



ICAO

3rd Civil Aviation Legal Advisers Forum
26th November 2024

AI in Aviation

Legal Frameworks for an Autonomous Future

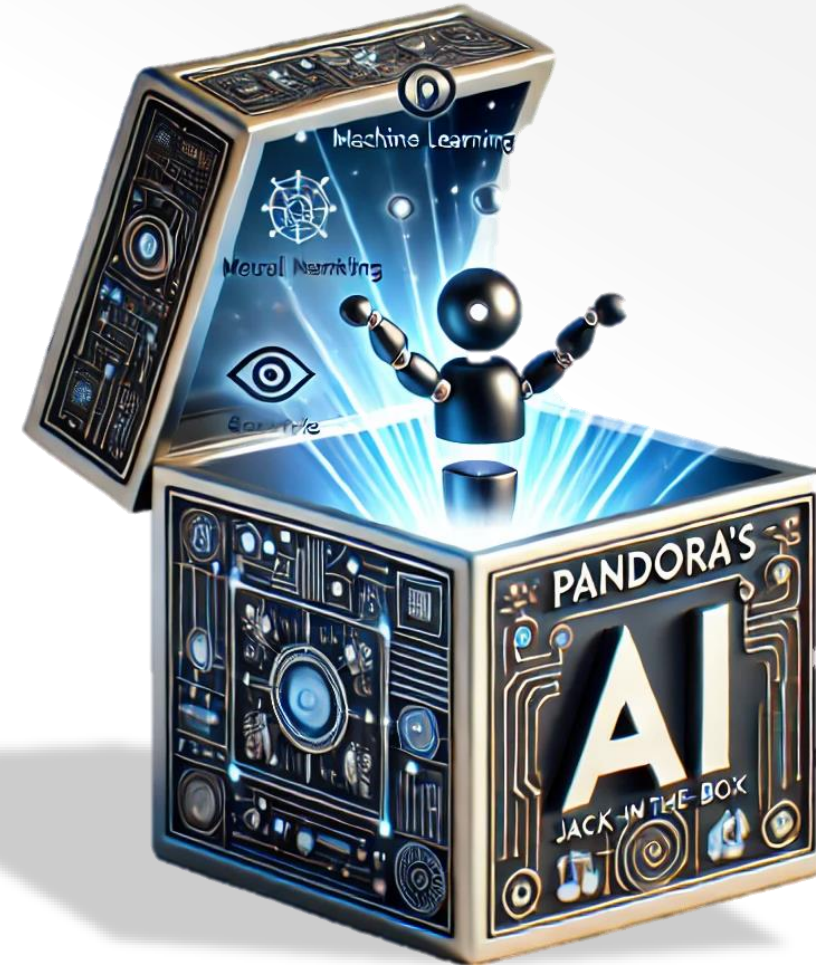
AI in aviation... Where won't it be used?



Pandora's AI Jack-in-the-Box: An Age for Agility?

Our Reality

- Traditional regulation can't contain AI development
- We can't predict where it will spring up next
- We must move forward with pace, agility... and caution

