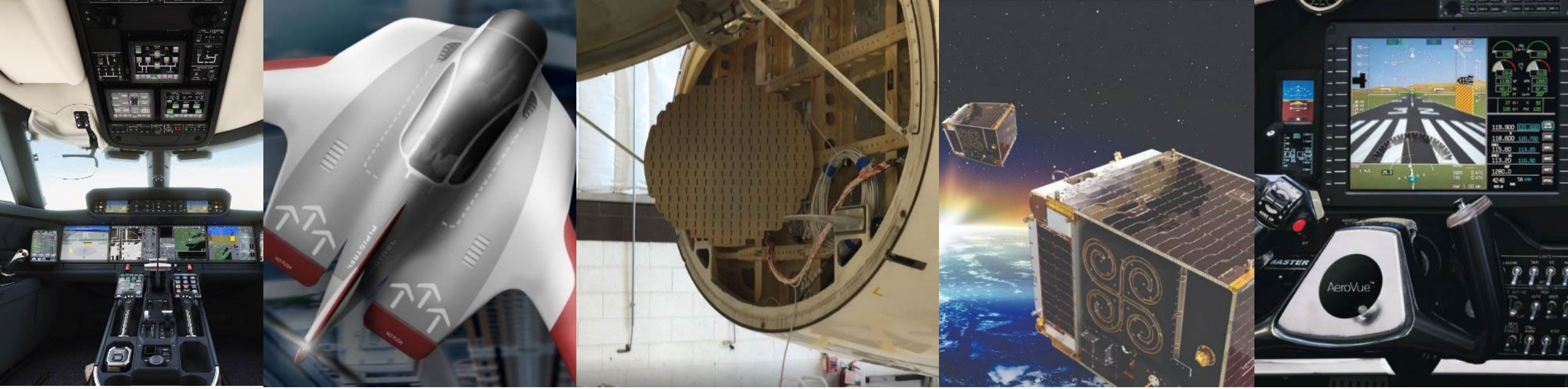

SESAR DARWIN PROJECT

Developing scalable human-AI collaborative systems for advanced operations

Hicham Atassi
Advanced Technology

Honeywell

April 30th, 2024

Acknowledgement

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Disclaimer

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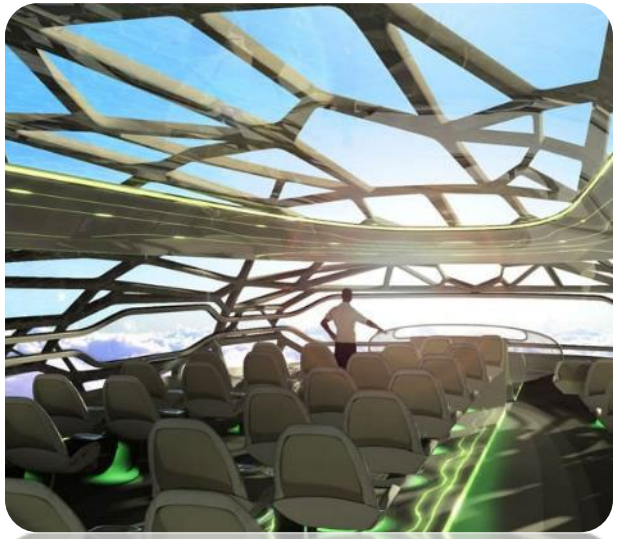
WHAT DRIVES CURRENT AVIATION R&D?

Autonomy



Digitalization

AI & Trust

Welcome to a new era of flight — while safety still comes first!

