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SAFE SKIES.
SUSTAINABLE FUTURE.

ICAO APAC Regional Office Workshop on Unmanned Aircraft System Integration in National and High Seas Airspace

Bangkok, Thailand

November, 2025

Global UAS Regulatory Implementation Challenges

Objectives

- Understand the Importance of a Regulatory Framework;
- Understand the Challenges of Implementing a Reg. Fmwk;
- Considerations for Regulatory Implementation.

IMPORTANT CONCEPTS

SAFETY IS PARAMOUNT!

SAFETY LEVEL IS NOT NEGOTIABLE!

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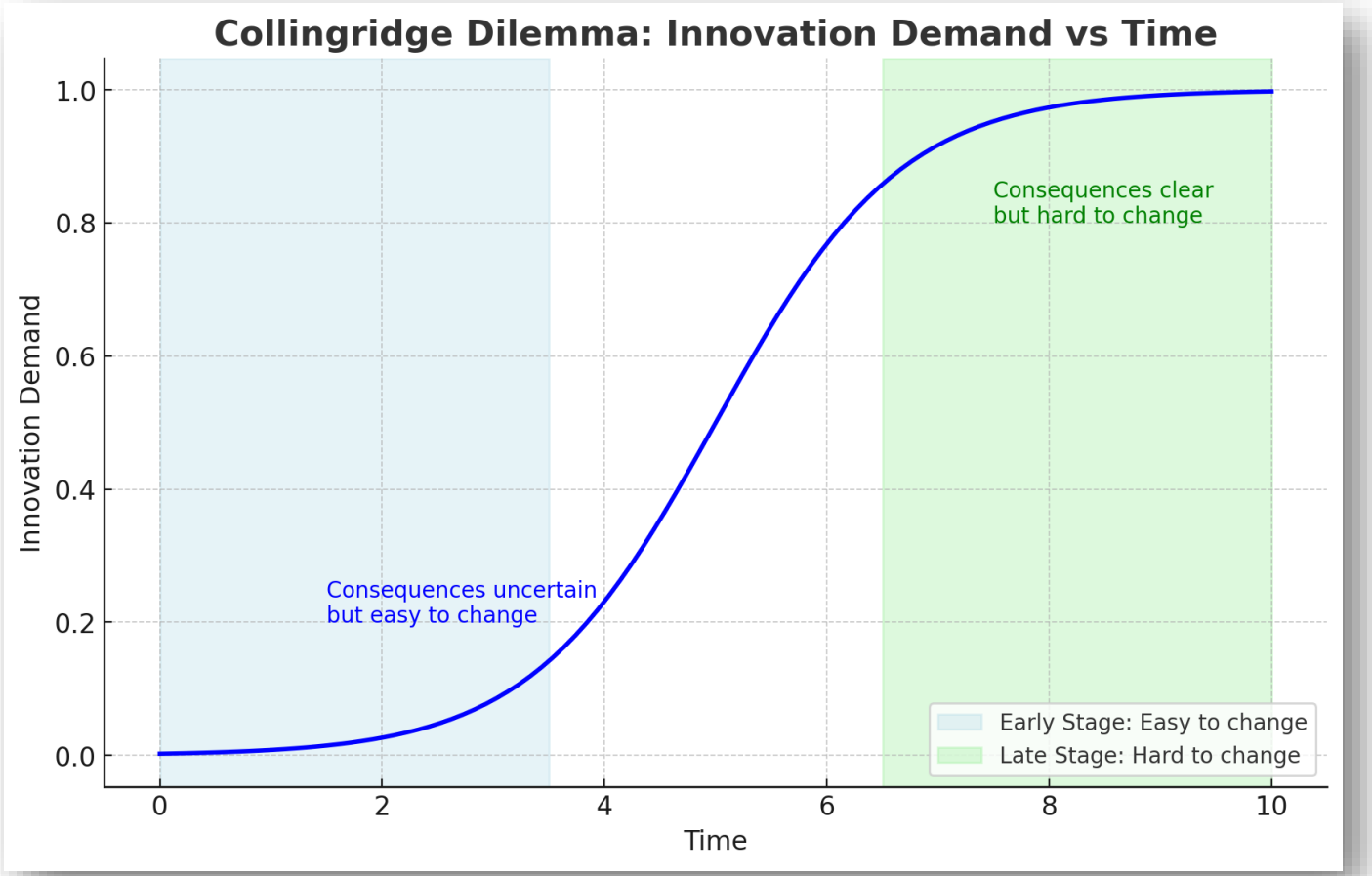
How to Regulate an Innovation?