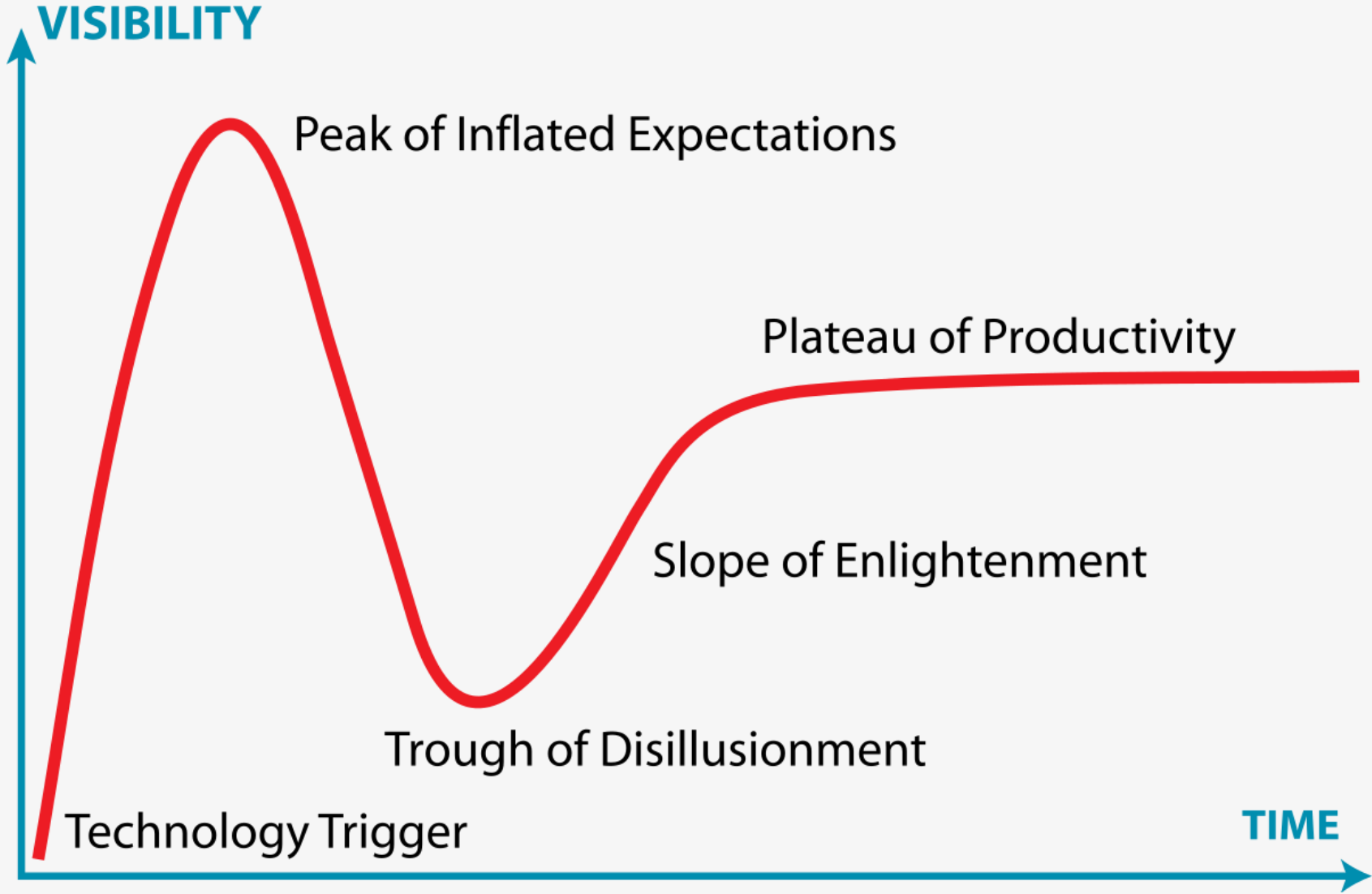




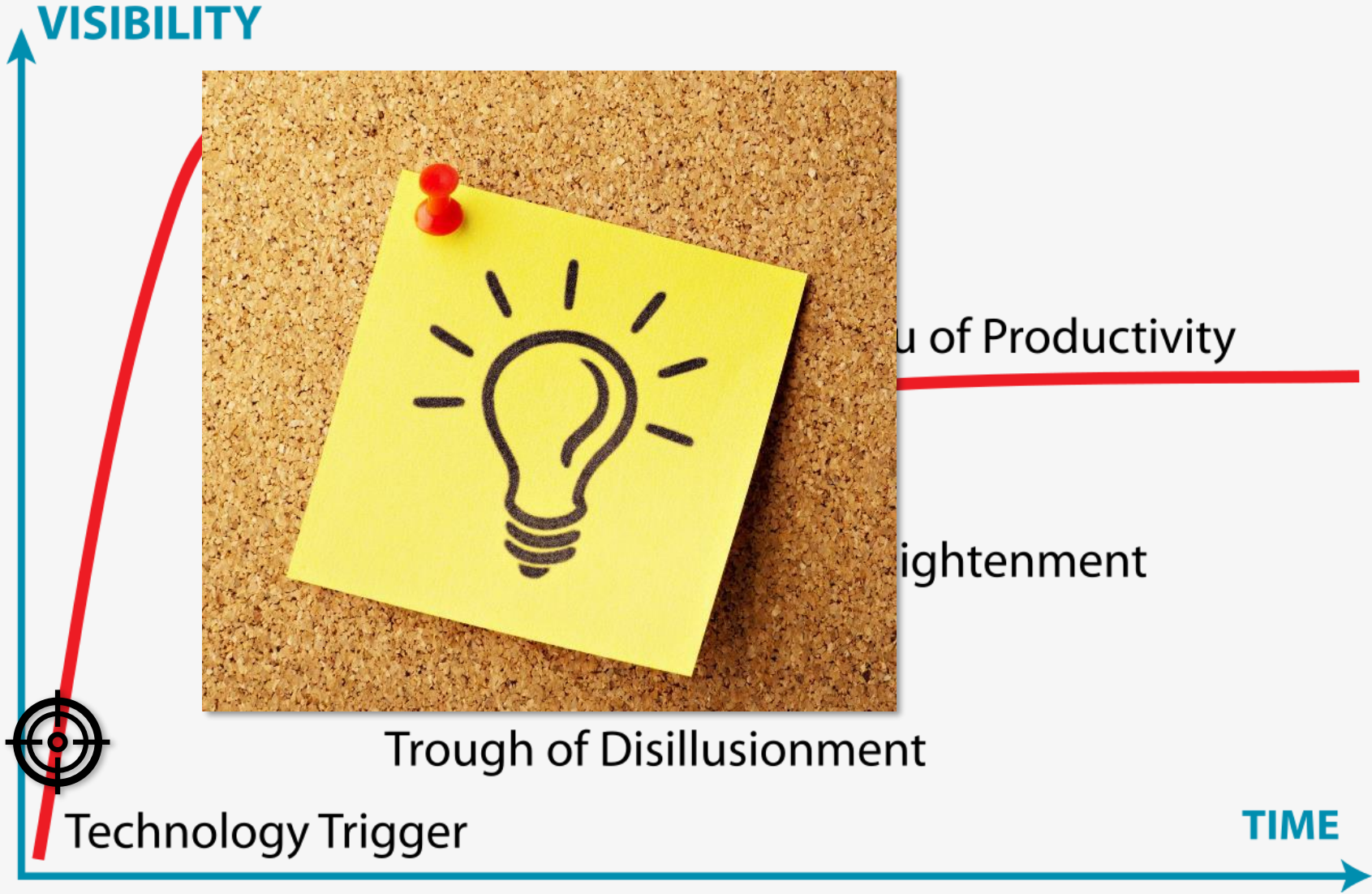
James Bell MEng CEng MIET
Innovation Strategy Lead
UK Civil Aviation Authority



