

# ALPHA BRAVO COLLINS

AEROSPACE REDEFINED



# IWES 2020

FEBRUARY 8,9 2021



# ALES: from UTRC to Collins Adv. Technologies Center



## MISSION

**Model Based Advanced Methods**  
**and Embedded Technologies for Validation,**  
**Design and Verification of Cyber-Physical Systems**

## Funding Split

30% **ERD**  
30% **CSR**  
40% **BU**

## Skilled Workforce

~40 Employees  
60% **PhD**

## Groups

Formal Methods  
Embedded Technologies  
System Simulation  
Software & Data Technologies

# COLLINS AEROSPACE - EUROPE AT A GLANCE

## WORKFORCE

~15,000\*

Direct Employees

~38,000

Indirect jobs

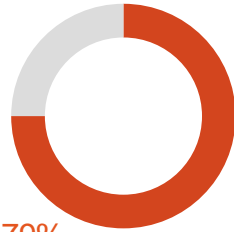
~3,000

Engineers

\*including 5,000 employees @ 16 UK sites

## SALES PORTFOLIO

21%  
Government



79%  
Commercial

## LOCATIONS

15  
European  
countries

88  
Locations

Roots dating to  
1890s

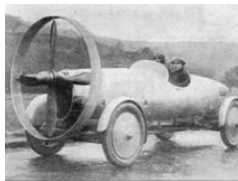


## LEGACY OF INNOVATION IN EUROPE

### PROPELLER SYSTEMS



Paulin Ratier



~20% of revenue  
Invested in R&D

Manufacturing & engineering

Services

# LEGACY OF INNOVATION

## AVIONICS AND COMMUNICATIONS



Arthur Collins



## ELECTRIC SYSTEMS



David Sundstrand



## ENVIRONMENTAL CONTROL SYSTEMS



Thomas Hamilton



## LANDING SYSTEMS



Benjamin Goodrich



## NACELLES



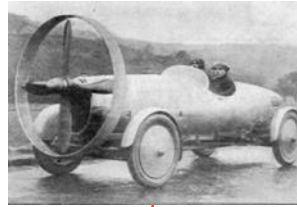
Fred Rohr



## PROPELLER SYSTEMS



Paulin Ratier



# A/D MARKET NUMBERS BEFORE PANDEMIC

**DEMAND for AIR TRAVEL** (3.28B to 4.8B + 1.6Bin 10 years)

- Demand for 250K new Pilot within 10 years
- Next Generation Air Transportation System (NAS) [ref] to increase number of planes and manage congestion plus entry of new vehicle UAS

## AIRFRAMER

- Air-framer design on-board and de-board (integrated transport system)
- Component re-use across industry (Rail and Automotive)
- Hyperloop Technologies (HTT) will disrupt Air-market?

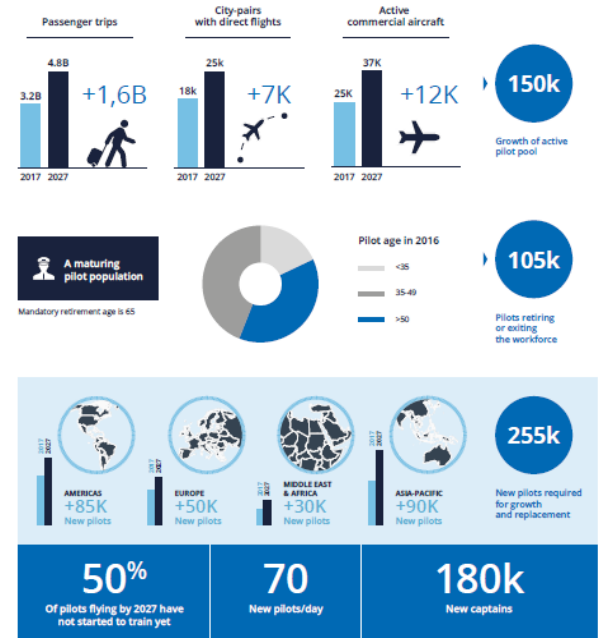
**EU Research Funding** European Defense Agency

