

AI in the cockpit – a good idea?

A man in a dark blue pilot's uniform is seated in the left-hand seat of a futuristic cockpit, viewed from behind. He is looking towards a large, metallic robot seated in the right-hand seat. The cockpit is filled with various control panels, screens, and instruments, all illuminated with a cool blue light. The robot has a sleek, humanoid form with a prominent head and jointed limbs. The overall atmosphere is high-tech and futuristic.

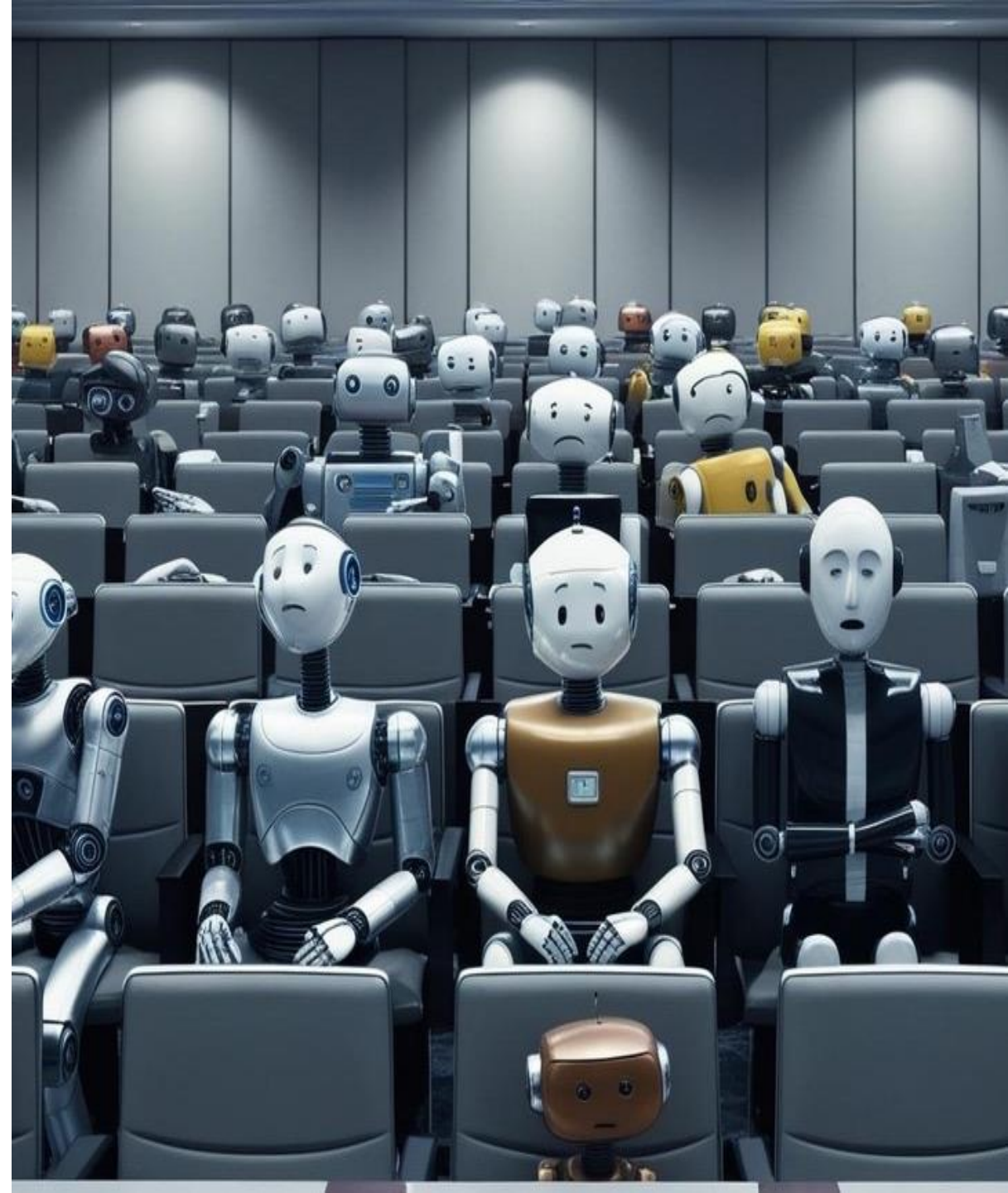
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HFESNZ Webinar, 30th April 2026

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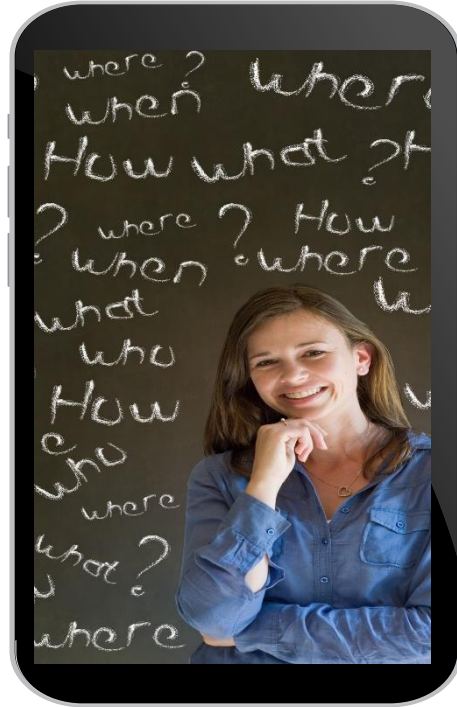
What I'm going to talk about...

1. AI Basics
2. Human-AI Teaming (HAT)
3. What it looks like in practice
4. A Human Factors Requirements toolkit for HAT design
5. Key Take-aways



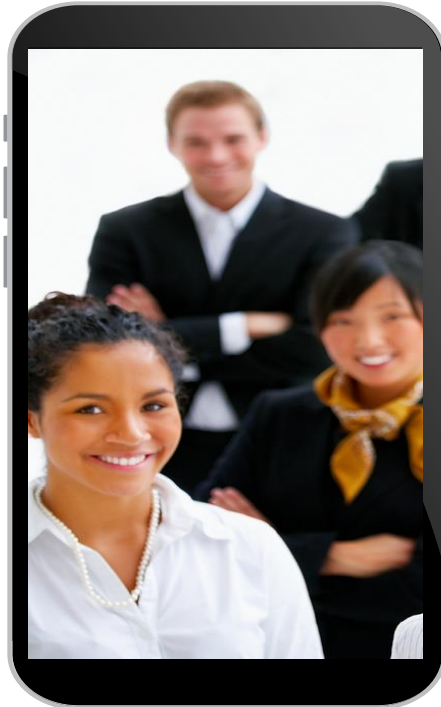
What is Artificial Intelligence (AI)?

“Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems.”



Narrow AI

Focusing on a particular domain, e.g. ATM. From Machine Learning to Cognitive Assistants
Number-crunching & Algorithms



