAIB 2030 aspires to position Malaysia as the leading aerospace nation in Southeast Asia and an integral part of the global aerospace value chain. It targets **RM55.2 billion in annual aerospace industry**

⁴ <https://www.mot.gov.sg/news-resources/newsroom/response-speech-to-the-adjournment-motion--low-altitude-economy--building-the-flying-car--air-tourism-and-drone-logistics-industry--by-senior-minister-of-state-for-transport-and-national-development-ms-sun-xueling/>

⁵ <https://www.reuters.com/business/aerospace-defense/chinas-low-altitude-economy-lacks-growth-roadmap-says-industry-group-2024-08-27/>

revenue and approximately 32,000 high-skilled jobs by 2030⁶, while strengthening national capabilities across manufacturing, maintenance, repair and overhaul (MRO), engineering, systems integration, research and innovation. Although developed before the emergence of the LAE as a distinct policy concept, many of its strategic priorities including advanced aerospace technologies, digitalisation, skilled talent and innovation, provide a natural platform for expanding into unmanned aviation, autonomous aerial systems and future AAM services.

Malaysia has also established a dedicated roadmap for drone technology through the **Malaysia Drone Technology Action Plan 2022–2030 (MDTAP30)**, led by the Malaysian Research Accelerator for Technology and Innovation (MRANTI) under the Ministry of Science, Technology and Innovation (MOSTI). MDTAP30 aims to accelerate the adoption of drone technologies across multiple sectors while strengthening research, innovation, commercialisation, talent development and ecosystem coordination. The Action Plan recognises drones as an important enabling technology for the digital economy and supports the growth of a domestic drone industry through collaboration among government, industry and academia. While MDTAP30 focuses primarily on advancing drone technologies and applications, the Malaysia LAE Framework extends beyond drones by providing the broader policy, regulatory and governance architecture required to support the safe, secure and scalable development of the wider low altitude ecosystem.

Together with Malaysia's established aerospace manufacturing capability, internationally recognised MRO industry, strong electrical and electronics sector, nationwide digital connectivity and strategic location within ASEAN, these initiatives provide a solid platform for the development of a competitive LAE.

1.5 WHY MALAYSIA NEEDS A NATIONAL LAE FRAMEWORK

Although Malaysia has made substantial progress in developing the building blocks of the LAE, these initiatives have largely evolved independently. Existing policies focus on individual aspects of the ecosystem, including aviation regulation, drone technology, aerospace development, digital infrastructure and industrial policy.

As commercial drone operations become increasingly sophisticated and AAM moves closer to commercial deployment, there is a growing need for a coordinated national framework that brings these initiatives together under a common strategic direction.

The Malaysia LAE Framework addresses this need by providing an overarching policy architecture that integrates aviation regulation, infrastructure development, industry growth, digital innovation, talent development and investment. It is intended to complement and not to replace existing national policies by strengthening coordination across government, industry and academia while providing greater regulatory certainty and a clearer long-term direction for the development of Malaysia's LAE.

By establishing a shared vision, common guiding principles and coordinated implementation roadmap, the Framework seeks to enable the safe, orderly and sustainable growth of Malaysia's low altitude ecosystem while positioning the country as one of Southeast Asia's key hub for the LAE.

⁶ https://www.miti.gov.my/miti/resources/8._Aerospace_Industry_.pdf

SECTION 2: PROPOSED MALAYSIA LAE FRAMEWORK

2.1 MALAYSIA LAE FRAMEWORK AT A GLANCE

The Malaysia LAE Framework is structured as an integrated policy architecture that brings together strategic direction, regulatory priorities, enabling foundations and implementation mechanisms into a single coherent model.

The roof of the framework represents Malaysia's Vision, Mission and Guiding Principles, which provide the overarching policy direction for all LAE initiatives in Malaysia.

The four strategic pillars form the core of the framework. Together they establish the regulatory, operational, infrastructure and industry development measures necessary to enable a safe, connected and commercially sustainable LAE.

These pillars are supported by five cross-cutting foundations, Talent & Innovation, Digital Capability, Public Trust, Strategic Partnerships and Sustainability, which provide the institutional capacity and long-term enablers required for successful implementation.

Collectively, these elements create an integrated national framework that balances aviation safety, economic development, technological innovation and public interest, providing Malaysia with a comprehensive roadmap for developing a globally competitive LAE.

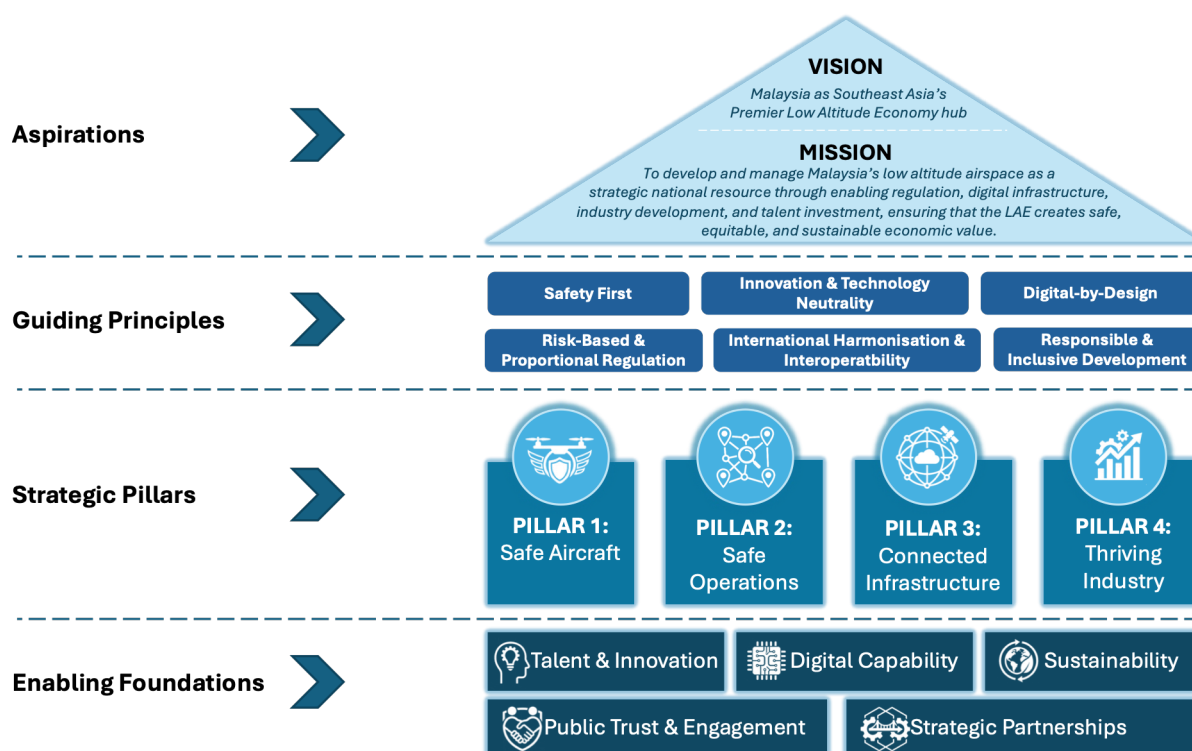


Figure 2: Malaysia Low Altitude Economy Framework

2.2 DEFINITION

Proposed Definition

The Low Altitude Economy (LAE) refers to the ecosystem of economic activities enabled by the safe, secure and efficient use of low altitude airspace through Unmanned Aircraft Systems (UAS), Advanced Air Mobility (AAM) and other emerging aviation technologies. It encompasses the aircraft, operations, infrastructure, digital systems, industries and services that support these activities and the economic value they generate.

Figure 3: Proposed Definition of LAE

For the purposes of this Framework, the proposed definition adopts an ecosystem-based approach, recognising that the development of the LAE depends not only on aircraft operations but also on the supporting regulatory, technological, infrastructure and industrial capabilities required to enable safe, secure and sustainable operations.

While the term "*Low Altitude Economy*" is widely used internationally, there is currently no universally accepted definition of its vertical limits. Some jurisdictions define the LAE by reference to a specific altitude, while others define it by the nature of the operations and economic activities involved without prescribing an altitude threshold. Accordingly, CAAM seeks stakeholders' views on the most appropriate approach for Malaysia.

Question 1

CAAM invites views on the proposed definition and scope of the LAE.

In particular:

- a. **Definition** - Does the proposed definition appropriately reflect the LAE as an ecosystem of economic activities, industries and enabling capabilities?
- b. **Altitude Threshold** - Should the Malaysia LAE Framework define the LAE by reference to a specific altitude, or should it remain technology- and operation-neutral without prescribing an altitude threshold?
- c. **If an altitude threshold should be adopted**, what altitude or altitude levels would be appropriate for the Malaysian context, and why? In responding, please also consider wider regional or cross-border circumstances
- d. **Scope** - Are there any additional activities, sectors or enabling capabilities that should be included within the scope of the Framework?

2.3 VISION, MISSION & GUIDING PRINCIPLES

Vision

Malaysia as Southeast Asia's premier Low Altitude Economy hub.

Mission

To develop and manage Malaysia's low altitude airspace as a strategic national resource through enabling regulation, digital infrastructure, industry development, and talent investment, ensuring that the LAE creates safe, equitable and sustainable economic value.

Guiding Principles

The development of Malaysia's LAE should be guided by a set of overarching principles that provide a common policy direction for all stakeholders involved in the planning, regulation, implementation and operation of the ecosystem. These principles serve as the foundation for policy development and regulatory decision-making, ensuring that Malaysia's LAE evolves in a manner that is safe, innovative, sustainable and internationally competitive. They apply across all four strategic pillars and underpin future legislative, regulatory and institutional initiatives as the ecosystem continues to mature.

1. Safety First

Safety should remain the overriding priority in the development of Malaysia's LAE. Every aspect of the ecosystem, from aircraft design and certification to operations, infrastructure and industry development, should uphold the highest practicable standards of aviation safety to protect people, property and national airspace. Economic growth and technological innovation must always be pursued without compromising aviation safety.

2. Risk-Based and Proportionate Regulation

Regulatory requirements should be proportionate to the level of risk presented by different aircraft, operations and technologies. A risk-based regulatory approach enables innovation while ensuring that higher-risk activities are subject to appropriate levels of oversight. Regulation should remain practical, scalable and responsive to technological developments, avoiding unnecessary burdens on low-risk operations.

3. Innovation and Technology Neutrality

The proposed Malaysia LAE framework should foster innovation by adopting technology-neutral and performance-based regulatory approaches. Regulations should define the outcomes to be achieved rather than prescribe specific technological solutions, enabling the adoption of emerging technologies, new business models and future operational concepts while maintaining safety, security and public confidence.

4. International Harmonisation and Interoperability

Malaysia should progressively align its LAE framework with internationally recognised standards, recommended practices and technical specifications to facilitate interoperability, cross-border operations and international investment. Alignment with global frameworks will strengthen Malaysia's position as a regional leader while ensuring compatibility with the evolving international aviation ecosystem.

5. Digital-by-Design

Digital technologies should be embedded into the planning, regulation and operation of the LAE from the outset. Digital platforms, automation, secure communications, data-driven decision-making and interoperable information systems should enhance safety, operational efficiency, regulatory effectiveness and the scalability of low altitude operations while supporting future autonomous aviation services.

6. Responsible and Inclusive Development

The LAE should be developed in a manner that delivers long-term economic, environmental and social value. Policies and regulatory decisions should promote responsible innovation, environmental sustainability, effective governance, collaboration across government and industry, protection of security and privacy, and meaningful public engagement. The benefits of the LAE should be accessible across all regions of Malaysia, supporting inclusive growth, national resilience and public trust.

