EASA
European Union Aviation Safety Agency

EASA AI Days 2025

Panel of discussion:
AI-based operational tools in approved Organisations

Moderator: Guillaume Soudain
EASA AI Programme Manager

Thiziri Belkacem
Airbus Protect

Martin Ricklin
Lufthansa Group

Erwan Prud'homme
SixFoisSept

Maxime Albertini
EASA

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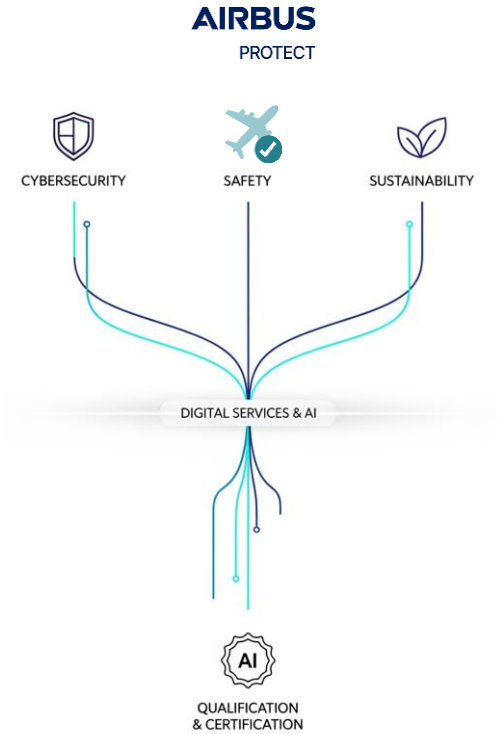
} Airbus Protect – Trusted Partner for AI Qualification & Certification

> **Airbus Protect, a Unique combination of Expertise**

- Triple domain expertise at the core of our activities: **Safety, Cybersecurity & Sustainability**, since 40 years.
- **A transversal *Digital Services* department** with dual-skilled teams (AI & Domain).

> **An Integrated, End-to-End approach**

- **Complete management of the qualification process**, natively integrating **Safety**, **Cybersecurity**, including also others connected domain like **Human Factors** through our core business.
- Systematic consideration of the **Sustainable** impact of AI solutions.



} AI-based System – Safety

Challenges & AI-related Risks

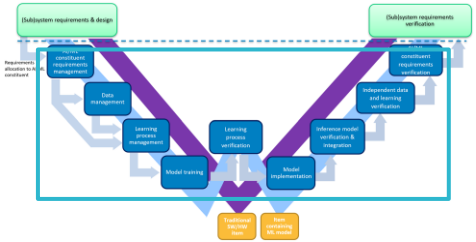
Scope	Classical Systems	AI-Embedded Systems
Development & Validation	• Deterministic & Prescriptive; • Top-down processes where system behavior is fully specified by requirements;	• Iterative & Evidence-Based; • Integrated, data-driven process focused on continuous verification and validation throughout the entire lifecycle.

Risks & Failures	• Predictable & Traceable
	• Failures stem from hardware faults or software logic errors:
	  ○ Function loss – Not responding to sollicitations
	  ○ Spurious Functioning – Starting to work without solicitation
	  ○ Erroneous Functioning – Working in a degraded manner
	• Traceable to a specific requirement or component;
	• Risks are well-defined and can be analyzed: Fault Tree Analysis (FTA), Model Based Safety Assessment (MBSA).
		• Emergent & Non-Deterministic behaviour;
		• Introduces new, statistical risks:
		  ○ Performance degradation (lack of generalisation);
		  ○ Limited performances due to biased training sets;
		  ○ Unmanaged outliers
		• Unpredictable *emergent* behaviors not explicitly defined;
		• ~~**Failures**~~ errors/lack of performance are often probabilistic, not easily traced to a single cause.

Regulatory Requirements	• Compliance-Based – strict adherence to prescribed development and assurance processes; • ARP4761, DO-178C (Software), DO-254 (Hardware).	• Regulations require a **holistic safety case** that demonstrates/guarantees *safety* (metrics, requirements…). • EASA Concept Paper Issue 2, EUROCAE ED-324 / SAE G-34.

- **Incompleteness of Requirements** – Impossible to explicitly specify requirements for all possible inputs to the AI
- ***Black Box* AI Problem** – Classical methods cannot analyze the internal logic to prove the *absence of unintended functions* or *hidden* failure modes
- **Data Dependency** – Classical assurance methods have no framework to assess risks originating from the data (e.g., bias, lack of representativeness…)
- **Static Verification vs. Dynamic Learning** – Unchanging software artifact vs Incompatible with an AI system whose core logic is learned from data

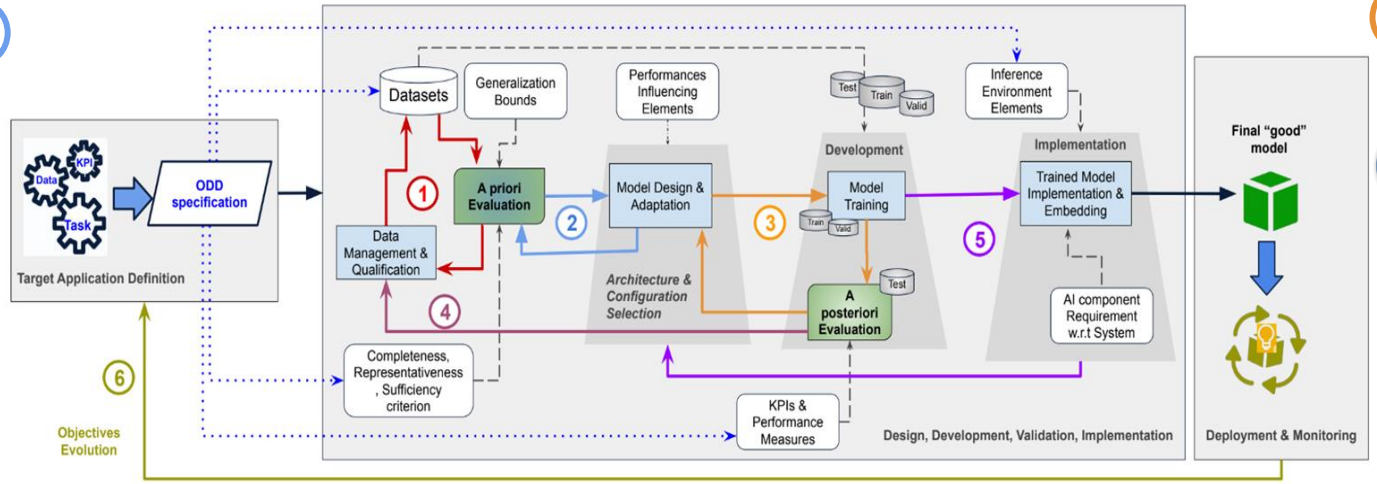
: Safety By Design – Implementation



ODD Coverage – Completeness vs Representativeness: Cleanlab, PCA, Entropy, Neuron Coverage, Feature set observation => **ODD based**

Requirements – System-level vs ML-level: generalisation bounds, optimization & regularization, Tuning (Ray, Optuna…), errors analysis (TFX, SHAP, PyCaret…) => **combined + numerous**

Verification – Generalization, Robustness, Stability: generalisation metrics, robustness & stability (empirical, statistical, formal) => **combined**



DEEL XPLIQUE
Explainability Toolbox for Neural Networks

Monitoring & ML evolution

DEEL DEpendable & Explainable Learning

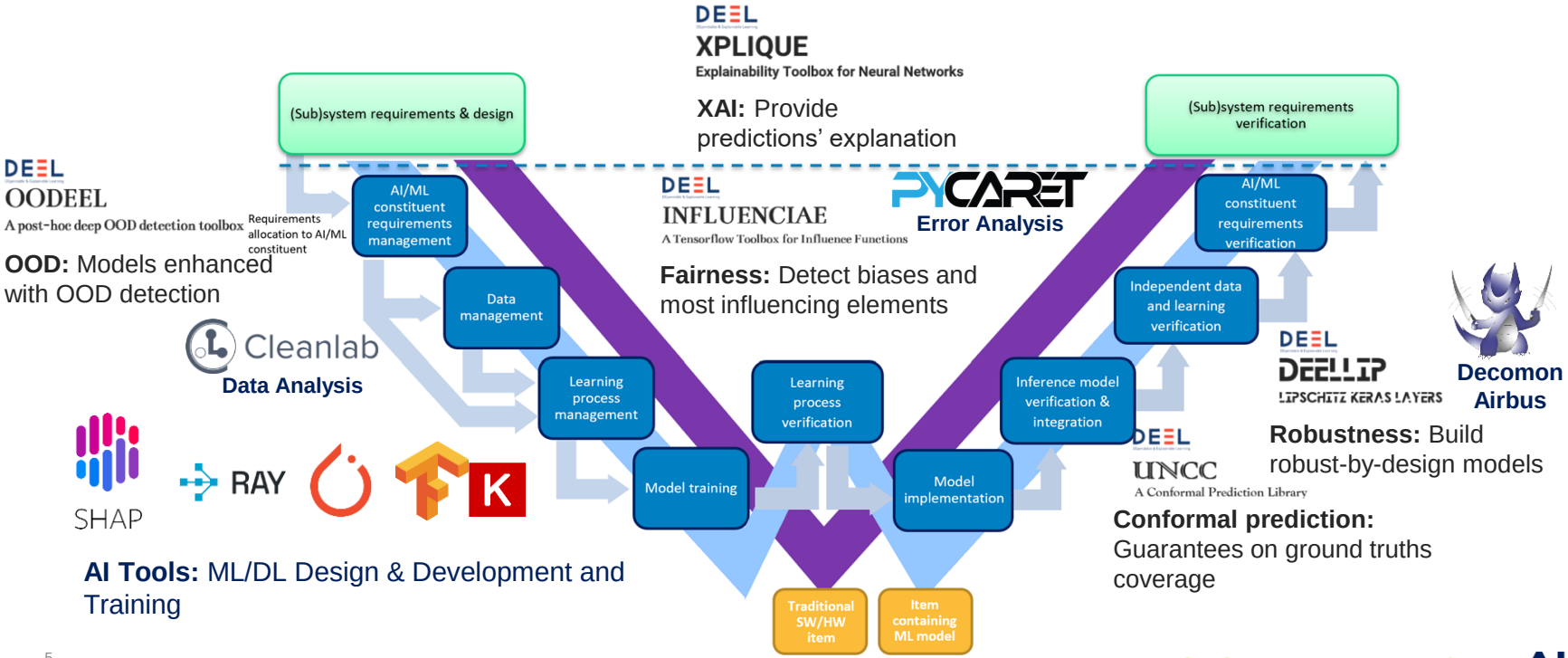
The Robust and Explainable Artificial Intelligence Program

Ref. MLEAP project public report.

MLEAP Machine Learning Application Approval EASA

: Safety By Design – Open Source Tools

Learning Assurance Execution: For the list of requirements, **open science** provides materials to cover the need of the community



Ref. EASA Concept Paper Issue 2

AIRBUS

{contact us}

Thiziri Belkacem

thiziri.belkacem@airbus.com

AI Leader, Digital Services

Jérémy Bascans

jeremy.bascans@airbus.com

HO, Digital Services

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EASA AI DAYS 2025

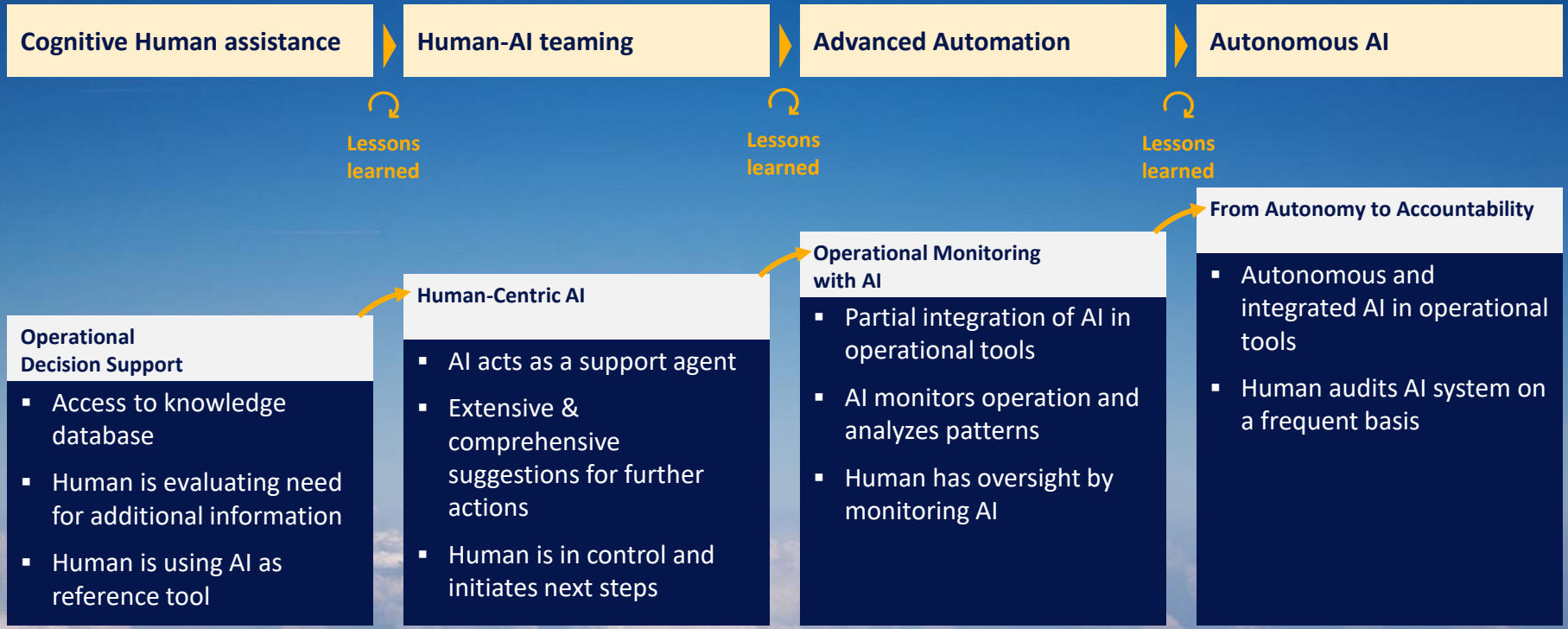
AI-based operational tools in approved organizations

28.08.2025, Cologne

M. Ricklin

Public

Safe AI integration in operations requires a step-by-step approach with continuous learning at every step



LUFTHANSA GROUP

Looking ahead


AI-generated image


AI-generated image


AI-generated image

How do we ensure safety & compliance in a chain of AI-driven actions?

LUFTHANSA GROUP

Thank you
for your attention

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Sémaphore Risk Monitoring

- AI-Based solution deployed within the French Authority to perform a RBO -

EASA
European Aviation Safety Agency

AI Days – August 2025

SIX FOIS SEPT

SÉMAPHORE RISK MONITORING

apave Aeroservices

osac

Just a word on SixFoisSept

SixFoisSept is a French company that has been created in nov. 2019. We have developed an innovative and integrated approach using AI/DataScience to measure and manage risk.

SÉMAPHORE
RISK MONITORING

This integrated solution, **Semaphore Risk Monitoring**, has been designed to optimize inspection **(#RBO)** and quality control. Proposed as a SAAS, Semaphore Risk Monitoring is already used by the French authority and some industrials (Aeronautics & Nuclear industries).

Risk Based Oversight

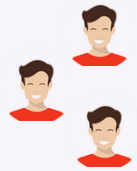
Why do we need it…

Constrained resources for your activities ?

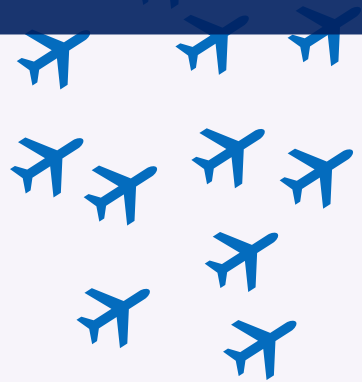
More and more to do…
14,000 aircraft, 100 inspectors, 350 inspections per year

Give priority to the riskiest aircraft, while remaining representative of the fleet.