- Innovation includes commercial applications of new technology, new material, or new methods and processes(1).
- Innovation also includes the invention of new technologies and disruptive business models(1).



(1) Cirera, Xavier; Maloney, William F.. 2017. The Innovation Paradox: Developing-Country Capabilities and the Unrealized Promise of Technological Catch-Up. © World Bank. http://hdl.handle.net/10986/28341.

How to Regulate Innovation?

- The pace, scope and complexity of innovation pose far-reaching and interrelated regulatory challenges for governments(2).
- These challenges can be grouped around four broad categories: the "pacing problem"; designing "fit-for-purpose" regulatory frameworks; regulatory enforcement challenges, and institutional and transboundary challenges. (2)

(2) OECD, Recommendation of the Council for Agile Regulatory Governance to Harness Innovation, OECD/LEGAL/0464. https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0464

How to Regulate Innovation?

- **"Pacing Problem" > gap between the rapid development of emerging technologies and the much slower pace at which regulatory frameworks evolve;**
- **"Fit-For-Purpose" > regulatory instruments to match specific policy targets.**
- **Regulatory enforcement challenges**

  (For instance - difficulties in apportioning and attributing responsibility for damages caused);
- **Transboundary Challenges: innovations can span multiple regulatory regimes.**

(2) OECD, Recommendation of the Council for Agile Regulatory Governance to Harness Innovation, OECD/LEGAL/0464. https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0464

How to Regulate Innovation?

Key implications of innovation on markets and societies (3)

- Competition
- New market failures
- Data privacy and security challenges
- Reduction in transaction costs
- Development of decentralised exchanges
- Development of networks
- Shift towards services
- Growing powers to consumers
- Socio-ethical challenges

(3) OECD/KDI (2021), Case Studies on the Regulatory Challenges Raised by Innovation and the Regulatory Responses, OECD Publishing, Paris, https://www.oecd.org/content/dam/oecd/en/publications/reports/2021/12/case-studies-on-the-regulatory-challenges-raised-by-innovation-and-the-regulatory-responses_82fcd441/8fa190b5-en.pdf