- European Defense Agency is coming

**Is Model Based System Engineer ready for these challenges?**

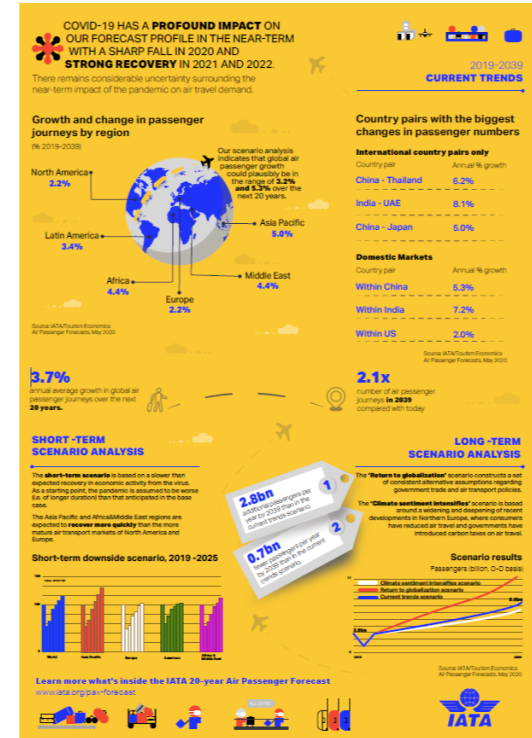
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## Airline Pilot Demand, 10-year outlook at a glance



# AEROSPACE MARKET: QUO VADIS ?

- IATA recently provided an update of the **air passenger forecast growth** for the next 20 years, including the impact caused by COVID-19. A 3.7% annual average increase is expected, with more than 2x air passengers by 2039.
- **Domestic** and **short-haul** markets **will recover faster**, with long-haul travel being the last to return to 2019 levels of demand.
- Next decades, the market will be mainly driven by **short-haul aircraft** and it is expected an increasing contribution of REG and SMR platforms to intra-continental mobility together with a **potential growth** of General Aviation and Urban Air Mobility platforms.



Source: <https://www.iata.org/contentassets/e938e150c0f547449c1093239597cc18/pax-forecast-infographic-2020-final.pdf>



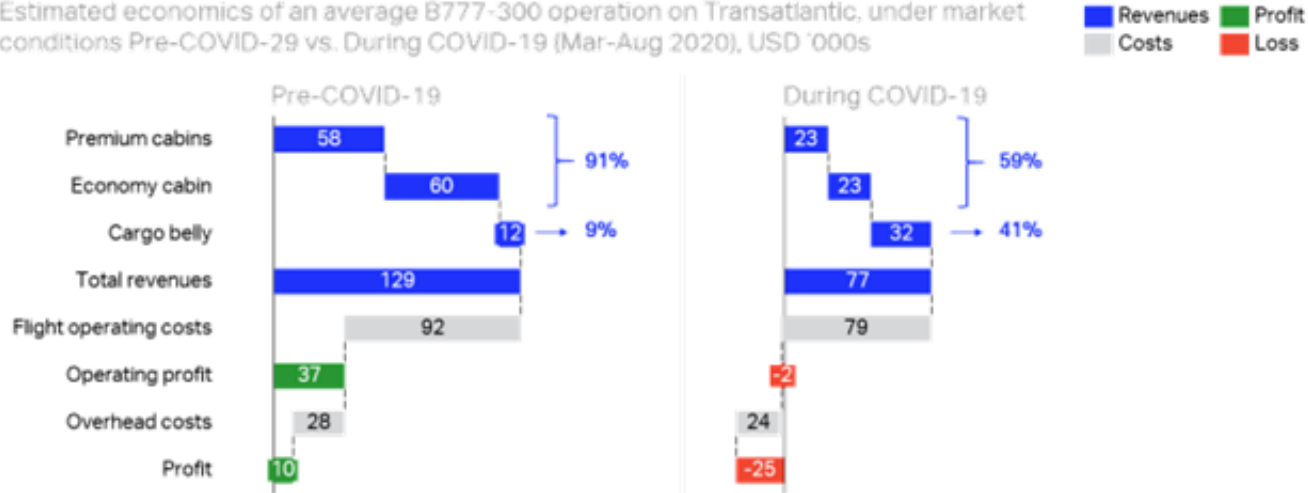


# IATA Economics' Chart of the Week

20 November 2020

## Strong cargo revenues making some long-haul services possible

Estimated economics of an average B777-300 operation on Transatlantic, under market conditions Pre-COVID-19 vs. During COVID-19 (Mar-Aug 2020), USD '000s



IATA Economics analysis based on data from SRS, DDS, ACMG, Cargo IS, IATA Statistics, Platts