Question 2

CAAM invites views on whether the proposed Vision, Mission and Guiding Principles provide an appropriate strategic foundation and direction for the development of Malaysia's LAE. In particular, CAAM invites views on the following:

- a. Whether the proposed Vision appropriately reflects Malaysia's long-term aspirations for the LAE?
- b. Whether the proposed Mission appropriately supports the achievement of the Vision?
- c. Whether the proposed Guiding Principles provide an appropriate foundation for policy development and implementation?
- d. Whether any additional Vision elements, Mission statements or Guiding Principles should be considered?

2.4 STRATEGIC PILLARS

The Strategic Pillars translate the Vision, Mission and Guiding Principles into a coherent framework for developing Malaysia's LAE. Together, they provide a comprehensive and integrated approach that balances aviation safety, operational efficiency, enabling infrastructure and industry development to support the safe, secure and sustainable growth of the LAE.

The Malaysia LAE Framework recognises that the LAE extends beyond aviation. It is a cross-sectoral national development agenda involving transportation, telecommunications, digital economy, manufacturing, smart cities, public services, defence, sustainability and regional connectivity. Accordingly, the four Strategic Pillars are designed to complement one another, ensuring that regulatory, technological and economic initiatives are developed in a coordinated manner.

Risk-Based Classification Framework

The LAE will comprise a diverse range of aircraft and operations, ranging from small recreational drones and agricultural UA to cargo drones, autonomous aircraft, eVTOL aircraft and future passenger air mobility services. These aircraft differ significantly in their design, capability, operating environment and the level of risk they present to people, property and other airspace users.

Recognising this diversity, the Malaysia LAE Framework adopts a **risk-based classification framework** as a fundamental regulatory principle. Rather than applying a single set of regulatory requirements to all aircraft and operations, the Malaysia LAE Framework adopts a proportionate approach under which regulatory obligations are commensurate with the level of risk presented. This approach supports innovation by reducing unnecessary regulatory burden for lower-risk activities while ensuring that more complex and higher-risk operations remain subject to appropriate regulatory oversight.

The Malaysia LAE Framework distinguishes between two complementary forms of classification:

1. **Aircraft Classification**, which determines requirements relating to aircraft design, certification, registration, airworthiness and continuing airworthiness based on the characteristics and inherent risks of different aircraft types.
2. **Operational Classification**, which determines operational requirements based on the nature of the operation, including the operating environment, operational complexity, proximity to people, airspace characteristics and the potential consequences of failure.

This risk-based approach is intended to provide a scalable and future-ready regulatory framework that can accommodate emerging technologies and new business models while maintaining the highest standards of aviation safety. It also provides flexibility for Malaysia to align progressively with internationally recognised standards and best practices as the global low altitude aviation ecosystem continues to evolve.

Building upon this regulatory philosophy, the Malaysia LAE Framework is structured around four Strategic Pillars:

1. **Safe Aircraft** – Ensuring that aircraft operating within the LAE are appropriately designed, certified, registered and maintained throughout their operational lifecycle.
2. **Safe Operations** – Establishing operational rules, operator certification, pilot competency requirements and safety oversight that are proportionate to operational risk.
3. **Connected Infrastructure** – Developing the digital and physical infrastructure required to support safe, scalable and integrated low altitude operations.
4. **Thriving Industry** – Creating an enabling ecosystem that supports innovation, investment, manufacturing, skills development and commercialisation, positioning Malaysia as a regional hub for the LAE.

Collectively, these pillars provide a balanced framework that integrates safety, infrastructure, regulation and economic development, enabling Malaysia to realise the full potential of the LAE while safeguarding public safety and maintaining public confidence.

Question 3

CAAM invites views on whether the proposed Strategic Pillars and Risk-Based Classification Framework provide an appropriate and comprehensive approach for the safe, secure and sustainable development of Malaysia's LAE. In particular, CAAM invites views on the following:

- a. Whether the proposed four Strategic Pillars comprehensively address the key policy, regulatory, infrastructure and industry development priorities for Malaysia's LAE?
- b. Whether the proposed Risk-Based Classification Framework provides an appropriate basis for developing proportionate regulatory requirements for different aircraft and operational risk profiles?
- c. Whether the relationship between the Strategic Pillars and the Risk-Based Classification Framework is sufficiently clear and coherent?
- d. Whether there are any additional strategic pillars, cross-cutting themes or regulatory principles that should be incorporated into the Framework?

2.4.1 Pillar 1: Safe Aircraft - Certification, Airworthiness and Registration

2.4.1.1 Overview

The Safe Aircraft pillar establishes the regulatory foundation to ensure that aircraft operating within Malaysia's LAE are safe, reliable and fit for their intended purpose throughout their operational lifecycle. As the LAE evolves to include a diverse range of aircraft, from recreational UA and commercial drones to cargo drones, autonomous aircraft, eVTOL aircraft and future AAM platforms, Malaysia requires a regulatory framework that safeguards aviation safety while enabling innovation and technological advancement.

This pillar adopts a lifecycle approach to aircraft safety, recognising that regulatory oversight extends beyond initial approval to include design, production, registration, continuing airworthiness, maintenance, modifications and eventual retirement from service. The objective is to ensure that aircraft continue to meet appropriate safety standards throughout their operational life while supporting the introduction of new technologies and aircraft concepts.

2.4.1.2 Risk-Based Aircraft Classification

The Malaysia LAE Framework adopts a **risk-based aircraft classification framework** to ensure that certification, registration and airworthiness requirements remain proportionate to the risks presented by different aircraft.

Aircraft operating within the LAE vary considerably in their size, performance, complexity, intended use and operating environment. Consequently, regulatory oversight should be commensurate with the risks associated with the aircraft and its intended operation rather than applying identical requirements to all aircraft.

Aircraft classification should take into account a combination of factors, including:

- Maximum Take-off Mass (MTOM);
- aircraft performance and operational capability;
- passenger or cargo carriage;
- level of autonomy;
- kinetic energy and aircraft characteristics;
- intended operating environment;
- system complexity; and
- other safety-related considerations determined by CAAM.

No single characteristic should determine the level of regulatory oversight. Instead, classification should adopt a holistic risk-based assessment that reflects the overall safety implications of the aircraft.

The detailed classification methodology, including aircraft categories, certification thresholds and applicable technical requirements, should be established through regulations, CADs and other regulatory instruments issued by CAAM. This approach enables the framework to evolve alongside technological developments and internationally recognised best practices.

2.4.1.3 Design, Certification and Production Approval

Aircraft intended for commercial, public service or other prescribed operations should demonstrate compliance with applicable design, safety and airworthiness requirements before entering service.

Malaysia should establish an aircraft certification framework that is proportionate to the risks associated with different aircraft classifications while remaining aligned, where appropriate, with internationally recognised standards and recommended practices.

The certification framework should address aircraft design, system integrity, flight performance, operational limitations, software assurance, cybersecurity, human factors and other safety-critical elements appropriate to the aircraft category.

Manufacturers should also demonstrate their capability to consistently produce aircraft that conform to approved designs through appropriate production approval and quality assurance arrangements.

Where appropriate, CAAM should recognise or validate approvals issued by trusted foreign aviation authorities to facilitate international trade, investment and technology transfer while maintaining Malaysia's safety standards.

2.4.1.4 Airworthiness and Registration

Aircraft subject to registration requirements should be registered with CAAM before commencing operations.

Malaysia should establish a modern digital aircraft registration system capable of supporting efficient regulatory oversight and integration with future digital aviation services. The registration framework should capture information necessary to identify aircraft, owners, operators and operational status, while remaining scalable as the LAE ecosystem expands.

Aircraft subject to airworthiness requirements should obtain the appropriate airworthiness approval before entering service and should continue to comply with applicable safety requirements throughout their operational life.

2.4.1.5 Remote Identification

Remote Identification (Remote ID) should progressively become a foundational capability for aircraft operating within Malaysia's LAE.

Remote ID supports regulatory oversight, security, law enforcement, airspace management and future UASTM services by enabling aircraft to be identified during flight. As digital aviation services

mature, Remote ID will become an essential component of a scalable and integrated low altitude aviation ecosystem.

Implementation should be proportionate to aircraft classification and operational risk, taking into account international standards and interoperability requirements.

2.4.1.6 Continuing Airworthiness and Maintenance

Aircraft subject to certification or other prescribed airworthiness requirements should remain airworthy throughout their operational life. The extent of continuing airworthiness and maintenance obligations should be proportionate to the aircraft's classification, intended use and operational risk, recognising that different categories of aircraft require different levels of regulatory oversight.

Malaysia should establish a continuing airworthiness framework that specifies the categories of aircraft subject to ongoing airworthiness oversight and the corresponding maintenance requirements. Such requirements may include scheduled inspections, preventive maintenance, mandatory modifications, software and firmware management, compliance with Airworthiness Directives or equivalent mandatory instructions, maintenance record-keeping and periodic airworthiness reviews, where appropriate.

Aircraft that are not subject to continuing airworthiness requirements should nevertheless be maintained in a condition that ensures they are safe for their intended operation. Owners and operators should remain responsible for ensuring that aircraft are operated in accordance with applicable maintenance instructions, operational limitations and manufacturer recommendations.

Maintenance activities for aircraft subject to continuing airworthiness oversight should be performed by competent personnel or approved maintenance organisations, as appropriate to the aircraft category and applicable regulatory requirements.

Malaysia should also promote the development of domestic MRO capabilities for low altitude aircraft, including UAS, cargo drones and future AAM aircraft, thereby strengthening national aerospace capabilities and supporting long-term industry growth.

2.4.1.7 Modifications, Repairs and Importation

As aircraft technologies continue to evolve rapidly, modifications affecting aircraft safety or performance should receive appropriate regulatory approval before implementation. This includes changes involving flight control software, payload configurations, propulsion systems, batteries, sensors, communication equipment, AI-enabled systems, and structural modifications. Major modifications that significantly alter aircraft characteristics should undergo additional certification where necessary.

Malaysia should also establish clear procedures governing the import and export of low-altitude aircraft. Imported aircraft should undergo appropriate validation of foreign certifications, acceptance procedures, customs coordination, and airworthiness assessments before being

approved for operation. Temporary import arrangements should also be available to support demonstrations, research, testing and international operations.

2.4.1.8 End-of-Life Management

The regulatory framework should extend beyond operational service to include responsible end-of-life management for aircraft permanently withdrawn from operation. Aircraft retirement should include formal deregistration, environmentally responsible disposal, battery recycling, secure removal of operational data, compliance with environmental regulations and controls over the salvage and reuse of aircraft components where appropriate.

2.4.1.9 Application of the Guiding Principles

The Safe Aircraft pillar applies the Guiding Principles by establishing a comprehensive and proportionate regulatory framework that ensures all aircraft operating within Malaysia's LAE are safe, airworthy and fit for their intended purpose throughout their operational lifecycle.

- **Safety First** is reflected through rigorous requirements for aircraft design, certification, production, registration, continuing airworthiness and maintenance to ensure that only safe aircraft enter and remain in service.
- **Risk-Based and Proportionate Regulation** is achieved by applying certification, registration and oversight requirements that are commensurate with the risks posed by different aircraft categories, operational characteristics and intended uses.
- **Innovation and Technology Neutrality** enables the adoption of emerging technologies, including autonomous systems, advanced propulsion, AI and future aircraft designs through performance-based regulatory approaches.
- **International Harmonisation and Interoperability** is promoted by aligning certification and airworthiness requirements with internationally recognised standards and facilitating the validation and acceptance of approvals issued by trusted foreign aviation authorities.
- **Digital-by-Design** is embedded through digital aircraft registration, certification management, Remote Identification, continuing airworthiness oversight and lifecycle information management.
- **Responsible and Inclusive Development** supports sustainable aircraft technologies, responsible lifecycle management and the development of Malaysia's domestic aerospace manufacturing, maintenance and certification capabilities.