Aircraft scoring



Inspectors



Risk score

Risk Based Oversight

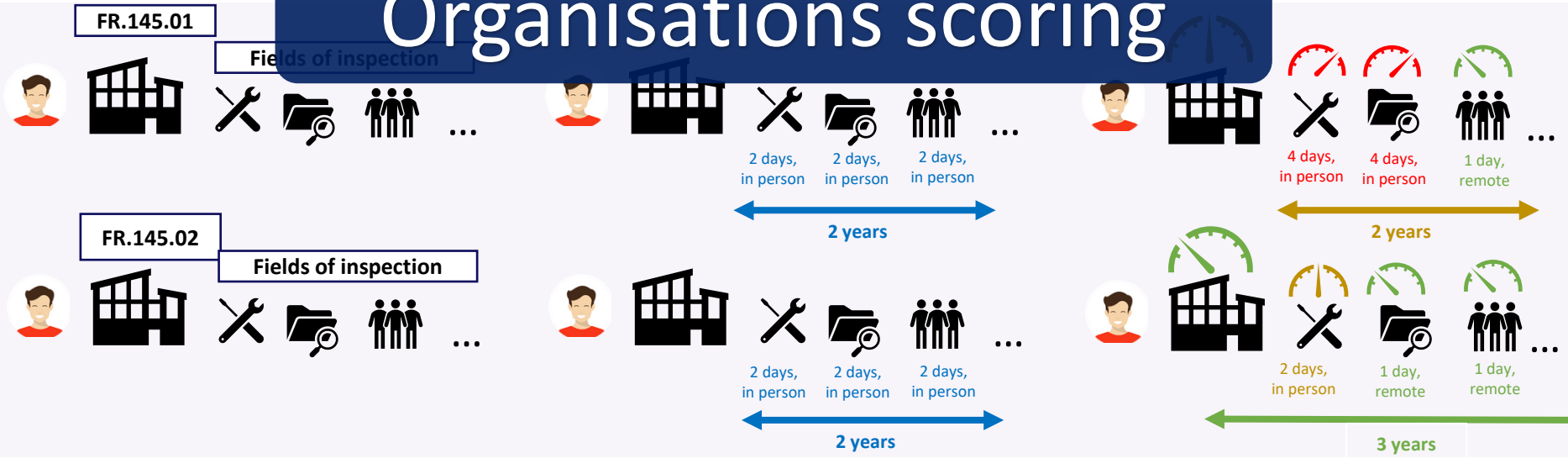
Why do we need it…

Want to improve exhaustive inspection ?

Part 145*, same rules of inspection for each of them

Modulate inspection depth and time according to risk.

Organisations scoring



**Part 145… and Part 21G, CAMO*

How did we transform RBO Project into an AI Solution

Calculate a risk with a transparent, robust and proven methodology : Semaphore Risk Monitoring®

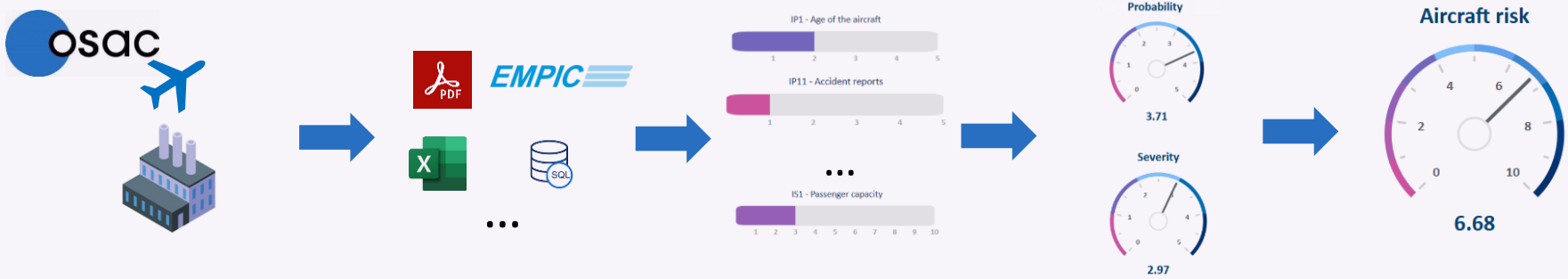
Definition of the risk object *(aircraft, organization etc.)*

→ **Data Ingestion** *Turning information into data (Symbolic AI & NLP)*

→ **Normalized KPI**

→ **Probability and severity scores**

→ **Risk score**



Normalization using symbolic AI (no black box).

Define and calculate the KPI – Measure risk

KPI are specific to each organization and have to be defined for each project

N Class Standardization

To calculate an accurate score, various KPI have to be combined such as finances, weight, aircraft type…

Consolidate an accurate Score

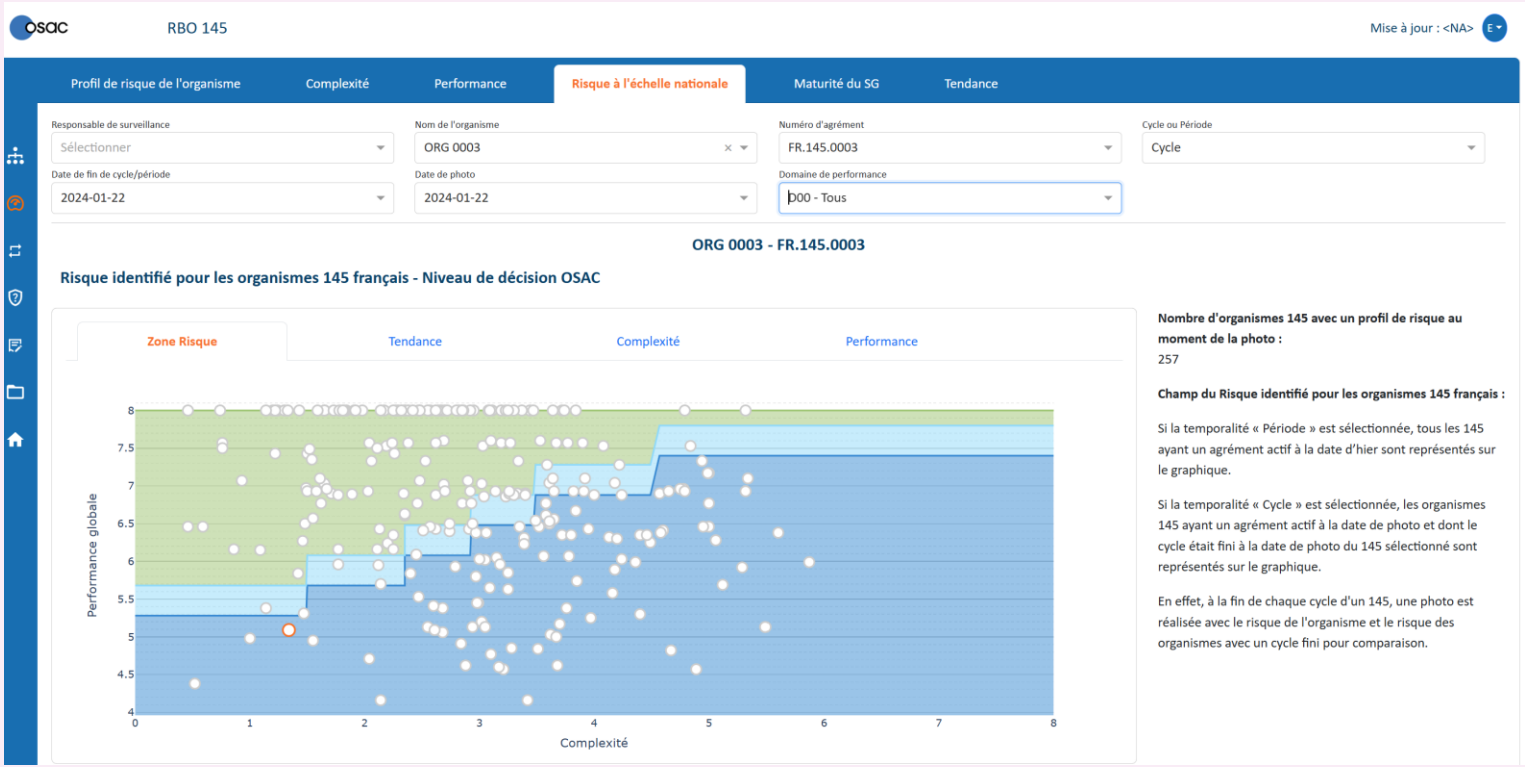
Business Allocation Process : the methodology we use to consolidate and weight elementary indicators

Create a RBO Program (and dataviz)

Industrialize the process of a transparent risk scoring
Creation of an Oversight Decision Support

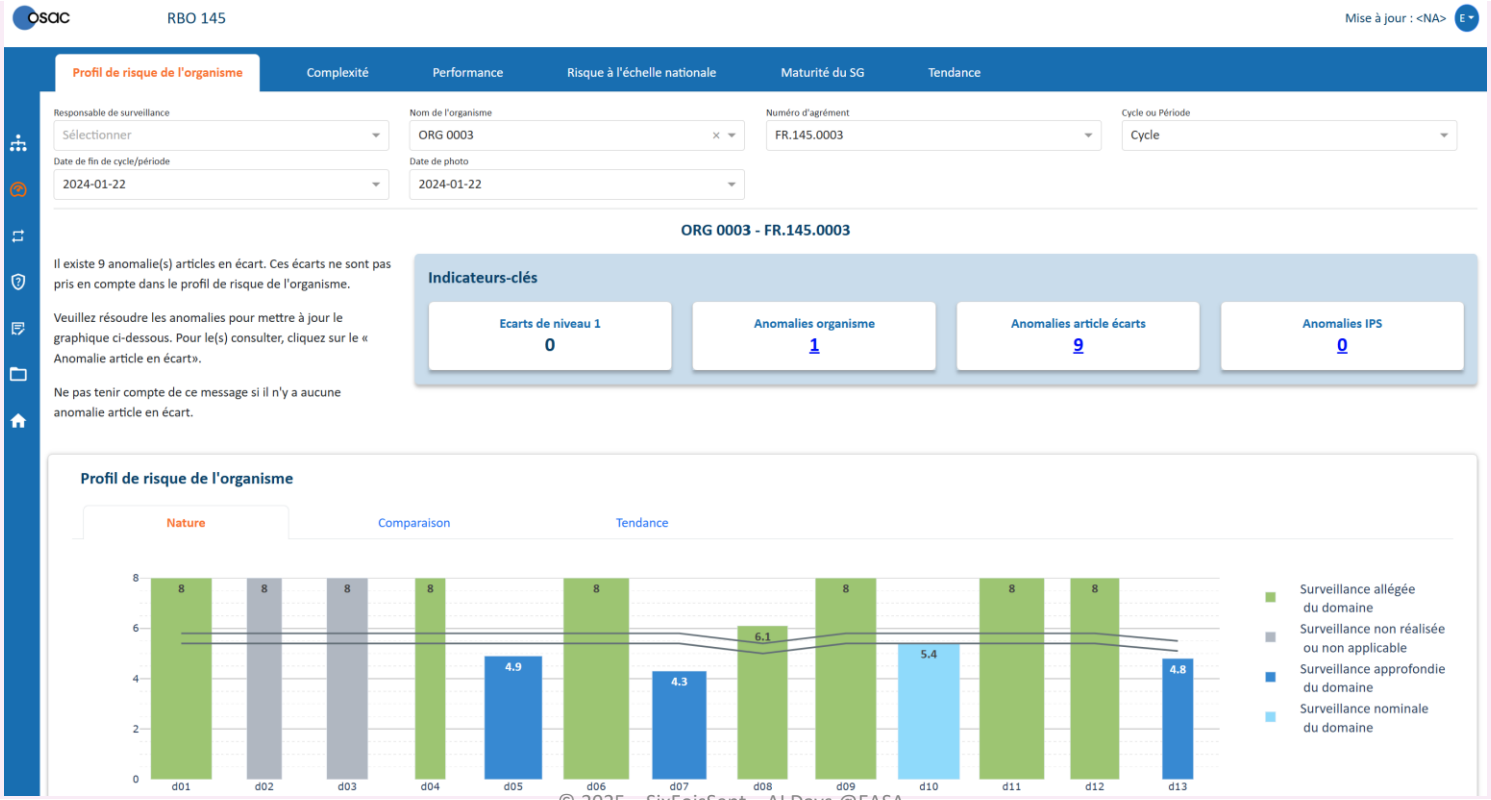
How can an AI-based tool contribute to improve safety 'by design'?

Relative Risks and Continuous improvement



How can an AI-based tool contribute to improve safety 'by design'?

Focus on critical area



A user's feedback

osac

Principles

Only a decision-making tool (we remain in control)

A relative ranking that lead to continuous improvement

A fine-tuned solution (tuned by our experts)

Not a fixed one : everything can be set or adjusted (sites, complexity, weight of criteria in performance factor...)

Not limited to a specific regulation

Benefits

Objective and justifiable decisions (using measures)

Easy-to-use steering tool with data visualization

Spend more time on identified risks

Reduction of the burden (reduced sampling or audit days, more possibilities for desktop audits)

Contacts

6 Rue Firmin GILLOT– 75015 PARIS

2 Boulevard Jean Monnet – 56260 LARMOR-PLAGE

https://www.sixfoissept.com/

contact@sixfoissept.com

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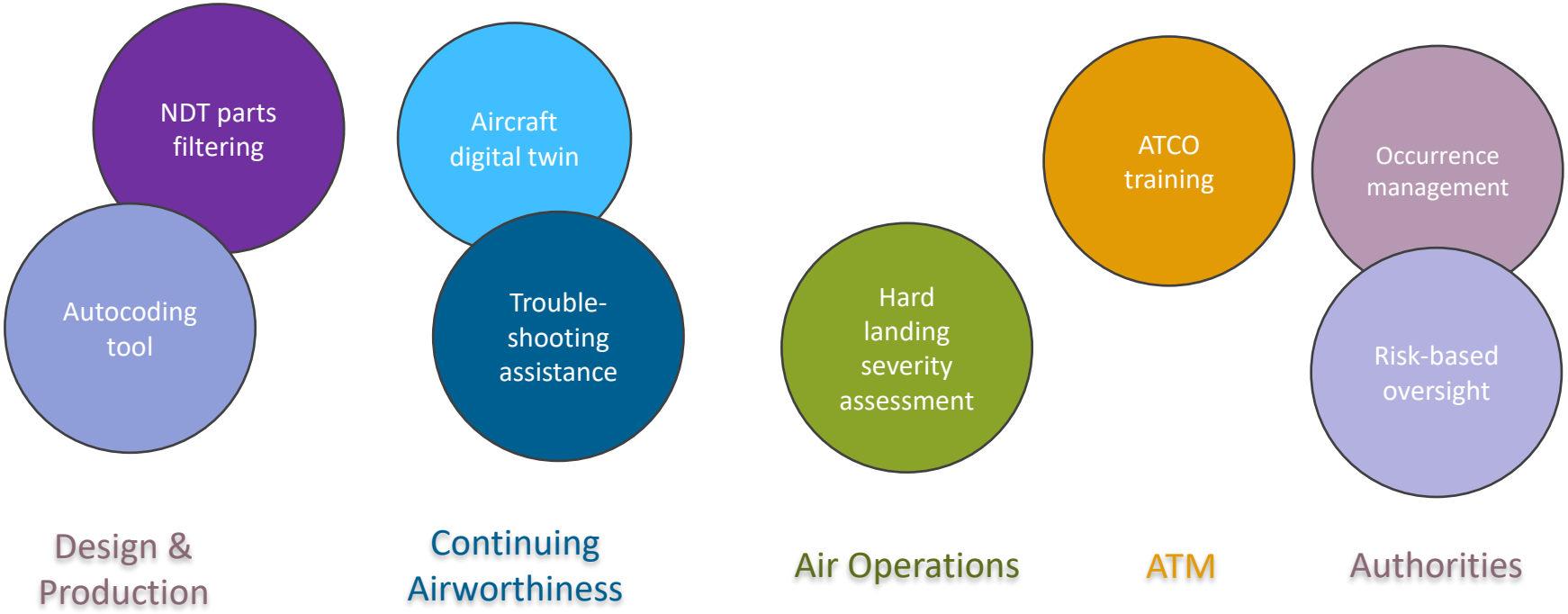
Operational AI-based tools: perspective



Internal use of AI @EASA: one example

LLM-based Query Assistant

⚠ Resources consuming activity

Handled by FS.1.1 (rulemaking + standardisation)
Estimated 2500 hours/year

Organisations
Private individuals
Competent Authorities

"Contact us"
EASA website

Filtered

Queries on implementation of
Regulation (EU) No 1321/2014

- CAW Standards
- CAM, Maintenance, Training orgs. requirements
- Maintenance Certifying staff licensing