Gartner Hype Curve



Gartner Hype Curve



Gartner Hype Curve

VISIBILITY



Peak of Inflated Expectations

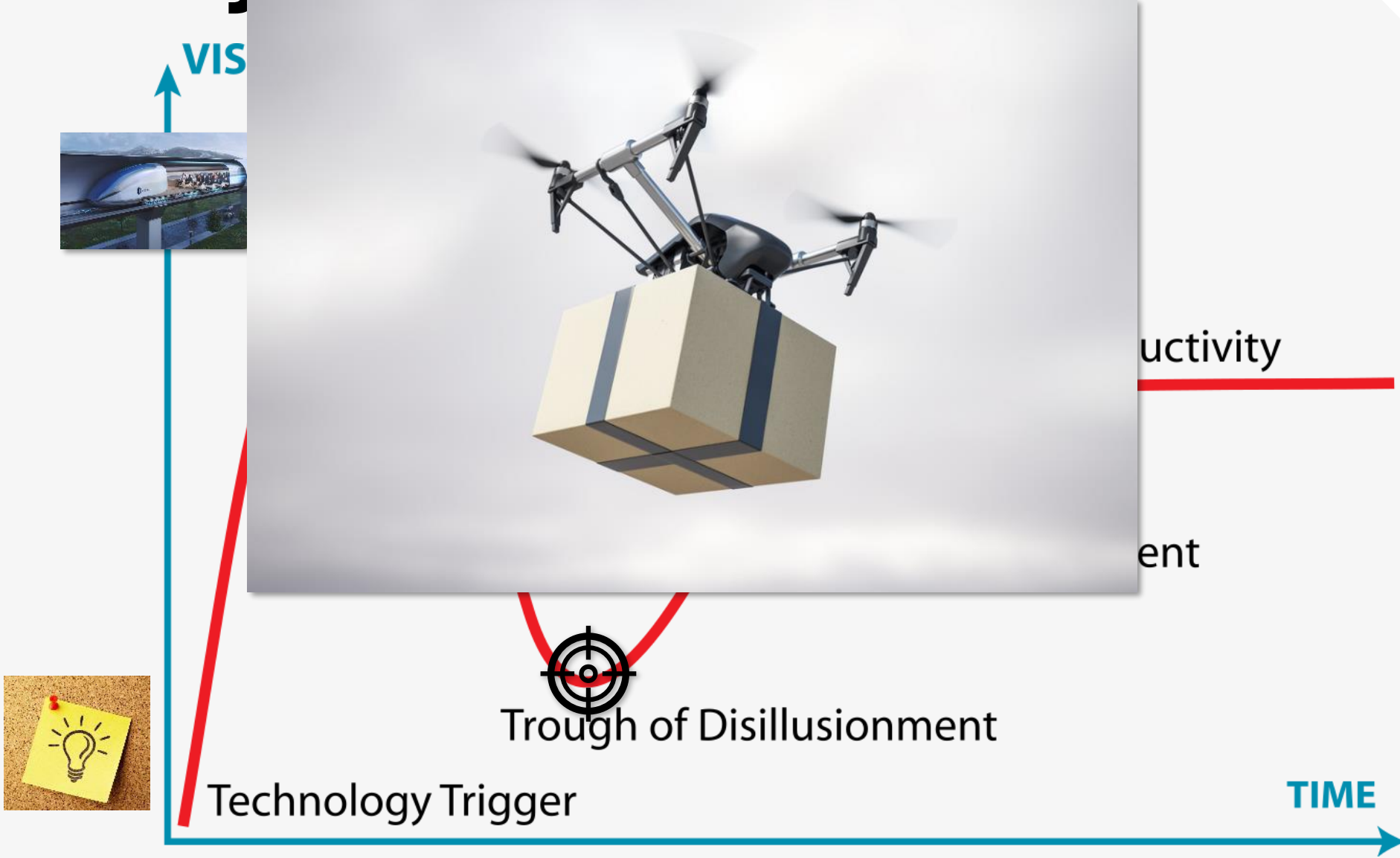


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TIME



Gartner Hype Curve



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Plateau of Productivity



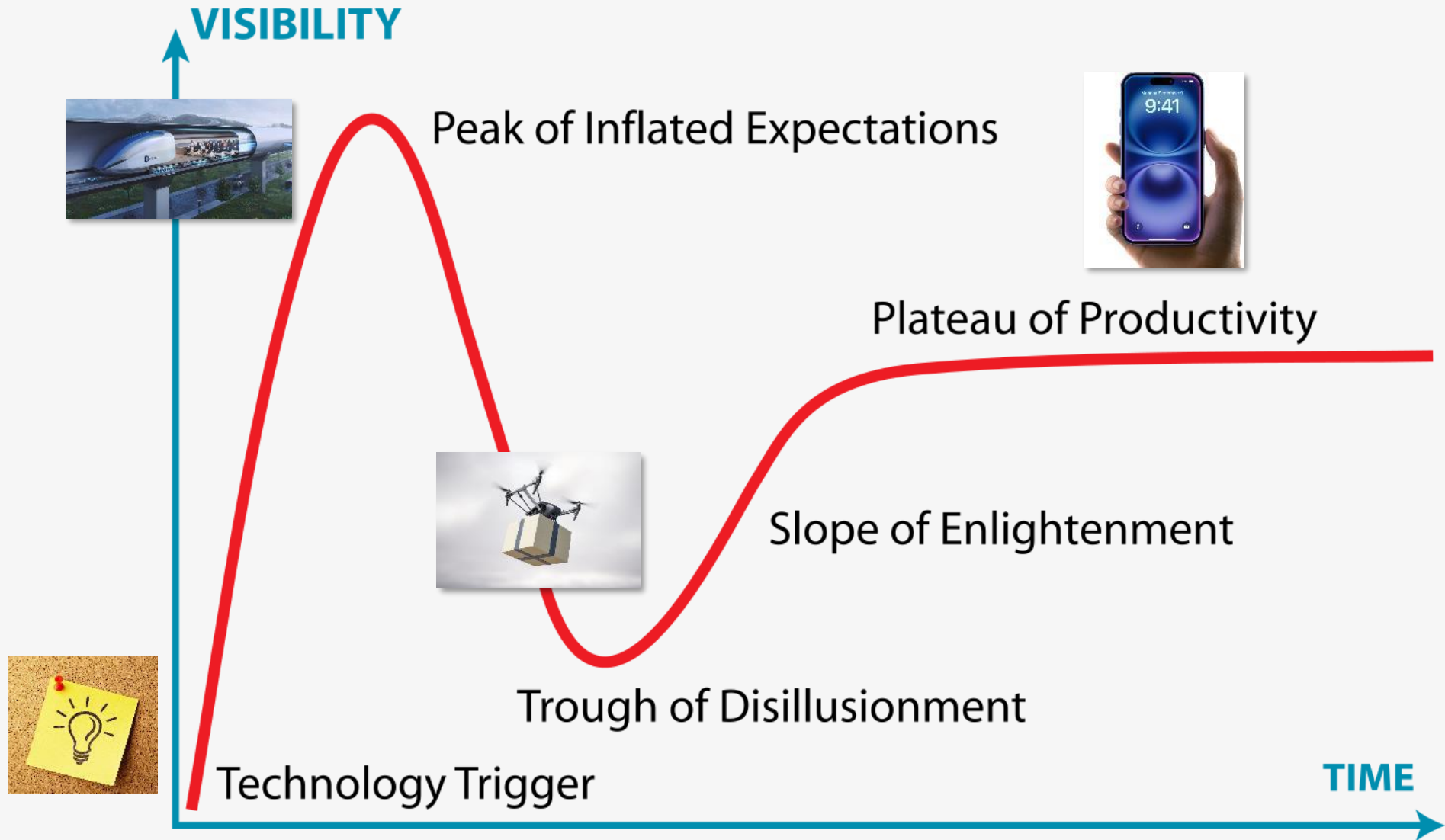
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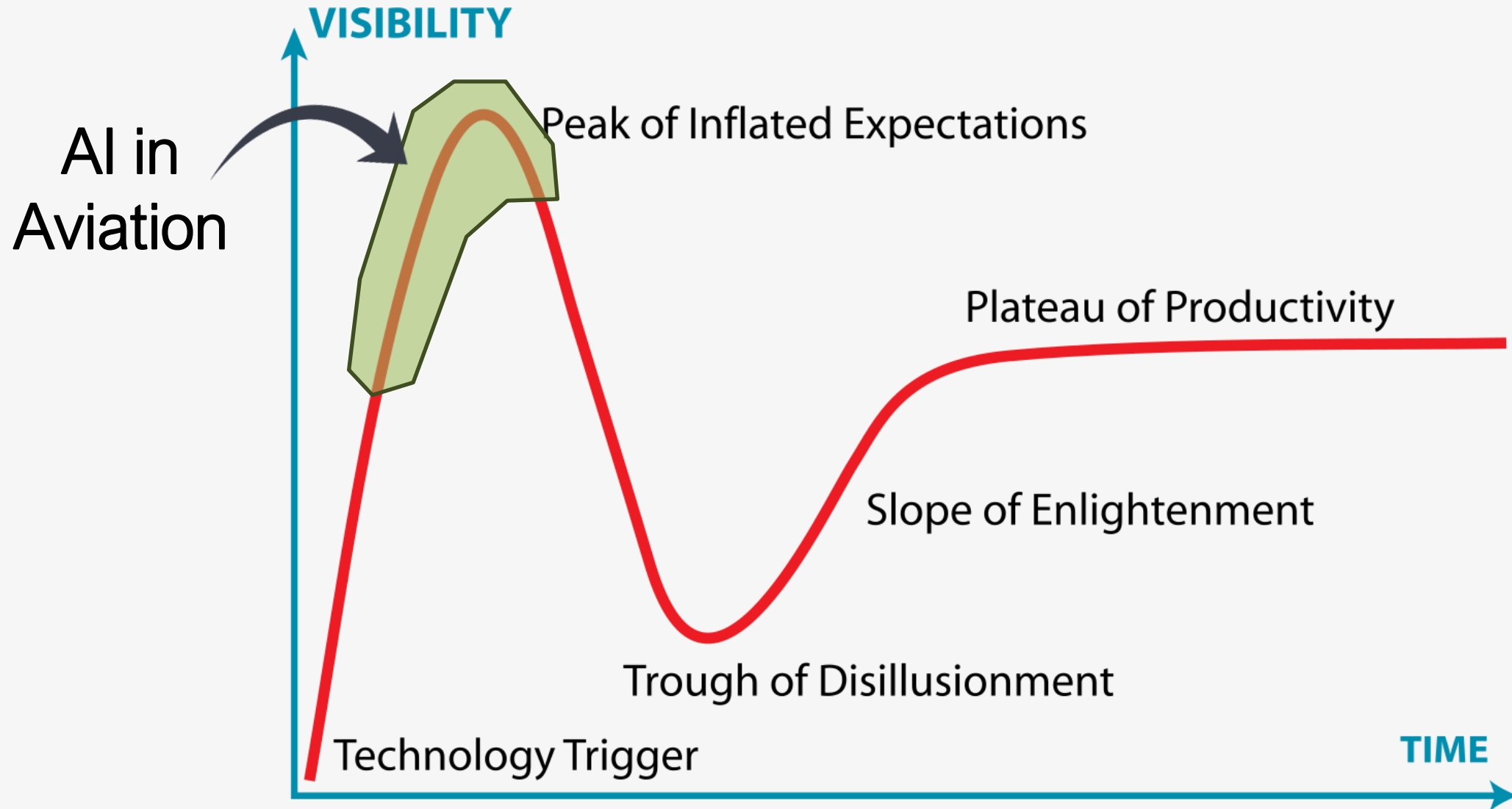
TIME