2.4.1.10 Desired Outcomes

Implementation of the **Safe Aircraft** pillar will establish a modern, risk-based and internationally aligned regulatory framework for aircraft operating within Malaysia's LAE. It will provide clear and proportionate pathways for aircraft certification, registration and continuing airworthiness while supporting innovation and facilitating the safe introduction of emerging aircraft technologies.

The framework will strengthen public confidence by ensuring that aircraft operating within Malaysia's low altitude airspace meet appropriate safety standards throughout their operational lifecycle. It will also support the growth of domestic aerospace capabilities, facilitate international

collaboration and investment, and provide a trusted safety foundation for the sustainable development of Malaysia's LAE.

Question 4

CAAM invites views on whether the proposed Safe Aircraft pillar provides an appropriate regulatory framework for ensuring the safety and airworthiness of aircraft operating within Malaysia's LAE. In particular, CAAM invites views on the following:

- a. Whether the proposed risk-based approach to aircraft classification provides an appropriate basis for determining certification, registration and airworthiness requirements?
- b. Whether the proposed lifecycle approach appropriately addresses the key stages of aircraft design, certification, registration, continuing airworthiness, maintenance, modification and retirement?
- c. Whether the proposed framework appropriately distinguishes between aircraft that should be subject to continuing airworthiness requirements and those that may be subject to simplified maintenance and safety requirements?
- d. Whether there are additional strategic policy measures or internationally recognised standards and best practices that Malaysia should consider in developing its aircraft certification and airworthiness framework?

2.4.2 Pillar 2: Safe Operations – Rules of Operation, Operator Certification and Operational Safety

2.4.2.1 Overview

The Safe Operations pillar establishes the operational framework governing how aircraft within Malaysia's LAE are operated safely, securely and efficiently. While Pillar 1 ensures that aircraft are safe to fly, this pillar ensures that operations are conducted by competent personnel, under appropriate operational procedures and within a regulatory framework that is proportionate to the level of operational risk.

As the LAE evolves from recreational drone activities to commercial logistics, autonomous operations, cargo transport and future passenger-carrying AAM services, Malaysia requires an operational framework that safeguards aviation safety while enabling innovation and new business models.

This pillar establishes the principles for operational classification, operator certification, pilot competency, operational approvals and safety oversight to ensure that aircraft operations remain safe, resilient and aligned with international best practices.

2.4.2.2 Risk-Based Operational Classification

Operational oversight should be determined primarily by the level of operational risk rather than solely by the characteristics of the aircraft.

The Malaysia LAE Framework therefore adopts a risk-based operational classification framework, under which regulatory requirements are proportionate to the risks presented by a particular operation.

Operational classification should consider a combination of factors, including:

- aircraft classification and capability;
- MTOM;
- operating environment;
- proximity to people and populated areas;
- airspace classification;
- Visual Line of Sight (VLOS), EVLOS or BVLOS operations;
- operating altitude;
- level of autonomy;
- carriage of cargo, dangerous goods or passengers;
- operational complexity;
- mission criticality; and

- the potential consequences of failure.

Based on these considerations, operations should be categorised according to progressively increasing levels of operational risk. Lower-risk operations may be subject to simplified regulatory requirements, while higher-risk activities should require progressively more comprehensive operational approvals, operator certification and regulatory oversight.

Category	Typical Operations	Illustrative Examples	Proposed Regulation
Category 1 – Low-Risk Operations	Recreational and simple operations conducted under prescribed conditions	Recreational flying, education and training, basic VLOS operations in sparsely populated areas	Compliance with standard operating rules, prescribed operating limitations and basic competency requirements where applicable. Individual operational approval is generally not required.
Category 2 – Standard Commercial Operations	Routine commercial operations presenting moderate operational risk	Agriculture, aerial photography, surveying, mapping, infrastructure inspection, environmental monitoring	Operator authorisation, qualified remote pilots, standard operating procedures, maintenance arrangements, insurance (where applicable) and compliance with prescribed operational requirements.
Category 3 – Specific Operations	Operations presenting elevated operational risk	BVLOS operations, operations over populated areas, swarm operations, heavy-lift operations, autonomous operations, dangerous goods transport, emergency response	Specific operational approval by CAAM supported by an operational risk assessment, enhanced pilot competency, additional operational procedures, safety management measures and continuing regulatory oversight.
Category 4 – Certified Operations	Highest-risk aviation operations	Passenger-carrying AAM, certified cargo transport, autonomous passenger transport and other operations determined by CAAM	Full aviation certification framework, including aircraft certification, operator certification, personnel licensing, continuing airworthiness, Safety Management System (SMS) and ongoing regulatory surveillance.

Table 1: Proposed Operational Categories and Regulatory Approach

The operational categories above are intended to illustrate the progressive application of regulatory oversight according to operational risk. The detailed eligibility criteria, approval pathways and associated regulatory requirements should be prescribed through regulations, Civil Aviation Directives (CADs) and other regulatory instruments issued by CAAM. This approach enables the framework to evolve in response to technological developments, operational experience and internationally recognised best practices.

2.4.2.3 Operator Certification

Commercial operators should obtain an operating authorisation or certificate appropriate to the category, scale and complexity of their operations.

Malaysia should establish a proportionate operator certification framework that specifies organisational, operational and technical requirements according to the applicable operational category, such as:

1. Air Operator Certificate (AOC) for commercial air transport (passenger and cargo) operations; and
2. UAS Aerial Work Certificate (UAWC) for commercial UAS activities, including agricultural operations.

Depending on the level of operational risk, these requirements may include organisational capability, operational procedures, personnel competency, maintenance arrangements, insurance, emergency response arrangements, record-keeping and SMS.

Higher-risk operations should be subject to progressively greater regulatory oversight, including periodic surveillance, safety performance monitoring and continuing compliance assessments.

2.4.2.4 Remote Pilot Competency and Licensing

Personnel responsible for operating aircraft within the LAE should possess competencies appropriate to the aircraft and operational category.

Malaysia should establish a structured competency framework covering remote pilot licensing, recurrent training, specialised operational endorsements and competency assessment for advanced operational privileges such as EVLOS, BVLOS, autonomous operations and future passenger-carrying services.

Competency requirements should remain proportionate to the operational category while evolving alongside technological developments and internationally recognised aviation practices.

2.4.2.5 Rules of Operation

Malaysia should establish a comprehensive operational framework governing the conduct of low altitude operations. The framework should define operating requirements for different operational environments, including VLOS, EVLOS and BVLOS operations, urban and rural operations, operations near aerodromes, controlled airspace, operations over people, night operations, emergency operations and future AAM services.

Operational rules should remain performance-based wherever practicable to support innovation while ensuring the safe integration of low altitude aircraft into Malaysian airspace.

2.4.2.6 Operational Approvals

Operations presenting elevated levels of operational risk should require specific approval from CAAM before commencement.

Such operations may include BVLOS operations, autonomous operations, passenger transport, dangerous goods transport, heavy-lift operations, swarm operations, flights within controlled or restricted airspace and other activities determined by CAAM.

Operational approvals should be supported by appropriate operational risk assessments and safety demonstrations commensurate with the complexity of the operation.

2.4.2.7 Safety Management and Operational Oversight

Commercial operators should establish SMS that are proportionate to the scale and complexity of their operations.

Safety management should promote proactive hazard identification, risk assessment, occurrence reporting, continuous safety assurance and organisational learning.

CAAM is considering taking a data-driven and risk-based approach to operational oversight, enabling regulatory resources to focus on activities presenting the highest safety risks while facilitating efficient oversight of routine operations.

2.4.2.8 Digital Flight Authorisation and Operational Information

Malaysia should progressively establish a digital operational environment supporting flight authorisations, operational approvals, incident reporting and operational information exchange.

Digital operational services should facilitate efficient regulatory oversight, improve operational situational awareness and support future integration with UASTM services.

The digital framework should be scalable, interoperable and capable of supporting increasingly automated aviation services.

2.4.2.9 Operational Resilience and Security

Operators should establish appropriate operational procedures to manage abnormal situations, emergencies and security threats.

The operational framework should promote resilient operations through contingency planning, communication procedures, cybersecurity measures, emergency response arrangements and operational continuity planning appropriate to the level of operational risk.

As aircrafts become increasingly connected and autonomous, cybersecurity should form an integral component of operational safety and regulatory oversight.

2.4.2.10 Application of the Guiding Principles

The Safe Operations pillar applies the Guiding Principles by establishing an operational framework that is safe, proportionate, future-ready and internationally aligned.

- **Safety First** is achieved through operator certification, pilot competency, operational approvals and ongoing safety oversight.
- **Risk-Based and Proportionate Regulation** ensures that operational requirements are commensurate with operational complexity and risk.
- **Innovation and Technology Neutrality** supports emerging operational concepts, including autonomous operations, BVLOS services and AAM.
- **International Harmonisation and Interoperability** promotes alignment with internationally recognised operational standards and best practices.
- **Digital-by-Design** supports digital flight authorisation, electronic reporting, operational information exchange and data-driven regulatory oversight.
- **Responsible and Inclusive Development** promotes secure, resilient and environmentally responsible operations while supporting equitable access to LAE services throughout Malaysia.

2.4.2.11 Desired Outcomes

Implementation of the Safe Operations pillar will establish a modern, risk-based and internationally aligned operational framework that supports the safe integration of increasingly complex low altitude operations into Malaysian airspace.

The framework will provide clear and proportionate pathways for operator certification, operational approvals and pilot competency while enabling innovation across commercial drone services, autonomous operations, cargo transport and future passenger mobility.

By strengthening operational safety, regulatory certainty and public confidence, this pillar will support the sustainable expansion of Malaysia's LAE while maintaining the highest standards of aviation safety, security and operational resilience.

Question 5

CAAM invites views on whether the proposed Safe Operations pillar provides an appropriate operational framework for supporting the safe, secure and efficient conduct of operations within Malaysia's LAE. In particular, CAAM invites views on the following:

- a. Whether the proposed risk-based operational classification provides an appropriate basis for determining operational approvals, operator certification and regulatory oversight?
- b. Whether the proposed operational categories appropriately distinguish between routine, higher-risk and certified operations?
- c. Whether the proposed framework adequately addresses operator certification, remote pilot competency, operational approvals, safety management and operational oversight?
- d. Whether there are additional strategic policy measures or internationally recognised best practices that Malaysia should consider in developing its operational framework for the LAE?

2.4.3 Pillar 3: Connected Infrastructure – Airspace, Digital Connectivity and Physical Infrastructure

2.4.3.1 Overview

The Connected Infrastructure pillar establishes the enabling infrastructure required to support the safe, secure and scalable development of Malaysia's LAE. While the preceding pillars ensure that aircraft are airworthy and operations are conducted safely, this pillar provides the airspace, digital, communications and physical infrastructure that connects aircraft, operators, regulators and service providers into an integrated operational ecosystem.

The increasing deployment of UAS, AAM, autonomous operations and future passenger services will require infrastructure that is resilient, interoperable and capable of supporting real-time information exchange, dynamic airspace management and increasingly automated aviation services. Infrastructure planning should therefore adopt a long-term, scalable and technology-neutral approach that accommodates future operational growth while maintaining aviation safety, security and public confidence.