Manual process

Tailored replies (non-standard)

AI-optimised process

AI training material

- EU regulations / AMC / GM
- relevant material (guidelines, standards, FAQ, ...)
- user instructions

+

9000+ replies saved on
the FS.1 Drive (since 2009)

Generative AI model
(running "locally" for data privacy)

Replies
drafting

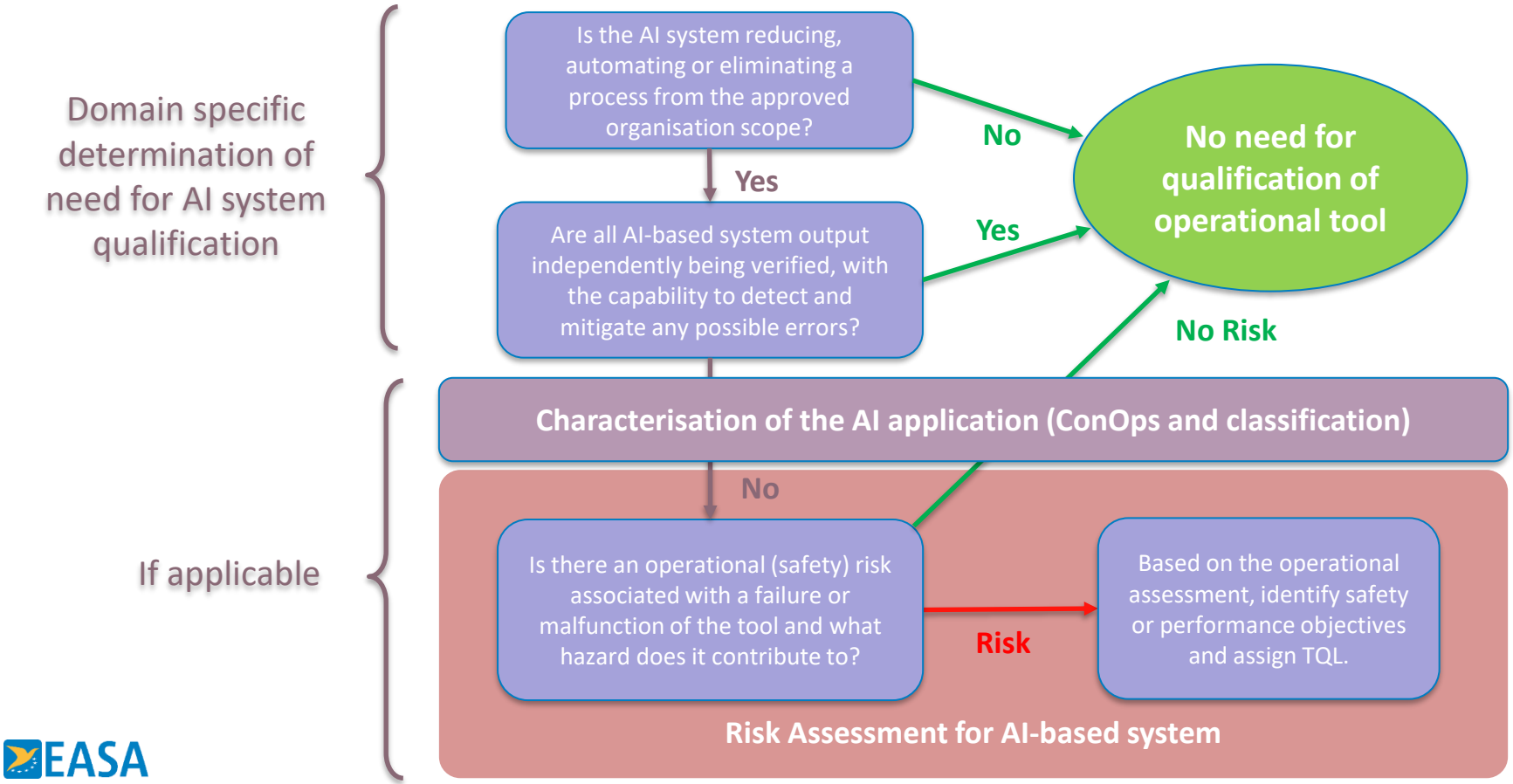
+

Expert review & fine-tuning

=

- Time efficiency
- Replies history searching
- Reusable process

Operational AI-based tools: risk assessment concept



Operational AI-based tools: regulation and oversight

- → The scope of RMT.0742 will be clarified with the European Commission to determine the appropriate handling of Operational Tools under the Aviation Basic Regulation
  - → Safety-related solutions that could be used by approved Aviation organisations would benefit from the AI trustworthiness framework.
- → Applicable guidance is one thing. Oversight is another…
  - → This is why a risk aware approach to qualification and a process oversight should be envisaged.

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Please use sli.do to raise your questions

www.sli.do
 # aidays2025
Passcode: kd7z53

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Coffee break – 15:00 to 15:30

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SINTEF / SynthAIR

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Automation and AI @SESAR

Jérôme Delmeulle
SESAR 3 JU Programme Manager

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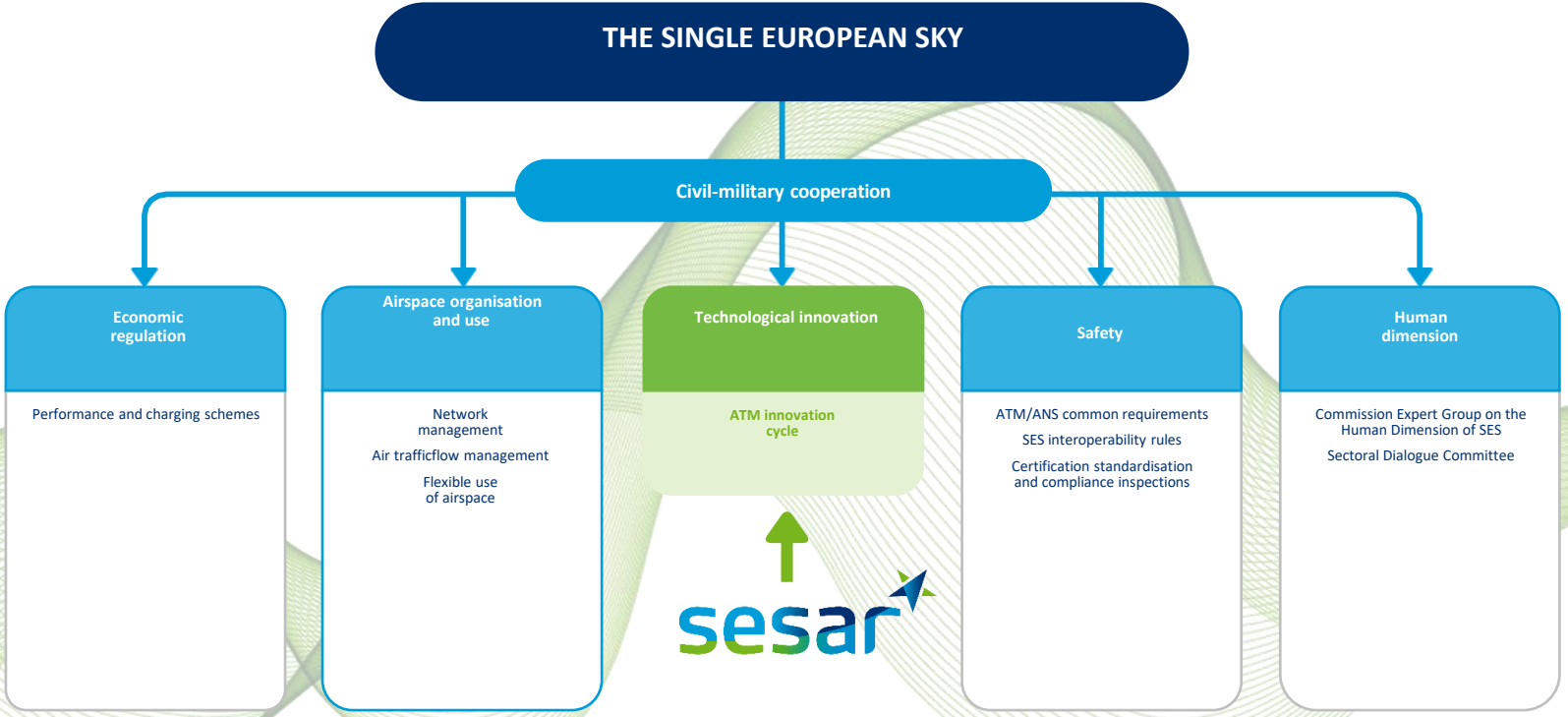
SESAR


THE SINGLE EUROPEAN SKY
Civil-military cooperation
Economic regulation
Performance and charging schemes
Airspace organisation and use
Network management
Air trafficflow management
Flexible use of airspace
Technological innovation
ATM innovation cycle
Safety
ATM/ANS common requirements
SES interoperability rules
Certification standardisation and compliance inspections
Human dimension
Commission Expert Group on the Human Dimension of SES
Sectoral Dialogue Committee
sesar

Core tasks

Strategic planning & monitoring

EUROPEAN ATM MASTER PLAN

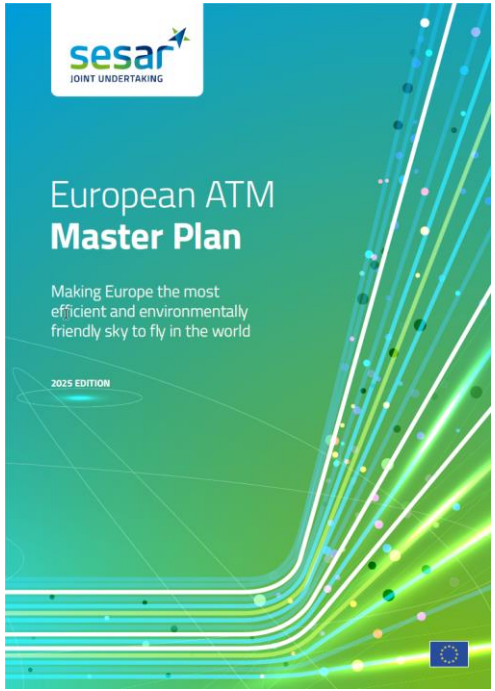
Manage research and development projects

DELIVER SESAR SOLUTIONS

Facilitate an accelerated market uptake of SESAR solutions

DEMONSTRATE COORDINATE SUPPORT

AI Supporting ATM Automation



Higher levels of automation

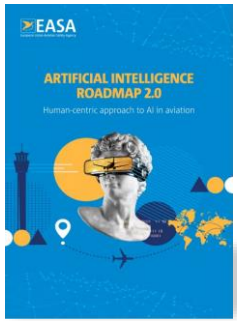
in the air and on the ground

to deal safely with

complex decision-making

while increasing the capacity and environmental performance.

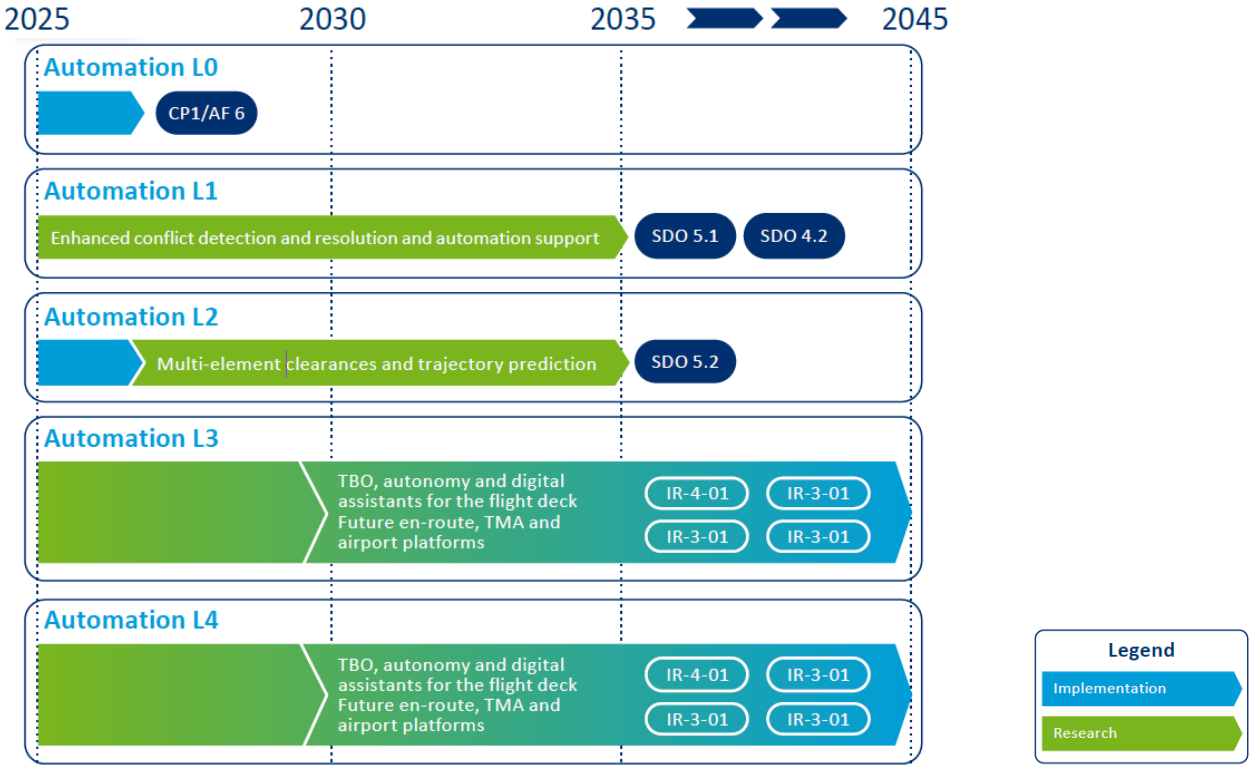
SESAR Automation Levels vs EASA AI Levels



DEFINITION	EASA AI level	PERCEPTION Information acquisition and exchange	ANALYSIS Information analysis	DECISION Decision and action selection	EXECUTION Action implementation	Authority of the human operator
LEVEL 0 **LOW AUTOMATION** **Automation gathers and exchanges data.** It analyses and prepares all available information for the human operator. The **human operator takes all decisions and implements** them (with or without execution support).	1A	●	●		◗	FULL
LEVEL 1 **DECISION SUPPORT** **Automation supports the human operator in action selection by providing a solution space and/or multiple options.** The **human operator implements the actions** (with or without execution support).	1B	●	●	◗	◗	FULL
LEVEL 2 **RESOLUTION SUPPORT** **Automation proposes the optimal solution** in the solution space. The **human operator validates the optimal solution** or comes up with a different solution. **Automation implements the actions** when due and if safe. Automation acts under **direction.**	2A	●	●	◑	●	FULL
LEVEL 3 **CONDITIONAL AUTOMATION** **Automation selects the optimal solution and implements** the respective actions when due and if safe. The **human operator supervises automation and overrides** or improves decisions that are not deemed appropriate. Automation acts under human **supervision.**	2B	●	●	●	●	PARTIAL
LEVEL 4 **CONFINED AUTOMATION** **Automation takes all decisions and implements all actions silently** within the confines of a predefined scope. Automation **requests the human operator to supervise** its operation if outside the predefined scope. Any human intervention results in a reversion to Level 3. Automation acts under human **safeguarding.**	3A	●	●	●	●	LIMITED

Legend
Full ● Partial ◗ Limited ○

Vision and key milestones for automation



AI Research Priorities

Exploratory Research

- **WA2-1 Research to help shape the future regulatory framework for a Digital European Sky**
  - **Evolution of the human operator role** and **automation**
  - **Research** on **human operator fatigue** and **rostering practices**
  - **Development of guidelines** for the **design of future AI systems**
  - **Enhancing robustness** and **reliability** of **machine learning (ML) applications**
  - **Support** to the **certification** of **novel ATM (AI-based and non-AI-based) systems** that enable **higher levels of automation**
  - **Development of a framework** to achieve **effective Human-AI Teaming**
  - **Explainable Artificial Intelligences (XAI)**

Industrial Research

- **WA3 IR-3 Future En-Route and TMA ground platforms**
  - IR-3-02: **AI capabilities** enabling the **next-generation platforms**.
- **WA4 IR-4 Future airport platform**
  - IR-4-02: **AI capabilities** enabling the **next generation of airport platforms**.
  - IR-4-05: **Future human–machine teaming**.
- **WA5-1 Increased automation assistance for the pilot for ATM tasks**
  - IR-5-01: **Single Pilot Operations (SiPO)**.
    - **AI to enhance flight crew capabilities**.
    - **Advanced on-board systems and procedures** in support of **highly automated ATM operations**.
  - IR-5-02: **Increased automation assistance** for the pilot for **ATM tasks**.
  - IR-5-03: **Highly automated ATM** for **all airspace users**.
  - IR-5-04: **Airborne capabilities** for **reducing ATM's environmental footprint**.