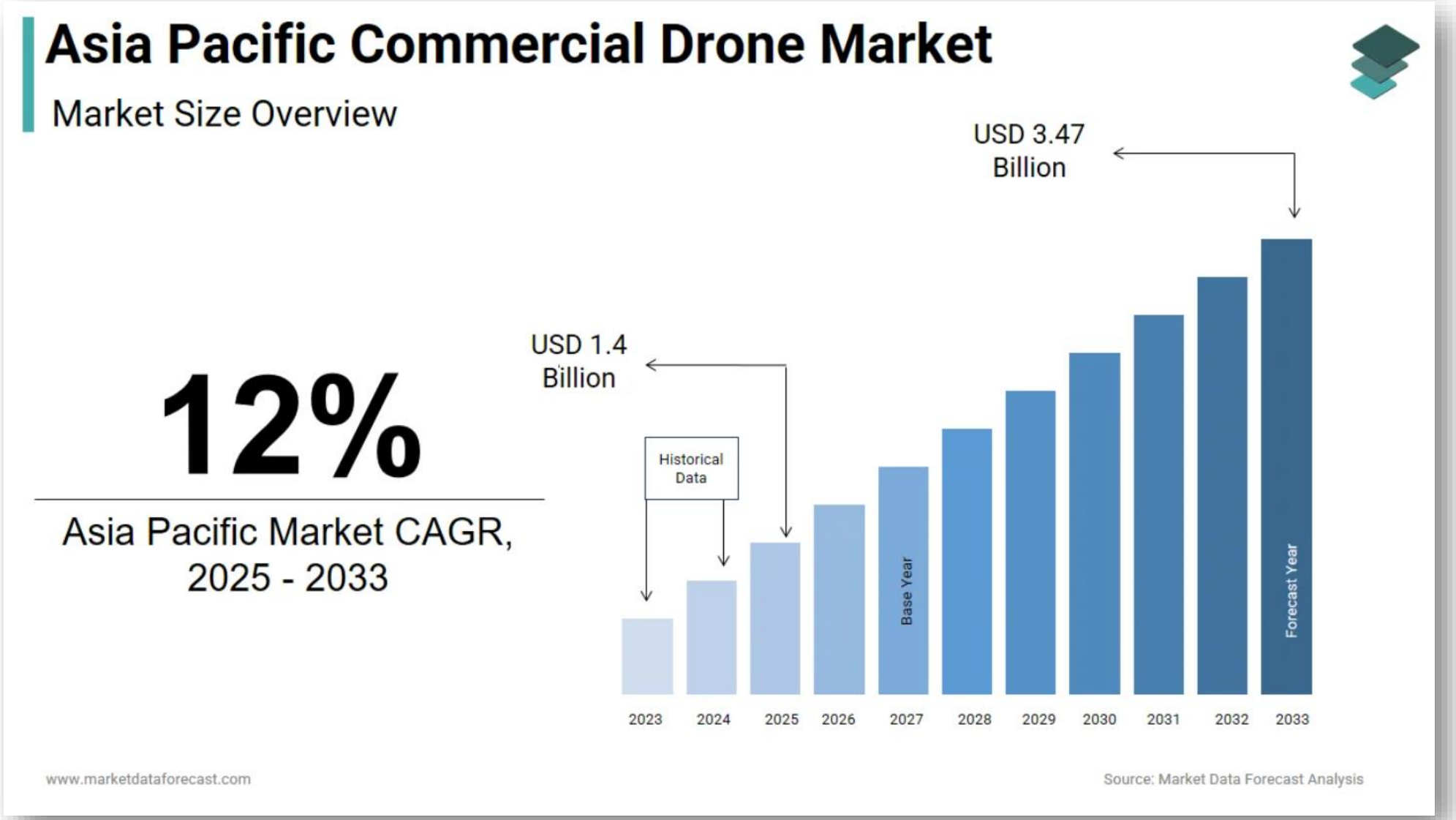
How to Regulate Innovation?

Regulate & Forget

Adapt & Learn Approaches

How to Regulate Innovation?

Challenges


Asia Pacific Commercial Drone Market
Market Size Overview
USD 3.47 Billion
USD 1.4 Billion
12%
Asia Pacific Market CAGR, 2025 - 2033
Historical Data
Base Year
Forecast Year
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
www.marketdataforecast.com
Source: Market Data Forecast Analysis

Challenges


Certified category
Specific Category
(Medium risk/regulated lower risk)
Open Category (Low risk)
A3
A2
A1
ICAO Annexes
Part 102
Part 101
Convention on International Civil Aviation
Convention relative à l'aviation civile internationale
Convenio sobre Aviación Civil Internacional
Конвенция о международной гражданской авиации
Unmanned Aircraft Systems Traffic Management (UTM) – A Common Framework with Core Principles for Global Harmonization
Edition 4
UTM Framework
Part 149
ICAO MODEL UAS REGULATIONS
• AC 101-1
• AC 102-1
• AC 102-37