2.4.3.2 Airspace Management

Malaysia should establish a structured and digitally enabled low altitude airspace management framework that supports the safe integration of diverse aircraft and operations while ensuring the efficient use of national airspace.

The framework should provide mechanisms for the designation and management of operational areas, flight corridors, restricted and prohibited areas, temporary reserved airspace, emergency priority routes and dynamically managed airspace. Airspace planning should facilitate the coexistence of conventional aviation, UAS, eVTOL aircraft, helicopters and future autonomous aircraft while remaining sufficiently flexible to accommodate emerging operational concepts and technological developments.

Airspace design should be supported by continuous monitoring, performance assessment and periodic review to ensure that the framework evolves in response to operational demand, technological innovation and changing safety requirements.

2.4.3.3 UAS Traffic Management (UASTM) and Digital Airspace Services

Malaysia should progressively establish a national UASTM ecosystem to enable the safe and efficient management of increasing volumes of low altitude operations.

The UASTM ecosystem should provide digital services supporting flight authorisation, strategic deconfliction, airspace reservation, conformance monitoring, dynamic airspace management, Remote Identification integration, operational information exchange and emergency coordination.

The UASTM framework should be interoperable with Malaysia's existing air traffic management (ATM) systems to ensure the coordinated management of both conventional and low altitude airspace while maintaining an appropriate level of aviation safety.

Digital airspace services should be scalable and capable of supporting future autonomous operations, AAM and cross-border interoperability.

2.4.3.4 Communications, Navigation and Surveillance (CNS)

Reliable CNS capabilities are fundamental to the safe and efficient operation of the LAE.

Malaysia should establish a resilient CNS framework capable of supporting command and control (C2), navigation, surveillance, operational coordination and future autonomous aviation services.

The CNS framework should support:

- reliable communications for safety-critical operations;
- resilient positioning, navigation and timing services;
- cooperative and non-cooperative surveillance capabilities;
- Remote Identification services;
- operational situational awareness; and
- interoperability with existing aviation infrastructure.

Recognising that radiofrequency spectrum is a strategic enabler of the LAE, stakeholders in Malaysia should work closely with the MCMC to ensure sufficient spectrum resources are available to support aviation communications, C2, Remote Identification, UASTM services and future AAM applications. Spectrum planning should also align with internationally recognised aviation requirements while supporting future technological evolution.

2.4.3.5 Physical Infrastructure

Malaysia should progressively develop the physical infrastructure required to support current and future low altitude operations.

Infrastructure may include drone ports, vertiports, landing facilities, logistics hubs, charging and energy infrastructure, maintenance facilities, operations control centres and other supporting infrastructure necessary to enable safe and efficient operations.

Infrastructure planning should be integrated with national, state and local structure and development plans to ensure compatibility with broader transport, logistics, urban development and regional economic strategies. Development should adopt a modular and scalable approach that accommodates future increases in traffic density, technological advancement and commercial demand.

2.4.3.6 Digital Infrastructure and Data Exchange

Malaysia should establish an integrated digital infrastructure that supports efficient regulatory oversight, operational coordination and ecosystem-wide information sharing.

Core digital services should include aircraft registration, operator certification, personnel licensing, operational approvals, digital certificates, incident reporting, fleet management and regulatory oversight systems.

The framework should also establish common data standards, interoperable digital platforms, application programming interfaces (APIs) and secure information-sharing arrangements to facilitate collaboration among government agencies, industry participants and authorised service providers.

Digital infrastructure should be designed to support automation, interoperability and data-driven decision-making while reducing administrative burden and improving service delivery.

2.4.3.7 Cybersecurity and Digital Resilience

Cybersecurity should be embedded as a foundational design principle across all digital infrastructure supporting Malaysia's LAE.

Malaysia should establish a comprehensive cybersecurity framework that protects communications, operational systems, digital platforms, aircraft connectivity and information exchange from evolving cyber threats.

Cybersecurity governance should be developed in close collaboration with the National Cyber Security Agency (NACSA) and relevant stakeholders to ensure alignment with national cybersecurity policies, Critical National Information Infrastructure (CNII) requirements and international best practices.

The framework should promote cyber resilience through secure system design, identity and access management, encryption, supply chain security, incident response capabilities and continuous monitoring. As quantum computing technologies mature, Malaysia should also assess the adoption of post-quantum cryptography (PQC) and other emerging security technologies to safeguard future aviation systems.

2.4.3.8 Infrastructure Planning and Investment

The successful development of the LAE will require coordinated long-term infrastructure planning supported by sustainable investment.

Government agencies should adopt a coordinated national infrastructure development approach that aligns aviation, telecommunications, transport, digital economy and urban planning policies.

Infrastructure development should be supported through collaboration among government, industry, investors, state governments and local authorities, including appropriate public-private partnership models where suitable.

Investment priorities should focus on strategic economic corridors, logistics hubs, industrial centres, smart cities and regional connectivity while ensuring equitable access to LAE infrastructure across urban, rural and remote communities.

Infrastructure planning should remain sufficiently flexible to accommodate future technological developments and evolving operational requirements without requiring significant redesign.

2.4.3.9 Application of the Guiding Principles

The Connected Infrastructure pillar gives effect to the Guiding Principles by establishing an integrated infrastructure ecosystem that enables safe, secure and scalable low altitude operations.

- **Safety First** is achieved through resilient airspace management, communications, navigation, surveillance and digital infrastructure that support safe flight operations.
- **Risk-Based and Proportionate Regulation** ensures that infrastructure development and deployment are aligned with operational demand, traffic density and safety considerations.
- **Innovation and Technology Neutrality** enables the adoption of diverse technologies and infrastructure solutions while avoiding dependence on any single technology or platform.
- **International Harmonisation and Interoperability** promotes compatibility with internationally recognised aviation standards, UASTM services and digital aviation ecosystems.
- **Digital-by-Design** embeds digital technologies, automation, interoperability and secure information exchange into the planning and operation of the LAE.
- **Responsible and Inclusive Development** promotes resilient, sustainable and equitable infrastructure that supports national connectivity, regional development and long-term economic growth.

2.4.3.10 Desired Outcomes

Implementation of the Connected Infrastructure pillar will establish a resilient, interoperable and future-ready infrastructure ecosystem capable of supporting the safe expansion of Malaysia's LAE.

The framework will enable the seamless integration of aircraft, operators, regulators and service providers through modern airspace management, digital traffic management, resilient communications, navigation and surveillance capabilities, integrated digital platforms and purpose-built physical infrastructure.

By strengthening digital connectivity, infrastructure resilience and inter-agency coordination, Malaysia will be well positioned to support routine commercial drone operations, AAM, autonomous aviation services and future innovations while enhancing national competitiveness, attracting investment and supporting sustainable economic development.

Question 6

CAAM invites views on whether the proposed Connected Infrastructure pillar provides an appropriate framework for developing the airspace, digital and physical infrastructure required to support Malaysia's LAE. In particular, CAAM invites views on the following:

- a. Whether the proposed framework appropriately addresses the development of airspace management, UASTM, communications, navigation and surveillance capabilities required to support safe and scalable LAE operations?
- b. Whether the proposed digital infrastructure, data exchange and interoperability arrangements provide an appropriate foundation for an integrated and efficient LAE ecosystem?
- c. Whether the proposed cybersecurity and digital resilience measures are sufficient to support secure, resilient and trusted low altitude aviation services?
- d. Whether the proposed approach to infrastructure planning, investment and inter-agency collaboration is appropriate to support the long-term development of Malaysia's LAE?
- e. Whether there are additional infrastructure priorities, emerging technologies or internationally recognised best practices that Malaysia should consider in developing its Connected Infrastructure framework?

2.4.4 Pillar 4: Thriving Industry – Industry Development, Innovation and Commercial Ecosystem

2.4.4.1 Overview

The Thriving Industry pillar establishes the strategic policy framework for developing a competitive, innovative and commercially sustainable LAE ecosystem in Malaysia. Building upon the regulatory, operational and infrastructure foundations established under the preceding pillars, this pillar focuses on strengthening Malaysia's industrial capabilities, accelerating innovation, facilitating commercialisation and creating an enabling environment for sustainable industry growth.

The objective is to foster a dynamic ecosystem that encourages investment, supports enterprise development, strengthens domestic capabilities and enables Malaysian companies to participate competitively in regional and global LAE value chains.

2.4.4.2 Industry Development and Competitiveness

Malaysia should establish a coordinated National LAE Industry Development Strategy that provides a long-term direction for the growth of the domestic LAE ecosystem.

The strategy should identify priority industry segments, strengthen industrial capabilities, improve productivity and competitiveness, and encourage greater participation by Malaysian enterprises across the LAE value chain. It should also establish measurable objectives and performance indicators to monitor industry development while remaining aligned with national development policies, including the New Industrial Master Plan 2030 (NIMP 2030), the Malaysian Aerospace Industry Blueprint 2030 (MAIB 2030), the Malaysia Drone Technology Action Plan 2022–2030 (MDTAP30) and the Thirteenth Malaysia Plan (RMK-13).

Industry policies should remain market-oriented, technology-neutral and responsive to evolving technological developments and commercial opportunities.

2.4.4.3 Research, Innovation and Commercialisation

Innovation should be a key driver of Malaysia's LAE.

Malaysia should promote an ecosystem that supports research, development, testing, demonstration and commercialisation of emerging aviation technologies, including UAS, AAM, AI, autonomous systems, advanced communications, digital aviation platforms, sustainable propulsion technologies and other enabling technologies.

Collaboration among government, industry, academia and research institutions should be strengthened to accelerate technology development, facilitate knowledge transfer and support the commercialisation of research outcomes.

Malaysia should continue to support regulatory sandboxes, pilot projects, demonstration programmes and controlled testing environments that enable innovative technologies and

operational concepts to be evaluated safely before wider commercial deployment. Knowledge gained from these initiatives should inform future regulatory development and facilitate responsible innovation.

2.4.4.4 Manufacturing and Supply Chain Development

Malaysia should strengthen domestic manufacturing capabilities to maximise local value creation and increase participation in regional and global aerospace supply chains.

Priority areas should include aircraft manufacturing and assembly, avionics, electronics, communications equipment, batteries, propulsion systems, composite materials, software, AI, precision engineering, maintenance equipment and other supporting technologies.

The development of resilient domestic supply chains should be supported through supplier development programmes, technology transfer, industrial collaboration and capability-building initiatives, particularly for small and medium enterprises (SMEs).

Strengthening domestic manufacturing capabilities will improve industrial resilience, create high-value employment and support the long-term competitiveness of Malaysia's LAE ecosystem.

2.4.4.5 Investment, Market Development and Commercialisation

Malaysia should establish an enabling investment environment that supports the growth and commercialisation of LAE technologies and services.

Government should work closely with investment promotion agencies, financial institutions, industry associations and private investors to facilitate investment, improve access to financing and encourage entrepreneurship across the LAE ecosystem.

Market development initiatives should encourage the adoption of LAE applications across multiple sectors, including logistics, healthcare, agriculture, infrastructure inspection, environmental monitoring, disaster management, public safety, utilities, smart cities and future passenger mobility.

Government should also play an important role as an early adopter of suitable LAE applications within public service delivery where these technologies can improve operational efficiency, enhance public services and demonstrate operational viability. Early public sector adoption can stimulate market demand, reduce commercial uncertainty and accelerate private sector investment.

2.4.4.6 Skills, Talent and Workforce Development

The sustainable growth of Malaysia's LAE will depend on the availability of a skilled and future-ready workforce.

