



CAA's Strategy for AI

Speaking a Common Language

A terminology framework for AI

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The CAA's Strategy for AI



Introducing the CAA's Strategy for Artificial Intelligence (AI). With a dual focus on enabling the deployment of AI within the aviation sector and utilising it as a regulatory tool, this initiative aims to elevate safety measures, enhance operational efficiency, and foster innovation.

The aviation industry continues to embrace the transformative power of AI. It already enhances safety and efficiency through predictive maintenance, aiding air traffic management, and refining pilot training with advanced insights and simulations. But the future of AI will usher in a new era in aviation.

But what does it mean for the CAA? How will it affect the way we work, and what we regulate? These are the questions the CAA's Innovation Hub hopes to tackle with a new **CAA Strategy for AI, to be published in Summer 2024**.

This document is the first of 3 tools to support the strategy.

1. **Addressing the terminology of AI** is important to create common language so that we can have a level and transparent conversation with innovators.
2. **Providing a set of principles** that will help to steer how we regulate AI while enabling AI innovation to flourish.
3. **Horizon scanning** the future of AI, to keep us abreast of the technological developments

Artificial Intelligence and increasing degrees of autonomy have the potential to impact every part of the sector and across the CAA itself. These effects can be described in 3 broad categories for the CAA.



What we regulate

We are already seeing applications of AI in some of the proposals that reach our Innovation Advisory Services team in the CAA, and even within applications received by our regulatory approval teams.



How we regulate

The power of AI to rapidly process and analyse large volumes of data presents us with an opportunity we should not ignore. We are just scratching the surface of the potential to improve how we carry out our regulatory duties.



How we operate

As with any other organisation, the power that AI brings to help colleagues on a day-to-day basis is transformative. Whether it's helping to draft a new CAA publication, create a financial report, or produce meeting notes, AI tools will soon become a natural and essential part of our working lives.

The CAA's forthcoming strategy will explore the use and regulation of modern **AI** and high degrees of **autonomy**.

“

**If you can't explain it simply,
you don't understand it
well enough**

Albert Einstein



Speaking in a Common Language

What's the issue with AI terminology, and why is it necessary to discuss language?

The term “artificial intelligence” was coined in the 1950s. Technology has developed exponentially since, and so the context associated with the term has also moved on significantly.

Terms relating to AI are often conflated or confused, especially in the media. After all, it is more exciting to talk about a “fully autonomous” aircraft, rather than describing the perhaps less-exotic reality where human oversight and control may be necessary to maintain the required level of safety and public acceptance.

To be a competent regulator in this subject, the CAA must be able to see past the headlines which are often tailored for investors or public sensation.

Transparency and early engagement on the technical details of an aviation system are critical to allow us to establish whether something is safe and secure in its design and operation.



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.

There are three central terms that are foundational to our understanding and appreciation of this topic:

- Automation
- Autonomy
- Artificial Intelligence

The 3 terms above 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 intends to use the terms.

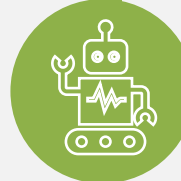
It is important to recognise that AI, automation, and autonomy are all independent of the **complexity** of the task or function that is being automated. For example, even a very simple task can be automated so that the system performing the task is fully autonomous, with no human oversight or control. They are also independent of **risk**. The degree of human intervention, control, or authority over a task does not correlate to the level of risk of the task or function itself. It may however result in new risks that need to be considered.



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



A Scale for Automation & Autonomy



It aids discussions and understanding to define some prescribed levels on a scale between complete human control and full computer control.

The scale below describes an inversely proportionate relationship between human control and computer control of a task.

By increasing the automation of the task, the degree of human oversight and control decreases, and so the autonomy of the system increases.

This was developed by the Joint Authorities for Rulemaking on Unmanned Systems ([JARUS](#)), a collaboration between global regulators who generate concept rulemaking frameworks.

While JARUS' primary focus is for remotely piloted aircraft systems, the scale provides a set of generic descriptions which can be applied to any system, aviation or otherwise. At this early stage, keeping it open in this way enables CAA teams to tailor the definitions to their own area of interest, while providing the same for flexibility for innovators.

The JARUS paper that describes this scale in detail can be read [here](#).



LEVEL 0

MANUAL OPERATION

Human is fully responsible

SYSTEM
AUTONOMY

LEVEL 1

ASSISTED OPERATION

Machine operates in out-of-the-loop supporting role

+

LEVEL 2

TASK REDUCTION

Machine operates in-the-loop, reducing human workload

++

LEVEL 3

SUPERVISED AUTOMATION

Machine executes functions under human supervision

+++

LEVEL 4

MANAGE BY EXCEPTION

Machine executes functions, alerts human to issues



LEVEL 5

FULL AUTOMATION

Machine fully responsible for functions. Human cannot intervene.

This scale is **independent of AI**, where task automation can be achieved using other methods.