Gartner Hype Curve



Gartner Hype Curve



Autonomous Traffic Management System

Who bears the liability?

Which jurisdiction's laws apply?

How do we evidence the system's decision?

How do we maintain trust in this new world?

Who bears the liability?

Which jurisdiction's laws apply?

How do we evidence the system's decision?

How do we maintain trust in this new world?



What is **trust**, in the context of AI?



Transparency

Code developed through
machine learning

What is **trust**, in the context of AI?



Transparency

Code developed through
machine learning



Explainability

Can we explain ML-
designed code?

What is **trust**, in the context of AI?



Transparency

Code developed through
machine learning

+



Explainability

Can we explain ML-
designed code?

...



Context

The public highway?
A distribution warehouse?
A nuclear energy facility?

The 5 AI Principles for building trust in AI

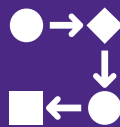
Safety, security, and robustness

No harm to people, things, or environment.



Fairness & bias

No unfair treatment based on who you are, and free from bias.



Accountability and governance

Someone responsible for AI's actions.



Transparency and explainability

Understand how AI works and why it decides.



Contestability and redress

Challenge unfair AI decisions and get help if harmed in some way.



AI Principles: Applied to an AI-Automated ATM

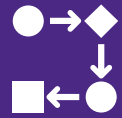


Safety & Robustness

Prioritise safe separation over traffic throughput

Reliably identify airspace infringements

Robust to uncertainties in the data



Transparency & Explainability

Operator documentation on application of AI

Where, when, how?

Explainable functions

All actions recorded



Fairness and Equity

Compliance with relevant regulations

Operation in accordance with UK Rules of the Air

Avoids unfair monopolisation of airspace



Accountability & Governance

Clear roles and responsibilities

Documented in Safety Management System

Clear accountability for all actions



Contestability & Redress

Clear and accessible route for raising concerns or disputes

Disputes are prioritised over non-safety activity

BUILDING TRUST

Building trust in aviation AI

- ✓ Introducing 5 AI Principles as the basis for building trust
- ✓ Describes how generic principles could be **applied**
- ✓ Outlines our **next steps**



UK CAA Innovation
AI Strategy

Accountability & Governance

DESCRIPTION OF THE PRINCIPLE

Organisations should ensure the proper functioning of the AI system throughout its lifecycle and that it is created, operated, and maintained in accordance with applicable regulatory frameworks. This should be clearly demonstrated through their actions and decision-making process.

CAA NOTES

Where "safety" is focused on the system, "accountability and governance" are aimed at the organisations involved. As such, there are organisational factors that affect the "proper functioning of the AI system" – roles, procedures, oversight, committees, and many more.

In aviation, the "operator" is a term defined in law and determines the legal responsibilities of an individual or organisation with regards to governance, safety reporting, training, and much more. Similar terms are defined for other stakeholders in the system. The application of an AI system into any of these roles should not predispose the application of existing legal responsibilities.

ILLUSTRATIVE APPLICATIONS OF THIS PRINCIPLE

1 | Detect & Avoid for RPAS


Depending on the system's assigned level of autonomy, accountability and responsibility are clearly established to provide clarity in the case of a collision or loss of separation.

The system manufacturer and RPAS operator have robust maintenance routines in place that ensure the software is updated regularly. They have procedures in place for issue identification and notification.

2 | Automated ATM

The ANSP's safety management by thorough procedures for routine in-flight operations, identification, and route issues, supported by clear organisational governance and procedures.