Challenges


WHAT IS HAPPENING?
Certified category
Specific Category
(Medium risk/regulated lower risk)
Open Category (Low risk)
A3
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Challenges

COMMON CONSTRAINTS

Regulatory Hurdles

Varying or unclear national/international drone laws; airspace restrictions

Limited Battery/Range

Drones can’t fly far enough or carry large payloads

Data Security/Privacy

Concerns about capturing images of civilians or sensitive areas

Community Acceptance

Fear or misunderstanding of drones among local populations

Weather Dependence

Many drones can't fly safely in high winds, rain, or extreme conditions

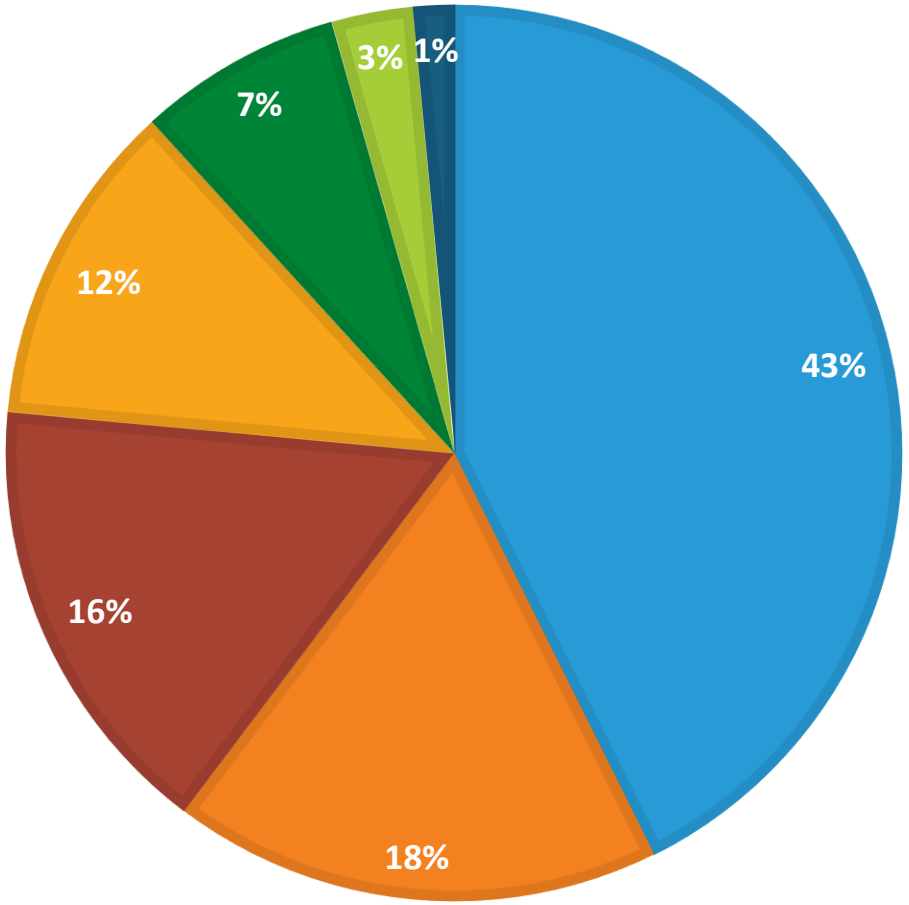
Cost and Logistics

High cost of advanced drones, plus transport and maintenance in remote areas

* Key constraints commonly mentioned in sources discussing UAS use in humanitarian contexts, identified across academic, NGO, and regulatory literature.