Malaysia should establish a coordinated talent development framework covering engineering, manufacturing, aircraft operations, maintenance, software development, AI, digital technologies, regulation, business development and entrepreneurship.

Close collaboration among government, industry, universities, Technical and Vocational Education and Training (TVET) institutions, RPTOs and professional bodies should ensure that education and training programmes remain responsive to evolving industry needs.

Talent development should promote lifelong learning, professional certification, research excellence and leadership development while supporting employment opportunities across the entire LAE value chain.

2.4.4.7 Standards, Certification and International Collaboration

Malaysia should strengthen its national quality infrastructure to support the safe, reliable and internationally competitive development of the LAE.

This should include strengthening capabilities in standards development, conformity assessment, testing, inspection, certification and quality assurance in collaboration with relevant national and international organisations.

Malaysia should actively participate in international standards development, regional cooperation initiatives and bilateral partnerships to promote regulatory harmonisation, interoperability, mutual recognition and market access.

International collaboration should also facilitate technology transfer, research partnerships, investment opportunities and export development while strengthening Malaysia's integration into regional and global LAE ecosystems.

2.4.4.8 Sustainable Industry Development

Malaysia's LAE should be developed in a manner that supports long-term economic, environmental and social sustainability.

Industry development should encourage environmentally responsible manufacturing, energy-efficient technologies, circular economy practices, battery recycling, sustainable supply chains and responsible resource management.

Businesses should also be encouraged to adopt sound environmental, social and governance (ESG) practices that strengthen long-term competitiveness while contributing to Malaysia's broader sustainability objectives.

2.4.4.9 Application of the Guiding Principles

The Thriving Industry pillar gives effect to the Guiding Principles by creating an enabling environment that supports innovation, investment and sustainable industry growth while maintaining high standards of aviation safety and public confidence.

- **Safety First** ensures that innovation and commercial growth are supported by safe technologies, responsible development and compliance with aviation safety requirements.

- **Risk-Based and Proportionate Regulation** provides regulatory certainty that enables innovation while ensuring appropriate oversight of emerging technologies and business models.
- **Innovation and Technology Neutrality** encourages research, technology development and commercialisation without prescribing specific technological solutions.
- **International Harmonisation and Interoperability** supports participation in international markets through alignment with globally recognised standards and strengthened international cooperation.
- **Digital-by-Design** promotes the adoption of digital technologies, automation, AI and data-driven business models throughout the LAE ecosystem.
- **Responsible and Inclusive Development** supports sustainable industrial growth, environmental stewardship, equitable economic participation and opportunities for businesses and communities throughout Malaysia.

2.4.4.10 Desired Outcomes

Implementation of the Thriving Industry pillar will strengthen Malaysia's industrial capabilities across the LAE value chain by supporting innovation, investment, manufacturing, talent development and commercial adoption.

The framework will create an enabling environment for Malaysian enterprises to compete internationally, generate high-value employment, accelerate technology commercialisation and expand participation in regional and global aerospace markets.

Collectively, these outcomes will contribute to a resilient, innovative and commercially sustainable LAE ecosystem that supports Malaysia's long-term economic development and enhances national competitiveness.

Question 7

CAAM invites views on whether the proposed Thriving Industry pillar provides an appropriate framework for developing a competitive, innovative and commercially sustainable LAE ecosystem in Malaysia. In particular, CAAM invites views on the following:

- Whether the proposed framework appropriately addresses industry development, innovation, manufacturing, investment, commercialisation and market development?
- Whether the proposed measures are sufficient to strengthen Malaysia's capabilities in research, technology development, manufacturing, talent development and international competitiveness?
- Whether Government should play a stronger role as an early adopter of LAE technologies and services to stimulate domestic demand and accelerate commercial adoption?
- Whether the proposed framework provides an appropriate basis for strengthening Malaysia's participation in regional and global LAE value chains?
- Whether there are additional policy measures, incentives or internationally recognised best practices that Malaysia should consider in developing a thriving LAE ecosystem?

2.5 ENABLING FOUNDATIONS

The Enabling Foundations provide the institutional capabilities necessary to support the effective implementation of the Malaysia LAE Framework. While the four Strategic Pillars establish the policy, regulatory and operational framework for the development of the LAE, the Enabling Foundations strengthen the capacity of government, industry and other stakeholders to deliver these outcomes in a coordinated, resilient and sustainable manner.

Unlike the Strategic Pillars, which focus on specific policy objectives and regulatory measures, the Enabling Foundations are cross-cutting in nature. They provide the capabilities, partnerships and supporting ecosystem required to ensure that implementation remains effective, responsive and adaptable as technologies, operational concepts and industry needs continue to evolve.

Together, these Enabling Foundations reinforce all four Strategic Pillars and contribute to the long-term success of Malaysia's LAE.

2.5.1 Talent and Innovation

Talent and innovation provide the human capital and knowledge capabilities required to support the implementation of the Malaysia LAE Framework.

Malaysia should continue to strengthen professional capabilities across government, industry and academia to ensure that the workforce remains equipped to respond to evolving technologies, regulatory requirements and operational needs. This includes fostering multidisciplinary expertise across aviation, engineering, digital technologies, data analytics, AI and other emerging disciplines relevant to the LAE.

In parallel with developing industry talent, Malaysia must continuously strengthen the technical competency of its aviation regulator. CAAM should establish a structured competency development programme for UAS inspectors, RPAS airworthiness specialists, flight operations inspectors, licensing personnel and digital aviation specialists to ensure that regulatory oversight evolves in line with emerging technologies.

At the same time, Malaysia should cultivate a culture of innovation that encourages continuous learning, collaboration and responsible experimentation. Strengthening innovation capability will enable the LAE ecosystem to adapt to technological developments, improve regulatory effectiveness and support long-term competitiveness.

2.5.2 Digital Capability

Digital capability underpins the efficient implementation and continuous improvement of the Malaysia LAE Framework.

Government agencies and industry should strengthen their ability to leverage digital technologies, data and information systems to improve regulatory effectiveness, operational efficiency and evidence-based decision-making. Digital capability should also support integrated service delivery, regulatory coordination and effective information sharing across the LAE ecosystem.

As digital technologies continue to evolve, organisations should enhance their capability to adopt emerging technologies, improve data governance and strengthen digital resilience in support of safe and efficient LAE operations.

2.5.3 Public Trust and Engagement

Public trust is fundamental to the successful implementation and long-term acceptance of the Malaysia LAE.

Malaysia should promote transparent, inclusive and continuous engagement with industry, communities, academia and other stakeholders throughout the implementation of the Framework. Stakeholder engagement should facilitate policy refinement, improve regulatory effectiveness and encourage shared ownership of the LAE ecosystem.

Public awareness and communication initiatives should enhance understanding of the opportunities and safeguards associated with low altitude operations while addressing public concerns relating to safety, security, privacy and responsible technology adoption.

Maintaining openness, accountability and meaningful stakeholder participation will strengthen public confidence and support the sustainable growth of the LAE.

2.5.4 Strategic Partnerships

The LAE spans multiple sectors and disciplines, requiring close collaboration across government, industry, academia and international partners. No single organisation possesses all the expertise, resources or authority necessary to develop the ecosystem independently. This collaboration should include close coordination with agencies such as MCMC on communications infrastructure, NACSA on cybersecurity and cyber resilience, and other relevant agencies responsible for national security, digital economy and critical infrastructure protection.

This foundation strengthens cooperation through whole-of-nation coordination, public-private partnerships, industry collaboration and international engagement. It encourages knowledge sharing, joint research, technology transfer and coordinated infrastructure planning while promoting alignment with international standards and best practices. Strong partnerships will accelerate innovation, improve interoperability and maximise the effective use of national resources.

2.5.5 Sustainability

Sustainability should underpin the implementation of the Malaysia LAE Framework to ensure that its economic, environmental and social benefits can be realised over the long term.

Implementation should encourage responsible resource management, environmental stewardship, social inclusion and resilient institutional practices across government and industry. Sustainability considerations should also be integrated into policy development, regulatory implementation and investment decisions to support balanced and responsible growth.

Embedding sustainability as a cross-cutting foundation will strengthen the long-term resilience and adaptability of Malaysia's LAE while contributing to broader national development objectives.

2.5.6 How the Enabling Foundations Support the Strategic Pillars

The Enabling Foundations underpin every component of the Malaysia LAE Framework. While the four strategic pillars establish the regulatory and operational framework for the ecosystem, the foundations provide the capabilities that enable these pillars to be implemented effectively and sustainably.

Each foundation contributes across multiple pillars, ensuring that implementation remains coordinated, future-ready and responsive to evolving technologies, industry needs and societal expectations.

Question 8

CAAM invites views on whether the proposed Enabling Foundations provide the necessary institutional capabilities to support the effective implementation of the Malaysia LAE Framework. In particular, CAAM invites views on the following:

- a. Whether the proposed Enabling Foundations appropriately support the implementation of the four Strategic Pillars?
- b. Whether the proposed approaches relating to Talent and Innovation, Digital Capability, Public Trust and Stakeholder Engagement, Strategic Partnerships and Sustainability are sufficient to support the long-term implementation of Malaysia's LAE Framework?
- c. Whether there are additional institutional capabilities, implementation mechanisms or cross-cutting measures that should be incorporated into the Framework?

2.6 IMPLEMENTATION ROADMAP

The successful development of Malaysia's LAE requires a structured and phased implementation approach that balances regulatory readiness, infrastructure development, industry growth and technological innovation. Recognising that the LAE is an emerging ecosystem involving multiple sectors and stakeholders, implementation should be progressive, coordinated and responsive to evolving technologies, operational experience and market demand.

The Malaysia LAE Framework adopts a three-phase implementation roadmap comprising Foundation, Scaling, and Regional Leadership. Each phase builds upon the achievements of the previous phase while maintaining flexibility to accommodate future technological advances and international regulatory developments.

Implementation should be guided by the Framework's Vision, Mission and Guiding Principles, with progress monitored through the Governance Framework and supported by the Enabling Foundations. While activities are presented according to implementation phases, many initiatives will continue throughout the duration of the Framework as part of continuous improvement.

2.6.1 Phase 1: Foundation (2026–2027)

The first phase focuses on establishing the institutional, regulatory and technical foundations necessary for the development of Malaysia's LAE. During this period, priority will be given to creating a coherent regulatory environment, strengthening governance arrangements, developing initial digital capabilities and enabling early commercial operations.

Key priorities include:

Pillar 1 – Safe Aircraft

- Develop a risk-based aircraft classification framework.
- Establish aircraft certification and airworthiness requirements.
- Implement a national digital aircraft registration system.
- Introduce Remote Identification requirements.
- Develop continuing airworthiness and maintenance oversight arrangements.
- Develop a competency framework for CAAM UAS inspectors.
- Establish specialised inspector training and certification programmes.

Pillar 2 – Safe Operations

- Establish risk-based operational categories.
- Introduce operator certification and remote pilot licensing.
- Develop operational rules for VLOS, EVLOS and initial BVLOS operations.
- Implement digital flight approval and incident reporting systems.

Pillar 3 – Connected Infrastructure

- Develop the national Low Altitude Airspace architecture.
- Establish the roadmap for UASTM.
- Implement digital regulatory platforms supporting registration, licensing and operational approvals.
- Develop initial standards for drone ports and vertiports.
- Develop, in collaboration with NACSA, a cybersecurity framework and Code of Practice for the LAE, including a roadmap for adopting post-quantum cryptography for safety-critical communications and digital aviation systems.
- Develop, in collaboration with MCMC, a communications framework and technical standards for the LAE, including resilient command-and-control (C2) communications, spectrum planning, Quality of Service (QoS) and interoperability requirements for safety-critical aviation communications.