Generative AI

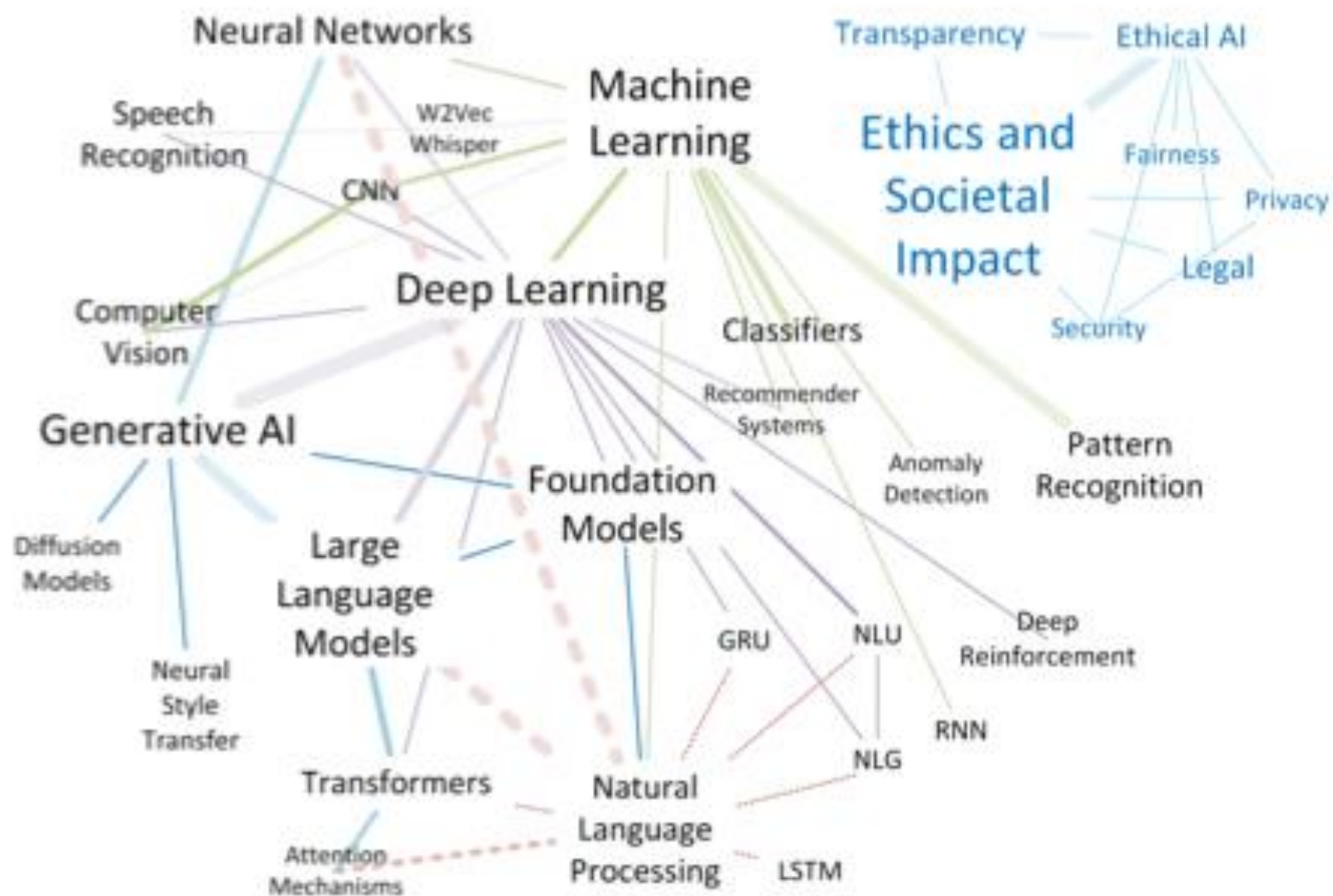
E.g., Large Language Models such as Chat GPT, which can ‘seem’ human.
Learn, mimic, create...



Artificial General Intelligence

True ‘thinking machines’, which will (one day) surpass human cognition. They do not exist yet.
Transformative, potentially sentient

*“...the broad suite of technologies that can match or **surpass** human capabilities, particularly those involving cognition.”*



The image depicts a futuristic cockpit with two humanoid robots seated in the driver and passenger seats. The robots have a sleek, metallic design with glowing green accents around their eyes and joints. The cockpit is filled with various control panels, screens, and instruments, all illuminated with a vibrant green light. The overall atmosphere is high-tech and futuristic.

AI is just running the
numbers...

For now...

For now, no AI allowed inside the cockpit...

- GenAI, as well as ‘continual learning AI’ excluded by the EU Act on AI for safety critical applications
- European regulator (EASA) also forbids it for now.
- GenAI hallucinates, can scheme, can lie, etc. (visit Anthropic’s own website)
- AI in ‘back office’ is beginning already. ‘Deterministic AI’ in operations may begin to appear by 2030 but must be shown to be safe and trustworthy first.



What is Human-AI Teaming?

Human-AI teaming (HAT) refers to the integration of humans and AI systems as **interdependent** and coordinated units, working to complete tasks and achieve goals.

The goal of HAT is to leverage the strengths of both humans and AI through a dynamic, collaborative and evolving distribution of tasks.

<https://unidir.org/event/human-ai-teaming/>



EASA Human-AI Teaming Classification: Level of Autonomy

As interpreted by HAIKU





“ To be, or not to be..”

00101011|11010100

What kind(s) of AI are we talking about?

Examples from the aviation sector (research prototypes)



Our goal

is to pave the way for **human-centric-AI** via the exploration of interactive AI **'Intelligent Agents'** in a **wide range of aviation contexts**



Our challenge

is to deliver truly *human-centric* Digital Assistants, capable to 'fit' the way humans work.



4 HAIKU Use Cases

Digital Assistant in the **cockpit** to assist in “**startle response**” adverse events

Led by ENAC



Digital Assistant for **tower controllers** to assist in **tasks for aircraft on approach**

Led by SkyWAY



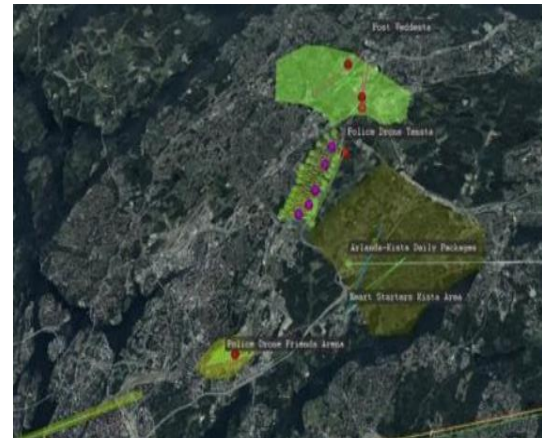
Digital Assistant in the **cockpit** to assist in **route planning/re-planning**

Led by TAVS



Digital Assistant for **Urban Air Mobility** to assist in **traffic management**

Led by LiU & LFV





Can AI assist pilots experiencing 'startle response'?

Sudden, unexpected event.

Psychophysiological response, cognitive performance impaired for 20s



HAIKU UC1 (led by ENAC, AI by DFKI)
Single Pilot in Startle Response Emergencies
AI-based Startle Detection (physiological measures)
Recovery, and Directed Situation Awareness (eye tracking, highlighting key display elements)

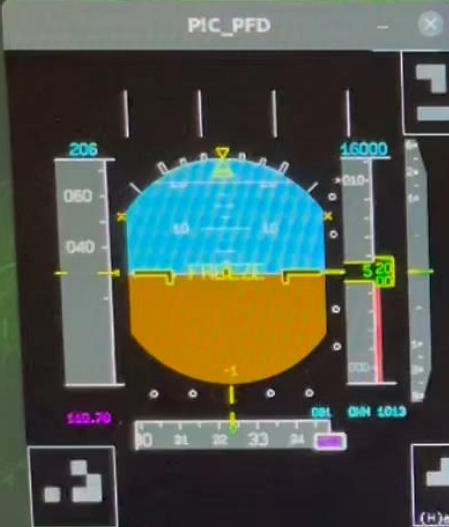


FOCUS: Flight Operational Companion for Unexpected Situations

Tobii Pro Glasses 2 live stream

Frame of 24153, 145
Watch: 40ms of 268
Position: 11703, 95, 117
Lock: 11703, 95, 117
Visualization: ...

Calibration succeeded Battery 86



(H)elp

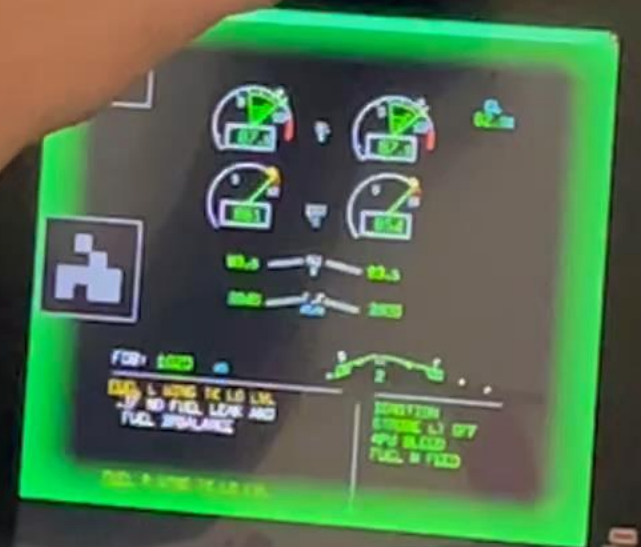


10:13

190

03000

APU



LOW GEAR

AUTOWORK

A/T/TO & NEW GEAR



So far pilots appreciate the support, especially if they have startle.