# EU WILL BE THE FIRST ?

Strategic Research and Innovation Agenda



**Digital European Sky**



DRAFT September 2020

Strategic research and innovation agenda



The proposed European Partnership for Clean Aviation

Courtesy of DLR Draft - Version July 2020

EUROPEAN AVIATION ARTIFICIAL INTELLIGENCE HIGH LEVEL GROUP

**The FLY AI Report**

Demystifying and Accelerating AI in Aviation/ATM

5<sup>th</sup> March 2020

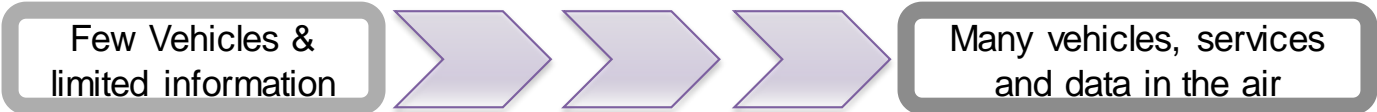
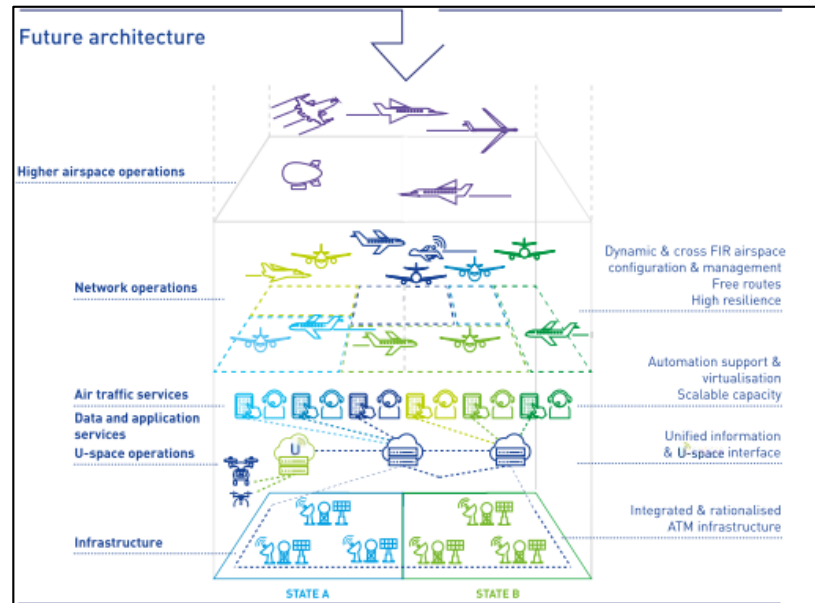
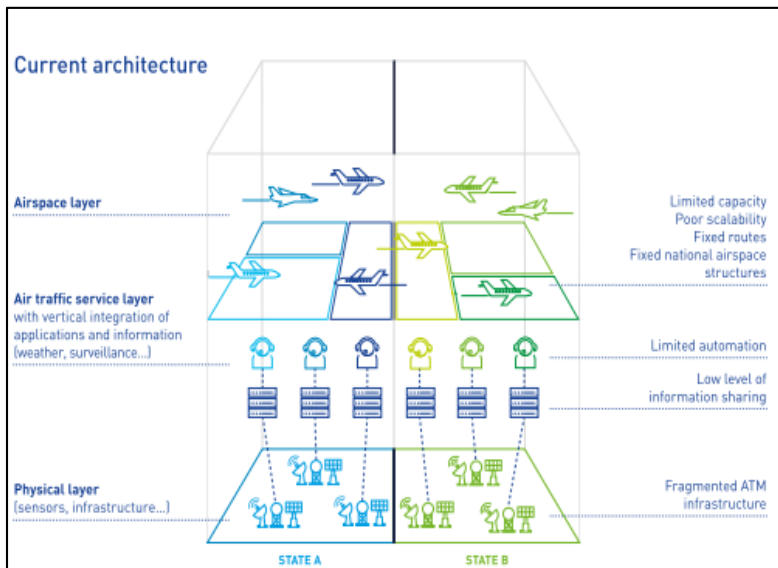