* Stakeholders Interactions

Challenges



* Data Collected in the Workshop on UAS for UN Missions (April, 2025)

Challenges

1. Lack of UAS Operational/Technical Training for Personnel
2. Absence of a UAS Regulatory Framework in States
3. Lack of Aeronautical Knowledge by Operators
4. Lack of Understanding by Staff/CAA of the State`s UAS Regulatory Framework
5. Lack of Knowledge related to the State`s regulatory framework (Operators perspective)
6. Absence of knowledge related to CofA, Continuity of Airworthiness or Type Certificate in States
7. Absence of Operational Agreement between States for Cross-Border Operations
8. How to establish UAS Operational, Technical or Governance Requirements for the Procurement Process
9. How to Establish a Risk Assessment for UAS Operations
10. Airspace Access Allowance Hurdles (Airspace density, ATM constraints,...)
11. Interference in C2 Link (Jamming, Spoofing, …)
12. Cybersecurity Issues
13. Absence of Agreement between States related to Certifications Recognition
14. Lack of Knowledge related to UAS Operations/Regulations in CAAs
15. Absence of a Clear Process or a slow process in Achieving Authorization for UAS Operations
16. Difficulty for Community or Local Social Acceptance Related to UAS Operations
17. Lack of Guidance Material for UAS Operations
18. UAS Operations Liability Issues