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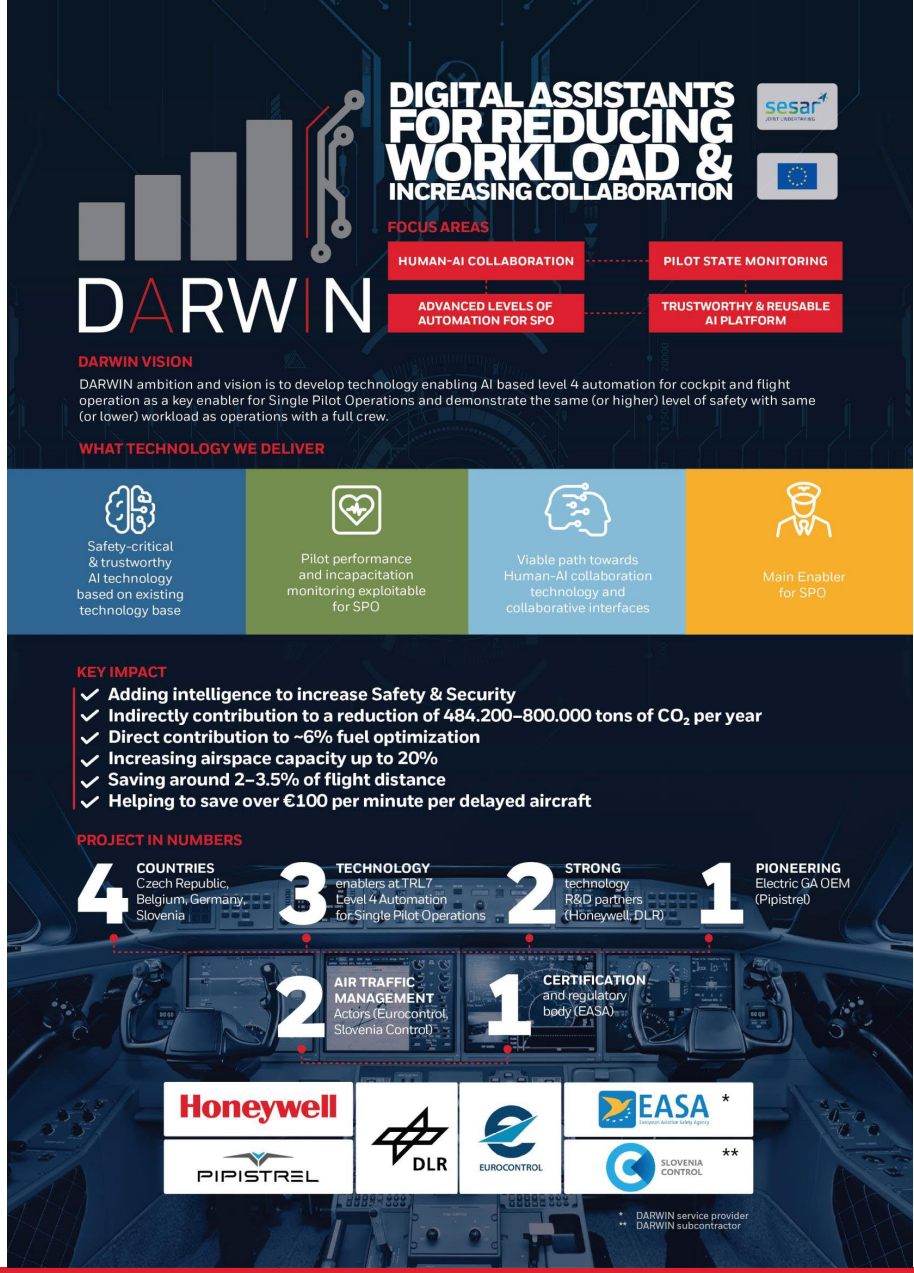
SESAR 3 | DARWIN

Honeywell leads consortium and project.

Highlights:

- **Execution:** (06/2023 – 05/2026)
- **Objective:** Demonstration on SPO OEM precursor.
- **Technologies : towards eMCO / SiPO**
  - Digital Co-pilot, and pilot assistants
  - Pilot State Monitor
  - Human-Machine teaming with Trustworthy Machine Reasoning Engine (EASA AI Level 2a/2b)

- **Agile & iterative** development with SPO OEM Part 23, aligned with Part 25.
- **Cooperation with EASA towards certification path.**



Delivering eMCO/SiPO enablers to TRL 7 with support of regulators.

