INNOVATION FAIR

12 | 14 MARCH 2024

Artificial Intelligence is driving the future of digital aviation

Daniel Faggella

CEO / Head of Research,
Emerj Artificial Intelligence Research

AI Forces Impacting the Future of Aviation

Current AI trends and pressing future questions

Marsal Gavalda, Head of AI, Square

David Carmona, GM of Artificial Intelligence, Microsoft

Jan Neumann, Head of Applied AI, Comcast

Jan Kautz, Learning & Perception Research, NVIDIA

Ann Miura-Ko, cofounder, Floodgate Capital

Shane Zabel, Head of AI, Raytheon

Ian Wilson, former Head of AI, HSBC

Adam Oliner, Head of ML, Slack

Stuart Russell, UC Berkeley, CS Professor

Yoshua Bengio, U. Montreal, Head of MILA Lab

All-Time Downloads

4,000,000

Popularity by Country

#1 USA

#2 United Kingdom

#3 Canada

Popularity by City

#1 New York City

#2 San Francisco

#3 Boston

UNICRI,
Singapore

"Computer Vision for Law Enforcement and Surveillance" 2018

INTERPOL,
Singapore

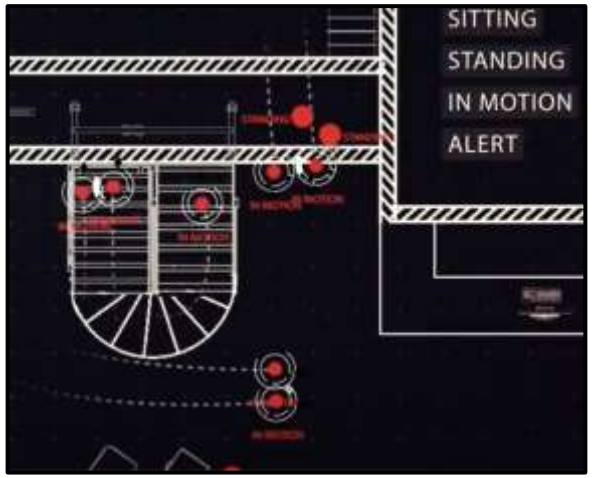
"Programmatically Generated Content and Security" 2019

United Nations
Headquarters, NYC

"Security Implications of Deepfakes" 2019

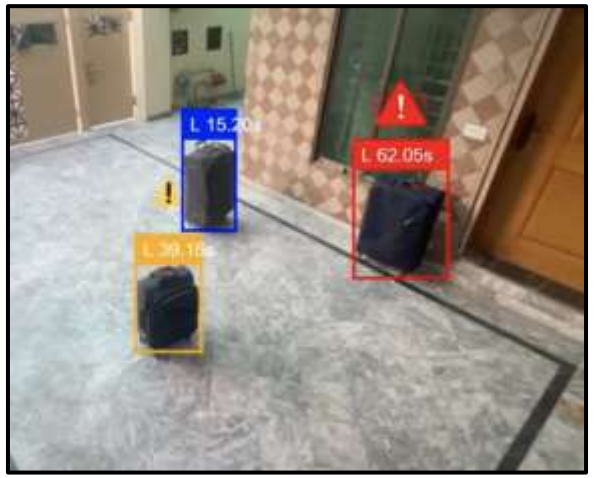
AI for Detection

Number / Movement / Activity of Crowds



Detecting the number and movement of people in different rooms / hallways. Tracking trends over time. (ex: Pointgrab / IBM TRIRIGA Application Suite)

Visually Tracking Luggage



Identifying unattended bags, altering personnel if bags unattended for specific periods of time.

Chemical Sensing (Explosives, Drugs, etc)

Detecting chemical traces on luggage, passengers, or even just generally in the air on airport premises. Replacing or augmenting canine aide.

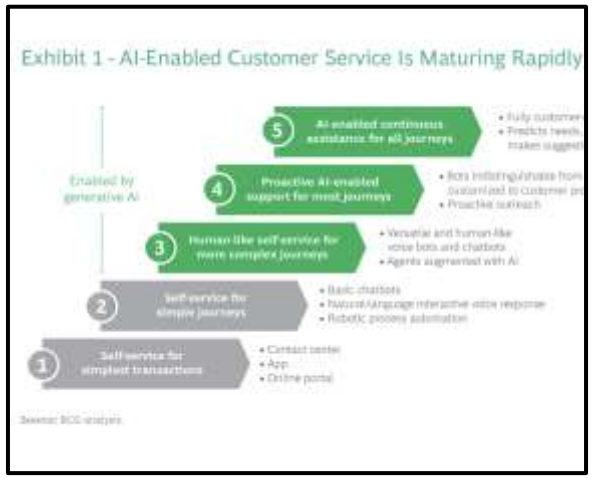
Sources: (1) pointgrab.com, (2) https://www.youtube.com/watch?v=5qOvdo08hPE, (3) https://screenrant.com/airport-ai-smell-sensors-bomb-coronavirus-detection/

AI Generation

Routing Planes, Vehicles, Supplies

Generative AI can aide in routing vehicles and inventory under different traffic and weather conditions.

Customer Service



GenAI is climbing the ladder of customer experience complexity, and in some industries will be able to provide robust conversational answers to tough questions.

Improving Computer Vision Systems

GenAI can generate unlikely scenarios to help train computer visions systems to be more accurate and responsive.

Sources: (1) https://peak.ai/us/applications/vehicle-routing/, (2) https://www.bcg.com/publications/2023/how-generative-ai-transforms-customer-service, (3) Screenshot of a Cruise vehicle.

Future Scenarios

Limited canine resources are augmented with ubiquitous chemical sensors in crucial checkpoints, which can flag humans / canines to potential risks more effectively than random screening.

Passengers and baggage are screened with incredible effectiveness for dangerous items and substances, with less human efforts.

Luggage is almost never lost or stolen, and suspicious bags are identified and dealt with almost automatically, anywhere in airport premises.

Future Scenarios

Chemical sensors that can tell whether you have drugs on you, but also if you have a peanut butter and jelly sandwich.

Biometric computer vision detecting not only faces, but gait and behavior, creating an ongoing record of the behavior of an individual over time.

Our safety and routing systems are self-improving in ways that humans no longer fully understand - ceding responsibility to AI systems.

Mostly Outside of Our Control

- **Whether artificial intelligence adoption becomes widespread among consumers and enterprises.**

- **Whether or not artificial general intelligence labs will try to blast forward and create intelligences beyond humanity**

Yoshua Bengio - Why We Shouldn't Blast Off to AGI Just Yet (AGI Destinations Series, Episode 1)

Sources: https://www.youtube.com/watch?v=P6Z5lgtH7_I&t=468s

Mostly Within Our Control

- **The vision of the future we want to build towards in aviation**

End

For the full slide deck, or for questions:

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Panel Speakers

Guillaume Soudain

EASA Programme Manager – Artificial Intelligence

Yann Pequignot

Research Professional at Université Laval and Institut Intelligence et Données (IID)