WITH INPUTS FROM EDA MILITARY EXPERTS AND NATO ATTENDING IN AN OBSERVING CAPACITY



# SESAR: EUROPEAN ATM MASTER PLAN 2020

EVOLUTION OF THE EUROPEAN SKY in the next 20 years



# AUTONOMOUS INTELLIGENT SAFETY-CRITICAL SYSTEMS



Flight in 2040 **16.2M** +53% 1.9%/year

**Overall cost saving \$110 billion per year**

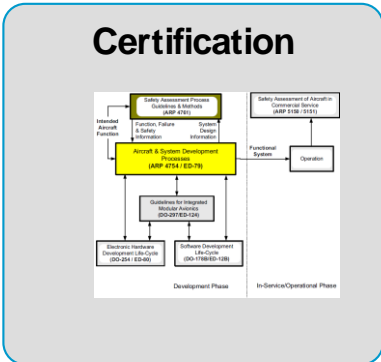
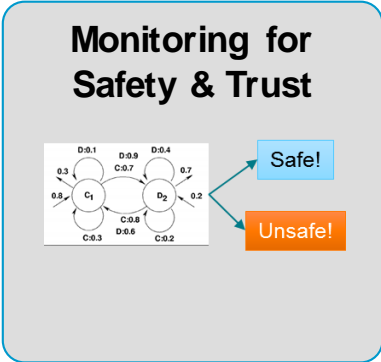
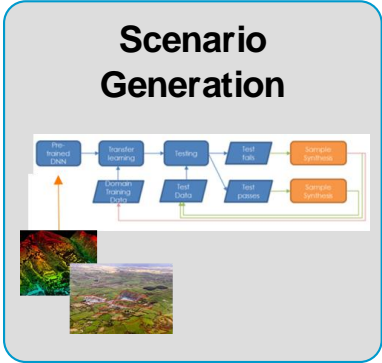
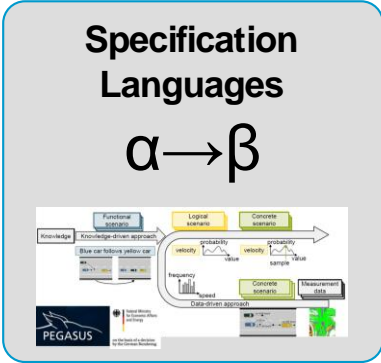
**Reduce 15% of fuel consumption per flight**

Dude, Where's My Autonomous Car? The 6 Levels of Vehicle Autonomy

<https://www.synopsys.com/automotive/autonomous-driving-levels.html>

The **specification, validation** and **verification** of Autonomous & Intelligent Systems is still an **open R&D** topic

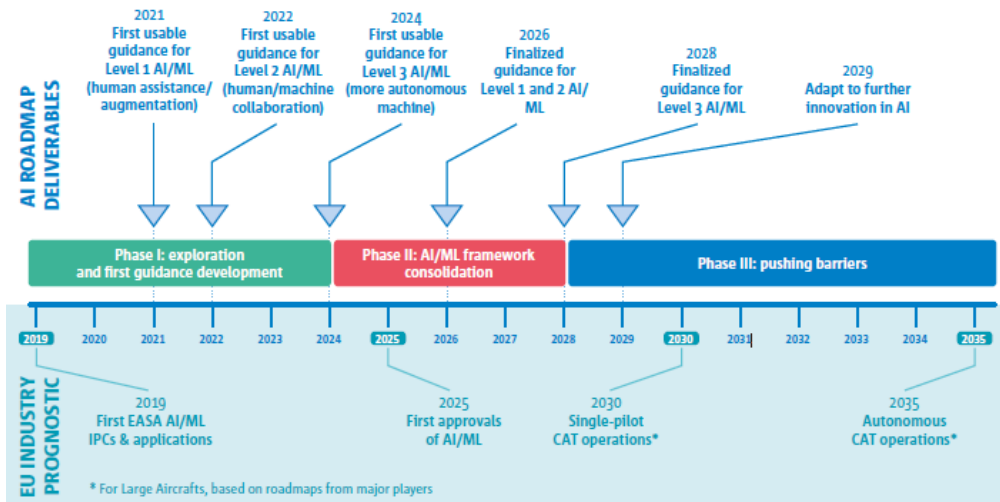
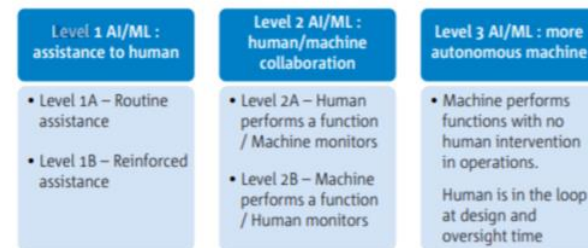
Focus Areas