AI applications in ATM

Airport / Tower surveillance
TRUSTY, JARVIS
Taxiway inspection (i.e., bird hazard, presence of drones and the need for drone protection, autonomous vehicle monitoring, human intrusion, etc.) and runway monitoring (approach and landing) misalignment warning.

Traffic hotspots
ARTIMATION, DART, ASTRA, ANTICIPATE, HARMONIC, HYPERSOLVER, DEEPFLOW
AI-based Flow Management Position to predict and resolve traffic hotspots. Automatic support for hot spot analysis and resolution, integration of constraints and dynamic airspace configuration. Data driven trajectory prediction.

Network state monitoring
PJ.09-W2-49
Prediction and management of network critical states and degraded performance.

Smart sectorization
SMARTS
Dynamic airspace configuration and the design of "smart sectors". This covers the design of basic volumes of airspace with optimal distribution of workload, tailored around specific safety and operational requirements, including complexity.

Optimised runway delivery
PJ.02-W2-14.6a
Enhanced optimised separation delivery with machine learning uses more accurate predictions of final speed profiles derived from advanced big data / machine learning techniques.

ATCO & Pilot decision support
TAPAS, MAHALO, AISA, JARVIS, TADA, DARWIN, RESPONSE, ORCI, AWARE, DIALOG
Various AI solutions solutions (digital assistants) to support Pilots, ATC operators and Airport operators in non-safety and safety critical operations.

Dynamic reconfiguration of airport resources
FASTNet
Airport-Airport coordination in strategic and pre-tactical phases based on airport stakeholders and network requirements, including both information and predictions.

Generating synthetic data for feeding AI Machine Learning
SynthAIR

Improved adverse weather forecasting + impact on network management
ISOBAR, KAIROS
Integration of AI-based convection prediction models within ATFM operational tools. Improve prediction of additional weather phenomena impacting aviation. More Precise Characterisation of Demand and Capacity Imbalances due to Convective Weather.

Understanding AUs' preferences and behavior
SIMBAD
Modelling of trajectories and estimation of non-observable variables from historical air traffic data. Particular attention will be paid to the estimation of variables related to AUs' preferences and behaviour (e.g., airline cost functions).

Passenger behaviour & Intermodality
IMHOTEP, BigData4ATM, MAIA, MultiModX, PRIAM
Characterisation of passengers and journeys attributes, aimed to capture relationships between the target variables missing in the mobile network data (i.e., number of persons travelling together and number of bags) and the explanatory variables that are present both in surveys and mobile network data (e.g., place of residence, purpose of the trip, last mode of transport used to access the airport).

Speech recognition
MALORCA, HAAWAI, PJ.05-W2-97, PJ.10-W2-96
Automatic speech recognition (ASR) to reduce the amount of manual data inputs by air-traffic controllers (using also airspace structure and radar data).

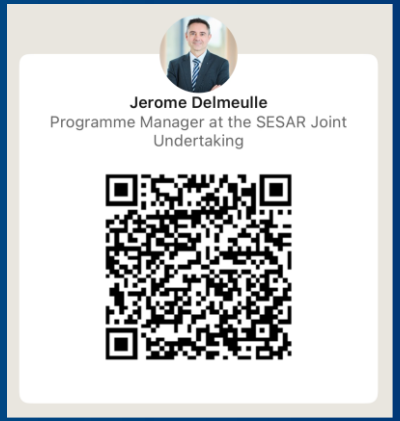
U-space
BUBBLES, USEPE, USPACE, AI4HyDrop
U-Space advanced (U3) 'separation management service'.

ICT security & CNS
SINAPSE, ASTONISH + others outside SESAR
AI based surveillance of network load distribution to detect anomalies. Usage of AI for PEN testing. Usage of AI for systems hardening. Software defined networking.

Novel methods and procedures of certification
HUCAN
Developed for ATM-related systems based on high levels ofautomation, including AI-powered ones.

THANK YOU FOR YOUR ATTENTION

Visit https://www.sesarju.eu for more information



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JARVIS

Building AI-Enabled Digital Assistants for Pilots, ATC, and Airports

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Dmitrii Kirov (Collins Aerospace)

EASA AI Days| 28th August 2025

JARVIS

JARVIS Outline

- Project overview
- AI-enabled digital assistants
  - Feature highlights
  - Current validation results and lessons learned
- Assurance and certification considerations
  - AI assurance
  - Human-AI teaming
  - AI ethics
- Takeaways

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JARVIS Partners

Kick off: June 2023
Duration: 3 years
16 partners
9 countries

Coordinator

Collins Aerospace
An RTX Business

CIRA
Italian Aerospace Research Centre

ATHENS INTERNATIONAL AIRPORT
ELEFTHERIOS VENIZELOS

DLR

deepblue
consulting & research

nais

CRIDA

nlr

INDRA

ENAIRE

AIRBUS

enav

LEONARDO

BOEING

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EUROCONTROL

Swedavia Airports

+

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(service agreement)

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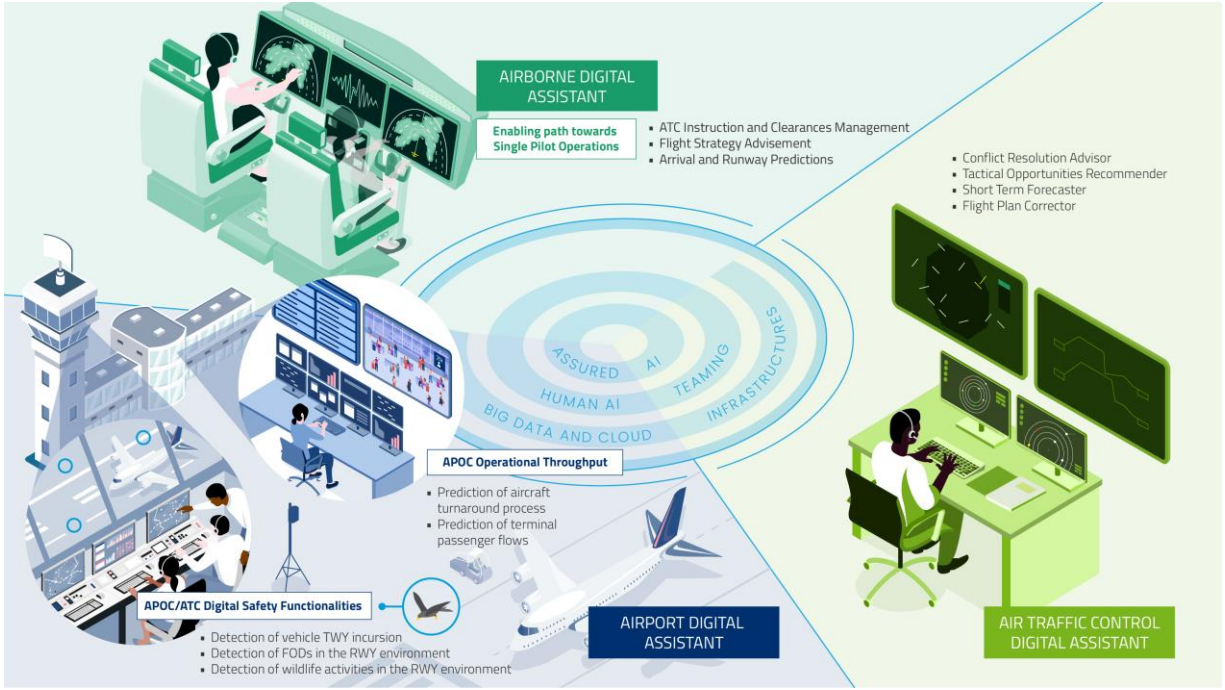
JARVIS: Just a Rather Very Intelligent System



- JARVIS develops and validates **AI-based digital assistants** that would enhance existing ATM operations and enable new ones
  - **Airborne** digital assistant
  - **ATC** digital assistant
  - **Airport** digital assistant
- **Key target** – increase human performance: acceptability, situational awareness, workload
- First steps towards **SRIA Automation Level 4**, Enhanced Ground Ops and Single Pilot Ops

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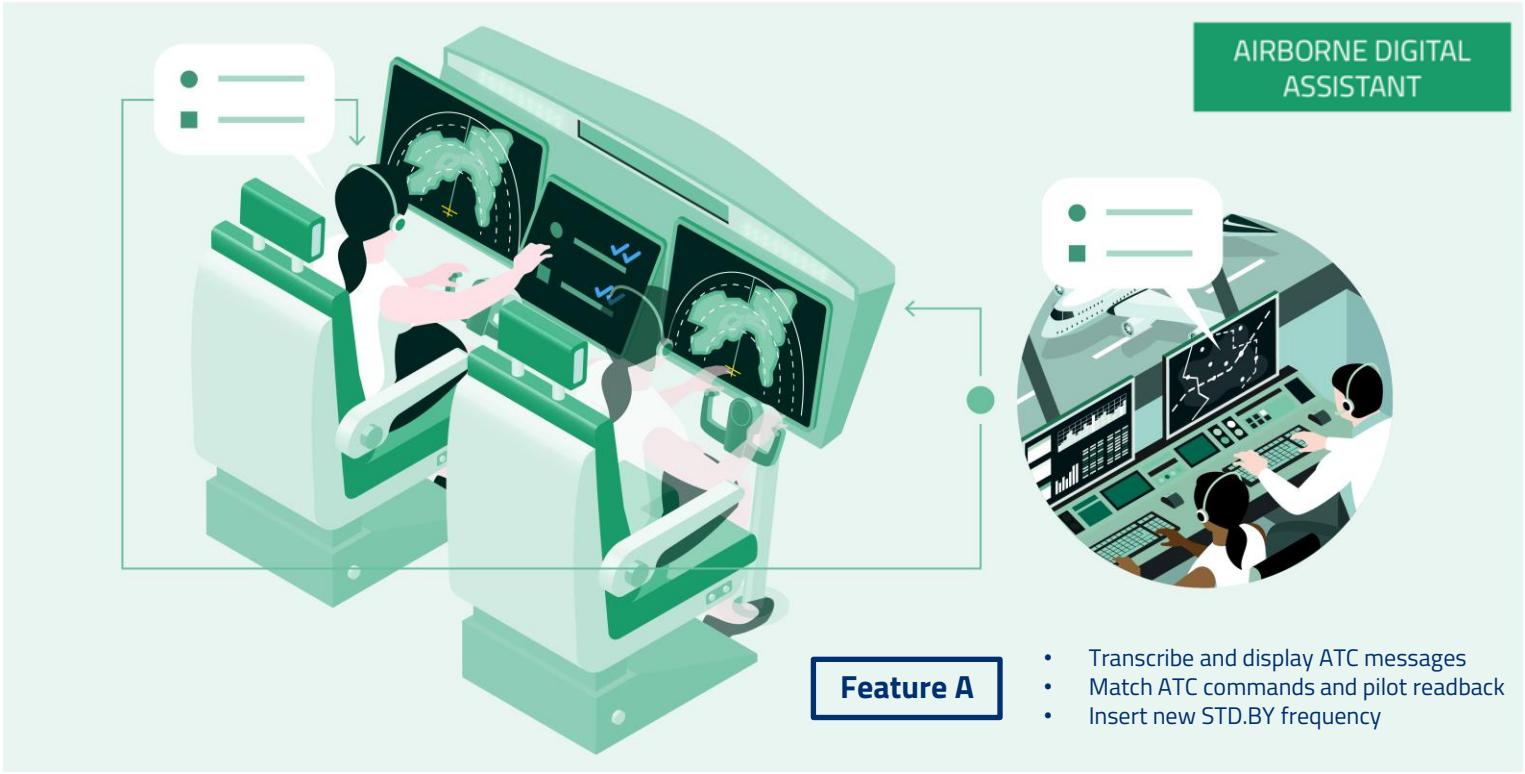

Benefits

- DECREASED WORKLOAD
- IMPROVED FLIGHT EFFICIENCY
- SITUATION AWARENESS

AIR-DA = Airborne Digital Assistant

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AIRBORNE DIGITAL ASSISTANT

Feature B

- Assess the risk level of the current flight strategy using automated reasoning
- Recommendations and Explainability

Benefits

IMPROVE PILOT DECISION MAKING

IMPROVED FLIGHT EFFICIENCY

ENHANCE SITUATIONAL AWARENESS

AIR-DA = Airborne Digital Assistant

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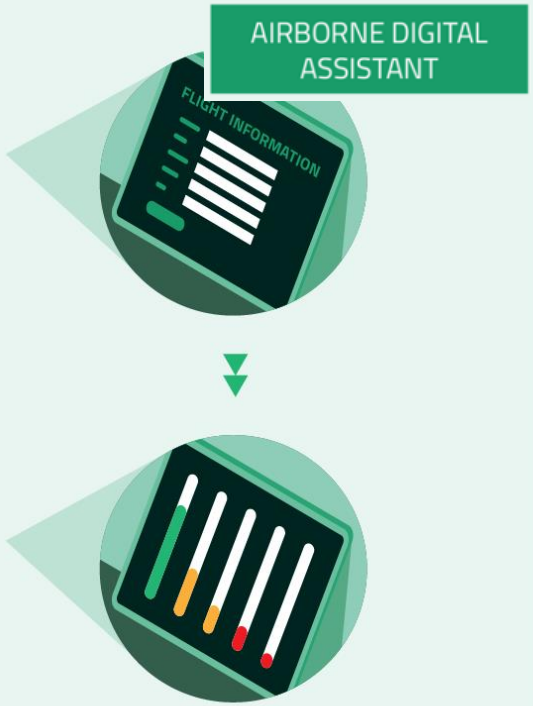

Feature C

- Machine Learning-based system to predict the most likely arrival and runway

Benefits

- DECREASED WORKLOAD
- IMPROVED FLIGHT EFFICIENCY
- SITUATION AWARENESS

AIR-DA = Airborne Digital Assistant

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Current Results

- First validation exercise was performed at Leonardo
- 7 pilots participated in the validation
- Lessons learned:
  - **Performance:** comm transcriptions were often not accurate, challenges to match pilot readback (too much rephrasing)
  - **Usability:** More complex scenarios need to be considered (current scenarios could easily be handled by the pilot without AIR-DA)
  - **Explainability** is crucial; there is room for improvement
  - **Interface design** is important: fonts, colors, visibility, readability
  - **Training material** must be available and detailed

Leonardo's flight simulator (General Regional Aircraft)

AIR-DA = Airborne Digital Assistant

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AIR TRAFFIC CONTROL DIGITAL ASSISTANT

- **AI-CORA:** Conflict resolution assistant based on reinforcement learning (RL)
- Ongoing discussion with EASA AI Research team on RL assurance

Benefits

- DECREASED WORKLOAD
- DECISION SUPPORT
- SITUATION AWARENESS

ATC-DA = ATC Digital Assistant

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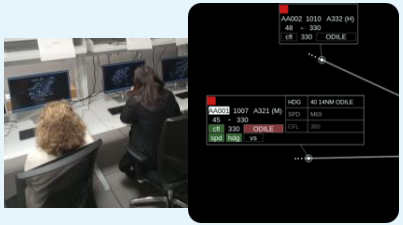
Current Results and Lessons Learned:

- Tested 2 solutions for ATC-DA: without AI (based on ATCO judgement) and with AI (reinforcement learning)
- Non-AI CORA solution had similar performance to AI CORA
  - In 90% of the situations, ATCO knew how to resolve the conflict
  - ATCO needs to maintain perfect situational awareness
- In the **short term**, AI-based solution can be used to:
  - Fine-tune conflict resolution proposals for complex scenarios
  - Post-ops to analyze past situations
- In the **long term**, AI can take more responsibility and automation – **but trust is key and must be built incrementally**