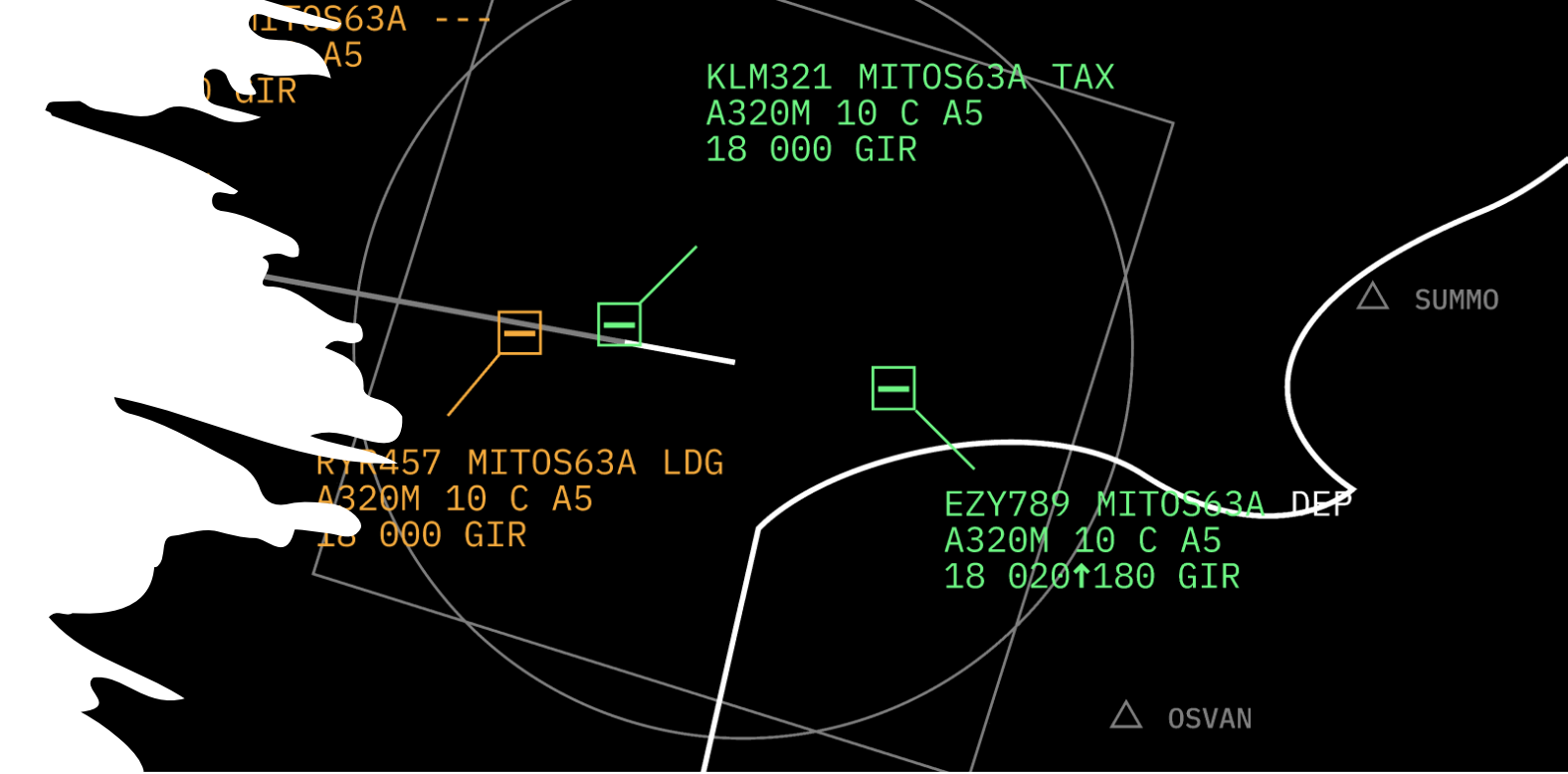
Directed SA helpful with aural support plus visual, though may need further refinement.

HAIKU Use Case 4

Intelligent Assistant for
tower controllers to
assist in **routine and
repetitive tasks for
aircraft on approach**

Led by SkyWAY

*Based on Alicante
airport, simulations in
Madrid.*





BAW412 MITOS63A ---
A320M 10 C A5
18 030 GIR

KLM321 MITOS63A TAX
A320M 10 C A5
18 000 GIR

RYR457 MITOS63A LDG
A320M 10 C A5
18 000 GIR

EZY789 MITOS63A DEP
A320M 10 C A5
18 020↑180 GIR

△ SUMMO

△ OSVAN

Intelligent Sequence Assistant (ISA)

2 L/U KLM321 A320 M 0945 10 45 MITOS3A I

Seq. change: window for take/off of KLM321 too small

2 ↑ --- BAW412 A320 M 0952

Tower controllers found the tool useful, particularly when busy...

ATCO remained in charge but could let the tool execute if busy (they trusted it)

In one case the tool helped an ATCO recover from a sequencing error

The Explainability was clear

The interface usability needs a little work

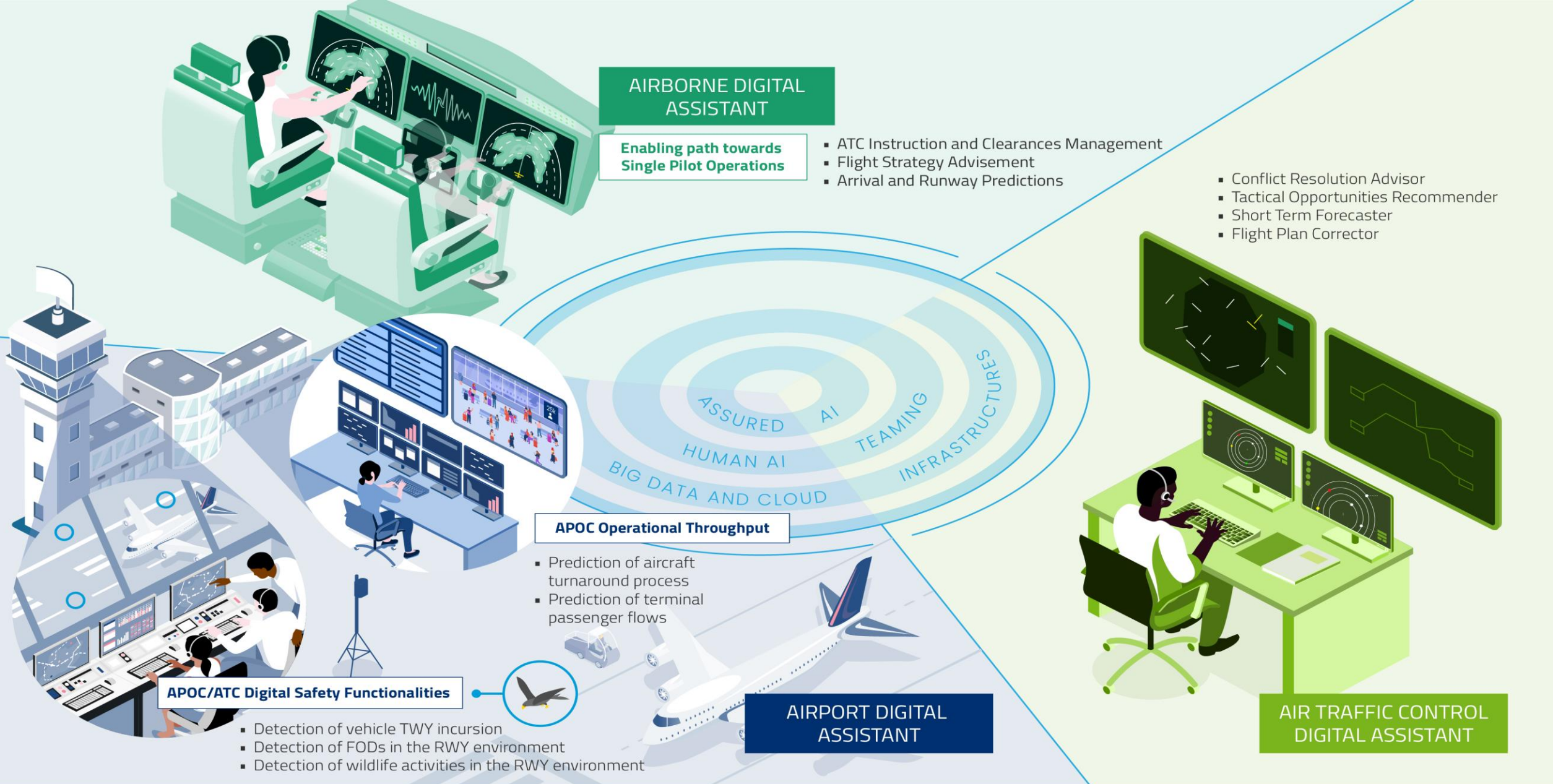
Sometimes the tool's 'tempo' didn't match the ATCO's (too slow/fast)



JARVIS

JARVIS ambition is to deliver three AI-based ATM solutions (digital assistants) to support pilots, ATC operators and airport operators and ensure safer and more efficient operations in complex scenarios.