Kinh Tieu, PhD

Senior Principal Engineer
Acubed, an Airbus innovation center

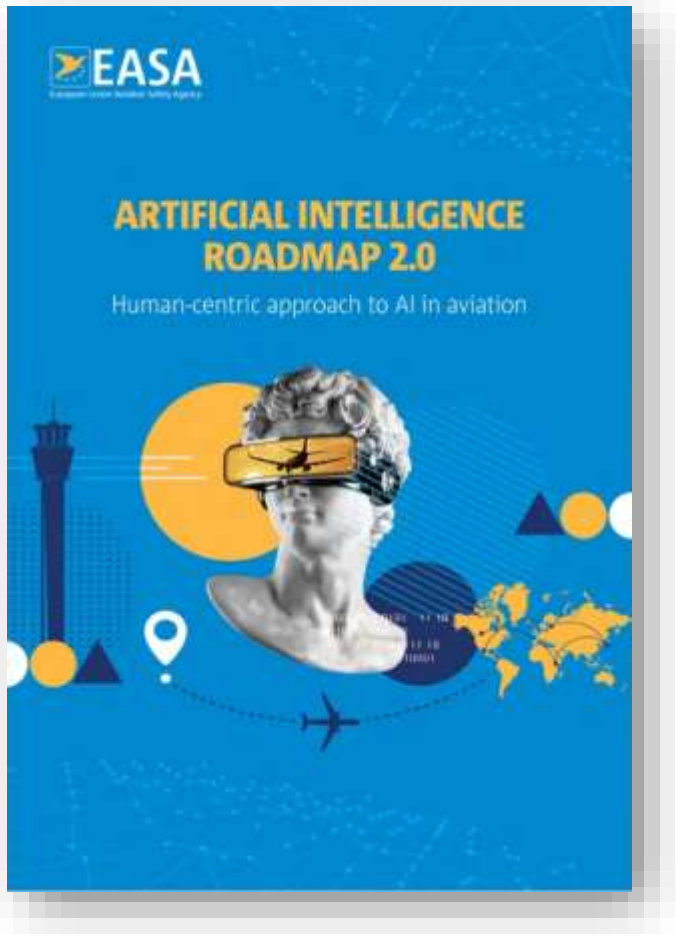
Craig Ramlal, PhD

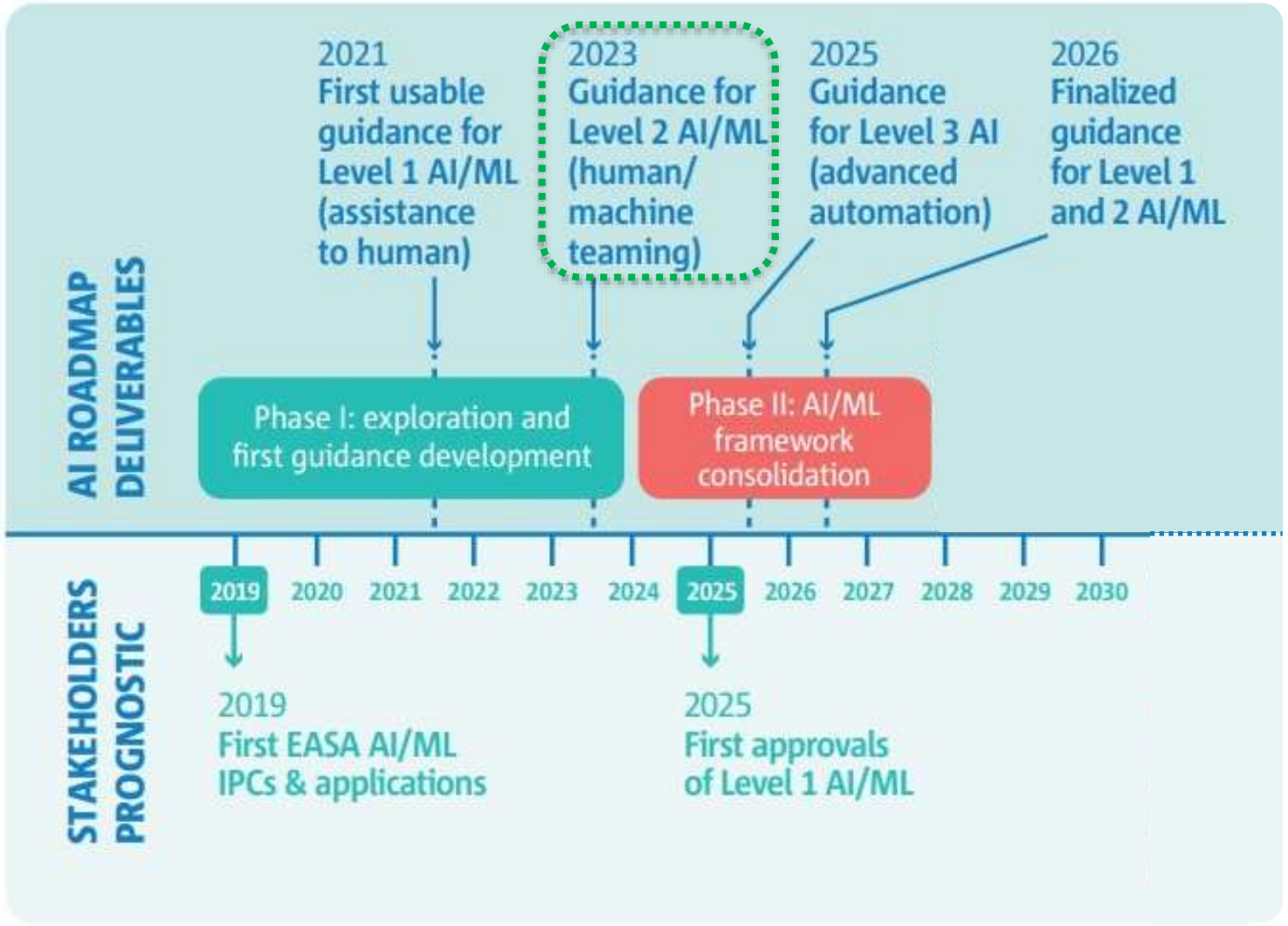
Head of the Control Systems Group, The University of the West Indies

Guillaume Soudain

EASA Programme Manager – Artificial Intelligence

EASA AI Roadmap 2.0 overview



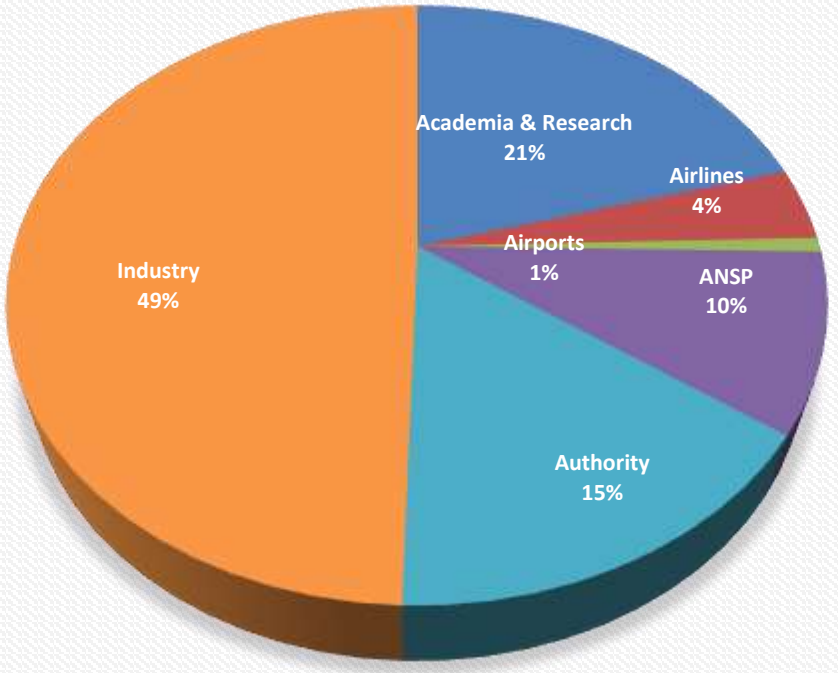


AI = Artificial Intelligence ML = machine learning IPC = Innovation Partnership Contract