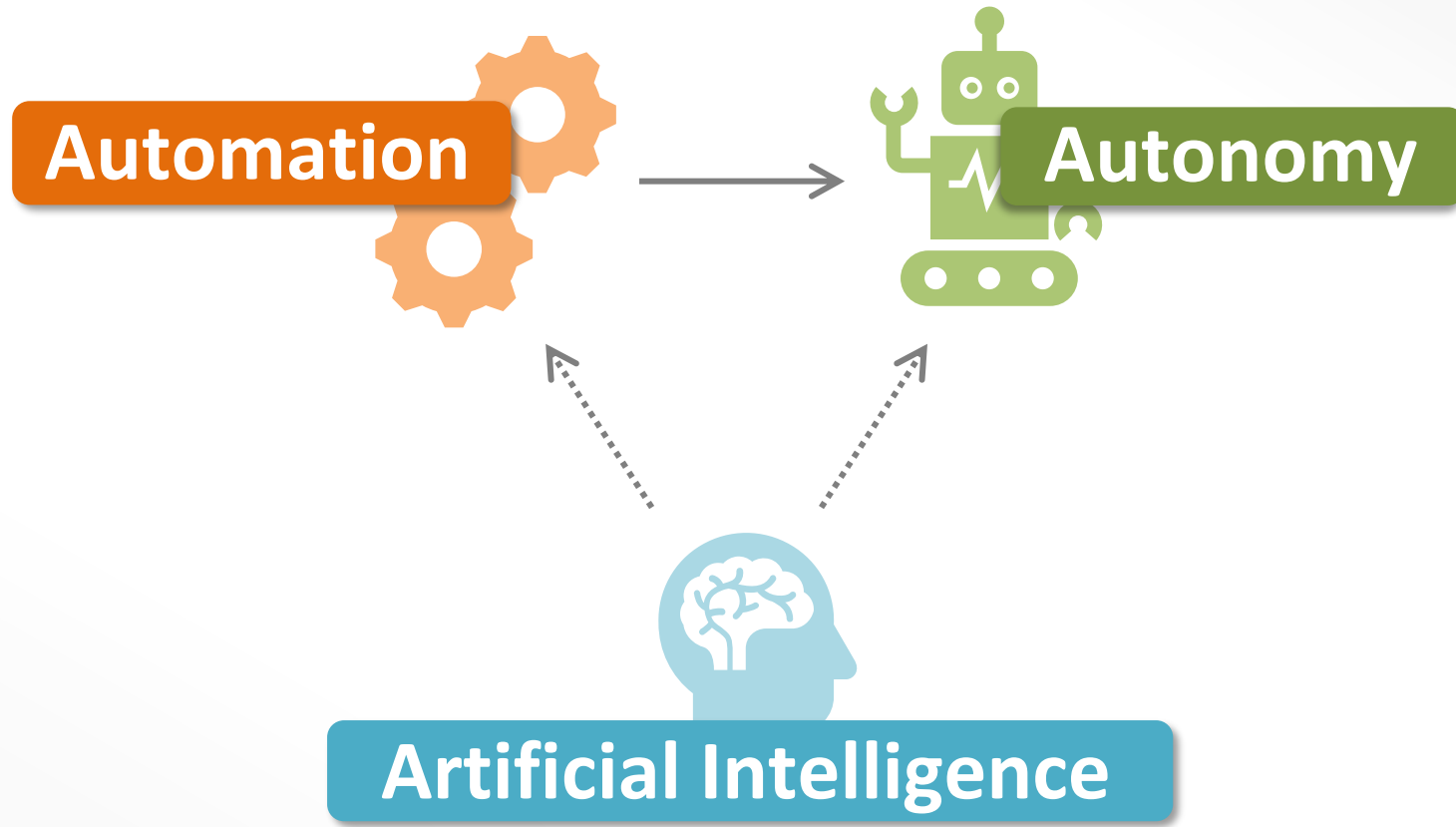
Depending on the system's assigned autonomy, and at every operating in-flight system, clear procedures exist to assign accountability in the case of a human incident to either the ATM system or human ATM operator using the best flight crew of the aircraft.



CAA's Strategy for AI
Building Trust in AI
5 Principles for AI and Autonomy

CAP25/0
February 2024

Using a common language



Using a common language

- ✓ Clear, straightforward language
- ✓ Alignment with **international standards** while focusing on aviation regulatory needs
- ✓ Supporting a **risk-based approach** to AI oversight



UK CAA Innovation
AI Strategy

The Foundations

To be able to create a level playing field for those critical first regulatory discussions, we have stripped back the core language to understand the fundamental concepts and the relationships between them.

These three terms are foundational to our understanding and appreciation of this topic. They are distinct, yet value also comes from knowing how they relate to each other.

These terms are often used interchangeably or according to different definitions to those described here. For example, some describe the three terms as distinct points on a scale of system complexity with automation as the simplest form, progressing to autonomy, and with artificial intelligence as the highest end of a scale. This is not how the



CAA's Strategy for AI
Speaking a Common Language
A terminology framework for AI
CAP2026
January 2024



Automation

The application of technology to perform tasks and operations in a way that reduces the need for human intervention.

... can be used to increase the autonomy of a system, with or without AI.

Autonomy

A characteristic of a system. It is represented by a scale that describes the level of human oversight and control of a system.

... can be achieved with or without AI.

Artificial Intelligence

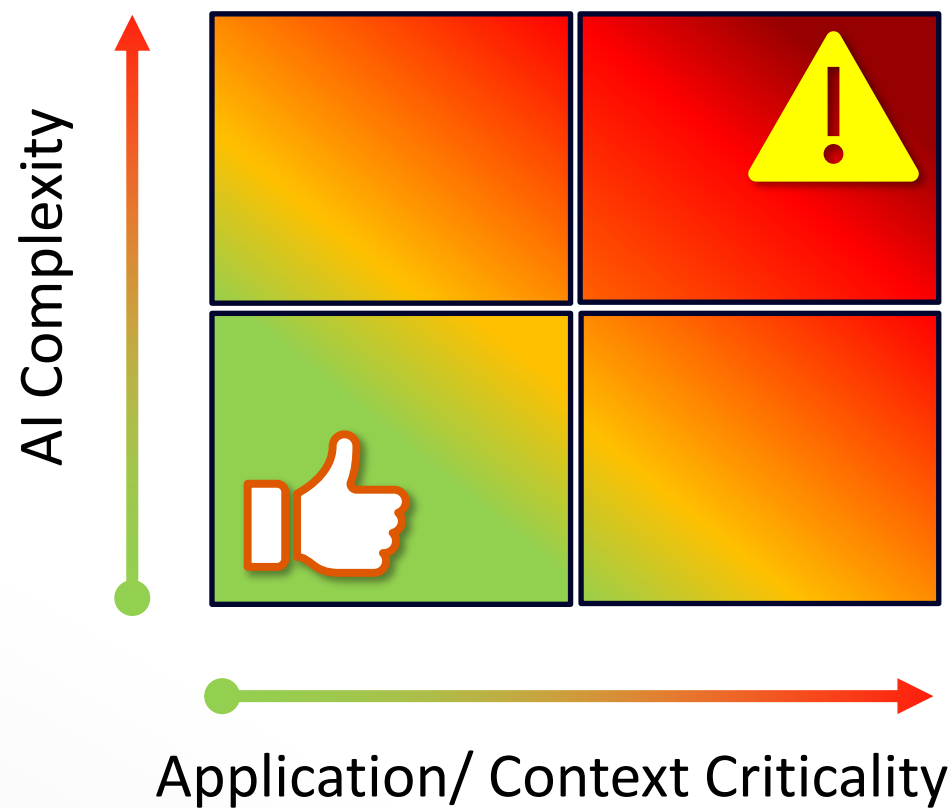
The development of computer systems that can perform tasks which typically require human intelligence.