AIRBORNE DIGITAL ASSISTANT

Enabling path towards Single Pilot Operations

- ATC Instruction and Clearances Management
- Flight Strategy Advisement
- Arrival and Runway Predictions

- Conflict Resolution Advisor
- Tactical Opportunities Recommender
- Short Term Forecaster
- Flight Plan Corrector

APOC Operational Throughput

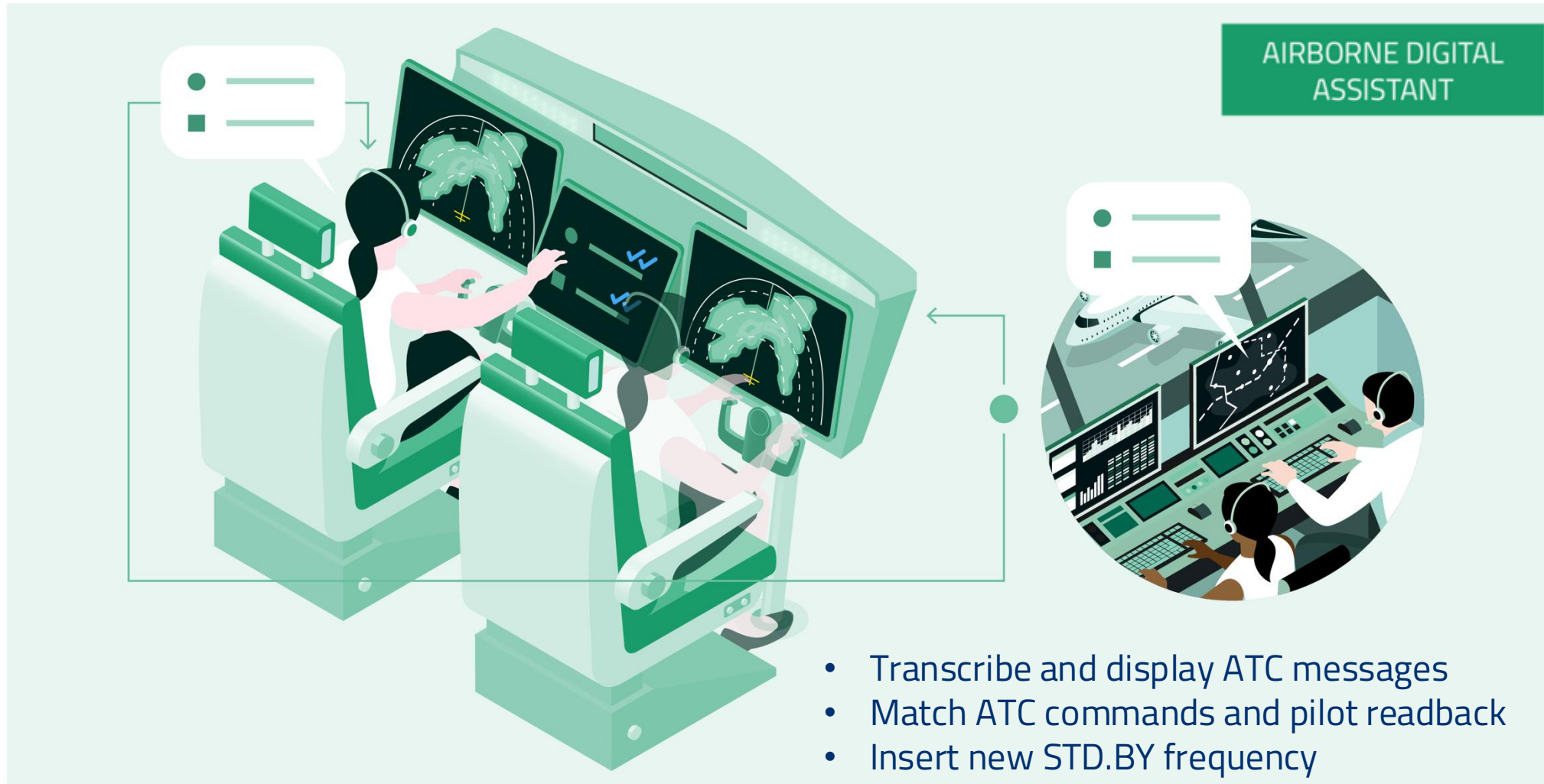
- Prediction of aircraft turnaround process
- Prediction of terminal passenger flows

APOC/ATC Digital Safety Functionalities

- Detection of vehicle TWY incursion
- Detection of FODs in the RWY environment
- Detection of wildlife activities in the RWY environment

AIRPORT DIGITAL ASSISTANT

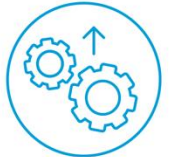
AIR TRAFFIC CONTROL DIGITAL ASSISTANT



Benefits



DECREASED
WORKLOAD



IMPROVED FLIGHT
EFFICIENCY



SITUATION
AWARENESS

Voice to text evaluation

- **Performance:** comm transcriptions were often not accurate, challenges to match pilot readback (too much rephrasing)
 - **Usability:** More complex scenarios need to be considered, attention/distraction challenges emerging
 - **Explainability** covered to a good extent but is crucial; room for improvement
 - **Interface design** important aspects: fonts, colors, visibility, readability
 - **Training material** must be available and detailed
-





Benefits



IMPROVED
SAFETY



INCREASED
AUTOMATION



IMPROVED
OPERATIONAL
EFFICIENCY

AI-enabled computer vision for detecting hazards on runways and taxiways: FOD, wildlife, incursions

- Active use of **synthetic data** to develop DL models
- Datasets of 6000+ labeled images (full synthetic, mixed)
- **Safety-critical:** Excessive false alarms may distract and increase the workload of airport operators
- Difficult to close the **simulation v. reality gap** due to the need of replicating the physics of objects (e.g., plastic bags)
- Better performance with **bigger objects**, challenges with smaller



A man in a dark uniform and a humanoid robot are seated in a futuristic cockpit. The man is on the left, and the robot is on the right. They are both looking forward at a complex dashboard filled with various screens and controls. The cockpit has a high-tech, metallic appearance with blue and white tones. The text "Key 'Takeaways' from HAIKU & JARVIS" is overlaid in the center of the image in a white, sans-serif font. A thin white horizontal line is positioned below the text.

Key 'Takeaways' from HAIKU & JARVIS



Don't underestimate the time it takes to get the AI working

Understand the existing workflow
Otherwise the AI will disrupt performance or add to workload when it's least desirable.

Gradual deployment
Trust takes time to build.
Introduce AI in controlled stages
Let the AI and human 'co-evolve'

Keep the human in charge
Only a human can value safety, morality and ethics, make sound judgement calls, and detect AI hallucinations & errors

Pilot insights

21 Pilots have experienced AI assistance in realistic HAIKU simulations.

They are not averse to AI and think it could be beneficial.

But it needs to be robust, fit their way of working, and be introduced gradually.