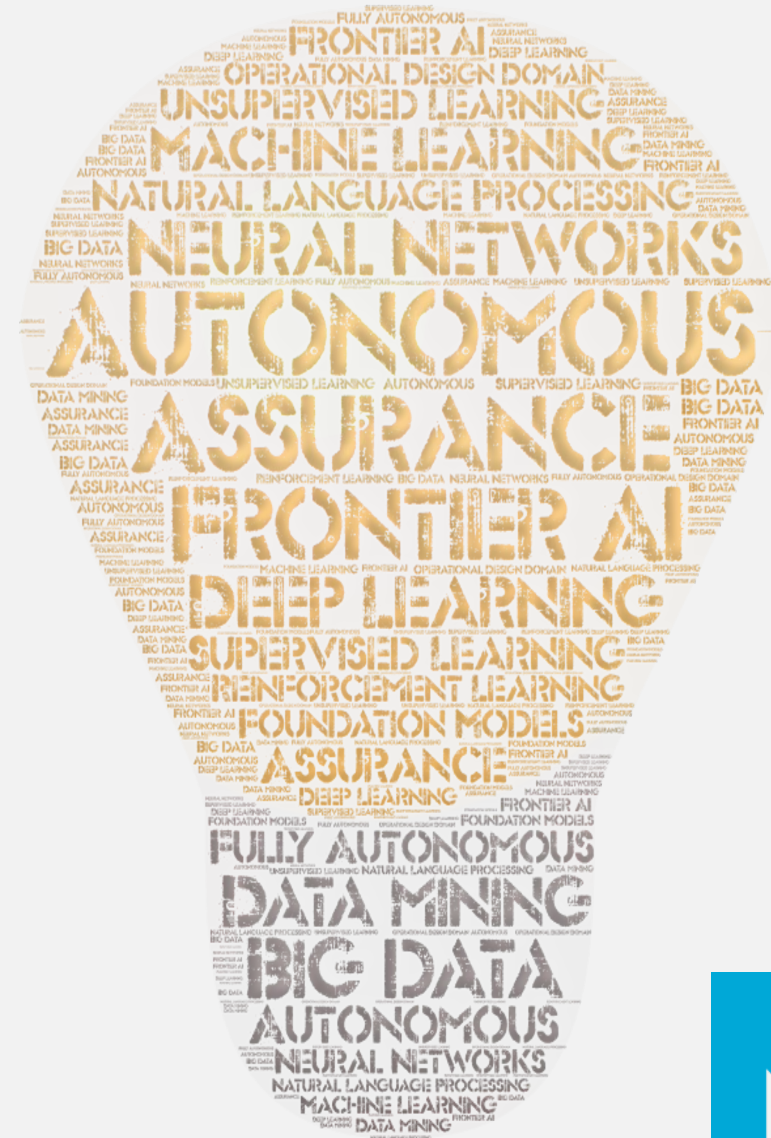
Building Up The Vocabulary

To make tangible progress on the regulation of AI and autonomy in aviation we will of course have to use or agree terminology beyond just automation, autonomy and AI.

Restricting ourselves to the three central terms of automation, autonomy and AI is insufficient for assessing the detailed issues and considerations of a system. Further terms include the various concepts, techniques, policies, and tools associated with AI.

We recognised that there is a **non-exhaustive list of definitions** when considering a specific application, system, or method and these are thoroughly described in specialist documentation such as industry standards.

For the sake of simplicity, the CAA's Strategy for AI will not venture into the detailed terminology unless necessary. However, the portfolio of activities and initiatives that will stem from the strategy will undoubtedly need to use detailed terminology.



A Pro-Innovation Approach to Regulating AI

The UK Science and Technology Framework sets out the UK government's strategic vision and identifies AI as one of 5 critical technologies. The framework notes the role of regulation in creating the environment for AI to flourish.

The UK Department for Science Innovation & Technology (DSIT) also published a [white paper](#) in 2023 on a pro-innovation approach to the regulation of AI. Within this, they propose that regulators should primarily be concerned about 2 characteristics of artificial intelligence: autonomy and adaptability



The **AUTONOMY** of a system, brought about by utilising AI, can make it difficult to assign **responsibility for outcomes**:

Some AI systems can make decisions without the express intent or ongoing control of a human.

*Reference:
DSIT, "A pro-innovation approach to
AI regulation", updated 3 Aug 23*

As a regulator of aviation safety and security, these characteristics pose a big concern. The challenges are regulatory, technical and ethical, but thankfully this is a well-known complexity and work is ongoing around the world to overcome these challenges collaboratively.

The **ADAPTIVITY** of AI can make it difficult to explain the **intent or logic** of the system's outcomes:

Some AI systems are 'trained' – once or continually – and operate by inferring patterns and connections in data which are often not easily discernible to humans.

Through such training, AI systems often develop the ability to perform inferences not explicitly programmed by their human designers.

What's Next?



The CAA's Strategy for AI will provide a 'north star' to guide how the CAA approaches the regulation of AI and autonomy, while also giving innovators guidance on how to prepare for engaging with the CAA.

During the early part of 2024, we will develop the 3 tools further (terminology, principles, technology outlook) while aiming to publish a strategy document in the Summer.

In parallel with this work, we will develop an initial portfolio of activity and deliverables across two parts:

- Part A: Regulating AI
- Part B: Using AI

During this time, and beyond the publication of the strategy document itself, the CAA is open for engagement and discussion, and ready to listen.



Visit the **CAA Innovation website**
for latest updates, guidance and challenges
caa.co.uk/innovation

Tell us what you think

We are keen to hear your views on the content of this publication. Please get in touch via the email address below.

To submit **feedback** please contact StrategyforAI@caa.co.uk

How did we develop this document?

We have explored the ways that AI could affect each part of the CAA. That includes AI employed in the areas of the aviation sector that we regulate, as well as using AI to help us regulate more effectively or even in how we work as an organisation.

This extensive breadth of impacts demands a high-level strategic approach to highlight the issues and overall approach. It will also give us a 'guiding star' to influence the range of activities and initiatives across the CAA which are necessary to prepare us and the aviation sector for AI.

This requires a common nomenclature that applies to all possible applications of AI across the CAA. For this reason, our definitions are purposefully generic. This allows for the specific context in each part of the CAA to add the necessary colour and detail to these definitions. It is expected that context-specific definitions will be produced at the proper time.

The CAA has also validated the definitions in these documents against ISO/IEC 22989:2022 "Artificial intelligence concepts and terminology", and is working with BSI to influence the development of BSI Flex 1903 "Future Flight systems vocabulary".