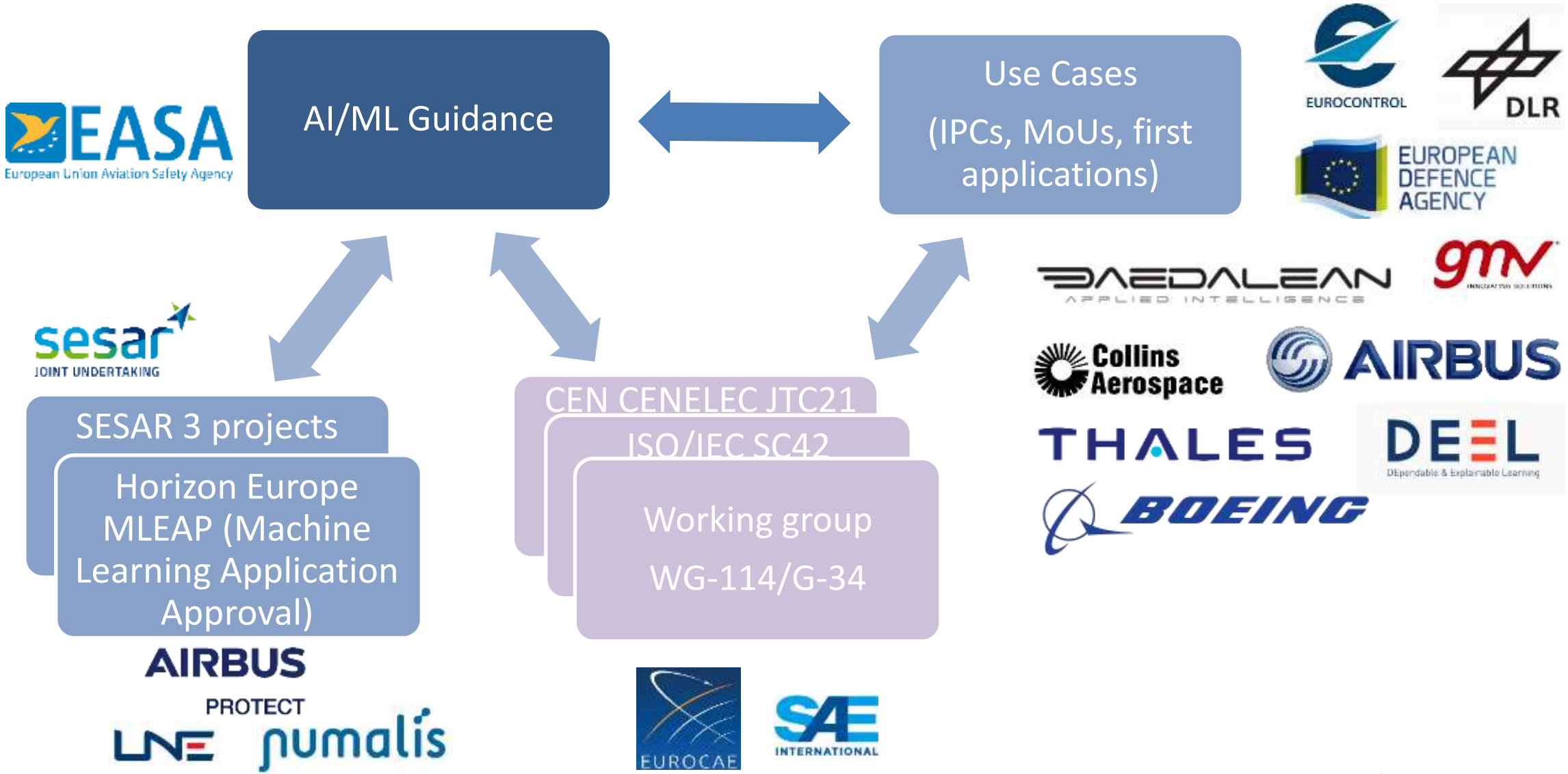
EASA AI Concept Paper – Publication of Issue 02

Published on 6 th March 2024
https://easa.europa.eu/ai

Consultation in 2023: EASA received 900 comments from 34 stakeholders

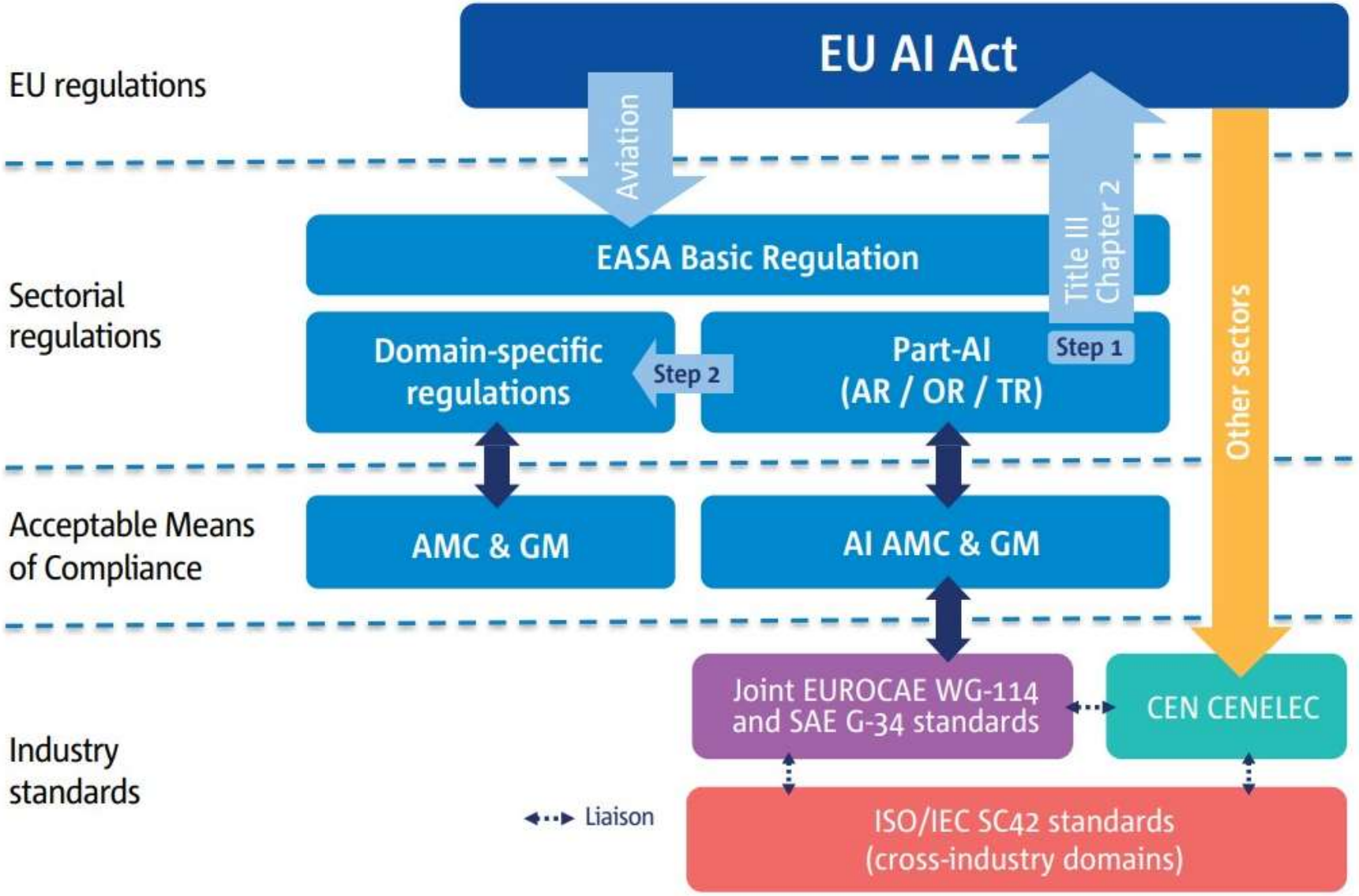


Collaborative approach with all Stakeholders



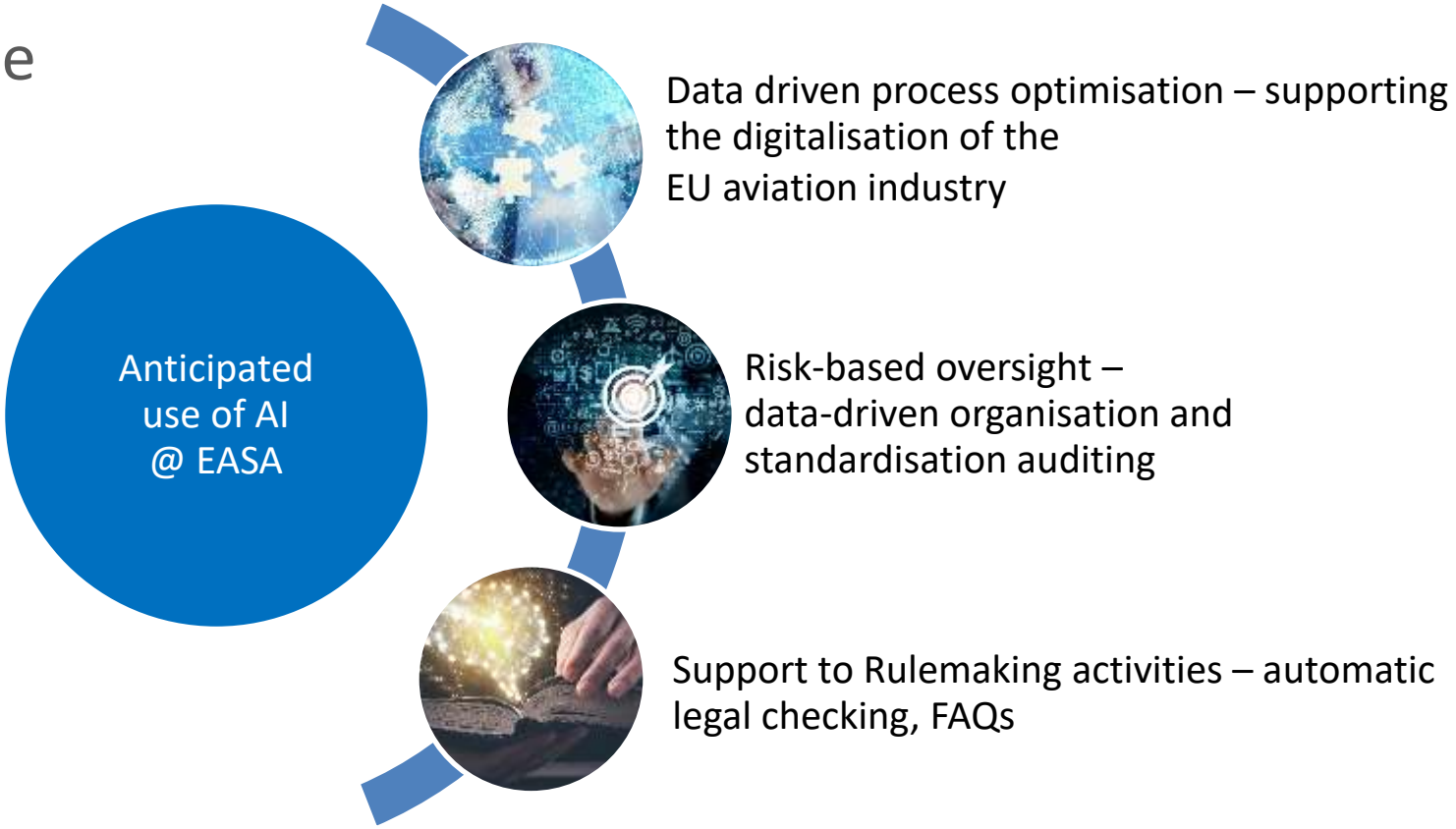
IPC = Innovation Partnership Contract
MoU = Memorandum of Understanding