Human Factors for AI



Get the Human Factors right in your AI-based system

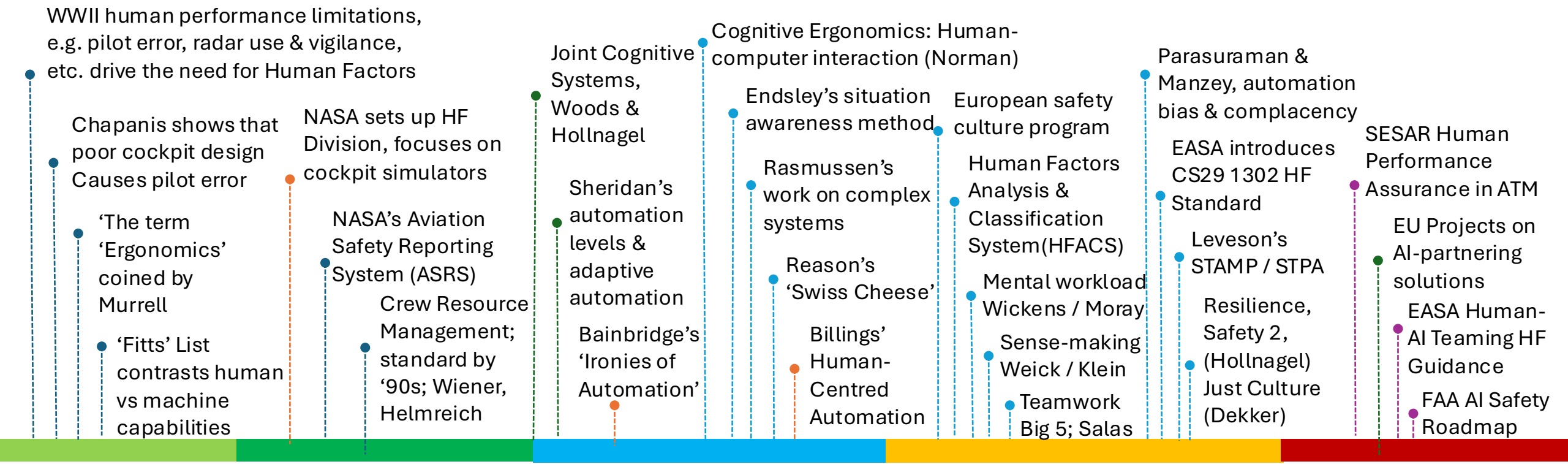
Move closer to compliance with aviation Human Factors regulations

Start now



Parallel Developments in AI and Human Factors

WWII human performance limitations, e.g. pilot error, radar use & vigilance, etc. drive the need for Human Factors



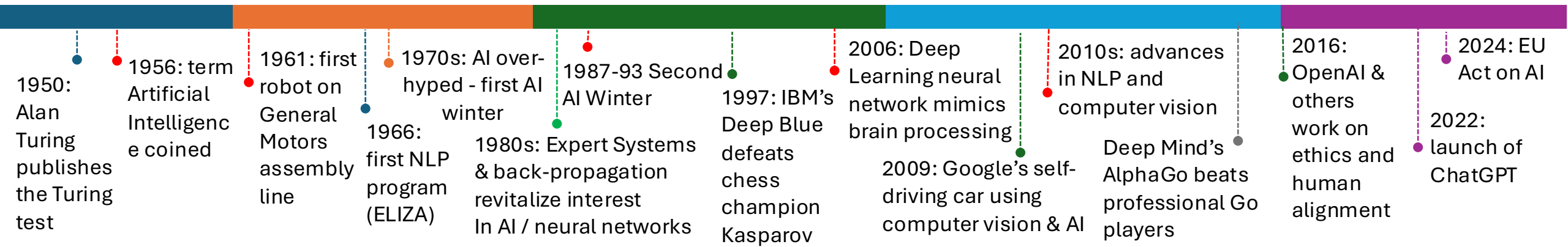
1940s -1950s

1960s - 1970s

1980s-1990s

2000s-2015

2016-2024



1950: Alan Turing publishes the Turing test

1956: term Artificial Intelligence coined

1961: first robot on General Motors assembly line

1966: first NLP program (ELIZA)

1970s: AI overhyped - first AI winter

1987-93 Second AI Winter

1980s: Expert Systems & back-propagation revitalize interest in AI / neural networks

1997: IBM's Deep Blue defeats chess champion Kasparov

2006: Deep Learning neural network mimics brain processing

2009: Google's self-driving car using computer vision & AI

2010s: advances in NLP and computer vision

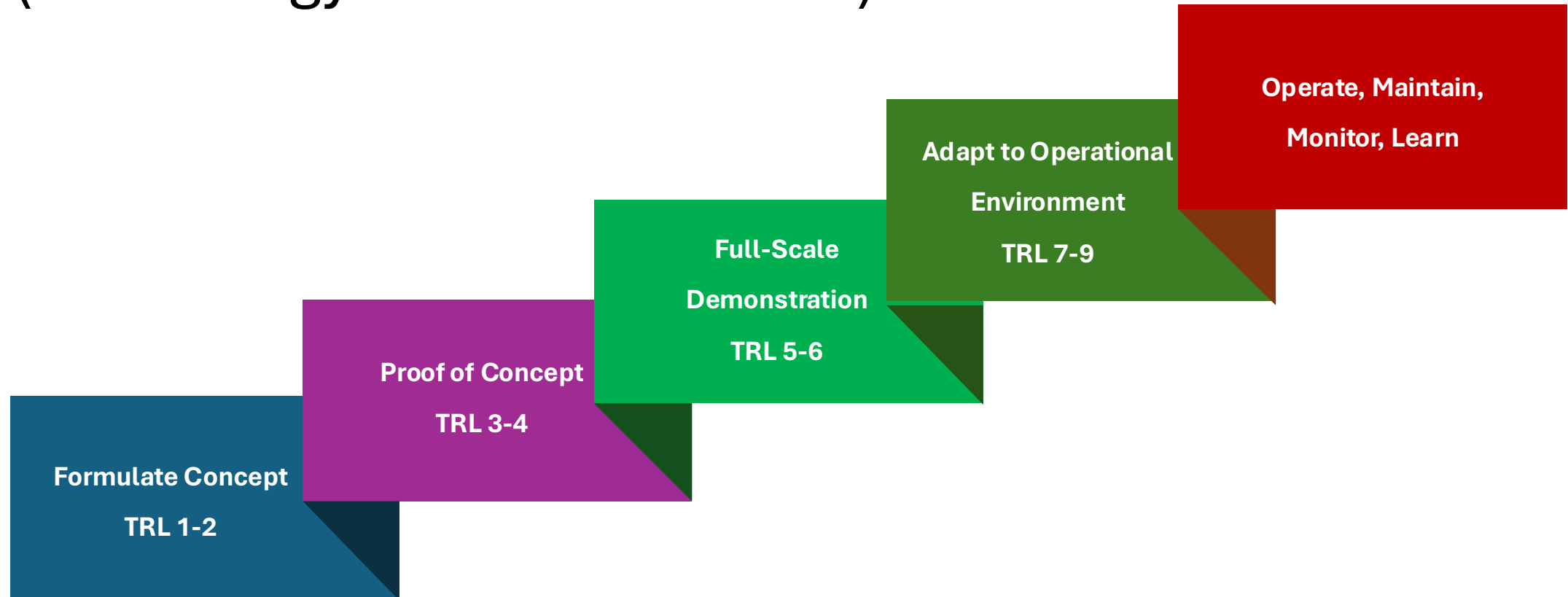
Deep Mind's AlphaGo beats professional Go players

2016: OpenAI & others work on ethics and human alignment

2022: launch of ChatGPT

2024: EU Act on AI

Human-AI Teaming Concept Maturity (Technology Readiness Levels)



Do end-users have their say in the design process?

01
Human Centred Design

Who's really in charge? Is there human oversight?

How much autonomy does the AI have?

Is the balance between human & AI tasks OK?

02
Roles & Responsibilities

Are the human and AI 'on the same page?' (shared situation awareness)

Is AI output trustworthy?

Can the AI explain itself?

Does the AI help in abnormal events and emergencies?

03
Sense-Making

Is human-AI dialogue effective?

Can the AI use speech / recognise gestures?