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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**

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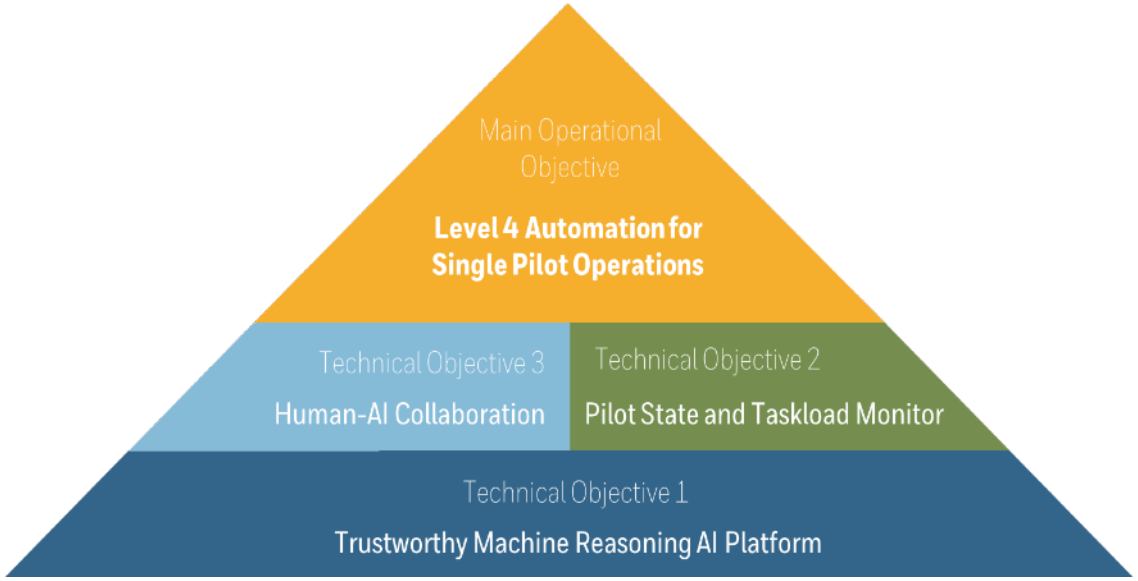
PROJECT OBJECTIVES



Human-AI Collaboration

- Dynamically distribute tasks based on pilot health state and task load,
- Provide collaborative capabilities for pilot interaction with adaptable automation and assistants,
- Ensure the pilot stays in the loop and in charge even in demanding situations

Pilot State and Task Load Monitor

- Monitor the condition of the pilot and identify drowsiness, sleep, or incapacitation,
- Predict periods of increased task load along the planned flight route, leading to an optimal distribution of work in the cockpit.

Trustworthy Machine Reasoning Platform

- Provide capabilities for rule-based, transparent, and explainable decision support or decision making.

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PILOT–AUTOMATION TEAMING

AI Level 1
(PSM)

AI Level 1 & 2
(PSM, Assistants, collaboration)

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PILOT STATE MONITORING

Unobtrusive pilot-acceptable **technology** for the detection and long/short-term monitoring of **states** that cause partial or full incapacitation

A key safety enabler to:

- extended Minimum Crew Operations (eMCO)
- Single Pilot Operations (SiPO)

State detection development:

Sleep, Drowsiness

- **Prevent sleep** (By notifying pilot)
- Multiple solutions available based on the selected sensor type

Incapacitation

- **Wake up pilot**
  (If sleep prevention failed)
- **Support eMCO operations**
  (e.g., by notifying Cabin Crew)