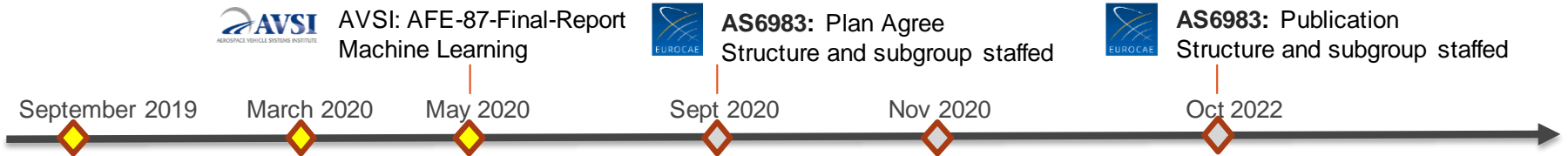
# EASA ARTIFICIAL INTELLIGENCE ROADMAP



Figure 3. Possible classification of AI/ML applications

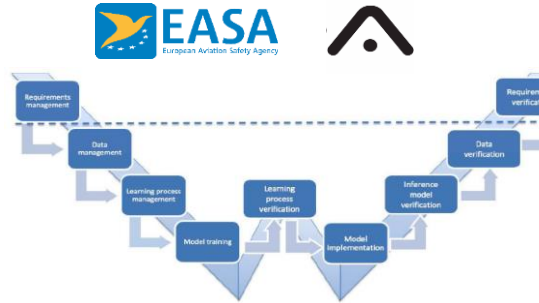


# WG114 EUROCAE: MACHINE LEARNING



**EASA**  
EASA-DDLN Concepts of Design Assurance For Neural Networks CoDANN

**AIR6988:** Artificial Intelligence in Aeronautical Systems: Statement of Concerns  
**AIR6987:** Artificial Intelligence in Aeronautical Systems: Taxonomy



1. Safety assessment
2. Development of system architecture
3. Safety requirements and DAL / SIL assignment
4. ML-based component specification
5. Data selection and validation
6. Model selection, training and verification
7. ML-based component implementation
8. ML-based component verification
9. ML-based component integration in the system
10. Operation and maintenance of the system

*Note: this process is not fully linear but iterative. In particular, the safety assessment is not performed once for all at the beginning, but it is updated all along the lifecycle and finalized only once the system is finished.*

# UTRC ITALY ERD PROJECTS

## MISSION (CS2-SYS-GAM-2014-2015-01)



Modelling and Simulation Tools for Systems  
Integration on Aircraft

Application of model-based methods and tools for aircraft development. Main UTRC focus is on model-based controls engineering, model-based automation, simulation-based virtual testing, standard-based tool integration



Period: 2015-23

Role: Tech & Meth & UC-provider  
Call: CS2-GAM-2018-SYS

## ICOBRAKE ()



Intelligent connected aircraft braking system

Innovative sensing for temperature and positioning detection, Temperature-based Wear detection and Optimization, Wireless Communication, Packaged for harsh environment, Advanced Brake health management and prognostics



Period: 2020-22

Role: Tech. Provider  
Call: JTI-CS2-2019-CfP10-LPA-01-73 (IA)

## CARVE



Combining Formal Model Based Design and  
Robotics Platform for Reusable Components

Application of Formal Methods to Robotic Systems



Period: 2018-19

Role: Technology & UC-provider  
Call: ICT-01-2019

## SHERLOCK (820689)



Provide a monitoring system to safeguard operators in a Human-Robot collaborative environment  
Increase operator trust on HRC safety leveraging formal exhaustive algorithms and machine learning

Formal Run-Time Analysis of Human-Robotic Collaboration  
Autonomous System Run-Time Validation



Period: 2019-22

Role: Specification and UC Provider  
Call: DT-FOF-02-2018 (RIA)

## COLLABS (871518)



A comprehensive cyber-intelligence framework for resilient collaborative manufacturing systems

Secure multi-party computations and homomorphic encryption, distributed deep learning and anomaly detection, distributed ledger technologies (blockchain) and smart contracts, and distributed remote software attestation



Period: 2020-22

Role: Tech. and UC Provider  
Call: H2020-ICT-2019-2 (RIA)



THANK YOU

Giacomo Gentile

Group Leader, Embedded System

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