Challenges for UN Entities

(1st Workshop on UAS for UN Missions)
DL – 25 Aug

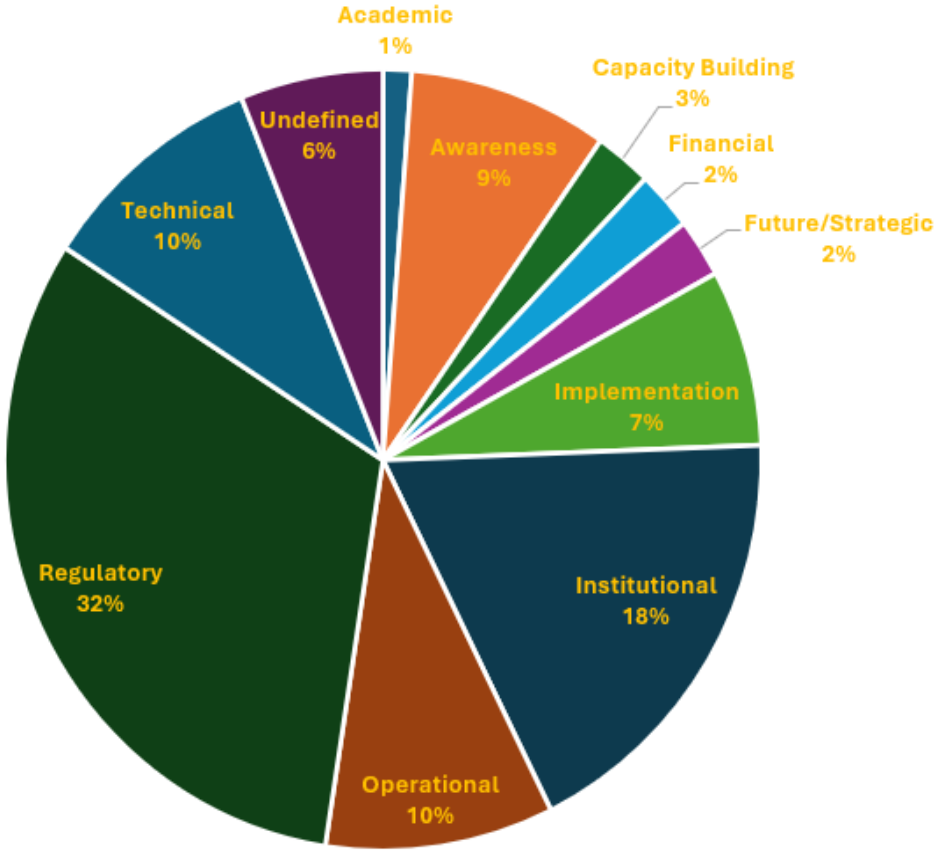
GOVERNANCE

OPERATIONAL

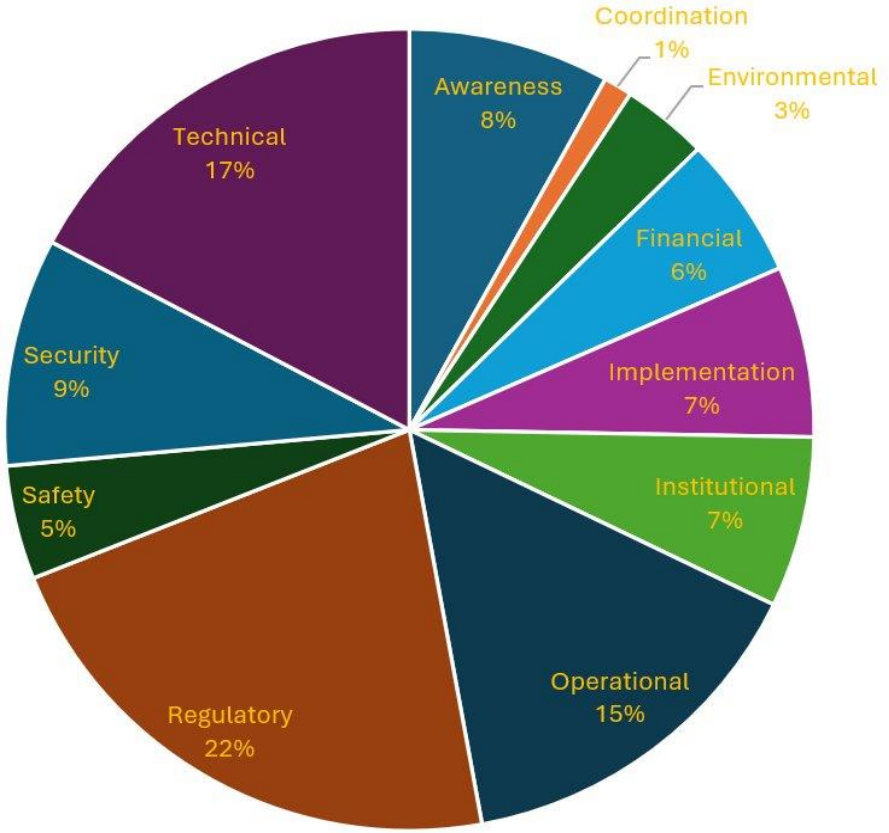
TECHNICAL

Challenges

Challenges for NACC/SAM States
(NACC/SAM Workshop on UAS/RPAS)
Based on States' Presentations



Challenges for ESAF/WACAF States
(ESAF/WACAF Workshop on UAS/RPAS)
Based on States' Presentations



Challenges

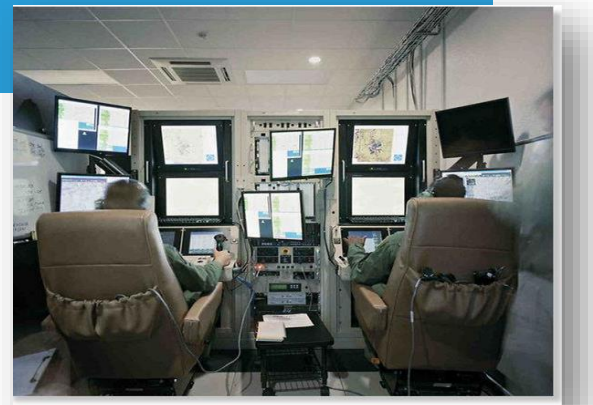
Manned vs Unmanned Concepts
HUMAN INTO THE SYSTEM

- Proprioceptive Condition (Pilot`s feeling);
- Noise, Smell, …;
- Cockpit Coordination;
- Visual Conditions (Human Eyes)
- Spatial Disorientation;
- Task Load vs Stress Level (Emergency vs Risk of Death);
- Comm Fail – Pilot On Board (No Comm);
- …

SITUATIONAL AWARENESS

Regulatory Perspective

- No Proprioceptive Condition (Pilot`s feeling);
- Limited Visual Cues (Sensors` Dependency);
- Cockpit Coordination;
- Low Level for Spatial Disorientation;
- Task Load vs Stress Level (Emergency vs Risk of Death);
- Comm Fail – Pilot Not On Board (Possible Comm);
- …



Implementation Considerations

Regulatory Approach

PRESCRIPTIVE

- ✓Prescribes in detail what must be done in order to be compliant;
- ✓Constrains operations to the technology available and procedures at the time the rule was implemented.