04
Communication

Will the AI support or disrupt my team?

05
Teamworking

06
Error & Failure Management

Will I know if the AI goes wrong?

Will I be able to take over if it fails?

Will the AI know if I make a mistake?

07
Competencies & Training

Will I need new competencies?

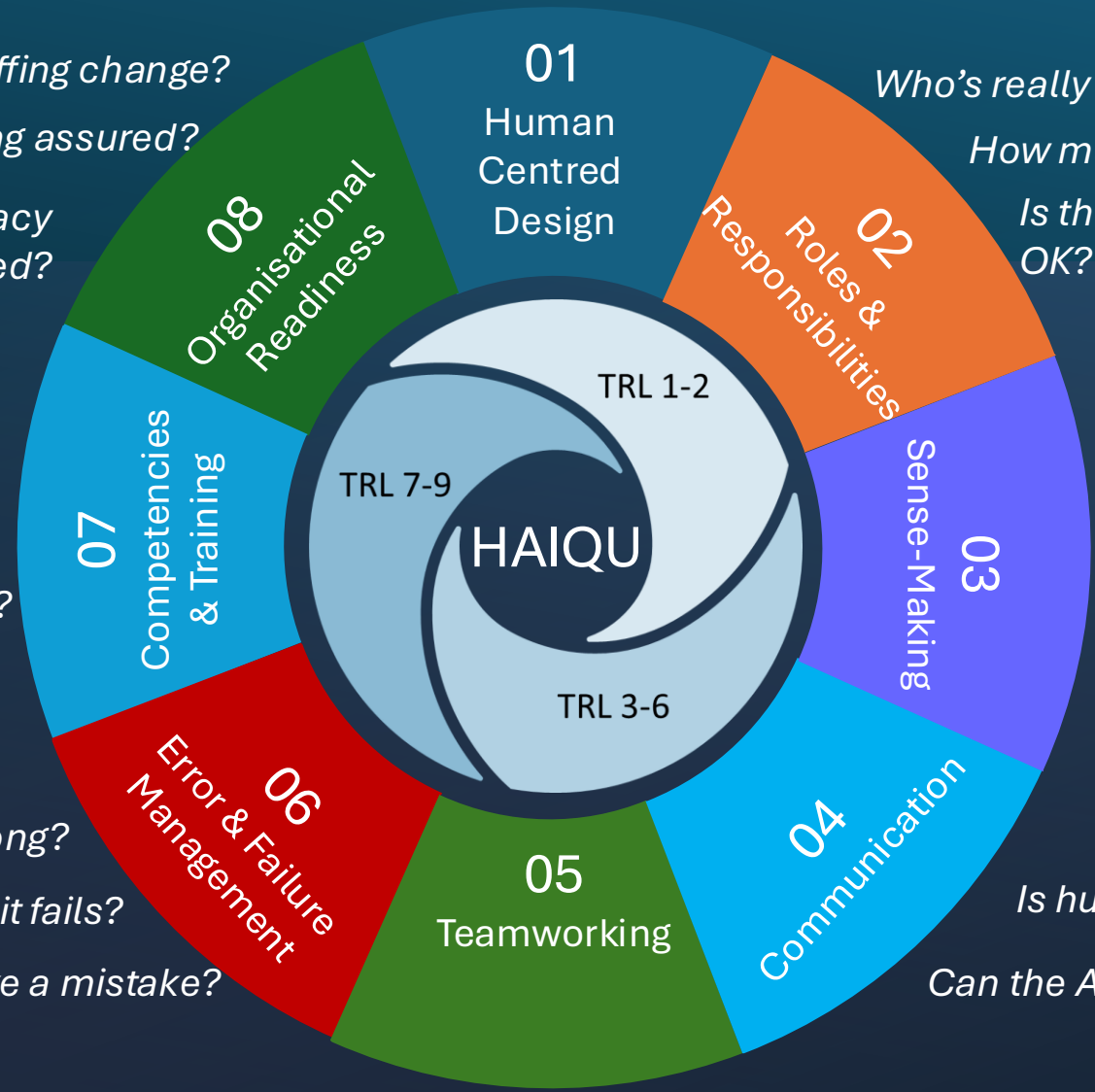
Will I be trained on how the AI works, and how to work with it?

08
Organisational Readiness

How will staffing change?

How is user acceptance being assured?

Will Just Culture and my privacy rights be maintained?



TRL 1-2

TRL 7-9

TRL 3-6

HAIQU

Q1

Are licensed end-users participating in design exercises such as focus groups, scenario-based testing, prototyping and simulation (e.g. ranging from desk-top simulation to full scope simulation)?

Q2

Are end-user opinions helping to inform and validate the design concept, as part of an integrated project team including product owner, data scientists, safety, security, Human Factors and operational expertise?

Q3

Are end-users involved in any hazard identification exercises (e.g. HAZOP, STPA, FRAM etc.)?

Q4

Are end users asked how the new system might affect their job satisfaction?

Q5

Do licensed end-users participate in validation and testing activities?

Yes

No

N/A

TBD

* Provide a justification for your answer ? :

Yes, both Val 1 and Val 2 real-time simulations in the Madrid simulation facility.

Q1

Is all the required information presented to the user in an uncluttered way?

Q2

Is the interaction medium appropriate for the task, e.g. keyboard, touchscreen, voice, and even gesture recognition?

Q3

Is at least one alternative / back-up interaction medium available, in case of technical problems?

Q7

Is the AI's situation representation made accessible to the end user, via visualisation and/or dialogue?

Q8

Does the AI-human interface reinforce the end-user's situation awareness, so that human and AI can remain 'on the same page'?