... used to automate a task, to enable a level of autonomy

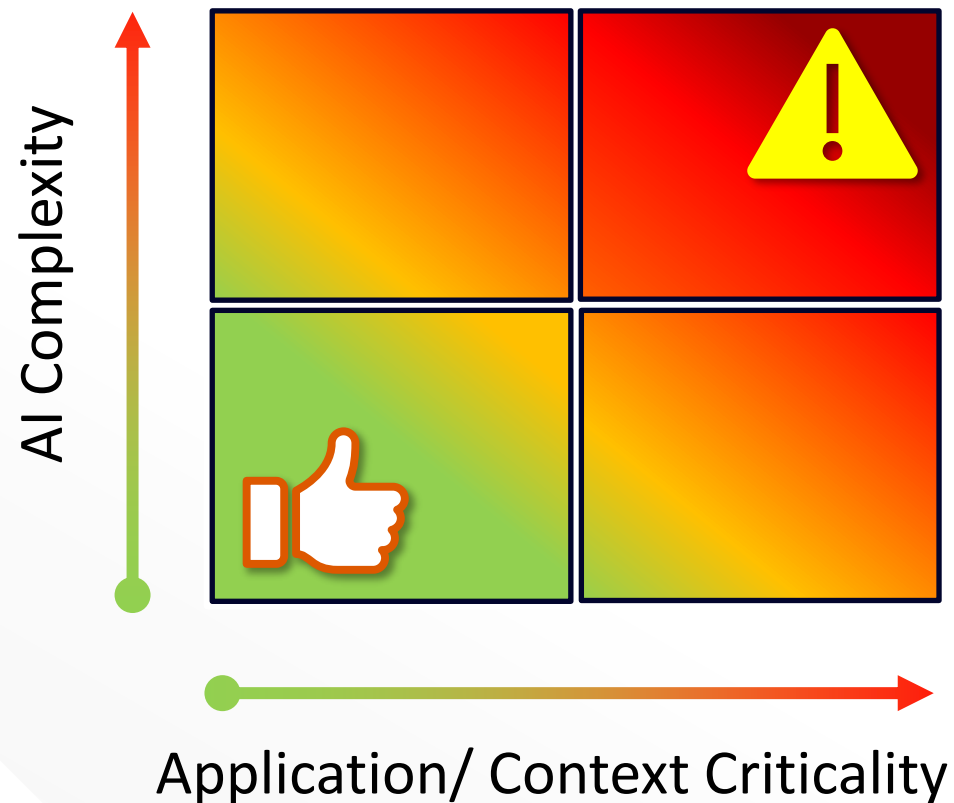
5

Using a Common Language

- But what really matters?



Using a Common Language - But what really matters?



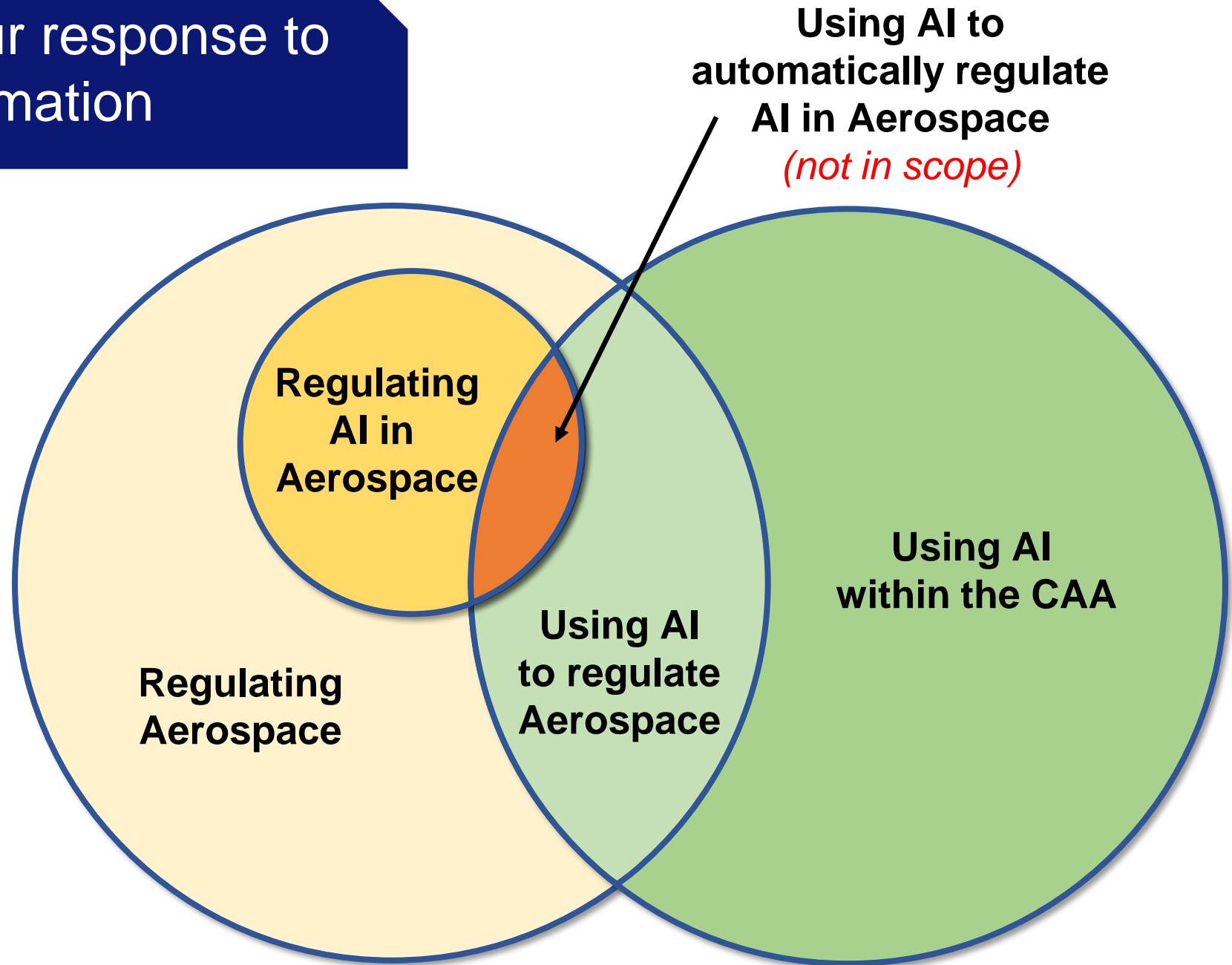
Example Factors

- Safety criticality
- Domain of operation
- Voluntary or non-voluntary
subjection
- Risk of externalities
- Degree of human oversight