Pillar 4 – Thriving Industry

- Develop the National LAE Industry Development Strategy.
- Establish regulatory sandbox programmes.
- Designate testing and demonstration corridors.
- Promote research, innovation and pilot commercial projects.
- Initiate investment promotion and SME development programmes.

During this phase, Malaysia will establish the regulatory certainty and institutional capability necessary to support the safe introduction of commercial LAE services while building public confidence and attracting early investment.

2.6.2 Phase 2: Scaling (2028–2029)

The second phase focuses on expanding operational capability, deploying national infrastructure and accelerating commercial adoption across multiple economic sectors. As regulatory frameworks mature, emphasis shifts towards scaling operations, strengthening domestic industry capability and integrating the LAE into the broader national transport and digital ecosystem.

Key priorities include:

Pillar 1 – Safe Aircraft

- Introduce certification pathways for advanced aircraft and eVTOL platforms.
- Expand domestic MRO capability.
- Strengthen manufacturing oversight and production approvals.

Pillar 2 – Safe Operations

- Expand approval for routine BVLOS operations.
- Enable autonomous and high-density operations under defined conditions.
- Introduce operational frameworks for cargo delivery, emergency response and advanced commercial services.
- Strengthen safety management and cybersecurity oversight.

Pillar 3 – Connected Infrastructure

- Deploy the national UASTM ecosystem.
- Integrate UASTM with conventional ATM systems.
- Expand vertiport and supporting infrastructure.
- Strengthen communications, navigation, surveillance and digital data exchange capabilities.

Pillar 4 – Thriving Industry

- Strengthen domestic manufacturing and supply chains.
- Expand research and commercialisation programmes.
- Attract regional investment in manufacturing, software development and maintenance services.
- Promote adoption of LAE applications across logistics, agriculture, healthcare, infrastructure inspection and public services.

By the end of this phase, Malaysia should possess a mature operational ecosystem capable of supporting large-scale commercial deployment while strengthening domestic industrial capability and creating new high-value employment opportunities.

2.6.3 Phase 3: Regional Leadership (2030)

The final phase seeks to position Malaysia as Southeast Asia's leading LAE hub through international leadership, advanced technology adoption and globally competitive industry capability.

Implementation during this phase will focus on enabling advanced aviation services, expanding international collaboration and strengthening Malaysia's position within global aviation value chains.

Key priorities include:

Pillar 1 – Safe Aircraft

- Develop advanced certification capabilities.
- Strengthen international recognition of Malaysian approvals.

- Support emerging aircraft technologies and autonomous systems.

Pillar 2 – Safe Operations

- Enable passenger-carrying AAM services.
- Support cross-border operations.
- Implement highly automated operational management supported by AI.

Pillar 3 – Connected Infrastructure

- Complete nationwide deployment of digital infrastructure.
- Implement AI-enabled traffic management.
- Expand integrated surveillance and digital regulatory services.
- Establish a resilient and interoperable national LAE digital ecosystem.

Pillar 4 – Thriving Industry

- Position Malaysia as a regional centre for LAE manufacturing, engineering, software development and maintenance.
- Strengthen exports of Malaysian technologies and services.
- Expand international research partnerships and investment.
- Promote Malaysia as a preferred destination for innovation and advanced aviation development.

Successful completion of this phase will establish Malaysia as a trusted regional leader with a mature, internationally connected and commercially sustainable LAE that contributes significantly to national competitiveness and economic growth.

2.6.4 Cross-Cutting Enabling Priorities

Throughout all phases of implementation, continuous investment should be made in the five Enabling Foundations.

- **Talent and Innovation** through workforce development, research collaboration and professional competency programmes.
- **Digital Capability** through interoperable digital platforms, secure information exchange and digital regulatory services.
- **Public Trust and Engagement** through stakeholder engagement, public awareness and transparent governance.
- **Strategic Partnerships** through collaboration among government, industry, academia and international organisations.
- **Sustainability** through environmentally responsible technologies, inclusive economic participation and responsible lifecycle management.

These enabling priorities should ensure that implementation remains coordinated, resilient and adaptable as technologies and market conditions continue to evolve.

2.6.5 Indicative Implementation Timeline

Phase	Period	Primary Focus	Expected Outcomes
Phase 1 – Foundation	2026–2027	Governance, regulatory framework, digital platforms, pilot operations	Regulatory certainty, institutional readiness and early commercial deployment
Phase 2 – Scaling	2028–2029	Infrastructure deployment, advanced operations and industry expansion	National-scale operations, integrated infrastructure and commercial growth
Phase 3 – Regional Leadership	2030	International leadership, advanced mobility and export competitiveness	Mature LAE ecosystem and Southeast Asia’s premier LAE hub

Table 2: Indicative Implementation Timeline for the Malaysia LAE Framework

Question 9

CAAM invites views on whether the proposed Implementation Roadmap provides an appropriate and practical approach for implementing the Malaysia LAE Framework. In particular, CAAM invites views on the following:

- Whether the proposed phased implementation approach appropriately prioritises the development of Malaysia’s LAE while balancing safety, innovation and industry readiness?
- Whether the proposed sequencing of regulatory, infrastructure, industry development and institutional initiatives is appropriate and achievable?
- Whether the proposed roles and responsibilities of government agencies, industry, academia and other stakeholders are sufficiently clear to support effective implementation?
- Whether the proposed implementation timeline is realistic and reflects the readiness of Malaysia’s LAE ecosystem?
- Whether the proposed governance, monitoring and review mechanisms are sufficient to ensure coordinated implementation and enable the Framework to respond to future technological, regulatory and market developments?
- Whether there are additional implementation priorities, milestones or collaborative mechanisms that should be considered in the Implementation Roadmap?

2.7 GENERAL COMMENTS

CAAM welcomes any additional views, comments or recommendations on the proposed Malaysia LAE Framework that are not specifically addressed in the consultation questions set out in this paper.

Stakeholders are encouraged to identify any additional issues, opportunities, implementation considerations or emerging developments that may assist CAAM in strengthening the proposed Malaysia LAE Framework. Where appropriate, respondents are encouraged to provide supporting evidence, practical examples or references to international best practices to support their recommendations.

CAAM also welcomes suggestions on how the proposed Malaysia LAE Framework can be further refined to enhance its clarity, effectiveness, practicality and long-term implementation.

SECTION 3: SUBMISSION OF RESPONSES

CAAM welcomes written submissions from industry participants, government agencies, academia, professional bodies, interested stakeholders and members of the public on any aspect of this Public Consultation (PC) Paper.

Responses should be submitted no later than **5.00 p.m. (Malaysia Time) on 2 September 2026**.

Respondents are encouraged to provide clear, evidence-based comments and, where appropriate, supporting information or practical recommendations to assist CAAM in refining the proposed Malaysia LAE Framework.

Confidentiality of Responses

Where a submission contains proprietary, confidential or commercially sensitive information, respondents may request that such information be treated as confidential by providing appropriate justification for CAAM's consideration.

In such cases, respondents should submit:

- a **non-confidential version** of the submission suitable for publication, with confidential information redacted where necessary; and
- a **separate confidential annex**, clearly marked **"CONFIDENTIAL"**, containing the information for which confidential treatment is requested.

CAAM will consider all requests for confidential treatment on a case-by-case basis. Where such a request is accepted, CAAM will take the confidential information into account but will not disclose it publicly. If a request for confidential treatment is not accepted, CAAM will notify the respondent accordingly, and the confidential information will not be considered unless the respondent agrees to its disclosure.

Submission Channels

Responses may be submitted electronically or by post to the following address:

Civil Aviation Authority of Malaysia (CAAM)

No. 27, Persiaran Perdana
Aras 1–4, Blok Podium, Presint 4
62618 Putrajaya
Wilayah Persekutuan Putrajaya
Malaysia

Attention: Strategy & Transformation Division

Email: lae.policy@caam.gov.my

APPENDIX A: LIST OF CONSULTATION QUESTIONS

Question No.	Section	Consultation Question
Question 1	Section 2.2 – Definition of the Low Altitude Economy	CAAM invites views on the proposed definition and scope of the LAE. In particular: Definition - Does the proposed definition appropriately reflect the LAE as an ecosystem of economic activities, industries and enabling capabilities? Altitude Threshold - Should the Malaysia LAE Framework define the LAE by reference to a specific altitude, or should it remain technology- and operation-neutral without prescribing an altitude threshold? If an altitude threshold should be adopted, what altitude or altitude levels would be appropriate for the Malaysian context, and why? In responding, please also consider wider regional or cross-border circumstances Scope - Are there any additional activities, sectors or enabling capabilities that should be included within the scope of the Framework?
Question 2	Section 2.3 – Vision, Mission and Guiding Principles	CAAM invites views on whether the proposed Vision, Mission and Guiding Principles provide an appropriate strategic foundation and direction for the development of Malaysia's LAE. In particular, CAAM invites views on the following: - Whether the proposed Vision appropriately reflects Malaysia's long-term aspirations for the LAE. - Whether the proposed Mission appropriately supports the achievement of the Vision. - Whether the proposed Guiding Principles provide an appropriate foundation for policy development and implementation. - Whether any additional Vision elements, Mission statements or Guiding Principles should be considered.
Question 3	Section 2.4 – Strategic Pillars	CAAM invites views on whether the proposed Strategic Pillars and Risk-Based Classification Framework provide an appropriate and comprehensive approach for the safe, secure and sustainable development of Malaysia's LAE. In particular, CAAM invites views on the following: Whether the proposed four Strategic Pillars comprehensively address the key policy, regulatory, infrastructure and industry development priorities for Malaysia's LAE.

		f. Whether the proposed Risk-Based Classification Framework provides an appropriate basis for developing proportionate regulatory requirements for different aircraft and operational risk profiles. g. Whether the relationship between the Strategic Pillars and the Risk-Based Classification Framework is sufficiently clear and coherent. h. Whether there are any additional strategic pillars, cross-cutting themes or regulatory principles that should be incorporated into the Framework.
Question 4	Section 2.4.1 – Safe Aircraft	CAAM invites views on whether the proposed Safe Aircraft pillar provides an appropriate regulatory framework for ensuring the safety and airworthiness of aircraft operating within Malaysia's LAE. In particular, CAAM invites views on the following: a. Whether the proposed risk-based approach to aircraft classification provides an appropriate basis for determining certification, registration and airworthiness requirements. b. Whether the proposed lifecycle approach appropriately addresses the key stages of aircraft design, certification, registration, continuing airworthiness, maintenance, modification and retirement. c. Whether the proposed framework appropriately distinguishes between aircraft that should be subject to continuing airworthiness requirements and those that may be subject to simplified maintenance and safety requirements. d. Whether there are additional strategic policy measures or internationally recognised standards and best practices that Malaysia should consider in developing its aircraft certification and airworthiness framework.
Question 5	Section 2.4.2 – Safe Operations	CAAM invites views on whether the proposed Safe Operations pillar provides an appropriate operational framework for supporting the safe, secure and efficient conduct of operations within Malaysia's LAE. In particular, CAAM invites views on the following: a. Whether the proposed risk-based operational classification provides an appropriate basis for determining operational approvals, operator certification and regulatory oversight. b. Whether the proposed operational categories appropriately distinguish between routine, higher-risk and certified operations. c. Whether the proposed framework adequately addresses operator certification, remote pilot competency, operational approvals, safety management and operational oversight.