Yes

No

N/A

TBD

D

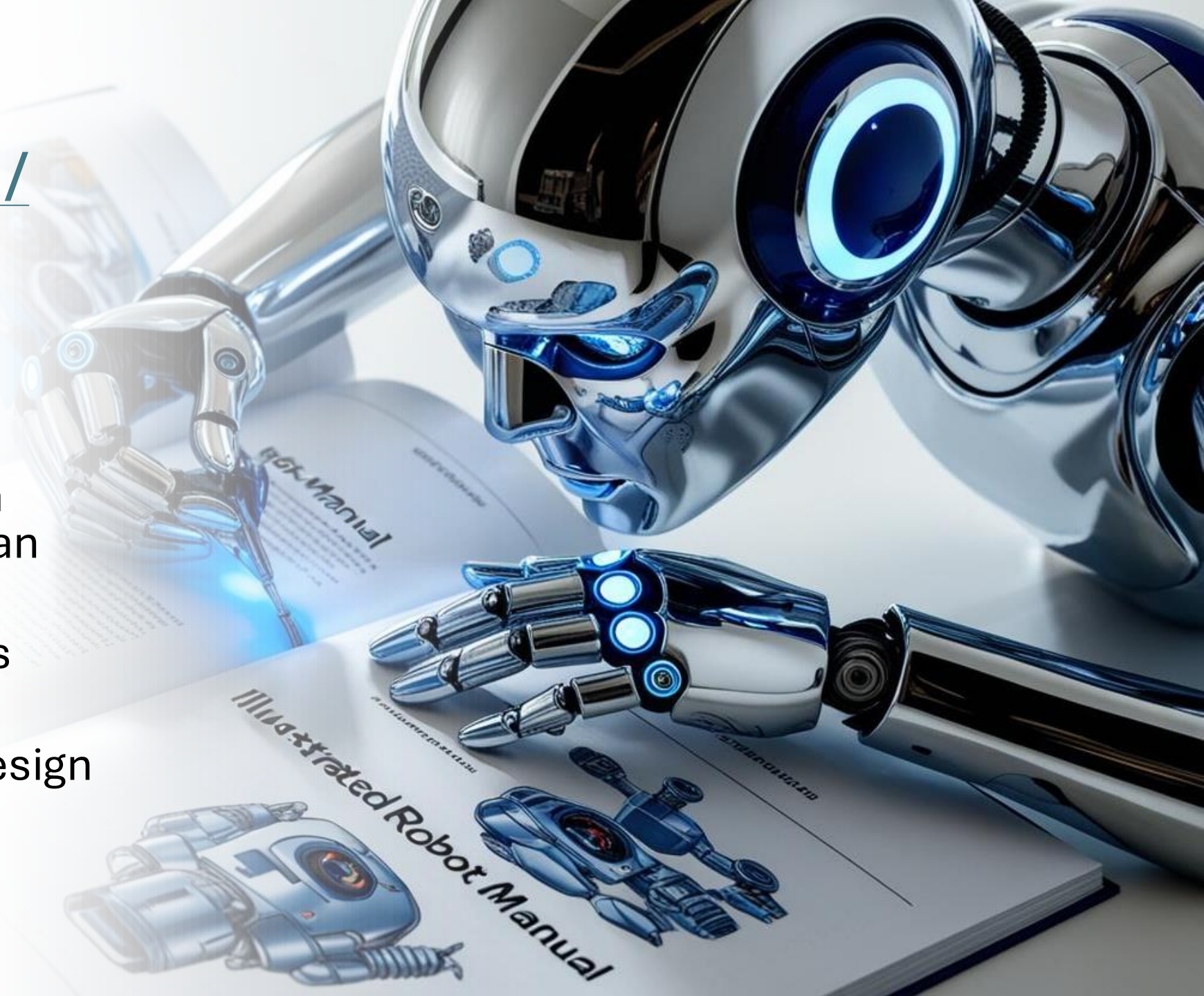
by pilots

* Provide a justification for your answer ? :

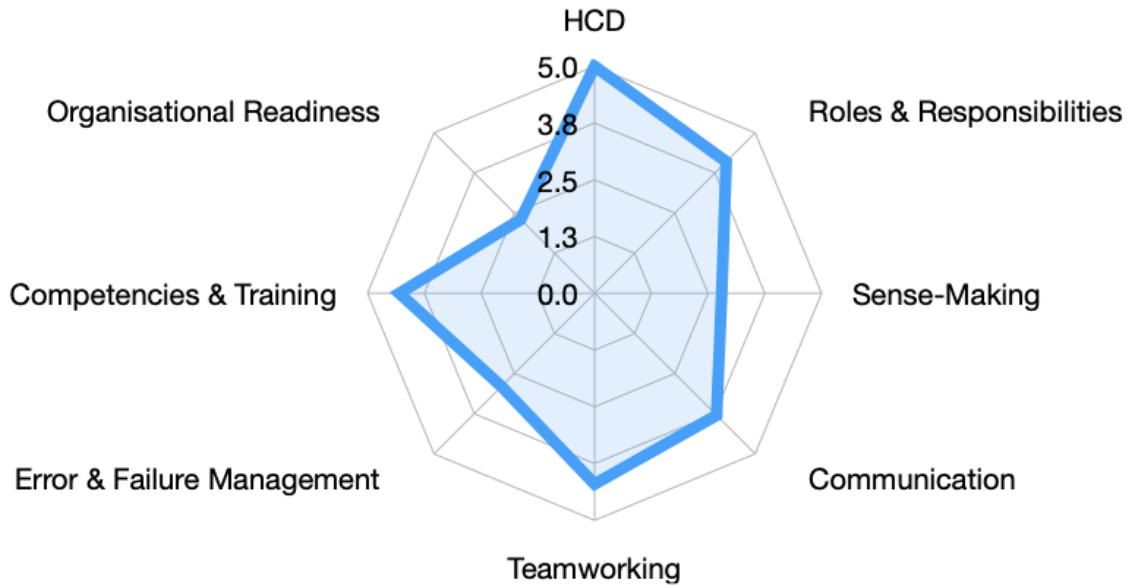
Pilots feel it helped their SA, and speed of gaining a situational picture. The scenario did cause startle-type reactions in Val 1 in two pilots.

<https://haiqu.eu/>

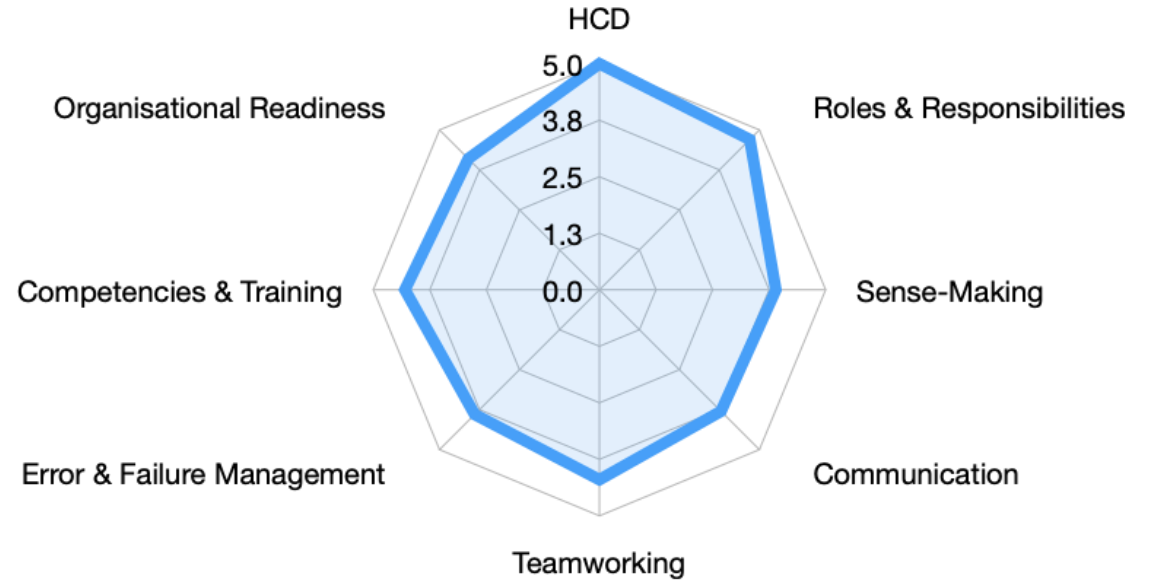
- Evaluate the Human-AI Teaming system
- Derive Human Factors Requirements
- Improve the HAT design while maintaining human agency
- Manage Human Factors process
- Evaluate progress as design concept matures