ATC-DA = ATC Digital Assistant

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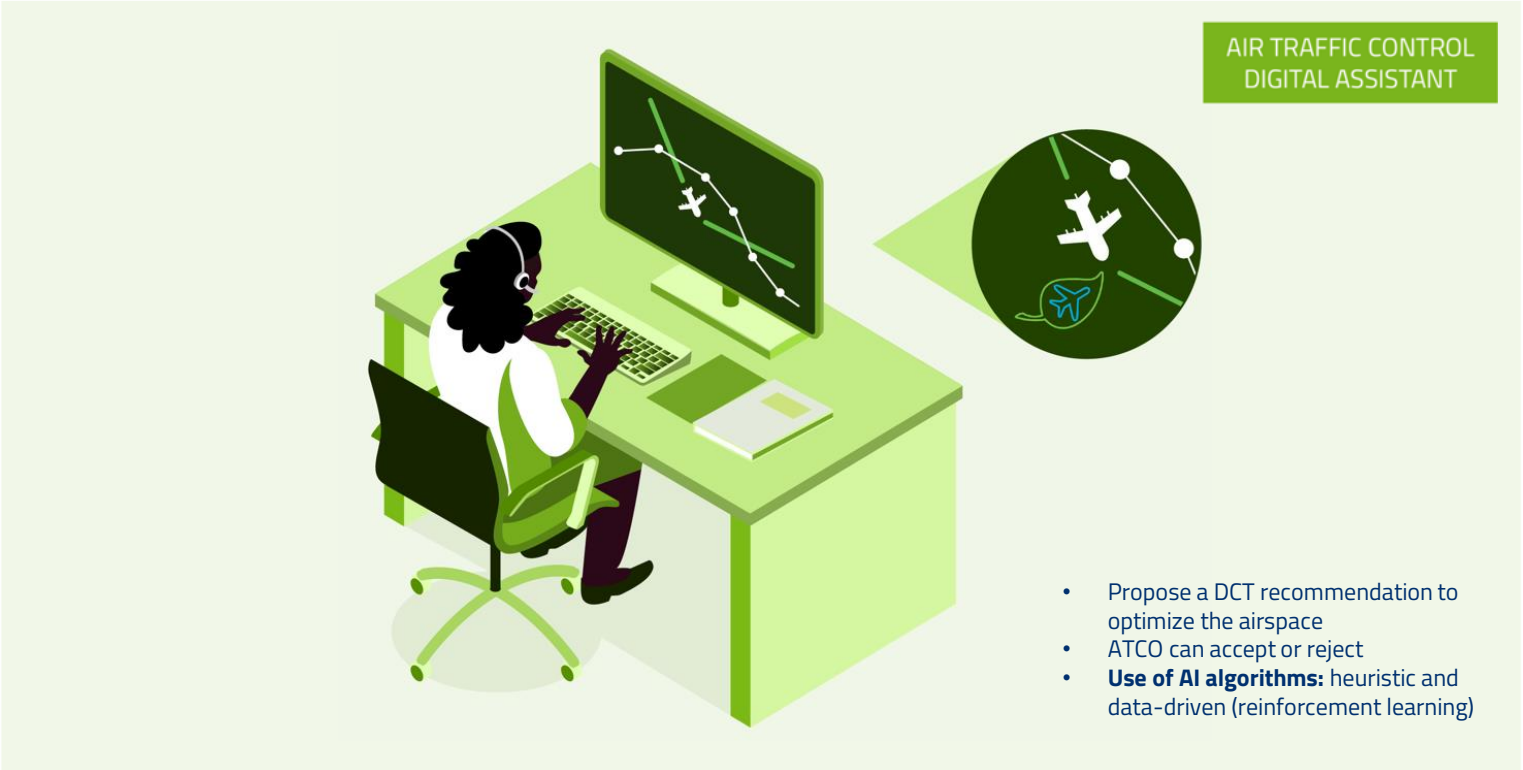

- Propose a DCT recommendation to optimize the airspace
- ATCO can accept or reject
- **Use of AI algorithms:** heuristic and data-driven (reinforcement learning)

Benefits

DECREASED WORKLOAD

DECISION SUPPORT

SITUATION AWARENESS

ATC-DA = ATC Digital Assistant

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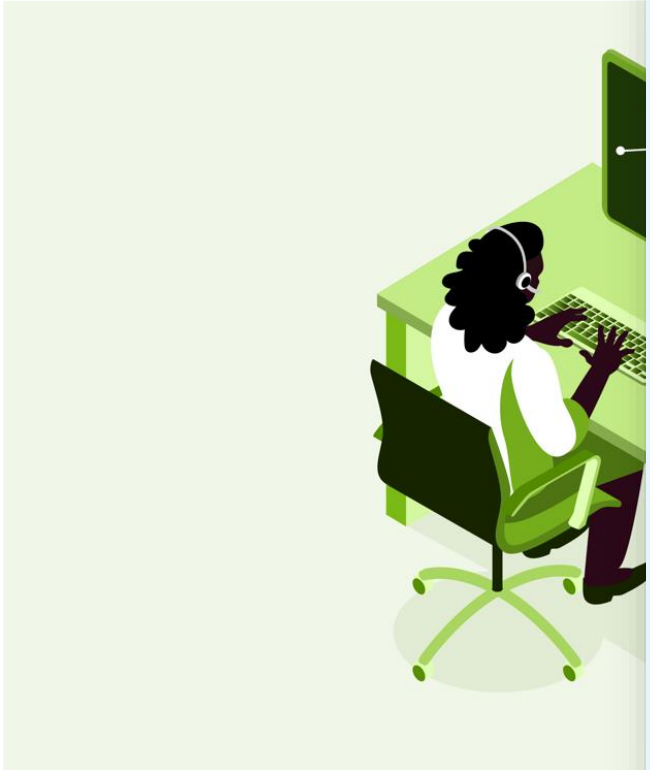

Current Results and Lessons Learned:

- **Avoid ATCO distraction** with obvious recommendations that have marginal improvement
- Providing DCT recommendation at the boundary of a sector may impact the ATCO downstream
- Baseline algorithm (AI heuristic) for DCT performed well
  - Challenging to justify the use of data-driven approaches, such as RL
  - Need to consider more complex/abnormal scenarios (e.g., high traffic) – AI can bring more value there

More details are available in the 2025 FlyAI forum presentation by INDRA (Álvaro Quintanar Pascual)

ATC-DA = ATC Digital Assistant

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Benefits

- IMPROVED SAFETY
- INCREASED AUTOMATION
- IMPROVED OPERATIONAL EFFICIENCY

AP-DA = Airport Digital Assistant

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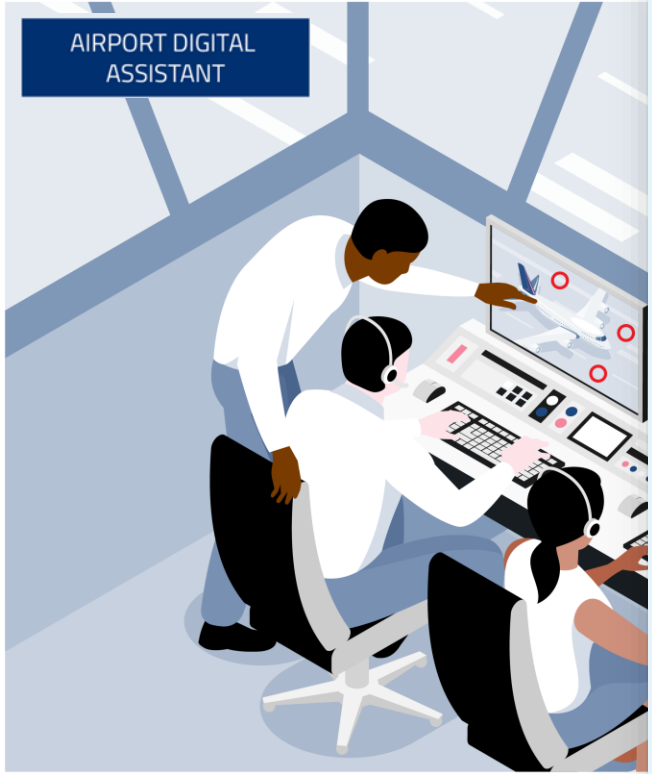

- AI-enabled computer vision for detecting hazards on runways and taxiways: FOD, wildlife, incursions
- **Safety-critical:** Excessive false alarms may distract and increase the workload of airport operators

Image provided by: INDRA

Image provided by: INDRA

AP-DA = Airport Digital Assistant

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Current Results and Lessons Learned:

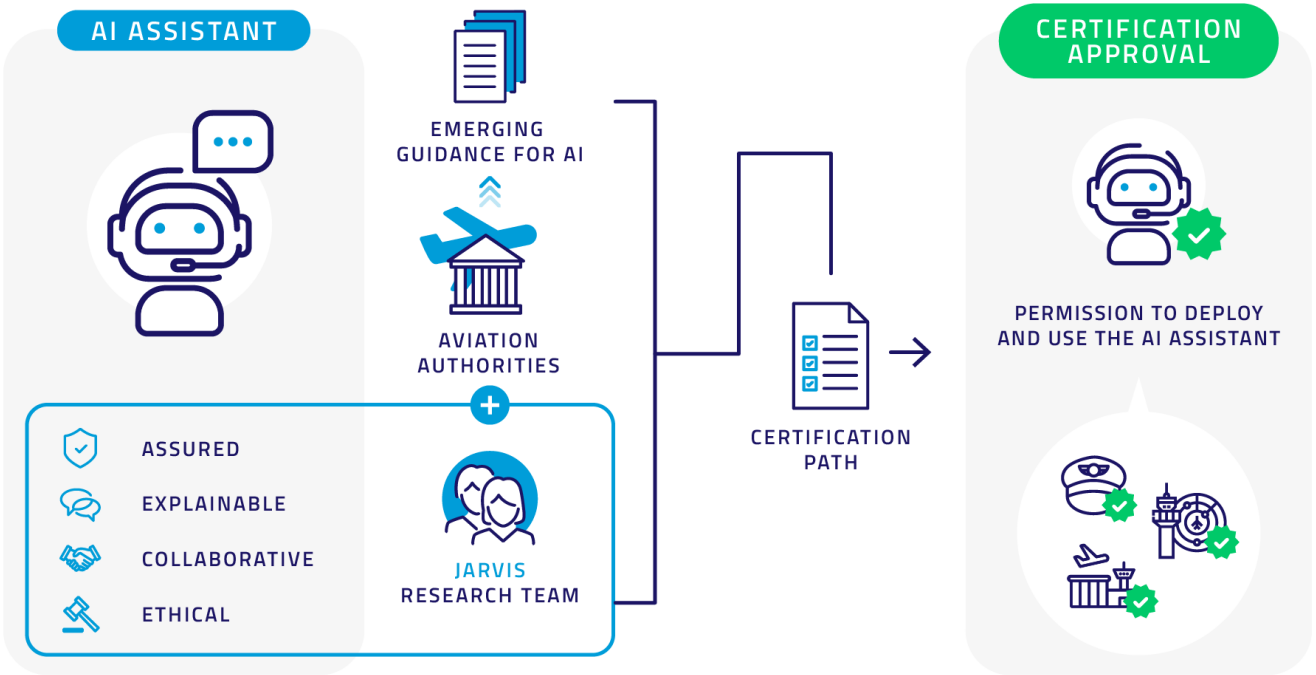
- Active use of **synthetic data** to develop DL models
  - Datasets of 6000+ labeled images (full synthetic, mixed)
  - Difficult to close the **sim2real gap** due to the need of replicating the physics of objects (e.g., plastic bags)
  - Better performance with bigger objects, challenges with smaller
- **Transformer-based** DL models provide better generalization
  - But they are optimized for accuracy, not for inference speed
  - Real-time performance is still challenging to achieve (also due to the use of 6K cameras in the airports)
  - Envisioned solution: Process separate tiles in the image

*DL = Deep Learning

AP-DA = Airport Digital Assistant

JARVIS

Path to Certification of AI Assistants



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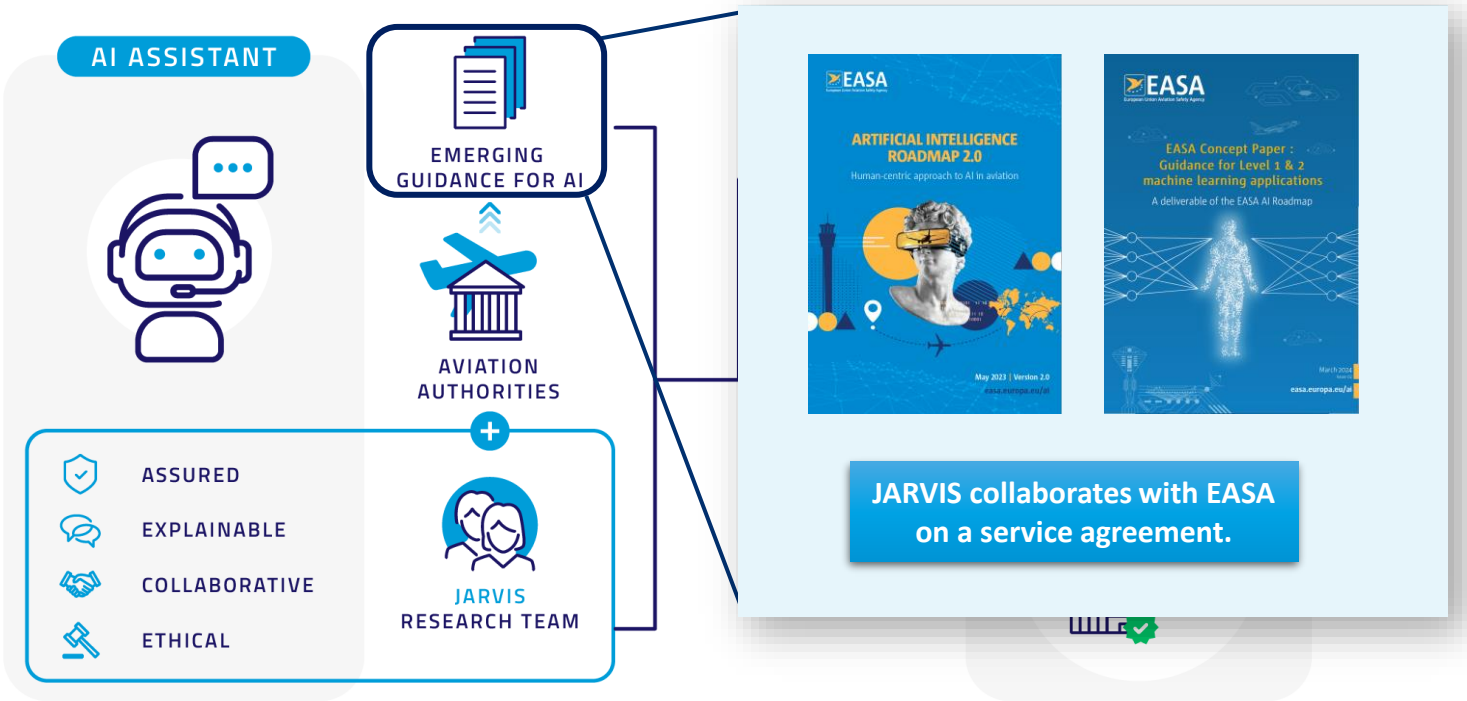
JARVIS

Path to Certification of AI Assistants



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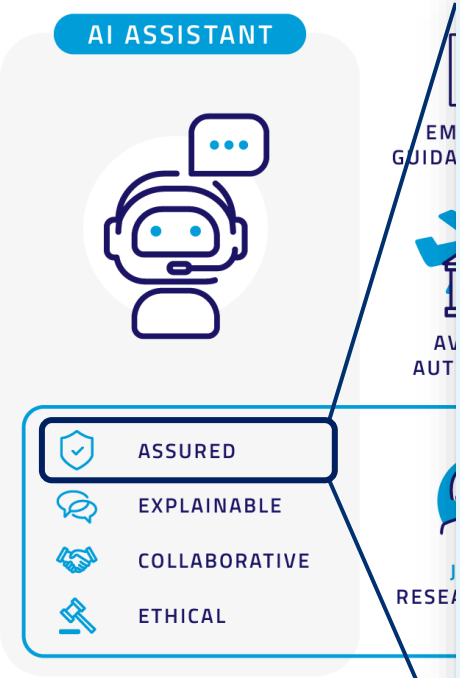
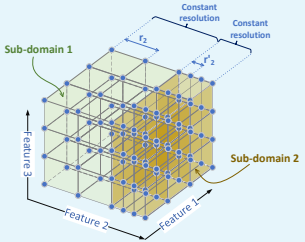
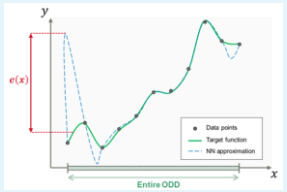
AI Assurance: Model/Constituent Level



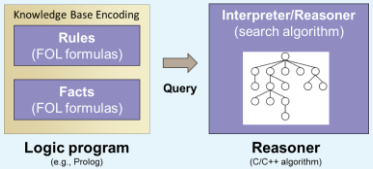
- Some AI technologies are not yet captured by the emerging guidance (EASA AI Concept Paper)
  - **Logic (automated) reasoning:** determinism, timing
  - **Reinforcement learning:** scenario quality, generalization
- Definition of **Operational Design Domain** (ODD) is a key step, challenging for perception systems (e.g., voice-to-text)
- Synthetic data generation and sim2real gap



ODD and data completeness analysis



Stability and generalization analysis



AI reasoner and logic program

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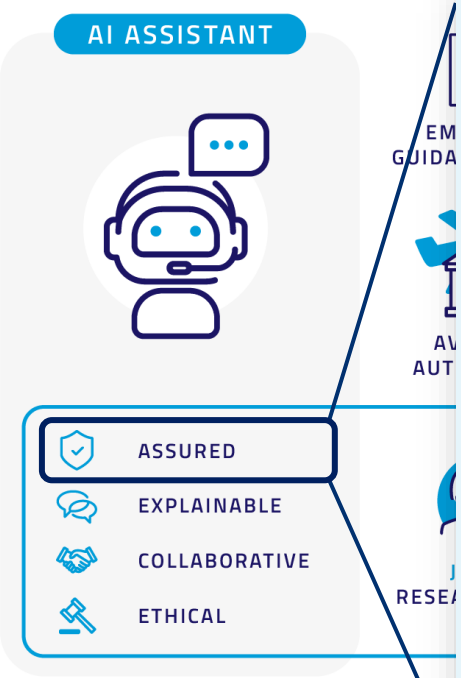
AI Assurance: System Level



- AI models/constituents will not be standalone – need to **integrate** into larger (often existing) systems
- AI level may be difficult to assign (e.g., 1B or 2A?) – depends on the boundary considered
  - The boundary itself may be difficult to identify – both for AI system and AI constituent
- **Specification** of ConOps and requirements for AI-enabled systems and high automation is an open challenge
- **Safety assessment:** how to link AI/ML performance limitations to system safety?