		d. Whether there are additional strategic policy measures or internationally recognised best practices that Malaysia should consider in developing its operational framework for the LAE.
Question 6	Section 2.4.3 – Connected Infrastructure	CAAM invites views on whether the proposed Connected Infrastructure pillar provides an appropriate framework for developing the airspace, digital and physical infrastructure required to support Malaysia's LAE. In particular, CAAM invites views on the following: a. Whether the proposed framework appropriately addresses the development of airspace management, UASTM, communications, navigation and surveillance capabilities required to support safe and scalable LAE operations. b. Whether the proposed digital infrastructure, data exchange and interoperability arrangements provide an appropriate foundation for an integrated and efficient LAE ecosystem. c. Whether the proposed cybersecurity and digital resilience measures are sufficient to support secure, resilient and trusted low altitude aviation services. d. Whether the proposed approach to infrastructure planning, investment and inter-agency collaboration is appropriate to support the long-term development of Malaysia's LAE. e. Whether there are additional infrastructure priorities, emerging technologies or internationally recognised best practices that Malaysia should consider in developing its Connected Infrastructure framework.
Question 7	Section 2.4.4 – Thriving Industry	CAAM invites views on whether the proposed Thriving Industry pillar provides an appropriate framework for developing a competitive, innovative and commercially sustainable LAE ecosystem in Malaysia. In particular, CAAM invites views on the following: a. Whether the proposed framework appropriately addresses industry development, innovation, manufacturing, investment, commercialisation and market development. b. Whether the proposed measures are sufficient to strengthen Malaysia's capabilities in research, technology development, manufacturing, talent development and international competitiveness. c. Whether Government should play a stronger role as an early adopter of LAE technologies and services to stimulate domestic demand and accelerate commercial adoption. d. Whether the proposed framework provides an appropriate basis for strengthening Malaysia's participation in regional and global LAE value chains.

		e. Whether there are additional policy measures, incentives or internationally recognised best practices that Malaysia should consider in developing a thriving LAE ecosystem.
Question 8	Section 2.5 – Enabling Foundations	CAAM invites views on whether the proposed Enabling Foundations provide the necessary institutional capabilities to support the effective implementation of the Malaysia LAE Framework. In particular, CAAM invites views on the following: a. Whether the proposed Enabling Foundations appropriately support the implementation of the four Strategic Pillars. b. Whether the proposed approaches relating to Talent and Innovation, Digital Capability, Public Trust and Stakeholder Engagement, Strategic Partnerships and Sustainability are sufficient to support the long-term implementation of Malaysia’s LAE Framework. c. Whether there are additional institutional capabilities, implementation mechanisms or cross-cutting measures that should be incorporated into the Framework.

Question 9	Section 2.6– Implementation Roadmap	CAAM invites views on whether the proposed Implementation Roadmap provides an appropriate and practical approach for implementing the Malaysia LAE Framework. In particular, CAAM invites views on the following: a. Whether the proposed phased implementation approach appropriately prioritises the development of Malaysia’s LAE while balancing safety, innovation and industry readiness. b. Whether the proposed sequencing of regulatory, infrastructure, industry development and institutional initiatives is appropriate and achievable. c. Whether the proposed roles and responsibilities of government agencies, industry, academia and other stakeholders are sufficiently clear to support effective implementation. d. Whether the proposed implementation timeline is realistic and reflects the readiness of Malaysia’s LAE ecosystem. e. Whether the proposed governance, monitoring and review mechanisms are sufficient to ensure coordinated implementation and enable the Framework to respond to future technological, regulatory and market developments. f. Whether there are additional implementation priorities, milestones or collaborative mechanisms that should be considered in the Implementation Roadmap.
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APPENDIX B: MALAYSIA LOW ALTITUDE ECONOMY FORUM 2026 POST-ENGAGEMENT REPORT

The Malaysia Low Altitude Economy Forum 2026, organised by the Civil Aviation Authority of Malaysia (CAAM) on 24 June 2026, served as a key stakeholder engagement exercise supporting the development of the Malaysia LAE Framework. The Forum brought together representatives from government, industry, academia, investors and international organisations to discuss strategic, regulatory, technological and commercial priorities for the development of Malaysia’s LAE.

The Malaysia Low Altitude Economy Forum 2026 Post-Engagement Report is reproduced in this Appendix to provide stakeholders with additional context on the discussions, key findings and recommendations that informed the development of this Framework. Stakeholders are encouraged to refer to the Report when considering the proposals contained in this Public Consultation Paper.

SESSION 1 - SHAPING MALAYSIA'S LOW ATTITUDE ECONOMY: BUILDING A NATIONAL LAE STRATEGY

MODERATOR

YBhg. Dato' Captain Norazman Mahmud, Chief Executive Officer, CAAM

The vision of advanced air mobility has existed since the futuristic ideas shown in *The Jetsons* (1962). LAE is becoming increasingly important because more than 240 companies worldwide are racing to certify eVTOL aircraft, driving innovation through hundreds of patents. With the Asia-Pacific region contributing about 30% of the global economy, Malaysia is well positioned to become a key LAE hub due to its established aerospace manufacturing capabilities, semiconductor production, growing investments in data centres, robust telecommunications supported by over 15,000 towers, and existing industrial use cases such as monitoring 2,000 km of gas pipelines, busy ship-to-shore operations at its major ports, and drone light shows. Building a successful LAE ecosystem will require collaboration beyond the CAAM, involving local authorities, startups, investors, and other stakeholders rather than working in silos. As over 80% of drone operations are recreational, clear roles, responsibilities, and coordination among all participants are essential to unlock the sector's projected value of approximately RM55 billion under the MDTAP by 2030.

PANELIST

1. **Ir. Ts. Dr. Shamsul Kamar Abu Samah** | Chief Executive Officer, National Aerospace Industry Corporation Malaysia (NAICO Malaysia)
2. **Mr. Ashran Dato' Ghazi** | Chief Executive Officer, Malaysian Research Accelerator for Technology & Innovation (MRANTI)
3. **Mr. Naguib Mohd Nor** | President, Malaysia Aerospace Industry Association (MAIA)
4. **YBhg. Datuk Hisham Hamdan** | Chief Investment Officer, Khazanah Nasional Berhad
5. **Mr. Lai Han Sheong** | Managing Director, Future Capital

KEY DISCUSSION

LAE as a Strategic Economic Enabler

- LAE is emerging as a new growth sector capable of generating significant economic value, attracting investment, and creating high-skilled employment opportunities.
- The sector represents the next evolution of Malaysia's aerospace industry beyond traditional manufacturing and MRO activities.
- Industry stakeholders foresee substantial contributions to GDP, talent development, and industrial growth over the next decade.

Government as the Ecosystem Catalyst

- Strong government leadership is critical to accelerate LAE development.
- Key government roles include establishing enabling policies, facilitating regulatory development, investing in infrastructure, and creating market demand.

- International examples, particularly China, demonstrate the importance of government support in developing a sustainable LAE ecosystem.

Regulatory Readiness and Airspace Integration

- A clear, predictable, and risk-based regulatory framework is essential to support industry growth.
- Regulatory certainty encourages investment, technology adoption, and operational deployment.
- Effective integration of drones, eVTOLs, and future AAM operations into existing airspace remains a key priority, with CAAM playing a central enabling role.

Testing, Validation and Sandbox Development

- National sandbox initiatives provide important platforms for testing emerging technologies and operational concepts.
- Facilities such as MRANTI's Area 57 enable technology demonstrations, autonomous operations testing, regulatory experimentation, and industry collaboration.
- Test environments help reduce adoption barriers and accelerate technology maturity.

Positioning Malaysia as a Regional LAE Hub

- Malaysia has strong potential to become a regional centre for eVTOL testing, Advanced Air Mobility (AAM), and autonomous UAS operations.
- Existing strengths include a mature aerospace sector, manufacturing capabilities, engineering talent, and supportive regulatory engagement.
- Becoming a regional testbed can attract international operators, technology developers, and investors.

Investment and Commercial Sustainability

- Long-term industry growth depends on sustainable investment and commercially viable business models.
- Strategic investors, financial institutions, and government-linked investment entities play an important role in nurturing the ecosystem and reducing early-stage risks.
- Technology development must be accompanied by demand generation, infrastructure development, and clear commercial pathways.

Strengthening Industrial and Manufacturing Capabilities

- Malaysia possesses strong foundations in aerospace manufacturing, MRO, electronics, and semiconductor industries.
- Opportunities exist to expand into higher-value activities such as component manufacturing, avionics integration, airframe production, and eVTOL supply chains.
- LAE can serve as a catalyst to strengthen Malaysia's position within the global aerospace value chain.

Talent Development and Workforce Readiness

- A skilled workforce is essential to support future industry growth.
- Demand is expected to increase for engineers, technicians, autonomous systems specialists, software developers, and aviation professionals.
- Continued investment in TVET, higher education, and industry training programmes will be required to meet future workforce needs.

International Collaboration and Technology Transfer

- Strategic partnerships with international industry players can accelerate technology adoption and ecosystem development.
- China was frequently referenced as a source of technology, investment, operational experience, and policy insights.
- International collaboration can support knowledge transfer while strengthening local capabilities and competitiveness.

Whole-of-Ecosystem Collaboration

- Successful LAE development requires coordinated participation from government agencies, regulators, investors, industry players, academia, and technology developers.
- No single stakeholder can develop the ecosystem independently.
- Continuous communication, collaboration, and alignment are necessary to achieve Malaysia's long-term LAE ambitions.

SESSION 2 - CULTIVATING FUTURE LAE ECOSYSTEM THROUGH ACADEMIC INNOVATION AND EXPERIMENTAL DRONE SYSTEMS

PRESENTER

Dr. Zulhilmy Sahwee | Associate Professor, Head Unmanned Aerial System Research Cluster, UniKL-MIAT

The discussion emphasised that the sustainable growth of Malaysia's drone ecosystem is fundamentally dependent on the availability of competent and highly skilled drone professionals. As drone applications continue to expand across various sectors, establishing a comprehensive drone education and talent development framework is essential to address future workforce demands. The UniKL Malaysian Institute of Aviation Technology (MIAT) has developed a structured academic pathway encompassing diploma programmes for drone technicians, undergraduate degrees for engineers and flight test specialists, and postgraduate studies for researchers, innovators, and technology entrepreneurs. MIAT distinguishes itself through its extensive expertise in aviation and airworthiness, producing graduates with dual competencies in both aerospace and unmanned aircraft technologies. The institution further strengthens national capabilities through its dedicated Drone Design Centre, which focuses on conceptual design and hardware-software integration, a Drone Prototyping Centre for the development of high-performance unmanned aircraft systems, and a Drone Flight Test Centre equipped with systematic outdoor testing facilities. These capabilities are complemented by strategic collaborations with industry in the areas of training, workforce reskilling, product development, testing and validation, and research and industrial partnerships, thereby supporting the development of a robust, innovative, and sustainable drone ecosystem in Malaysia.

MODERATOR

Ts. Dr. Julian Tan Kok Ping | Authority Member, CAAM

The session highlighted the evolution of drone technology, tracing its origins to the 1960s and noting that early multirotor concepts could be observed in aircraft such as the Chinook helicopter. Advances in computing have since enabled the development of modern UAS, driving innovation across the aviation sector. Drawing on examples such as SpaceX and aviation innovator Burt Rutan, founder of Scale Composites, the discussion emphasised the importance of nurturing technology developers and fostering a strong domestic ecosystem to build a sustainable drone industry from the ground up.