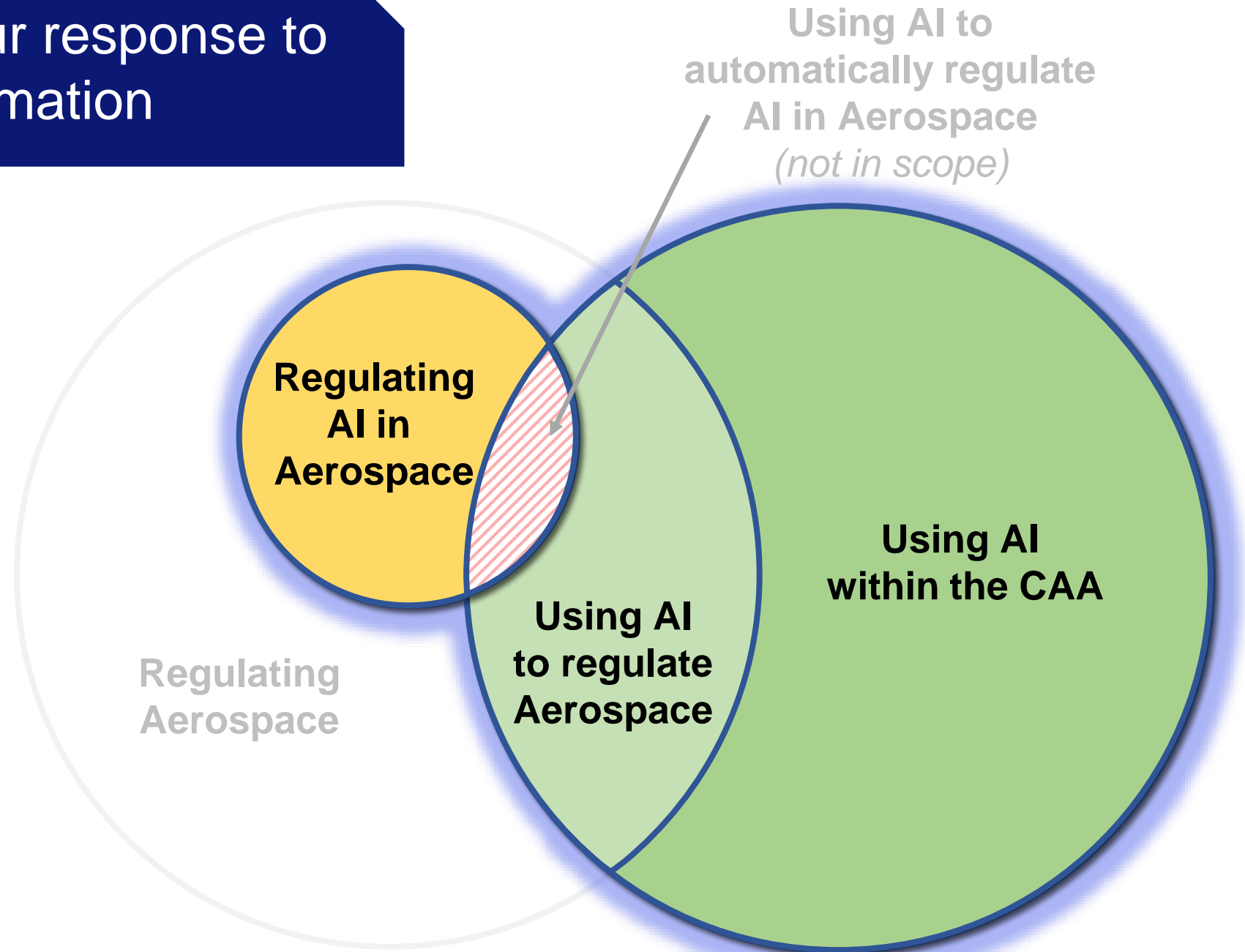


UK Civil Aviation Authority
**The CAA's Response to
AI-Enabled Automation**

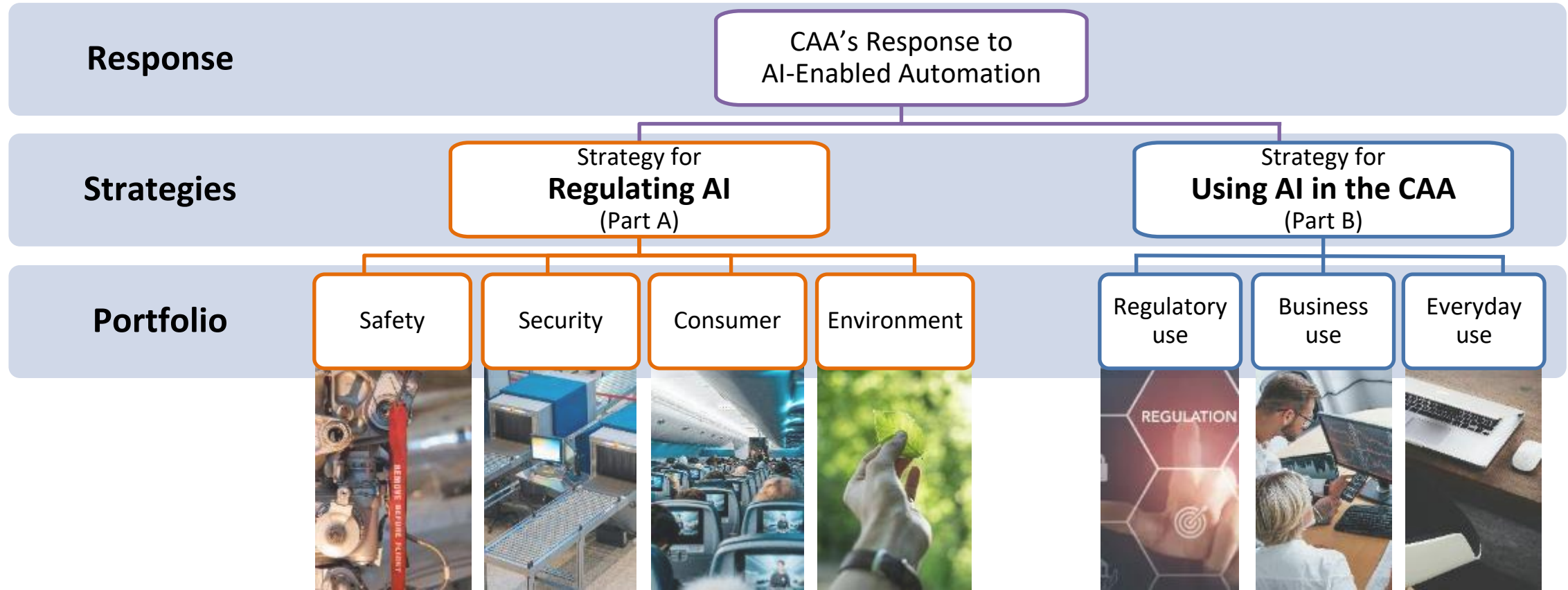
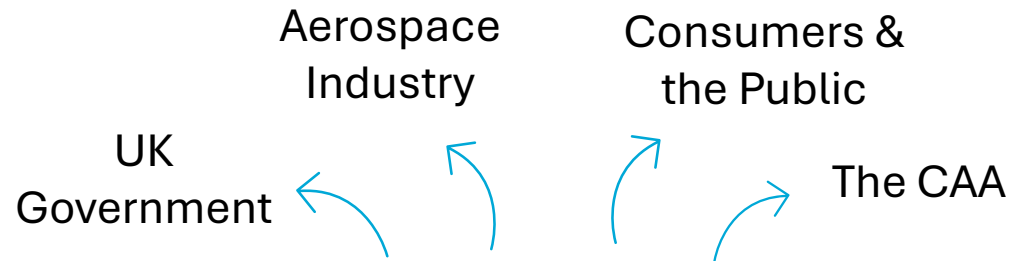
The scope of our response to AI-enabled automation



