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# AI IN AVIATION

## What can we really expect in 2030 and beyond?

## The future of AI in aviation - the HAIKU viewpoint

Funded by Horizon Europe R&I Program.

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> Some people call this artificial intelligence, but the reality is this technology will enhance us. So instead of artificial intelligence, I think we'll augment our intelligence.
>
> Ginni Rometty, IBM former CEO

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# AI IN AVIATION

## What can we really expect in 2030 and beyond?



This project has received funding by the European Union's Horizon Europe research and innovation programme HORIZON-CL5-2021-D6-01-13 under Grant Agreement no 101075332

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# The future of aviation

Looking ahead to 2030 and, going even further towards 2050, a continual **increase in operational complexity** is a critical challenge: more traffic and more traffic variety, driven by different users (e.g. drones, sky taxis…) and by new business concepts (e.g. urban air mobility). This future airspace architecture defies the current mode of operation based on segregating different traffic in dedicated airspace, relying upon constant human intervention to maintain safe, smooth and efficient traffic flow. The future aviation landscape is as challenging as it is full of **opportunities**. Realising this future will require a **strong partnership between human ingenuity and artificial intelligence** support. Envisioning such partnerships is a core goal of the HAIKU project.

## What are the dominant features characterising the evolution of the coming years?

### 01 - Increased & Heterogeneous traffic

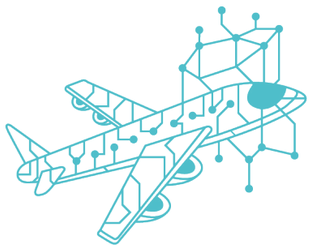
50.000 flights on a peak day in Europe are expected by 2030, approximately +50% compared with the 2019 traffic demand (EUROCONTROL, 2022). UATM operations will start by 2030 and a rapid increase is envisaged during the 2030s. For managing such diverse traffic, segregation is projected to be the most likely solution by 2030 with an essential shift towards a fully integrated airspace in the forthcoming years.

### 02 - Sustainability

The aviation sector is estimated to account for 25% of global CO2 emissions by 2050 if no remedial action is taken (Gilder et al., 2021). Sustainability, seen by many today as an aspiration, will become a ‘given’, an essential attribute of future air traffic that is non-negotiable. It will require high investments and effort by airlines and aircraft manufacturers and, more generally, the aviation community as a whole.

### 03 - Integrated multi-modal transport system

The integrated multi-modal transport system is expected to be in place well before 2050, offering a user-centric and highly personalised service to passengers and UATM customers.



### 04 - Digitisation and introduction of AI

Digitisation is a trend expected to have a significant impact on aviation. By 2030, the whole infrastructure is expected to be more and more digitised. Full digitisation opens the way for AI-based operations. AI assistants are expected to become more prevalent in the sector, helping operators with a range of tasks, ensuring optimization of workload and increasing safety.

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# The Top-10 challenges

## What are the main challenges the aviation industry is expected to face in the forthcoming years?

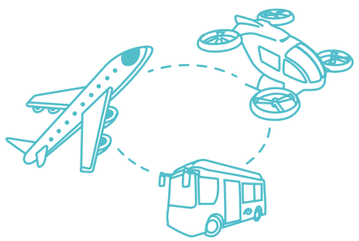
### INCREASED & HETEROGENEOUS TRAFFIC

| | | |
|---|---|---|
| 1 | **HIGH LEVEL SAFETY STANDARDS** | Developing new resilient, flexible and proportionate safety procedures and approaches for risk management to anticipate and manage emerging risks. |
| 2 | **STRONG SAFETY CULTURE** | Maintaining a strong safety culture across the entire aviation system, in particular extending it to new entrants. |
| 3 | **ADAPTIVE REGULATION** | Enabling regulations to progress in step with the evolution of operations to avoid the risk of regulatory lag or gaps that could undermine the safety of operations, specifically for UATM. |
| 4 | **FROM SEGREGATION TO INTEGRATION** | Developing a robust global architecture for fully-inclusive traffic management, integrating ATM and UATM systems. |

### SUSTAINABILITY

| | | |
|---|---|---|
| 5 | **MINIMAL CARBON FOOTPRINT** | Enabling the aviation system to sustain traffic demand, while minimising the carbon footprint to a level acceptable to society. |
| 6 | **SUSTAINABLE FUEL SOURCES** | Producing Sustainable Aviation Fuel, battery and hydrogen-fuelled gas turbine engines. |
| 7 | **ADAPTATION TO EXTREME WEATHER EVENTS** | Developing the capability to adapt to and operate in more extreme and severe weather conditions due to climate change. |

### INTEGRATED MULTI-MODAL TRANSPORT SYSTEM



| | | |
|---|---|---|
| 8 | **MULTIMODAL TRANSPORT SERVICES** | Enhancing connectivity of transport hubs and integrating their systems to allow mixed-traffic interoperability. Developing multimodal services, platforms and apps to ensure smooth journeys for passengers and simple usage of UATM delivery services to customers. |

### DIGITISATION AND INTRODUCTION OF AI

| | | |
|---|---|---|
| 9 | **SYSTEM INTEGRATION** | Effectively integrating new tools and technologies with existing legacy systems. |
| 10 | **CYBER-RESILIENCE** | Developing robust security measures to prevent and neutralise attacks and ensure the safety of operations and critical supporting infrastructure. |

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# Conclusions

Changing the way aviation operates is not only a matter of **technological change**. It must be done by considering what **society desires** - the world we wish to live in - to achieve a **truly human-centric system**. For this to happen, there are a number of enabling actions that must be addressed, to manage new emerging risks. Focusing specifically on AI, its successful deployment in this safety-critical industry requires:

01

Definition of **safe and desirable Human-AI teaming models** for each AI application, identifying the most effective explainability strategy, ensuring that the operators' Situational Awareness will be adequately sustained during operations, and preventing risks associated with human over-reliance on AI.

02

**Workforce redesign**, defining new roles, skills and competencies, training approaches and career paths.

03

**Data availability and accessibility**, while protecting people's rights to **data privacy**.

04

Developing **high-performing algorithms** capable of ensuring safe and effective outcomes. More specifically, the most challenging aspects are:

- Enabling the system to constantly **learn and evolve**, also capturing tacit knowledge;
- Developing a **context-aware system**, capable of understanding when to intervene and when not;
- Ensuring AI's ability to **deal with human variability**;
- Ensuring applicability and proficiency for different scenarios.

05

Clear definition of **responsibilities** from a legal point of view.

06

Understand and address **user and societal concerns** and resistance concerning the application of and reliance on AI in a safety-critical system such as aviation, including ethics, job satisfaction, security and privacy aspects.

AI systems themselves must value what we value. The only way we will achieve this is if **human-centred, value-based considerations are embedded into the Intelligent Assistants design**, from the very beginning, literally into its datasets and coding.

# HAIKU Consortium

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