EASA Rulemaking plan for AI - EPAS RMT.0742



Use of AI in support of EASA processes

→ The deployment of concrete AI use cases at Agency level will be managed as part of EASA's **digital transformation programme**



AI as enabler for a more sustainable aviation

ATM/ANS

Optimisation of trajectories is one example of how AI can help reducing carbon emissions

Environmental Labelling Scheme

Optimisation of carbon estimation algorithms in support of part of the ReFuelEU regulation voluntary labelling scheme

Environmental impact assessment

Data and computation-intensive activity that has significantly evolved over the past decades together with machine capabilities

EASA
European Union Aviation Safety Agency

Thank you for your attention!

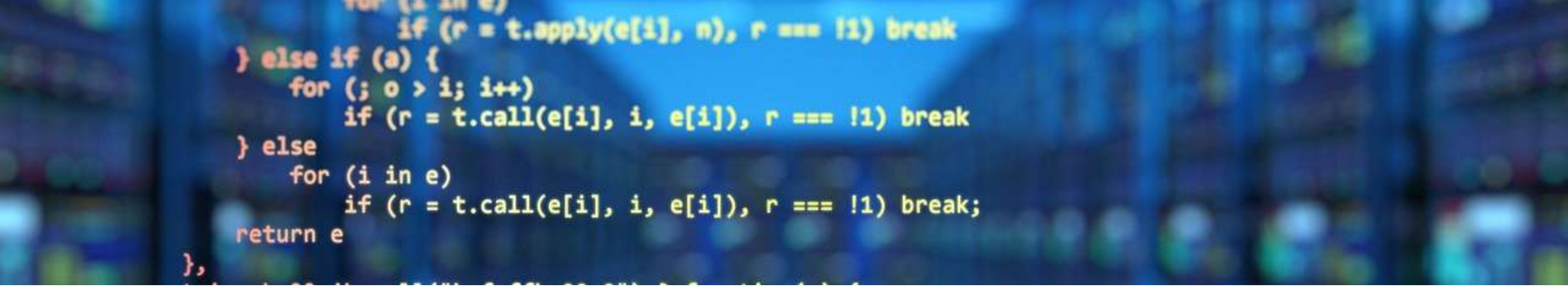
ai@easa.europa.eu

Yann Pequignot

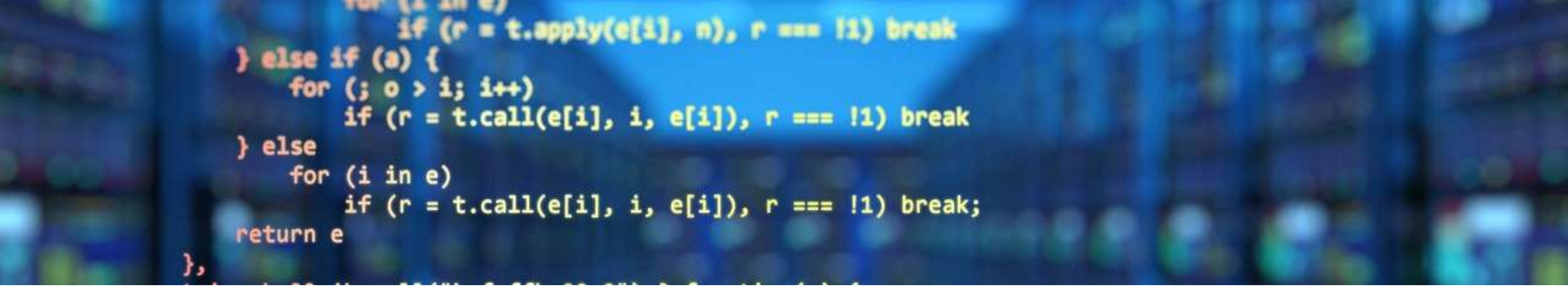
Research Professional at Université Laval and
Institut Intelligence et Données (IID)

Research in trustworthy AI

Insights from research in the DEEL project
(DEpendable and Explainable Learning)

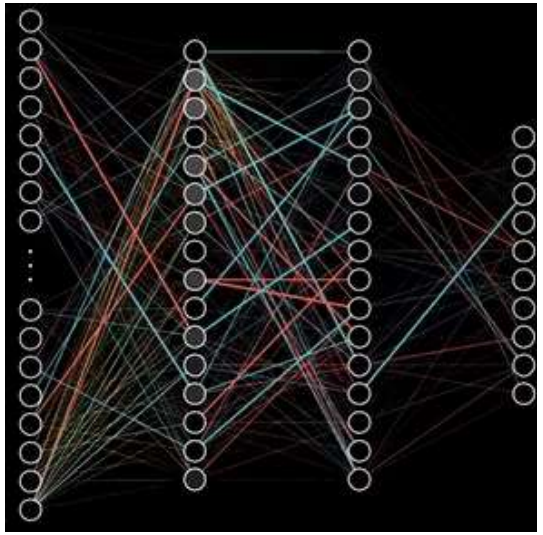


Computer programs have been assisting us reliably with many tasks for years…



Computer programs have been assisting us reliably with many tasks for years…

Why do we need Machine Learning / AI ?



How to ”learn” a program from data?

Optimize a network (parametrized program) on data for an objective.

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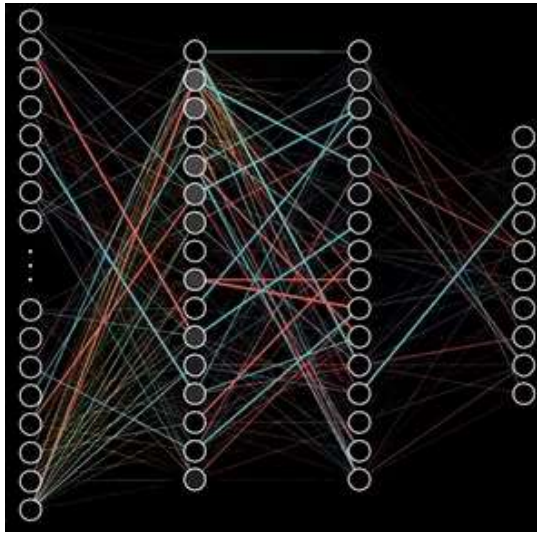
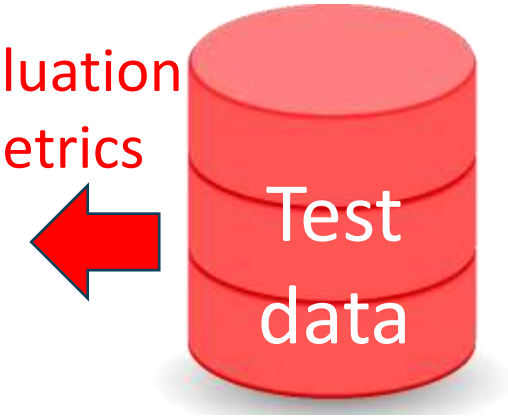


ML/AI model

Evaluation metrics



How do you know you found the program you were looking for?