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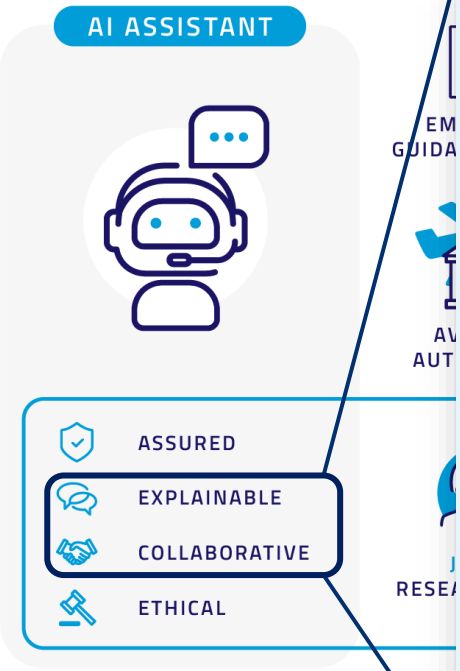
JARVIS

Human-AI Teaming (HAT)



- Human-AI Teaming objectives* are important for JARVIS digital assistants, even if they target higher AI levels
- Use of different explainability “levels” (based on context, time criticality of the task)
- **Challenge:** over-reliance on digital assistants and de-skilling of users (pilots, controllers)
- **BUT:** Under-reliance and lack of trust is a more near-term problem to be solved

* From EASA AI Concept Paper guidance

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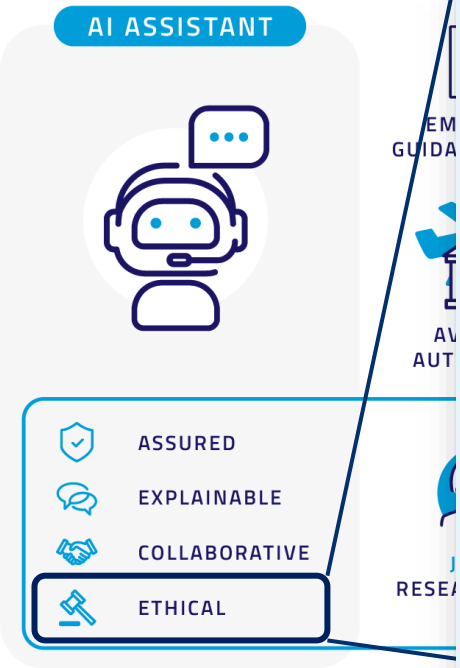
JARVIS AI Ethics



- Identifying bias in data is crucial because it impacts what AI is learning (human validation is recommended)
- …but presence of bias is not necessarily harmful
  - If real world operations are biased by themselves, it may be more practical to replicate that bias
- Due to overly high expectations for AI, trust can be lost quickly if AI makes errors; hard to gain it back
- **AI Ethics assessment will be conducted for JARVIS digital assistants, with EASA support and mentorship**

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AI Ethics: Key References and Regulation

Primary References:

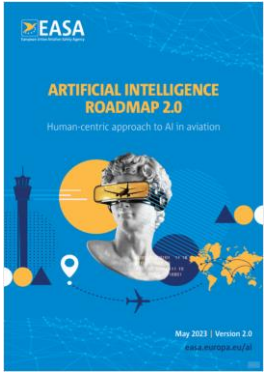
EU HLEG on AI: "Ethics Guidelines for Trustworthy AI" (2019)

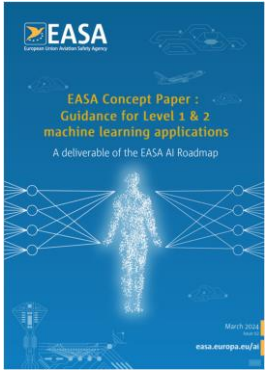
EU HLEG on AI: “The Assessment List for Trustworthy AI” (2020)

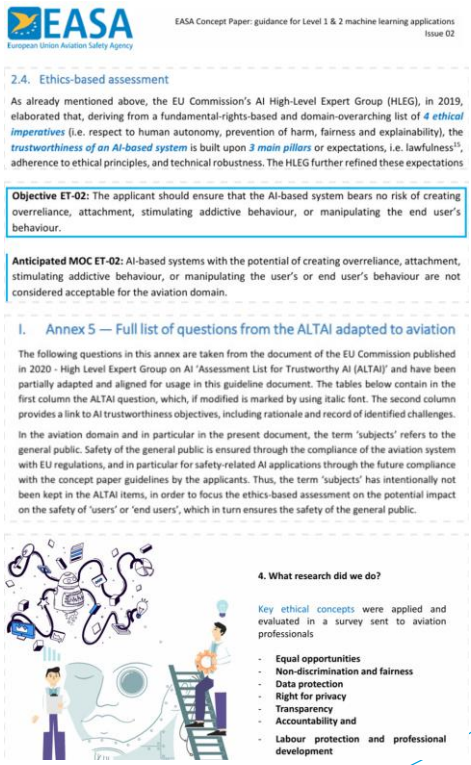
EASA: "Artificial Intelligence Roadmap 2.0" (2023)

EASA: "Concept Paper: Guidance for Level 1 & 2 machine learning applications" (Issue 02, 2024)

EASA: “EASA AI Days 2024” (Day 1, 2024)






EASA Concept Paper: guidance for Level 1 & 2 machine learning applications
Issue 02

2.4. Ethics-based assessment

As already mentioned above, the EU Commission’s AI High-Level Expert Group (HLEG), in 2019, elaborated that, deriving from a fundamental-rights-based and domain-overarching list of *4 ethical imperatives* (i.e. respect to human autonomy, prevention of harm, fairness and explainability), the *trustworthiness of an AI-based system* is built upon *3 main pillars* or expectations, i.e. lawfulness[15], adherence to ethical principles, and technical robustness. The HLEG further refined these expectations

Objective ET-02: The applicant should ensure that the AI-based system bears no risk of creating overreliance, attachment, stimulating addictive behaviour, or manipulating the end user’s behaviour.

Anticipated MOC ET-02: AI-based systems with the potential of creating overreliance, attachment, stimulating addictive behaviour, or manipulating the user’s or end user’s behaviour are not considered acceptable for the aviation domain.

I. Annex 5 — Full list of questions from the ALTAI adapted to aviation

The following questions in this annex are taken from the document of the EU Commission published in 2020 - High Level Expert Group on AI ‘Assessment List for Trustworthy AI (ALTAI)’ and have been partially adapted and aligned for usage in this guideline document. The tables below contain in the first column the ALTAI question, which, if modified is marked by using italic font. The second column provides a link to AI trustworthiness objectives, including rationale and record of identified challenges.

In the aviation domain and in particular in the present document, the term ‘subjects’ refers to the general public. Safety of the general public is ensured through the compliance of the aviation system with EU regulations, and in particular for safety-related AI applications through the future compliance with the concept paper guidelines by the applicants. Thus, the term ‘subjects’ has intentionally not been kept in the ALTAI items, in order to focus the ethics-based assessment on the potential impact on the safety of ‘users’ or ‘end users’, which in turn ensures the safety of the general public.

4. What research did we do?

Key ethical concepts were applied and evaluated in a survey sent to aviation professionals

- Equal opportunities
- Non-discrimination and fairness
- Data protection
- Right for privacy
- Transparency
- Accountability and
- Labour protection and professional development

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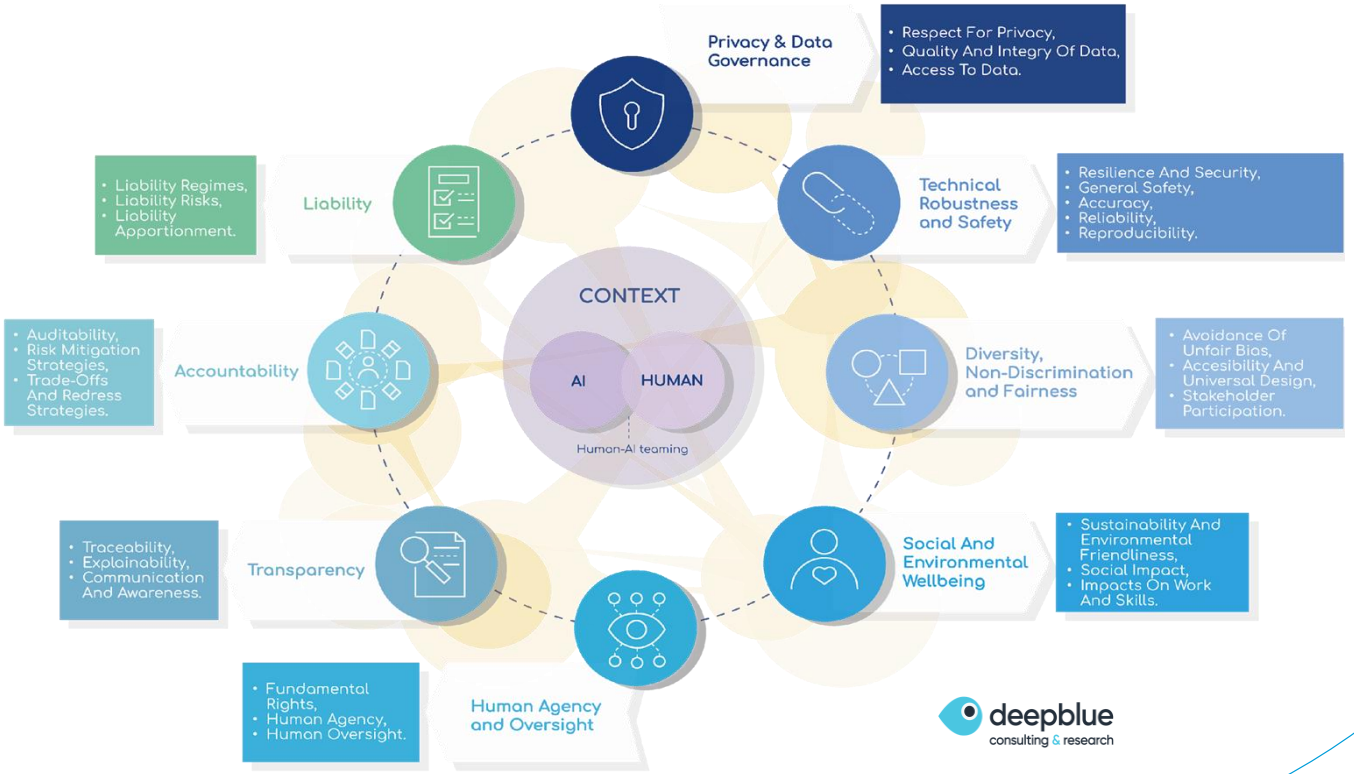
JARVIS Ethics Assessment Approach

The approach draws on general AI Ethics assessment but is tailored for the specific needs of the aviation sector.

- **Qualitative:** Based on expert judgement
- **Multidisciplinary:** Involves experts from Safety, Design & Engineering, Human Factors



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AI Ethics: The Analysis

Relevance

Potential ethical impacts of the proposed solution on fundamental rights and ethical values

→ All dimensions are included in the analysis, yet each is explored according to its specific and contextual risk profile

0	*Not applicable*	*Due to technical, societal, or contextual factor(s), the consenqueces cannot be estimed*
1	**Low** ethical impact	Consequences that can easily be addressed and mitigated with standard ready-to-use solutions
2	**Moderate** ethical impact	Consequences that need dedicated actions, but using ready-to-use solutions
3	**High** ethical impact	Consequences that need dedicated actions and new mitigative initiatives

Coverage

Already implemented measures that can directly on indirectly mitigate the estimated ethical impact(s)

→ Based on the solution's maturity, the impact of existing measures (including from other KPAs) on ethical risk management is assessed, along with areas for improvement.

0	*No data available*	*Due to the maturity level of the solution, there is not data available to explore the dimension*
1	**Not** addressed	New dedicated initiatives are needed to adequately mitigate the ethical impacts
2	**Partially** addressed	Compliance and security measures in force need to be integrated to mitigate the ethical impacts
3	**Fully** addressed	Compliance and security measures in force adequately mitigate the ethical impacts

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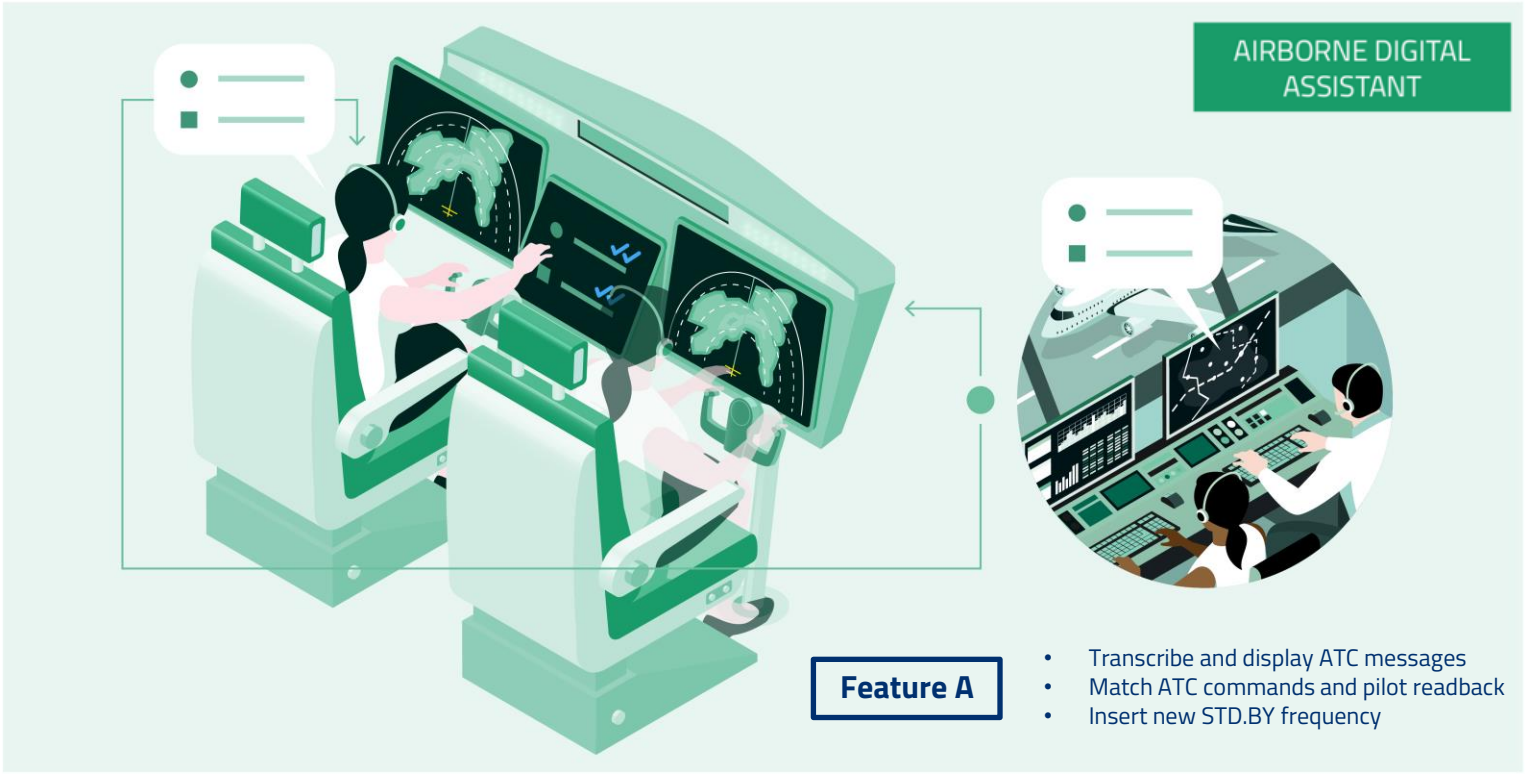

Benefits

- DECREASED WORKLOAD
- IMPROVED FLIGHT EFFICIENCY
- SITUATION AWARENESS

AIR-DA = Airborne Digital Assistant

Feature A: Initial Ethics Analysis

AI system performance may increase pilot's liability risk exposure

Over-reliance on the AI system, possible loss of critical communication skills

Who owns the voice data? AI system provider? OEM? Airline?