PANELIST

1. **Ir. Ts. Dr. Joanne Lim Mun Yee** | Associate Professor, Lead for IOT and Drone Lab & ECSE Course, Director, Monash University Malaysia
2. **Mr. Alvin Tan Xing Kai** | Accountable Manager, AirAsia Magic
3. **Ir. Ts. Dr. Hanafi Bin Azami** | Associate Professor, Department of Mechanical & Aerospace Engineering Kulliyyah of Engineering, International Islamic University Malaysia (IIUM)
4. **Mr. Fong Choong Fook** | Managing Director, LGMS Berhad

KEY DISCUSSION

Innovation and Indigenous Technology Development

- Innovation remains the foundation for Malaysia's future UAS, AAM, and LAE ecosystem.
- Research is expanding into AI, IoT, embedded systems, autonomous operations, and advanced human-machine interaction technologies.
- Indigenous development capabilities are increasingly important to reduce dependence on imported technologies and strengthen national competitiveness.
- Research and development activities should be translated into commercially viable products and operational solutions.

End-to-End UAS Capability Development

- Successful drone development requires an integrated ecosystem covering the entire value chain:
 - Conceptual design.
 - System engineering.
 - Hardware and software integration.
 - Prototyping.
 - Flight testing.
 - Validation and certification.
 - Operational deployment.

- All layers of drone development are interdependent and require coordinated expertise.
- Malaysia should focus on building complete development capabilities rather than relying solely on imported technologies and systems.

Human Capital and Competency Development

- Competent drone personnel are critical to supporting future industry growth and operational safety.
- Questions were raised regarding whether Malaysia has sufficient qualified drone pilots, engineers, technicians, and specialists to support future demand.
- A structured drone education framework has been established to develop talent across multiple levels:
 - Diploma programmes producing drone technicians.
 - Degree programmes producing engineers and flight test specialists.
 - Master's and PhD programmes producing researchers, innovators, entrepreneurs, and industry leaders.
- Workforce development must support both aviation competency and emerging technology skills.

Development of Dual-Competency Professionals

- Future industry growth will require professionals with expertise in both aviation and technology disciplines.
- Institutions such as MIAT differentiate themselves through strong aviation and airworthiness foundations combined with engineering and technology capabilities.
- The development of dual-competency graduates is essential to bridge the gap between aerospace, software, AI, autonomy, and operational requirements.

Research, Testing and Validation Infrastructure

- Dedicated facilities are essential to support innovation and industrial growth.
- Key capabilities highlighted include:
 - Drone Design Centres for conceptual development and system design.
 - Drone Prototyping Centres for building and refining high-performance systems.
 - Drone Flight Test Centres for structured outdoor testing and operational validation.
- Testing and validation infrastructure enables safer technology development and accelerates industry maturity.

Safety and Regulatory Readiness

- Safety remains the primary consideration throughout the development lifecycle.
- Emerging technologies must be supported by:

- Robust regulatory frameworks.
- Effective airspace governance.
- Structured sandbox environments.
- Comprehensive risk management practices.
- Collaboration between industry, academia, and regulators is required to ensure innovation and safety evolve together.

Cybersecurity and System Resilience

- Increasing autonomy and connectivity expose UAS operations to cybersecurity threats.
- Ground control stations, communication networks, and digital systems require stronger cyber protection measures.
- Cybersecurity must be integrated into system design, operations, and regulatory frameworks from the outset.

Collaboration and Industry Partnership

- Sustainable ecosystem development requires strong collaboration between:
 - Academia.
 - Industry.
 - Government agencies.
 - Regulators.
- Collaboration areas include:
 - Training and reskilling.
 - Product development.
 - Testing and validation.
 - Research activities.
 - Industrial partnerships and commercialisation.
- Multi-stakeholder cooperation is necessary to accelerate technology adoption and industry growth.

SESSION 3 - USE CASES DIVING VALUE: REFINERY, PUBLIC SAFETY, AGRICULTURE AND SURVEYING

MODERATOR

Dr. Andi Rossi | Head of Innovation Ecosystems, Futurise Sdn Bhd

The session commenced with an introduction of the key organisations involved in advancing the LAE ecosystem, including Petroliaam Nasional Berhad (PETRONAS), Jabatan Ukur dan Pemetaan Malaysia (JUPEM), Pasukan Gerakan Udara Polis Di-Raja Malaysia (PGU PDRM), Aonic and Alphaswift Industries, each contributing unique expertise and operational capabilities. The discussion then explored practical use cases demonstrating the value of unmanned aircraft systems across key sectors, including refinery and industrial inspections, public safety and law enforcement, precision agriculture, and geospatial surveying, highlighting how collaborative efforts between government agencies and industry are driving innovation, operational efficiency, and the adoption of drone technologies in Malaysia.

PANELIST

1. **Ir. Ts. M. Zaparel Awang** | General Manager & Project Directorate, Projects, Technology & Health, Safety, Security & Environment (PT&HSSE), Petronas
2. **ASP Nitas bin Camillus Tan Sing Bee** | Drone Pilot, Pasukan Gerakan Udara (PGU), Polis DiRaja Malaysia (PDRM)
3. **Lt. Col. Mohd Faizalfitri Hj. Mansor** | Pengarah Seksyen, Keselamatan danKeupayaan Sistem, Jabatan Ukur dan Pemetaan (JUPEM)
4. **Mr. Cheong Jin Xi** | Founder & Chief Executive Officer, Aonic
5. **Dr. Shian Lee** | Chief Executive Officer, Alphaswift Industries

KEY DISCUSSION

PETRONAS

- Industrial LAE application: LAE is used as a scalable operational layer, mainly for drone-based monitoring of critical assets such as pipelines and offshore facilities.
- Centralised command & data use: A drone command centre enables real-time monitoring of nationwide operations, supporting decision-making through live data and feedback.
- Ecosystem development: Growth of LAE is driven by integration of digital airspace, regulatory collaboration, and strong industrial use cases with expanding operational scale and capability.

PDRM

- Legal and operational coverage: UA operations in Malaysia are governed within a defined land and maritime jurisdiction, supporting a wide range of national security and public safety functions.
- Multi-agency operational use: UAS are deployed for crime prevention, intelligence gathering, tactical support, and humanitarian assistance, including roles such as first responder support.

- Critical mission applications: Key uses include geospatial mapping, search and rescue, public order management, counter-terrorism support, and explosive ordnance disposal, enhanced by real-time data and thermal imaging capabilities.

JUEM

- Data sovereignty framework: LAE airspace data is governed under strict national data sovereignty principles, ensuring controlled access and use of aerial and geospatial information.
- Regulatory authority role: The national mapping authority serves as the technical advisor and custodian for geospatial data, supporting government and defence-related requirements.
- Legal and compliance requirements: All aerial mapping activities are subject to national legislation and directives, including the Official Secrets Act 1972 and relevant government circulars.

AONIC

- Core agricultural operations: Business activities focus on agricultural applications, including paddy fields, oil palm plantations, and durian farming.
- Key challenges and offerings: Main operational challenges include awareness, procurement, usage, and after-sales support, while core offerings include financing, software, hardware, inputs, spare parts, spraying services, and training.

ALPHASWIFT

- Drone Logistics Solutions: Development and deployment of drone-based delivery and logistics solutions to enhance operational efficiency and support emerging LAE applications.
- In-House Flight Control Technology: Development of proprietary flight control systems, including autonomous autopilot capabilities, to improve aircraft performance, reliability, and operational independence.

SESSION 4 - AAM & UAS : GLOBAL TRENDS SHAPING THE FUTURE OF AVIATION

MODERATOR

Captain Radzi Alias @ Abd Majid | Deputy Chief Executive Officer – Regulatory, CAAM

The session opened with a forward-looking discussion on the future of the LAE, highlighting how the rapid advancement of AAM is reshaping the global aviation industry and creating new opportunities for economic growth, connectivity, and innovation. As emerging technologies continue to redefine the way people and goods move within low-altitude airspace, the discussion emphasised the importance of developing an enabling ecosystem supported by progressive

regulations, technological innovation, infrastructure, and cross-sector collaboration. It also underscored the need for Malaysia to proactively prepare for this transformation to ensure the nation remains competitive and well-positioned to harness the full potential of the LAE.

PANELIST

1. **Mr. Zhang Hongfei** | Chief Executive Officer & Founder, Hangzhou Star Ports Tech
2. **Mr. Derek Cheng** | Head of Commercial APAC, Vertical Aerospace
3. **Mr. Haotong Gao** | Chief Product Officer, Aridge
4. **Mr. Yusuke Yamaguchi** | Head of Sales, UniFly
5. **Mr. Apurva Kumar** | Chief Executive Officer, CityData.ai

KEY DISCUSSION

Hangzhou Star Ports Tech

- End-to-end vertiport solutions covering design, construction, operation, and maintenance of eVTOL infrastructure.
- Sustainable and modular design integrating solar power, energy storage, and charging systems for efficient operations.
- Safety-focused development through site assessments, environmental evaluations, and operational risk considerations.
- Smart and passenger-centric approach emphasising seamless operations, connectivity, and user experience.
- Guangzhou Haixinsha Vertiport serves as one of China's first operational eVTOL vertiports and a model for future developments.

Vertical Aerospace

- Transforming Future Mobility: AAM is reshaping the aviation and transportation sectors through zero-emission propulsion systems, seamless point-to-point connectivity, innovative aircraft designs, and supporting airspace and ground infrastructure.
- Potential Applications in Malaysia: Key use cases include airport connectivity, tourism and leisure transport, and inter-city/business corridor mobility services.
- Aircraft Capabilities: Current eVTOL platforms are designed to accommodate 4 to 6 passengers, with operational ranges of approximately 160 km and cruising speeds of up to 240 km/h.

- **Multi-Mission Configurations:** Aircraft platforms can be configured for passenger transport, medical evacuation, and cargo logistics operations.
- **Industry Development:** The growth of the AAM ecosystem is supported by evolving certification standards, infrastructure development, and increasing industry commitments, positioning the region for future commercial deployment of eVTOL operations.

Aridge

- **Industry Positioning:** Over five years of experience in developing sustainable and innovative flying vehicle solutions, with a focus on scalable aerial mobility technologies.
- **Product Strategy:** Development roadmap comprises three phases:
 - Personal eVTOL operations for limited-use scenarios.
 - Commercial eVTOL operations for broader transportation applications.
 - Fully integrated flying car solutions enabling three-dimensional mobility.
- **Modular Flying Vehicle Concept:** Features a dual-purpose platform combining a two-passenger aircraft with an electric ground vehicle, addressing challenges related to storage, charging, and transportation.
- **Commercialisation Roadmap:** Progression from product trials to commercial operations, followed by certification, continuing airworthiness approval, and pilot licensing requirements.

Unifly

- **Integrated Airspace Management Solutions:** Provision of drone service and digital airspace management systems to support safe and efficient unmanned aircraft operations.
- **Operational Challenges:** Key issues include managing high volumes of flight approvals, mitigating air traffic conflicts, and distinguishing between compliant and non-compliant (rogue) drone operations.
- **Regulatory Efficiency Needs:** Requirement for a more streamlined and efficient flight plan approval process to ensure timely operational clearance while maintaining regulatory compliance.

CityData.ai

- **Demand-Driven LAE Development:** LAE growth must be guided from the ground up by accurately measuring real market demand before scaling infrastructure and operations.
- **Key Strategic Questions:** Critical considerations include passenger demand for aerial mobility, the required number of vertiports, and optimal locations for infrastructure deployment.

- **Connectivity & Market Alignment:** A mismatch between aircraft development and actual demand can limit commercial viability, highlighting the importance of integrating aircraft deployment with network connectivity planning.
- **Data-Driven Planning:** Effective LAE development requires demand modelling, market sizing, profitable route identification, and strategic vertiport site selection to ensure sustainable ecosystem growth.