The scope of our response to AI-enabled automation



Creating an AI Portfolio



Legal Framework for Aviation Autonomy



**Law
Commission**
Reforming the law



A review of the law around **autonomous flight**, to support the safe development of rapidly advancing technology



Legal Framework for Aviation Autonomy



**Law
Commission**
Reforming the law



A review of the law around **autonomous flight**, to support the safe development of rapidly advancing technology



Rules of the Air

Rely on human judgement and interpretation.
How can autonomous systems be accommodated?

Liability Frameworks

As the human's role shifts from pilot, to remote operator, to overseer.
Where is responsibility attributed when things go wrong?



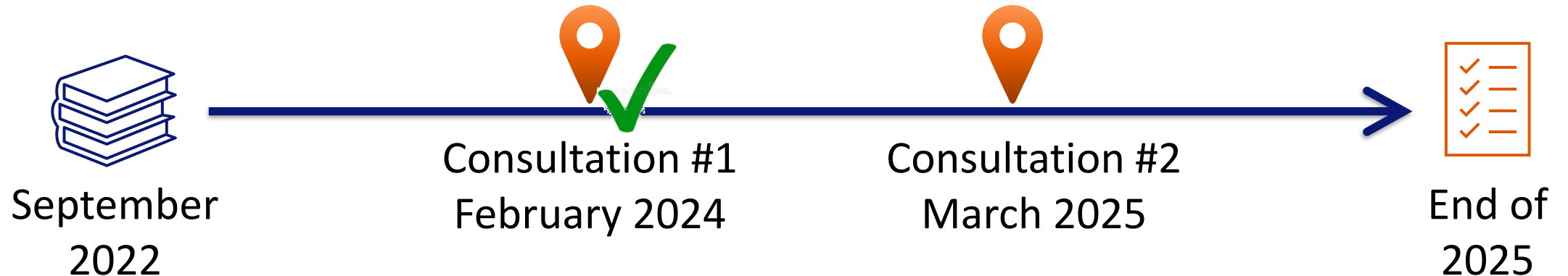
Legal Framework for Aviation Autonomy



**Law
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A review of the law around **autonomous flight**, to support the safe development of rapidly advancing technology





**CREATING
CONTENT**



**ANALYSING
DATA**

Using AI within the CAA



**MODELLING
THE FUTURE**



**MANAGING
KNOWLEDGE**



**CREATING
CONTENT**



**ANALYSING
DATA**

Using AI within the CAA



**MODELLING
THE FUTURE**



**MAKING
DECISIONS**



**MANAGING
KNOWLEDGE**

**CREATING
CONTENT**

**ANALYSING
DATA**

Improving Communication & Engagement

AI tools provide new ways to **inspire people** and communicate important messages.

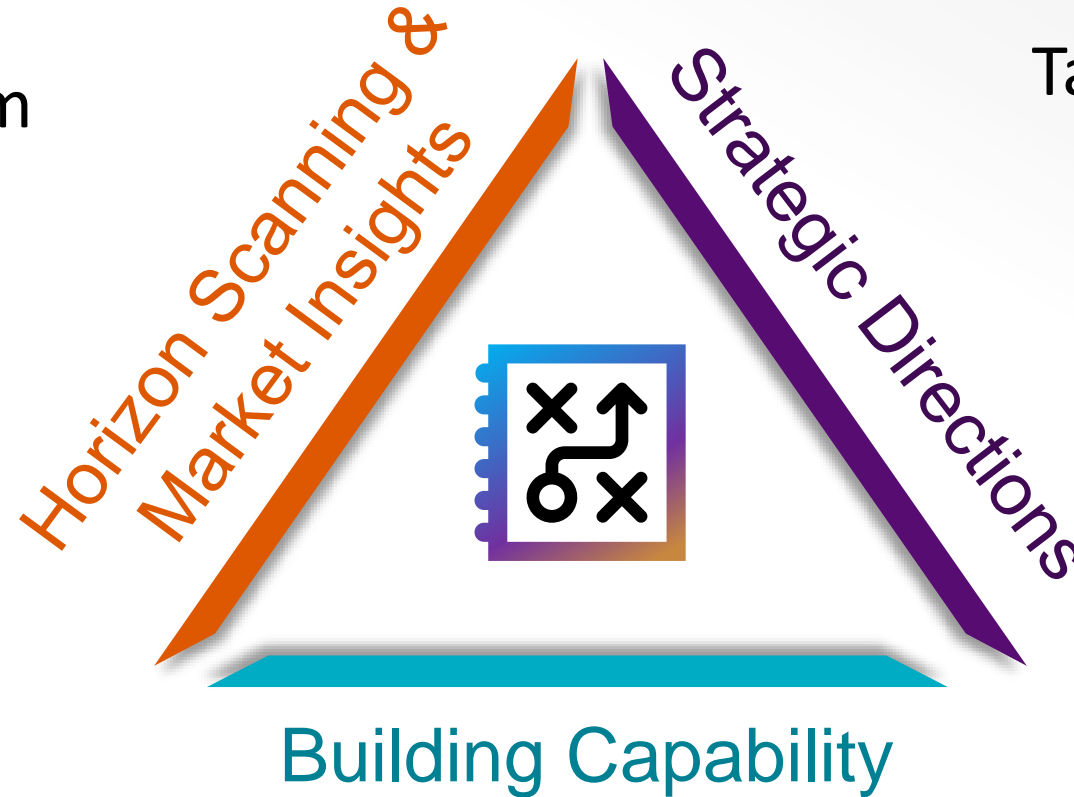


**MODELING
THE FUTURE**

DECISIONS

**MANAGING
KNOWLEDGE**

Evidence to inform
and influence the
strategy



Targeted action
prioritised by
market &
strategy

**Implementation in
2025/26 across 3 areas**

Ensuring the UK CAA has
the right skills and
resources needed



ICAO

Aviation
Authorities

**Collaboration
is critical**

Industry

The public

Research
Institutions

Government

Consumers



Credit: DALL-E Generative AI image



Launching the UK CAA's
Response to AI-Enabled Automation
28th November 2024

Credit: DALL-E Generative AI image



Thank you for listening – let's talk...

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