Privacy: Must ensure that data is not use for other purposes (e.g., assess individual's performance)

Risk of accent discrimination

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JARVIS Feature A: Initial Ethics Analysis

Diversity, non-discrimination, and fairness as essential enablers of technical robustness and safety

- The risk of accent discrimination as a major concern
- Privacy and data governance as the main legal and technical challenges

Human oversight: apparently marginal, but to be reconsidered in light of accountability and liability.

- Despite this, AIR-DA should work as a 'supportive and relatively passive' tool
- Accuracy, reliability, and traceability performance, and their impact on PICs' accountability duties, could increase their liability risk exposure

Operators' skills as a transversal medium/long term challenge in terms of social impact, accountability and resilience

- Pilots might unconsciously alter their communication style to make it easier for the AI system to understand, potentially leading to unintended operational consequences
- Over-reliance on the AI system, if it becomes highly reliable, could lead to pilots losing critical communication skills

JARVIS Concept Image

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AI Ethics: Challenges and Lessons Learned

Multidisciplinary Expertise is Key

- While a multidisciplinary team is clearly needed, identifying and integrating the most essential experts is a complex process. For sure, all the KPAs (Safety, HF, Security) should be covered, but additional AI-specific experts are advisable (Ethics, Regulation, Data Science and AI Assurance)

Mind the Terminology Gap

- Ethical concepts have specific meanings and implications and their interpretation and practical application can vary significantly across different fields or contexts. This necessitates careful contextual analysis to avoid misinterpretations and ensure effective ethical discourse and decision-making.

Iterative Assessment for R&D

- It's challenging to accurately predict positive or negative impacts when a solution is still in its early development phases. Ethics assessments shall be iterative, evolving with the solution, and requiring a gradual, progressive approach.

Navigating Overlapping Dimensions & Trade-offs

- The ethical dimensions within the framework frequently overlap, making it difficult to prioritize them distinctly. Inherent trade-offs are faced, such as balancing ethical ideals with real-world viability.

Takeaways

- Gaining trust in an AI assistant is a shorter-term problem than over-reliance on AI
- Trust is achieved incrementally. Can’t jump directly to high AI levels. But can’t be too simple (otherwise AI feature may not be useful). Tradeoff: use AI in complex scenarios
- AI assurance starts at system level. Specification of an AI assistant and requirements are open challenges
- AI Ethics can impact different groups of users, as well as safety. Ethics includes various aspects, some of which are covered by other building blocks of trustworthy AI
- Defining the certification path for AI technologies and starting to walk that path early – key to success

Thank you

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Project Coordinator: Stefano Riverso, stefano.riverso@collins.com
Dissemination Manager: Viviana Couto Sayalero, viviana.coutosayalero@dblue.it
https://research.dblue.it/jarvis/
https://www.linkedin.com/company/jarvisproject
https://twitter.com/JARVIS_sju

JARVIS

EASA
European Union Aviation Safety Agency

EASA AI Days 2025

Panel of discussion: Human oversight in Level 3 AI

Moderator: Jerome Delmeulle
SESAR JU

Dmitrii Kirov
JARVIS / Collins

Joeri DeRuytter
Honeywell / DARWIN

Massimiliano Ruocco & Martina Ragosta
SINTEF / SynthAIR

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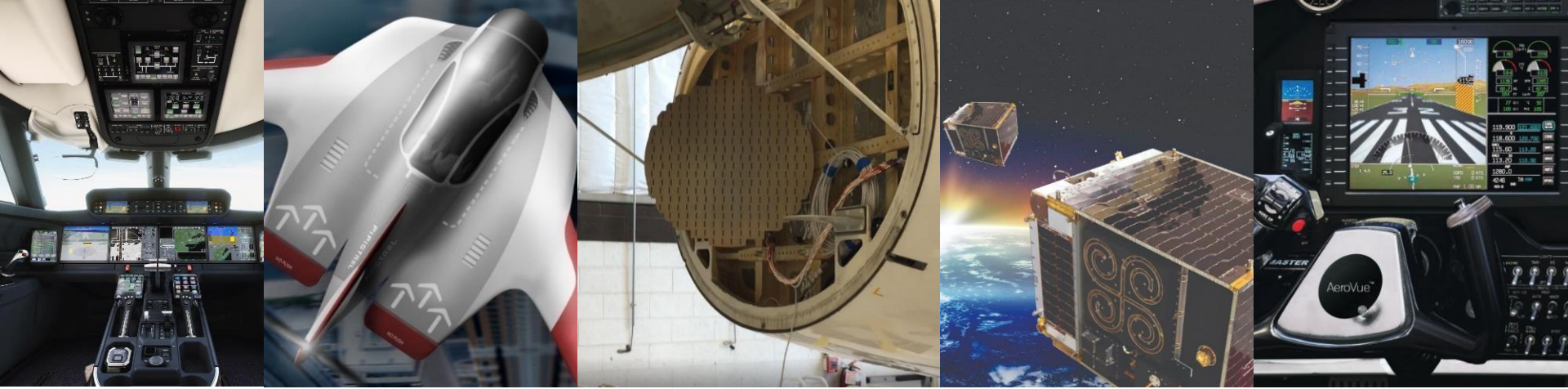

EASA AI DAYS 2025

SESAR project **DARWIN**

Digital Assistants for Reducing Workload and Increasing cooperatioN

Honeywell DLR PIPISTREL EUROCONTROL EASA European Aviation Safety Agency SLOVENIA CONTROL

Aug 27, 2025

Acknowledgement

The project is supported by the SESAR 3 Joint Undertaking and its founding members.

Disclaimer

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WHY DO WE NEED AI IN COCKPIT ?

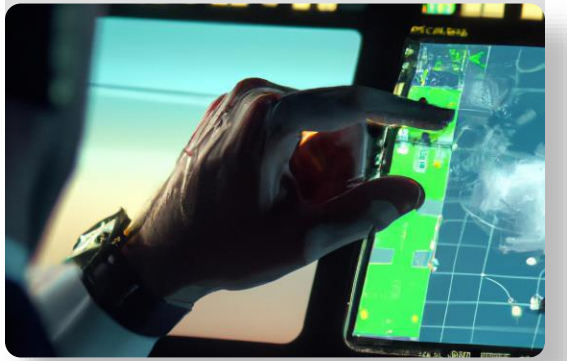
Current Cockpit Operations

- New interaction modalities
- Rule-based systems with reasoning
- Portable electronic devices

Simplified Cockpit Operations

- Pilot state monitoring
- Pilot assistants
- ATC compliance monitoring
- Certifiable machine learning and reasoning

More Autonomous Operations



- Intelligent assistants
- Human-Machine teaming

DARWIN

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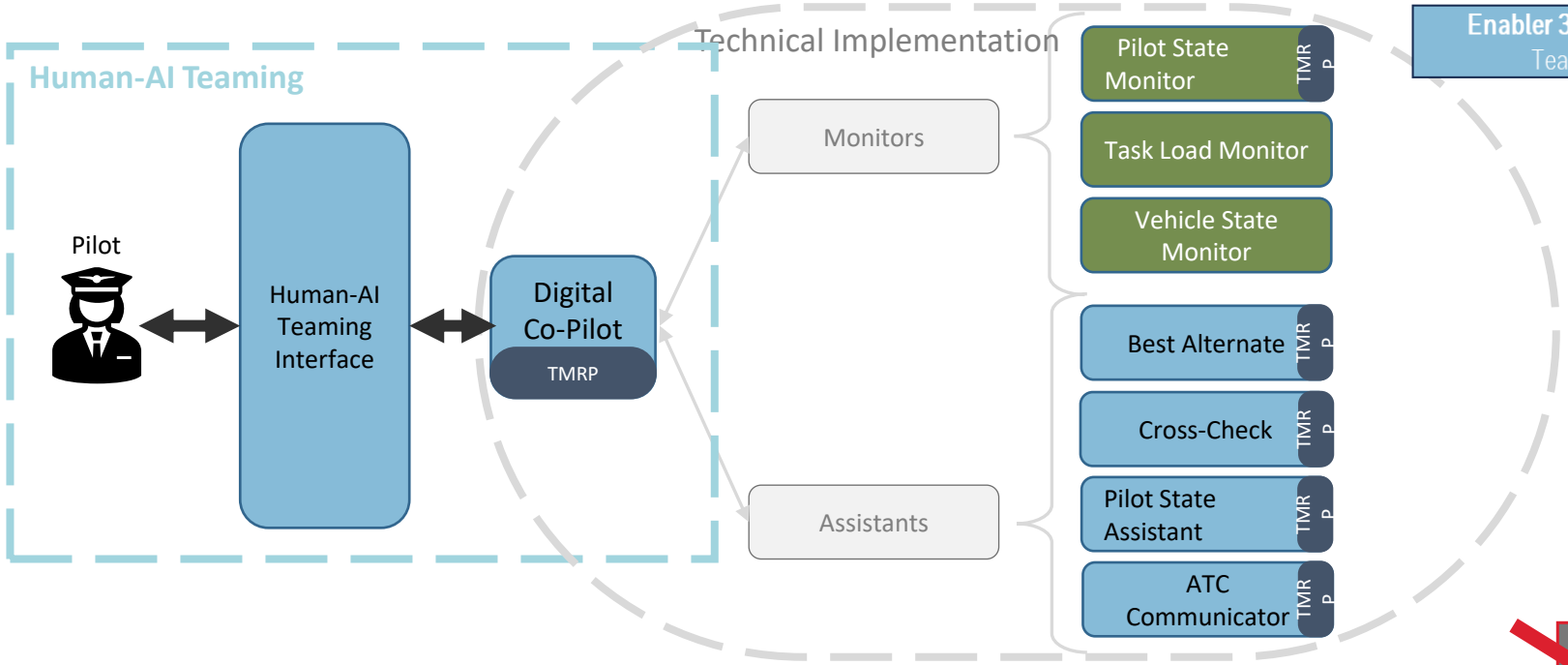
- Project duration: 2023 –2026
- Objective: Demonstration on Pipistrel's Miniliner
- Technology enablers
  - Pilot State Monitor, Task Load Monitor
  - Trustworthy Machine Reasoning Platform (Certifiable AI / MR)
  - Human-AI Teaming (AI Level 2)
- Agile & iterative development CS-23, technology elements applicable to CS-25
- Cooperation with EASA

Partner	Focus areas
Honeywell	Project lead, Digital co-pilot, PSM, Human-AI Teaming, Validations
PIPISTREL	ConOps, Scenarios, Integration into avionics, Flight tests
DLR	Task analysis, Task Load Monitor, Human-AI Teaming, Validations
EUROCONTROL, SLOVENIA CONTROL	ConOps, Interoperability requirements, Validation support
EASA	Certification path, Standardization & Regulatory inputs

DIGITAL CO-PILOT: HUMAN-AI TEAMING

Legend

- **Enabler 1**: Trustworthy Machine Reasoning Platform
- **Enabler 2**: Pilot State & Task Load Monitor
- **Enabler 3**: Human-AI Teaming



Human-AI Teaming, Human-AI Teaming Interface and digital co-pilot (i.e.,, AI Level 2 application) are defined in EASA Concept Paper: Guidance for Level 1 & 2 AI applications.

PILOT STATE MONITORING

Unobtrusive pilot-acceptable technology
long/short-term monitoring of states that cause partial or full incapacitation

At TRL 6

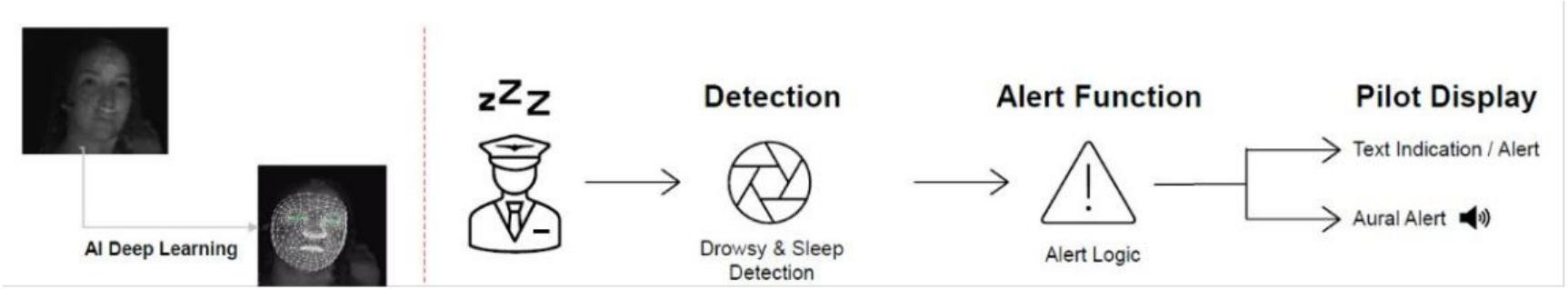
Sleep, Drowsiness

- **Prevent sleep** (By notifying pilot)
- **Inform about drowsiness**

DARWIN

Obvious Incapacitation

- Alerting & mitigation strategies



PILOT STATE MONITORING VALIDATIONS

Test aircraft – alerting functionality

- Assessment of various alerts
  - Sleep & Drowsiness
  - Visual, Audio, Aural
- Evaluation of acceptability and understandability of the alerts

Normal aircraft – detection functionality

- Both Sleep/Drowsiness and incapacitation detection algorithms
- Successful evaluation of incapacitation detection algorithm.