Tracking HF Requirements Progress



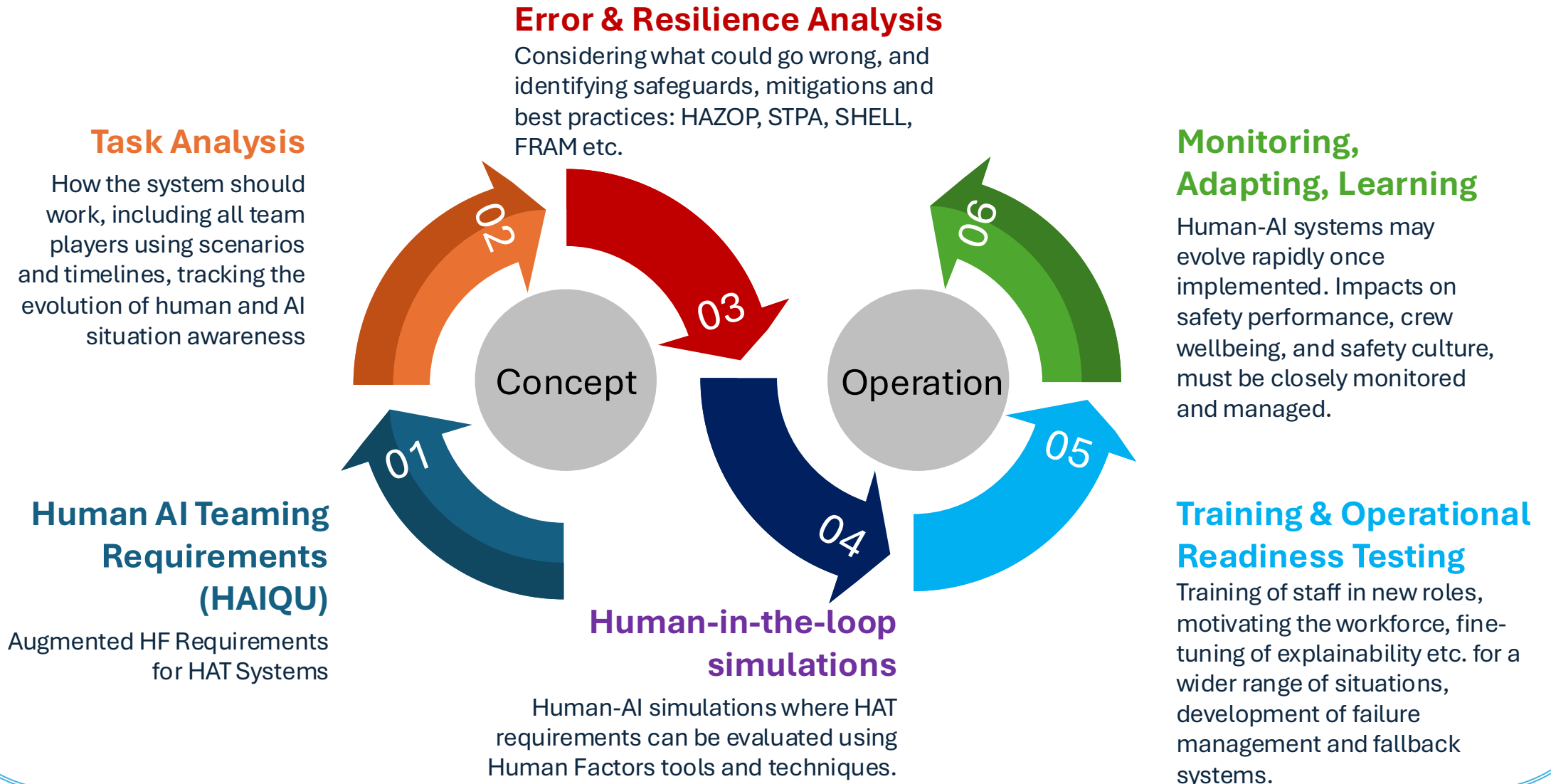
2024



2026



Human-AI Teaming Human Factors Assurance Process



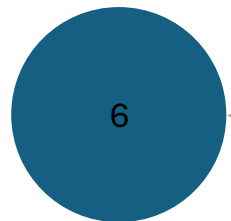


Wrapping up...

Design & Development Safeguards

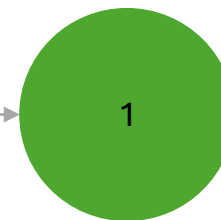
SAFETY NETS FOR STAFF

Just Culture protocols and practices
No loss of critical human safety expertise



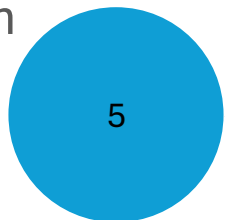
HUMAN-CENTRED DESIGN

User-centred development
Human in decision loop



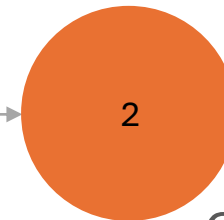
GRADUAL IMPLEMENTATION

Gradual rather than sudden implementation, allowing learning & adaptation
Extensive testing and evaluation.



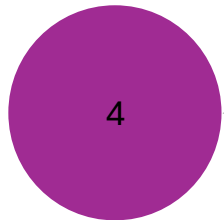
SHARED SA

Awareness of key IA parameters
Operational explainability



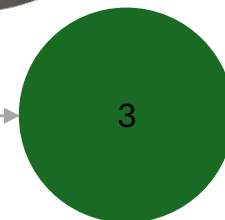
TRAINING & COMPETENCE

Training on the IA and how to master its use
Strategies for skill retention



H-IA INTERACTION QUALITY

High quality Human-IA interaction:
relevant, contextual, helpful, timely

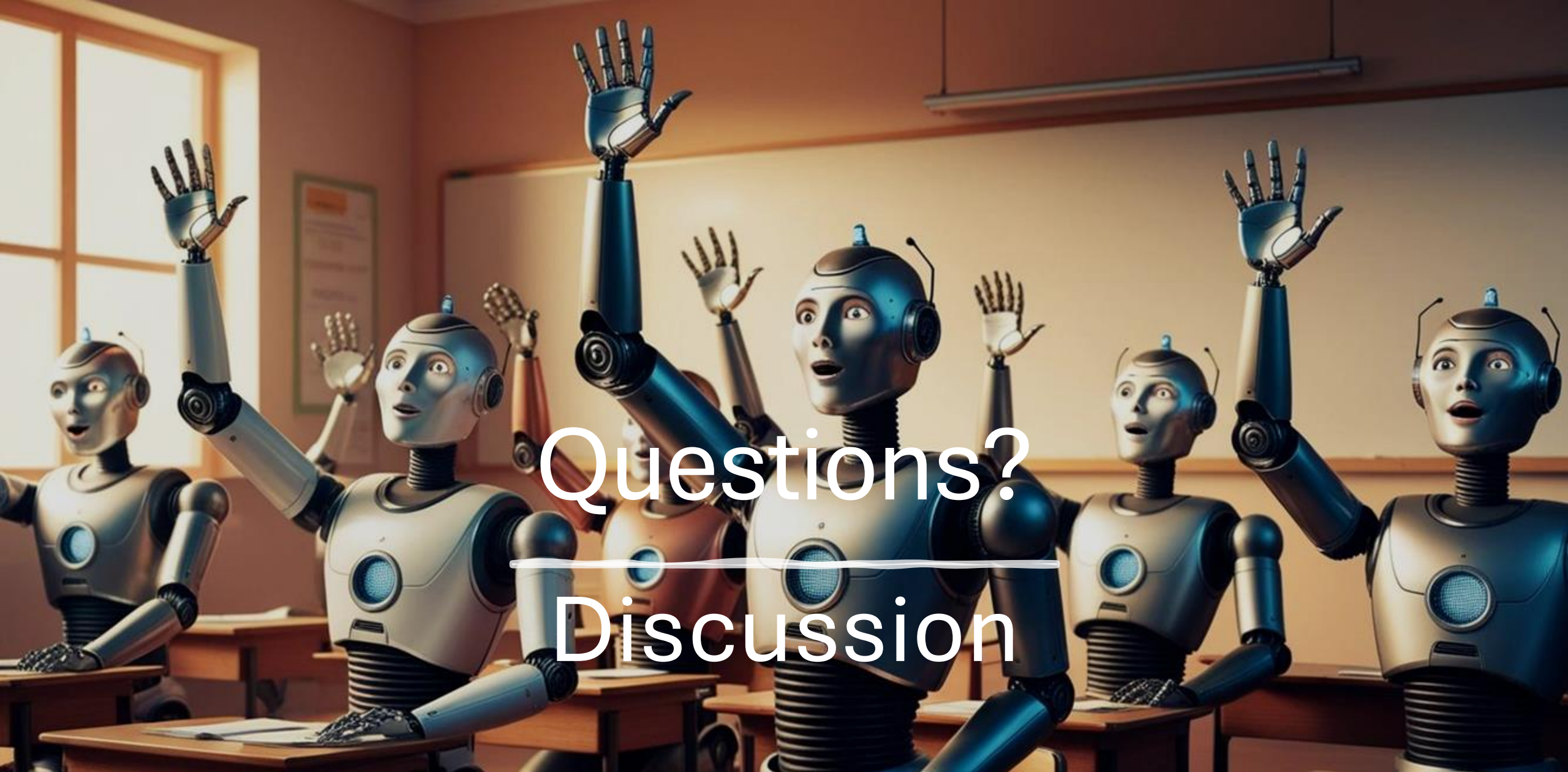


Closing Comments

- **Human-AI partnerships** in safety-critical workplaces will benefit from asking the right questions. Human Factors has **the right mindset** for this task.
- Many techniques in the **HF toolset** will work for now, supplemented by new ones as they arise (e.g. HAIQU).
- There remains much research to do, much experience to be gained on **AI integration** into aviation systems, e.g. human-AI CRM, explainability, shared situation awareness and alignment assurance.
- Generally, all the HAIKU and JARVIS use cases are **augmenting** – not replacing – human capabilities. This is the way to go in aviation.
- **Inter-domain collaboration** will be beneficial. Contexts may differ, but there will be common issues.

Human Centred AI
development isn't
optional if you want
true technology
acceptance.





Questions?

Discussion

<https://haikuproject.eu/>

<https://www.sesarju.eu/projects/JARVIS>