PERFORMANCE BASED

- ✓Specifies the desired outcome;
- ✓Specifies the risks or hazards which must be mitigated against;
- ✓Allows operator to adapt operation to more efficient models.

COMPETENCY BASED

- ✓Human performance;
- ✓Knowledge, skills, and attitude;
- ✓Conditions, performance, standards.

Implementation Considerations

PRESCRIPTIVE APPROACH

Benefits

- **Clarity & Simplicity**: Provides clear rules and checklists (e.g., specific altitude limits, equipment standards).
- **Ease of Enforcement**: Inspectors and operators know exactly what to comply with.
- **Consistency**: Uniform standards reduce ambiguity and disputes.
- **Safety Baseline**: Good for new or immature industries — sets minimum acceptable safety levels.

Drawbacks

- **Inflexibility:** Hard to adapt quickly to new technologies or unique operations.
- **Stifles Innovation**: Operators must comply with rules even if better, safer methods exist.
- **One-Size-Fits-All**: May not fit all risk levels — small drones and large BVLOS (Beyond Visual Line of Sight) operations are very different but can be constrained by the same rigid rules.

Implementation Considerations

PERFORMANCE-BASED APPROACH

Benefits

- **Flexibility:** Encourages operators to innovate and use the best technology to meet safety outcomes.
- **Adaptability**: Better suited for rapidly evolving drone tech and new use cases.
- **Risk-Based**: Can scale requirements based on operation risk instead of blanket rules.
- **Encourages Best Practices**: Operators can demonstrate compliance through advanced safety cases, rather than box-checking

Drawbacks

- **Complexity**: Requires operators to develop and prove safety cases, which demands expertise and resources.
- **Enforcement Challenges**: Regulators must have skilled staff to assess compliance with broad performance goals.
- **Uneven Application**: May favor large companies that can afford robust compliance demonstrations, leaving small operators behind.
- **Potential for Loopholes**: Vague standards can lead to exploitation if oversight is weak.

Implementation Considerations

COMPETENCY-BASED APPROACH

Benefits

- **Focus on Skills & Outcomes**: Ensures drone pilots/operators can demonstrate required knowledge, skills, and decision-making ability — not just hold a paper license.
- **Better Safety Culture**: Encourages continuous training and real-world skill checks, not rote box-ticking.
- **Flexibility**: Adapts to varying levels of operation complexity (e.g., hobbyist vs. commercial BVLOS pilot).
- **Supports Innovation**: Operators can adopt new tech if they prove staff are competent to handle it safely.

Drawbacks

- **Training & Assessment Burden**: Requires robust training organizations and skilled assessors to verify competency.
- **Possible Inconsistency**: Different training providers may vary in rigor if oversight is weak.
- **Resource Intensive**: Small operators may struggle to maintain competency programs, especially for specialized operations.
- **Regulator Oversight**: Authorities need to monitor both training orgs and individual competencies over time.