Simulator – external factors

- Low, moderate and severe turbulences
- Other external factors

DIGITAL CO-PILOT INTEGRATED VALIDATIONS

May 13-16 in Gorizia, Italy

Integration of all technologies

Successful test all use cases

Next steps & Upcoming validations:

Human Factors bench evaluations

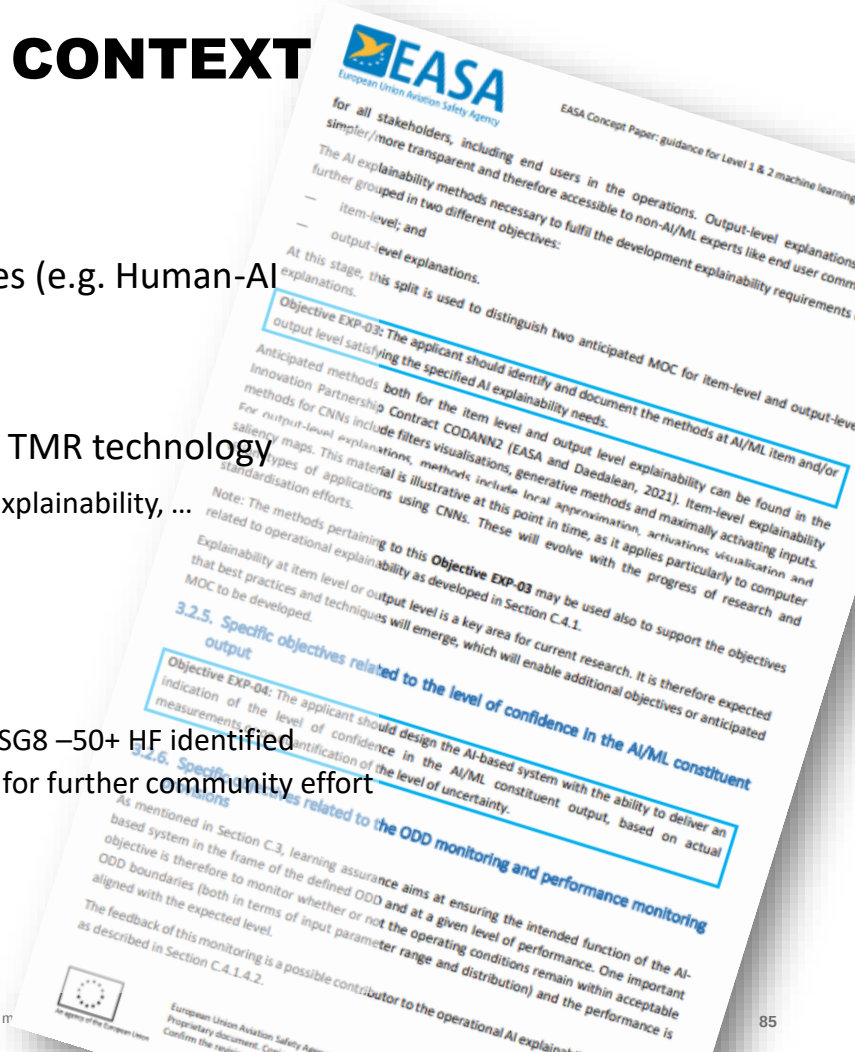
Flight tests on Pipistrel and Honeywell test aircraft for both operational and technical validations.

VIDEO:

https://youtube.com/shorts/jOFqKbq_Mp4?feature=share

DARWIN IMPACT IN A BROADER CONTEXT

- **element** in AI standardization efforts
- **vehicle for exercising** EASA AI Level 2B Guidance objectives (e.g. Human-AI Teaming, Explainability)
- **goes beyond** EASA AI Guidance scope with non-ML based TMR technology
  - Gaps identification for non-ML techniques / Human-AI Teaming / Explainability, …
  - MOCs for Symbolic AI / TMR
- **two main technology streams**
  - Human-AI Teaming – Human Factors aspects, use-case in WG-114 SG8 –50+ HF identified concerns related to Human-AI teaming and other aspects, a driver for further community effort (MOCs, guidance, standards)
  - Certifiable AI technology for Machine Reasoning



REFLECTIONS AND LESSONS LEARNED

- **Human Factor** challenges in Human-AI teaming
  - Disruptive change in CRM
  - Lots of interactive and dynamic aspects – difficult to simulate and evaluate
  - Learning curve and long-term learning effects
  - Aircraft is not necessarily the most representative environment
  - Designing HMI for novel operations – breadth first, depth second (explore, select, mature)
  - Need for careful feedback/results interpretation, consider roles

- TRL4 to TRL6 AI **technology** maturation is demanding
  - requires novel approaches, "certifiable by design" vs "wait for standards" or "wait for technology"

- Maturation is **rewarding**


THANK YOU !
TOGETHER WE SHAPE THE FUTURE

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Honeywell

EASA
European Union Aviation Safety Agency

EASA AI Days 2025

Panel of discussion: Human oversight in Level 3 AI

Moderator: Jerome Delmeulle
SESAR JU

Dmitrii Kirov
JARVIS / Collins

Joeri DeRuytter
Honeywell / DARWIN

Massimiliano Ruocco & Martina Ragosta
SINTEF / SynthAIR

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SynthAIr

SYNTHAIR - Improved ATM automation and simulation through AI-based universal models for synthetic data generation

Massimiliano Ruocco & Martina Ragosta (SINTEF)

EASA AI Days – 28 August 2025

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SynthAIr
The project

PROJECT TYPE	Exploratory research
FLAGSHIP	Artificial intelligence for aviation
STATUS	Ongoing
SESAR PROGRAMME	Digital European Sky
PROJECT DURATION	2023-09-01 > 2026-02-28
TOTAL COST	€1.215.003,75

SINTEF

deepblue CONSULTING & RESEARCH

TU Delft

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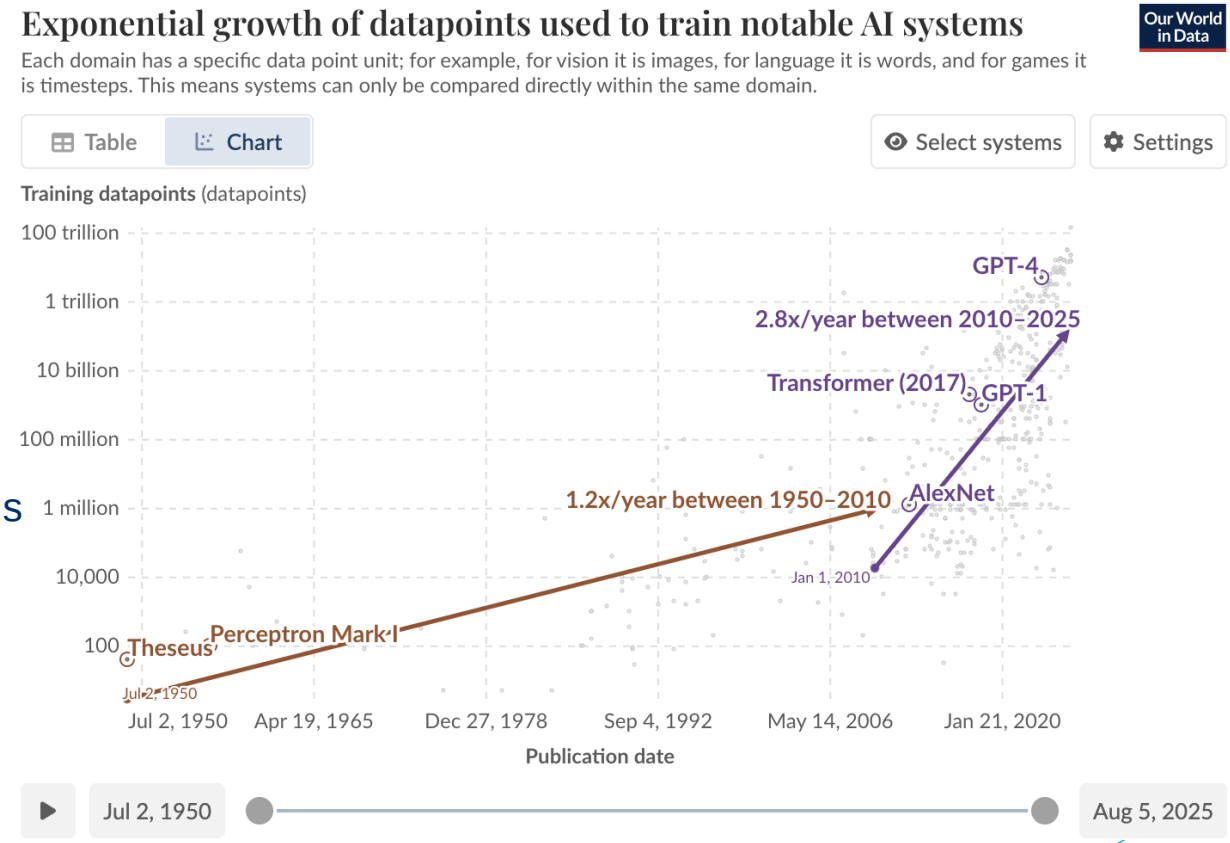
SynthAIr

Importance of Data in AI

- Data Explosion Fuels AI
- From Millions to Trillions
- More data = Smarter models
- Bottleneck: **data access**



*https://ourworldindata.org/scaling-up-ai

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SynthAIr

Aviation Industry persistent barriers in developing high-risk AI System

Data Access Problem

Data Scarcity

Limited access to comprehensive operational datasets

Privacy Constraints

Commercial sensitivity preventing data sharing

Regulatory Barriers

Strict compliance requirements limiting data availability

Solution SYNTHETIC DATA

AI-Generated – Created by generative models learning patterns from real data

Plausible & Rich – Maintains the statistical properties and relationships of reality

Accessible & Scalable – Freely available, customizable, and ready for AI training

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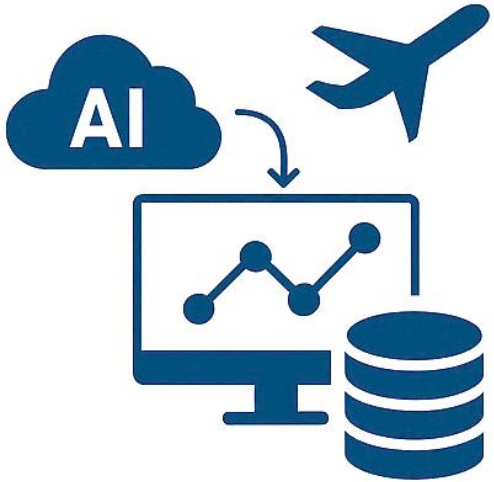
SynthAIr

Context & Mission

SynthAIr's mission is to increase the level of automation of ATM system by delivering **novel AI-methods for synthetic data generation**.



Improve ATM Efficiency

Support AI Adoption in ATM

Support Innovation

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SynthAIr

Impact of synthetic data on selected use cases

UC1 Turnaround Time Prediction

Predict the duration from aircraft in-Block to Off-Block

UC4 Synthetic Traffic Generator

Creating realistic aircraft trajectories for ATM simulations

UC2 Flight Delay Prediction

Prediction of Pre-tactical departure and arrival delay

UC5 Flight Diversion Prediction

Predicting of **rare flight diversion** before landing

UC3 Passenger Flow Prediction

Prediction of passenger flow at terminals

UC6 Schedule Prediction

Generating synthetic flight schedules for machine learning prediction models

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UC2: Flight Delay

*Synthetic data: **nearly real**, but **safe***

Scope

Pre-tactical prediction of **departure/arrival delays** using only scheduled flight info.

Key Results

✅ Models trained on synthetic data **perform almost as well** as those trained on real data.
✅ Synthetic data **preserves** the same **operational drivers** as real data (e.g., time of day, airports, flight duration).

Key takeaways

- Proactive **delay mitigation strategies**
- **Optimized** crew and **resource allocation**
- Improved **passenger communication** and **network** flow management.

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UC5: Flight Diversion

*Synthetic data for **rare** but **critical** events*

Scope

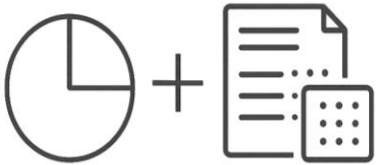
Predicting of **rare flight diversion** before landing

Challenge

Diversions are rare (<1% of flights) but highly disruptive

Solution

✅ Generating synthetic rare data and **augment** the real data with those synthetic data



Key takeaways

- Machine Learning models trained on **augmented data outperformed** real-data-only models.
- Synthetic **diversion records** achieved **high realism** and were hard to distinguish from real data.
- Demonstrated value of **synthetic augmentation** in tackling scarcity.

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UC6: Flight Schedule

*Synthetic data turns **incomplete** records into **actionable schedules***

Challenge

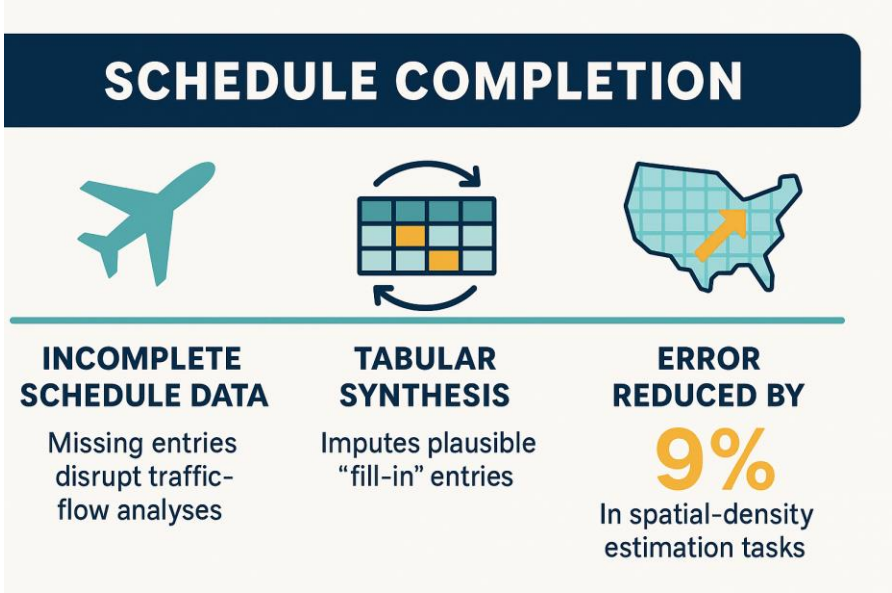
Schedule data is often **incomplete** or **inaccessible**

Solution

✅ Synthetic data used to **fill gaps** and **impute missing schedule entries**, preserving operational constraints

Key takeaway

Enables researchers and practitioners to **reconstruct full traffic pictures** without needing expensive proprietary data.



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Synthetic Data: Privacy & Compliance

- **Protects sensitive information** – avoids use of real personal/operational data
- **Minimizes re-identification risks** – safe for sharing & collaboration
- **GDPR alignment** – supports privacy-by-design and data minimization
- **EU AI Act (Aug 2024)** – synthetic data helps meet transparency, safety & quality obligations for high-risk AI systems

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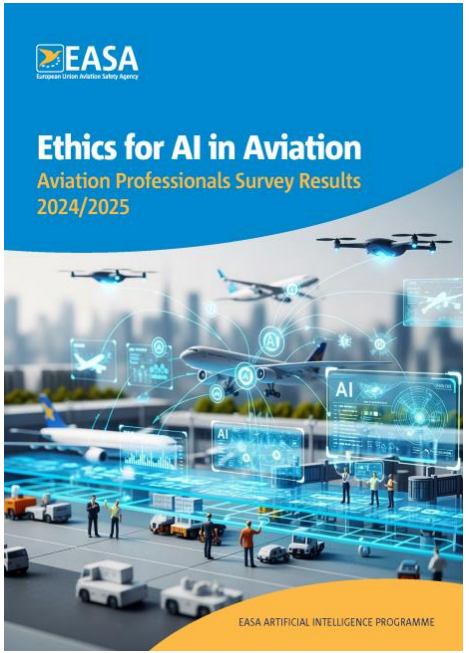
EASA AI Roadmap & Trustworthiness

- **EASA Concept Paper Issue 2** – framework for AI safety & oversight in aviation
- **Ethics for AI in Aviation**
  - AI trustworthiness & learning assurance
  - Explainability & ethics-based assessment
  - Governance for AI levels 1 & 2 (automation in ATM/aviation)
  - From principles to regulation (RMT.0742) – shaping concrete certification & compliance pathways



Synthetic data as enabler – trusted testing & training datasets, aligned with safety + ethics requirements

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Impact & Value

- **Accelerates AI innovation** by reducing dependency on scarce real-world data.
- Enables **safe experimentation** with rare or safety-critical scenarios.
- **Reduces bias** through balanced, controlled synthetic datasets.
- **Supports compliance** with GDPR, EU AI Act, and upcoming EASA regulatory pathways (RMT.0742).
- **Builds trust & resilience** in AI for aviation, aligned with EASA's trustworthiness framework.
- **Fosters collaboration** by allowing secure data sharing across stakeholders.

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Thanks for your attention!

massimiliano.ruocco@sintef.no
martina.ragosta@sintef.no

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European Union Aviation Safety Agency

EASA AI Days 2025

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EASA AI Days 2025
Conference wrap-up and next steps

Guillaume Soudain
EASA AI Programme Manager

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Conference closure

David Solar
HoD Sustainablity, Research & Innovation

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Thank you for your participation!

Have a safe trip back!

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