CAE

THALES

BOMBARDIER

BELL

Institut intelligence et données

DEEL

DEpendable & Explainable Learning

CRIAQ

Économie et Innovation Québec

NSERC CRSNG

IVADO

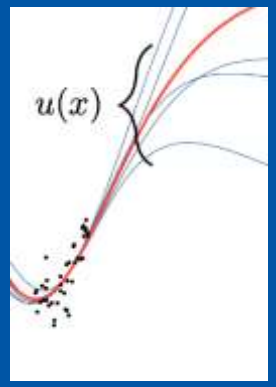
The DEEL (*DEpendable and Explainable Learning*) project is a collaboration between academic and industrial partners for the development of interpretable, robust, secure and certifiable artificial intelligence applied to critical systems in the aerospace field.

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
MINISTÈRE DE L'EUROPE ET DES AFFAIRES ÉTRANGÈRES

Relations internationales et Francophonie Québec

COOPÉRATION FRANCE-QUÉBEC

A transatlantic collaboration between Toulouse & Québec !



What if?

Robustness

What if the model is used in situations that differ

- A little from training data?

Uncertain behavior

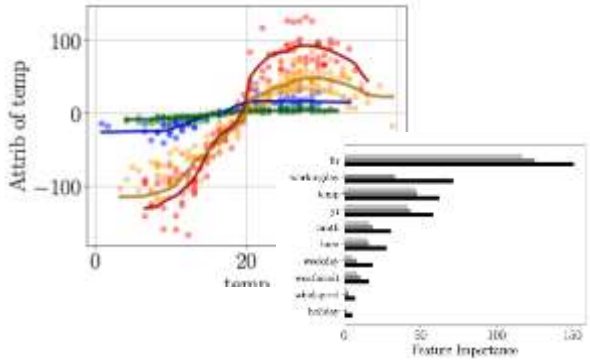
- A lot from training data?

Unpredictable behavior

Research goals : Learn robust models and reliably quantify their uncertainty and scope.

How?

Explainability



What features in the data allow the model to perform?

- In general?

Help analyze the model, detect biases.

- In a specific situation?

Help experts or end user understand the model's decisions

Research goals : Reliably quantify feature contributions towards model's prediction.

Are secrets safe?

Privacy by Design

Is it possible for someone to manipulate the model

- To extract information contained in training data?
- To induce a specific behavior?

Research goals : Quantify data confidentiality, enable collaborative learning.

Can I trust it?

Trustworthiness

If the AI model is deployed as part of a system:

- Are necessary requirements satisfied?
- Will the program operate as intended?

Research goals : Advance Software Engineering to address testing, deployment and maintenance of this generation of programs.

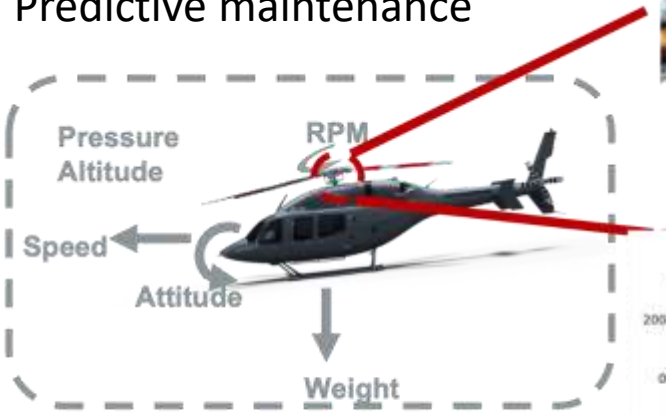
Industrial collaborations

These challenges takes different forms on applied use-cases.

Pilot's vigilance

Figure 1: Illustration of the experimental set-up with neurophysiological equipment

Predictive maintenance



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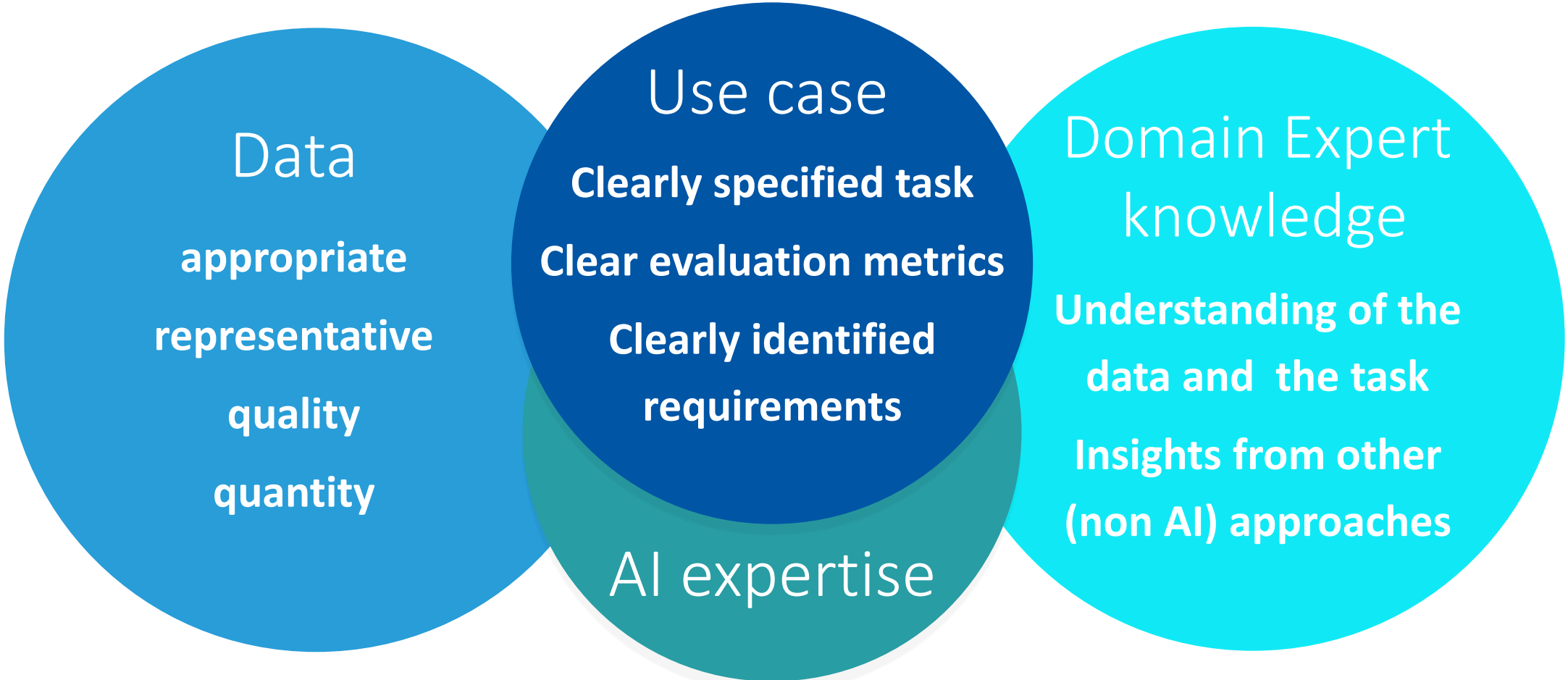
Many techniques have been developed to answer these.
But these questions are hard to answer reliably in general…

They can become more manageable on a good use case:



Thank You

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Kinh Tieu, PhD

Senior Principal Engineer
Acubed, an Airbus innovation center

Rapid, Data-Driven
AI Software Development for Aviation

Acubed Portfolio

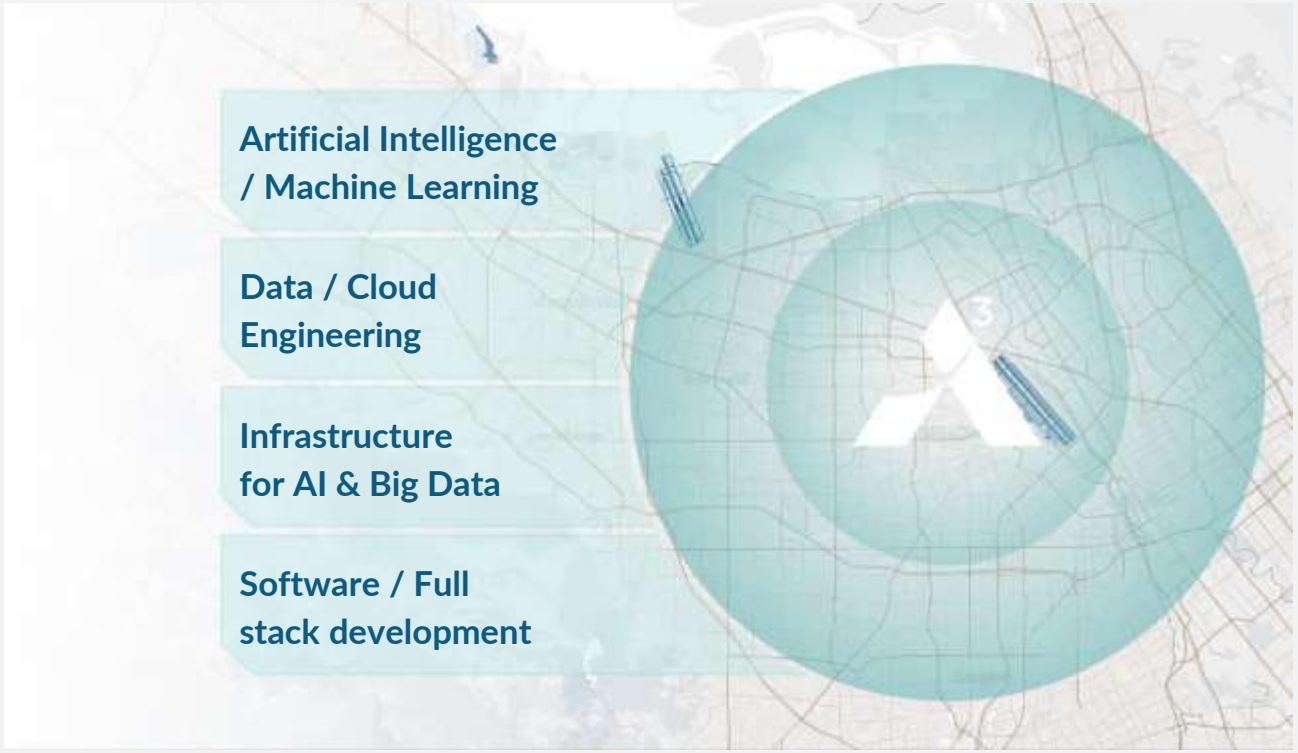
Autonomous Flight Autonomy

UTM & Digital Airspace Services

Onboard Connectivity

Digital Design & Manufacturing

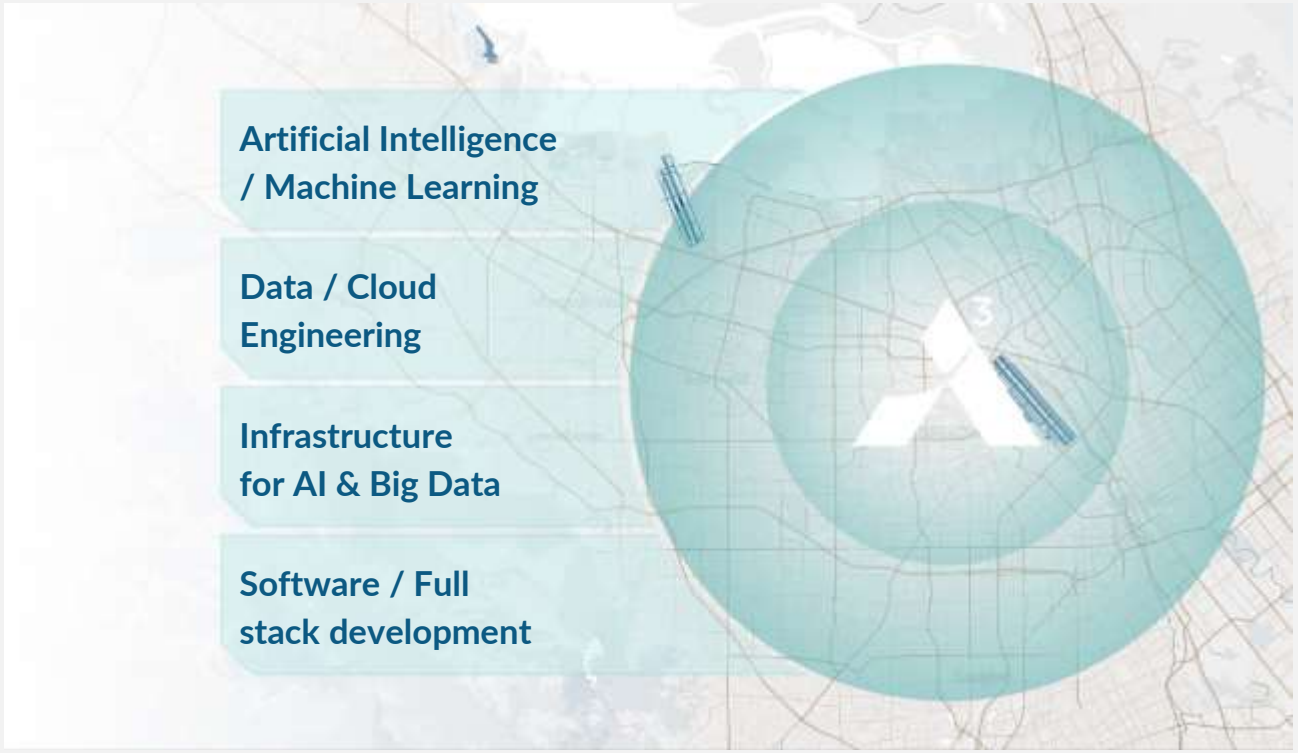
Applying AI/ML & Digital Capabilities to Opportunities & Challenges



Acubed Portfolio

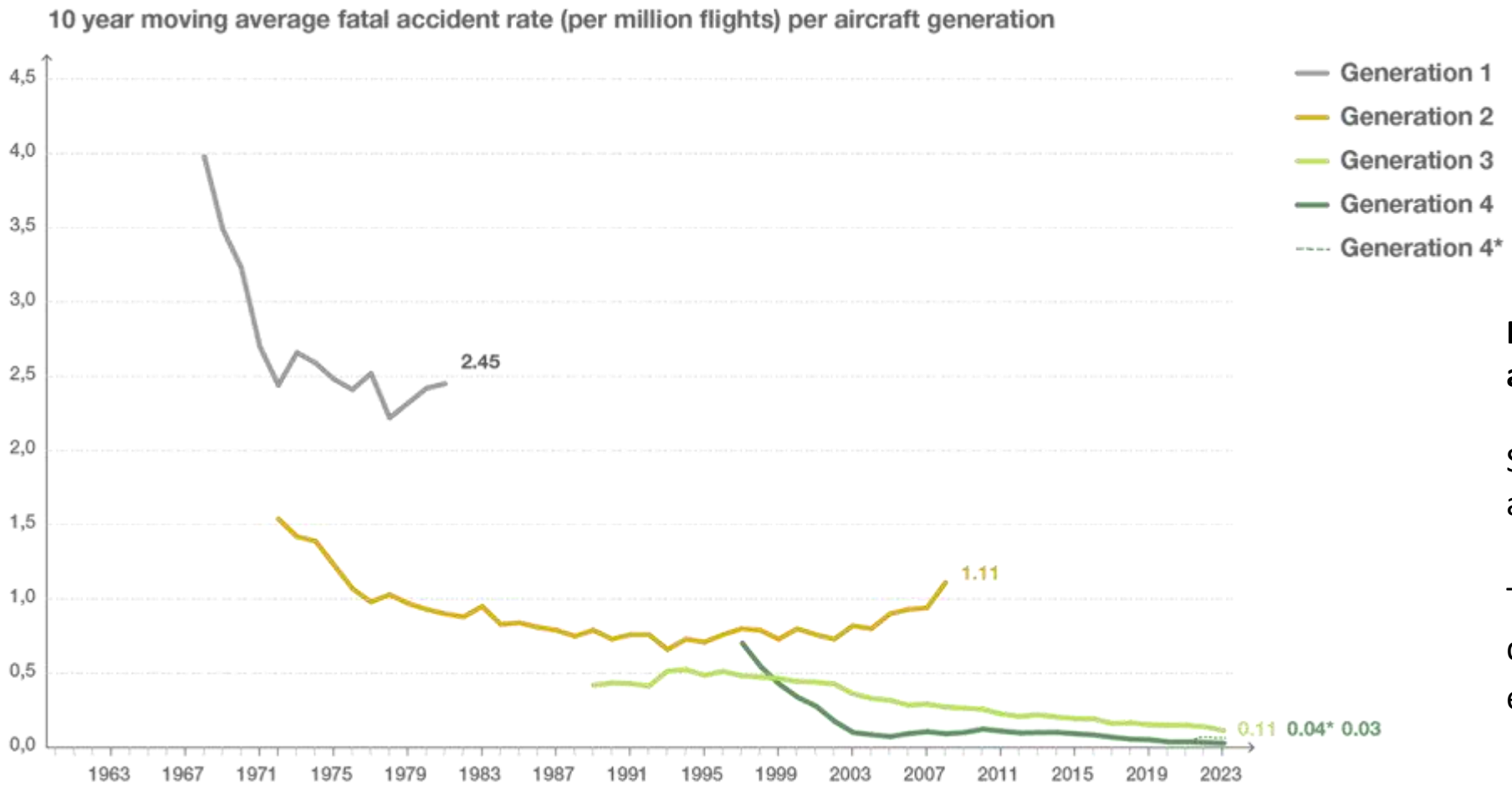
- Autonomous Flight Autonomy
- UTM & Digital Airspace Services
- Onboard Connectivity
- Digital Design & Manufacturing