Implementation Considerations

OPERATION-CENTRIC

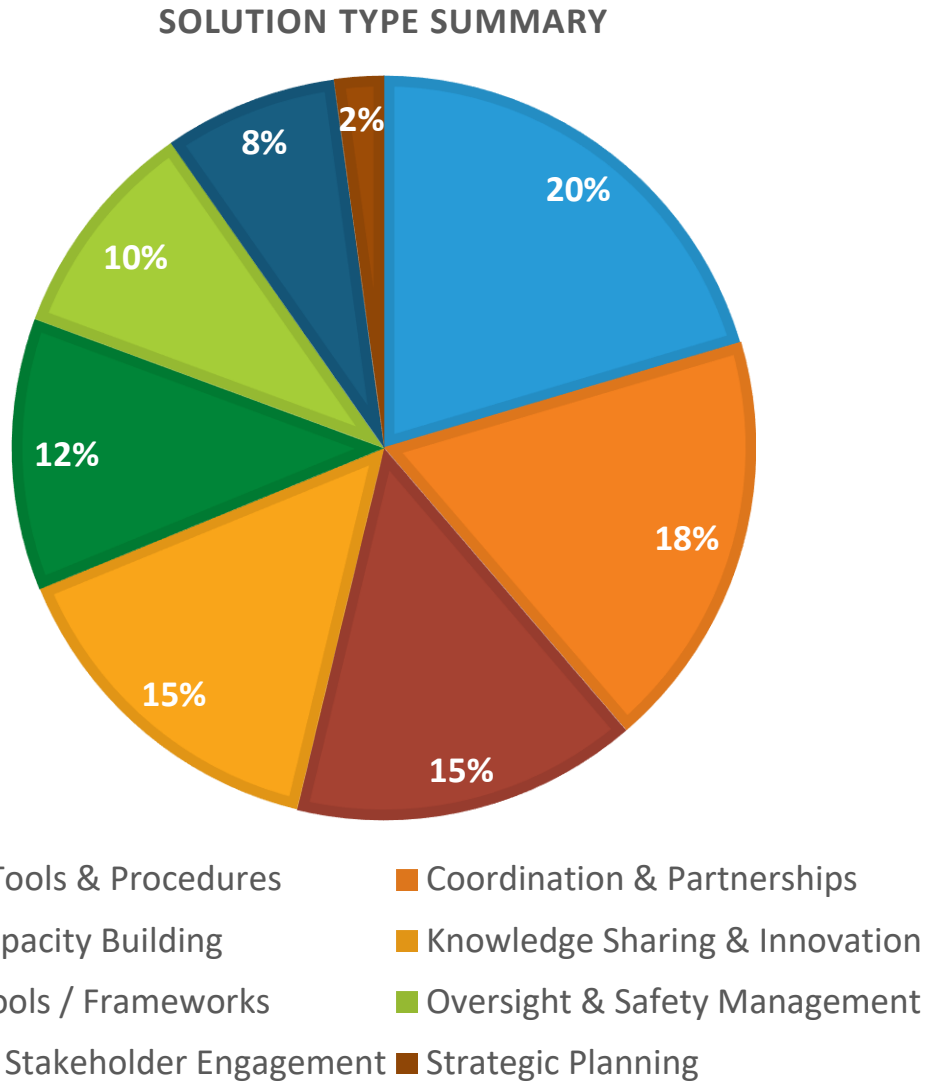
"An evaluative approach focused on the entirety of an activity".

+

RISK-BASED

"A proactive approach involving safety risk management principles to reduce and control risks to a tolerable level."

Implementation Considerations



* Data Collected in the Workshop on UAS for UN Missions (April, 2025)

Implementation Considerations

Understanding the relation between regulation & innovation.

Assess the market demands & operational needs (contact people).

Assess regulatory relationships & regulatory impact (Sandbox, Enabling Clause,…).

Leverage the use of technology to reach out the users (Digital Platforms).

Promote Regulatory Knowledge (Training, Workshops, Seminars,..).

Seek for International Harmonization.

ICAO


*“By **embracing innovation and working together,** we can create a **new era in aviation** that is inclusive of a broad range of users and operations. To achieve this vision, **high levels of global cooperation** should be enabled by strategic planning while remaining adaptable to changes”.*

Call to Action AAM 2024

Thank You

ICAO 80