Applying AI/ML & Digital Capabilities to Opportunities & Challenges



The Challenge

Safety Improves with Each Generation of Aircraft



Fatal accident rate by aircraft generation

Source: accidentstats.airbus.com

Technology advances have decreased accident rates for each successive generation

Automation is a key contributor to aircraft safety

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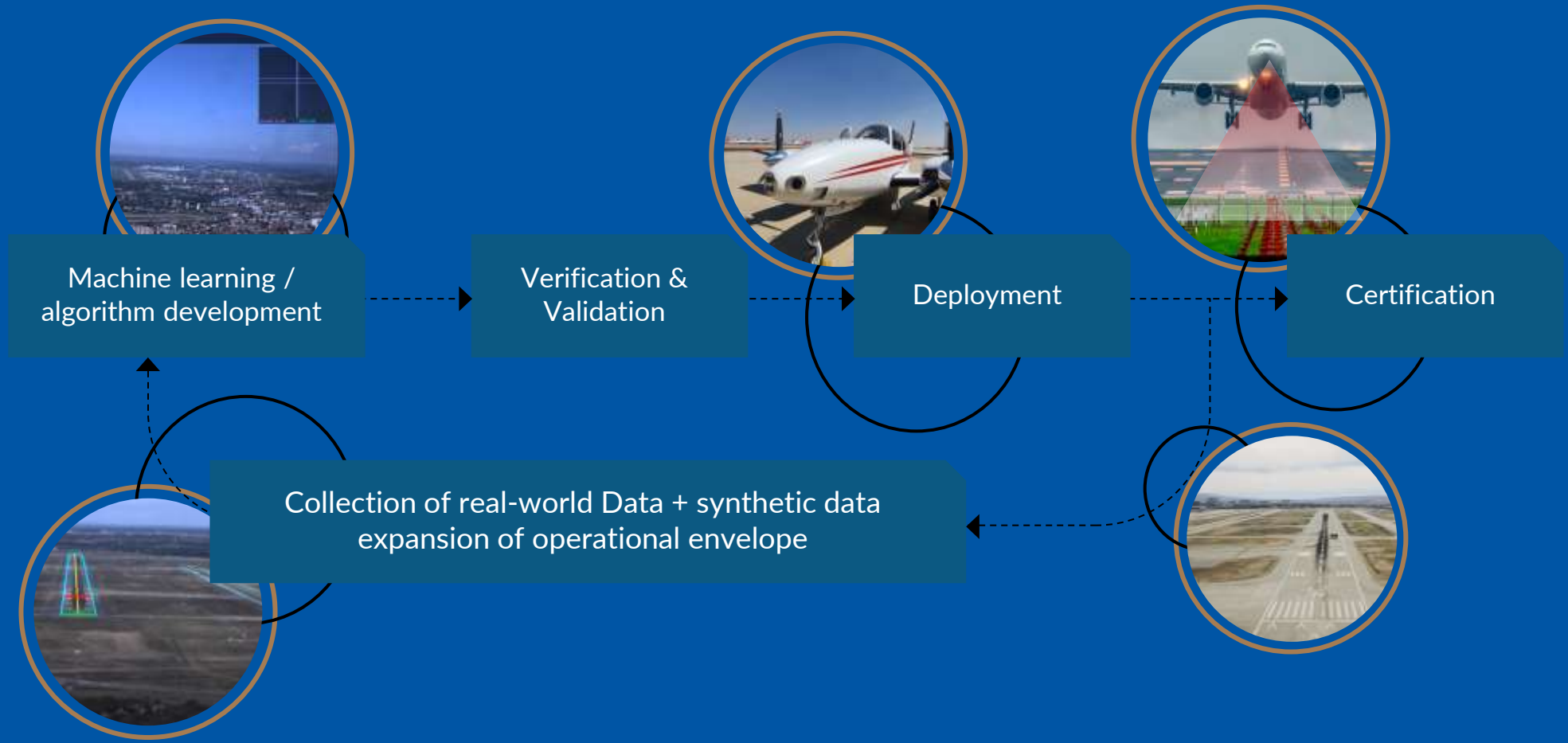
A3+AI
AI Development for Commercial Flight

Path Towards Certifiable and Safe AI



Iterative Large-Scale Testing

Aviation AI Ecosystem

- Aviation Authorities & Safety Bodies
- Pilots & Passengers
- Airports & Airlines
- Innovation Centers
- Aerospace Manufacturers & Suppliers
- Academia

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Craig Ramlal, PhD

Head of the Control Systems Group, The University of the West Indies

From Classroom to Cockpit: Re-envisioning Aviation with AI Foundations

AI in Aviation

01 **Analyses of in-service events**

Intelligent data analyses

02 **Air traffic Control**

Optimize air traffic management and airport capacity

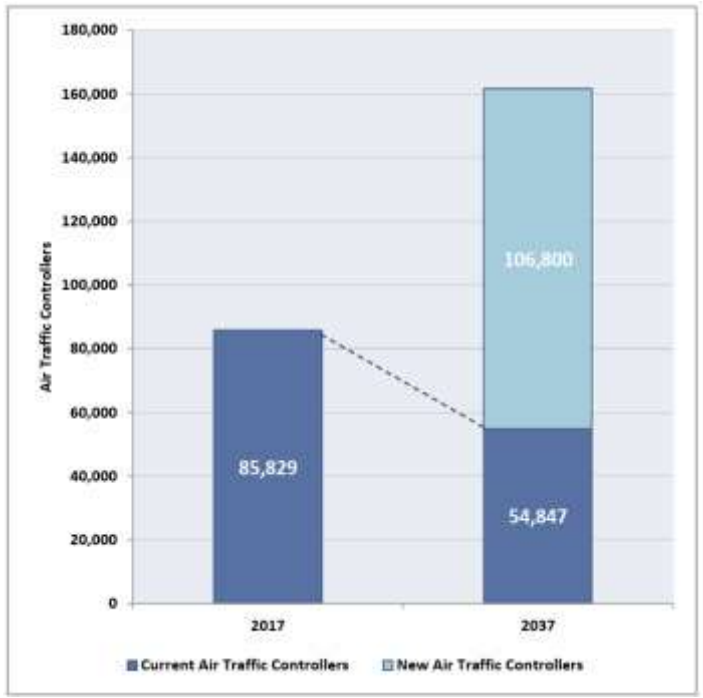
03 **AI for autonomous flight planning**

04 **Customer Service**

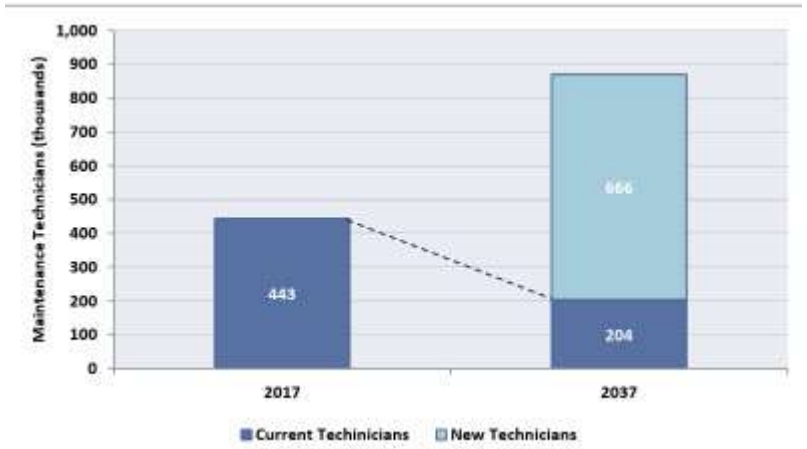
05 **Ground Operations**

Commercial Demand Forecasts and Attrition

Air Traffic Controllers

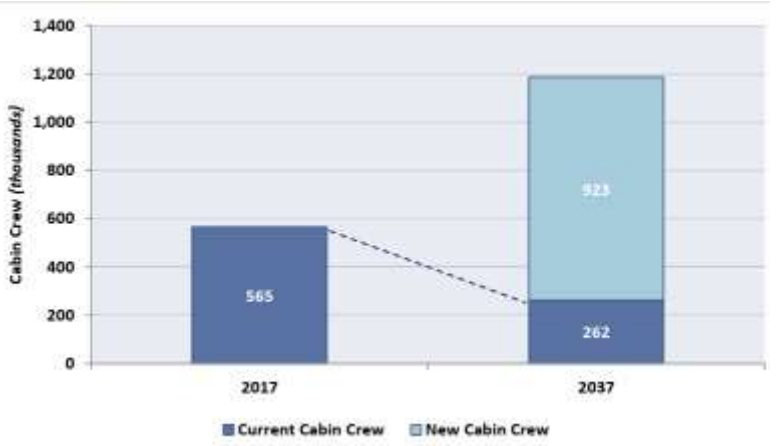


Maintenance Crew



Over 50% of aircraft maintenance technicians are over the age of 40.

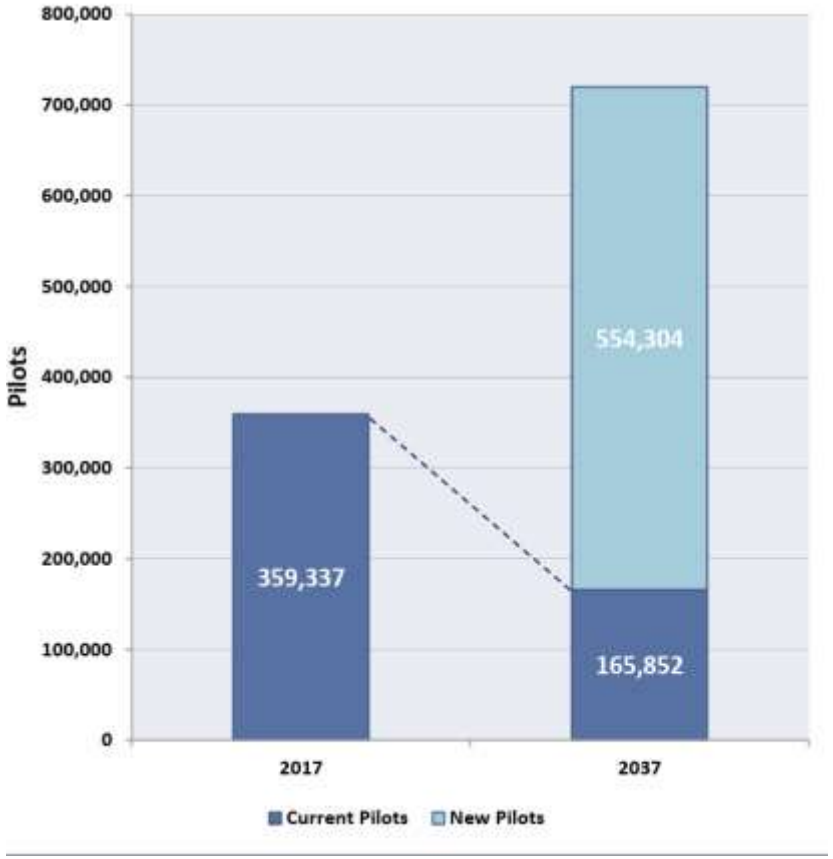
Cabin Crew



34% of cabin crew in the United States (U.S.) are over the age of 50.

Commercial Demand Forecasts and Attrition

Source: ICAO's ADAP4 Aviation Personnel and Gender Statistics



3.8% Retirements/year

By 2030 30% of total pilot civil aviation industry pilot pool will be over 50 years of age

Commercial Aviation. Source:
CAE

high dropout rate over the years

70% FAA
80% AOAP

Rapidly Changing Technology

AI adoption is evolving aviation

Promote the innovation of technology and develop new career paths

Safety and regulatory policies

Implement Responsible Human AI Teaming

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Increasing Demand

Changes in Recruitment and Training

Develop ways to stifle attrition and collaboration the industry

Continuing education in safety and ethics with aviation in AI

Inculcate a best practice relationship with AI

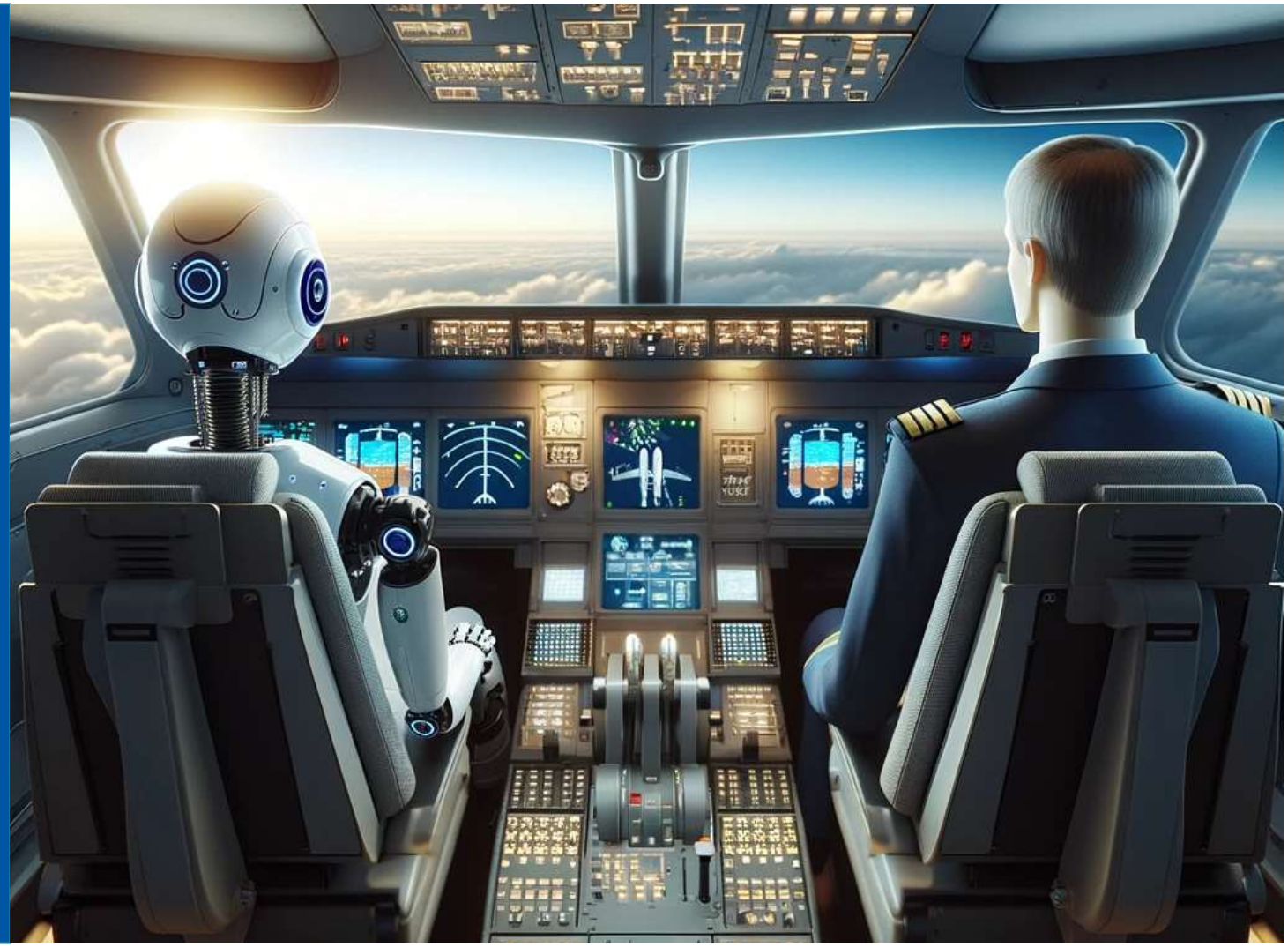
Aircraft maintenance simulator (Virtual/Augmented Reality)

Digital twins and high-fidelity models

- Predictive analytics
- Maintenance and Repair
- Design and Engineering optimization

-

AI Virtual instructors and adaptive learning platforms



High-Fidelity Simulator Trainer

SimuNEX

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