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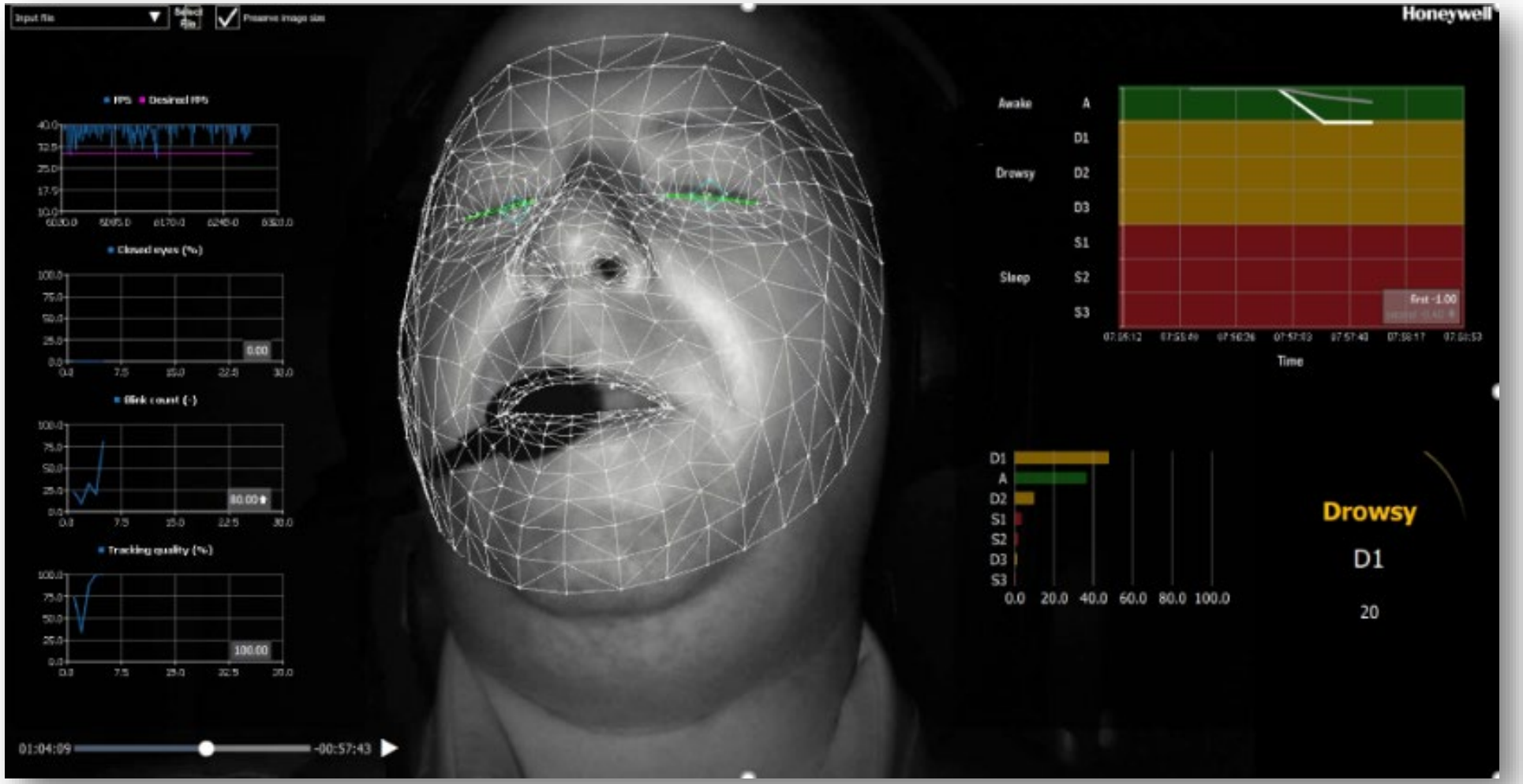
PILOT STATE MONITORING



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VARIABILITY IN DATA

	Human being variability in behavioral features Gender, age, ethnicity, etc.	**Human psycho-physiological signature** Behaviors, Bio metrics	**Aircraft conditions variability** Camera location, Lighting, Dynamics
VARIABILITY	**Significant**	**Low**	**Significant**
AVIATION SPECIFIC?	**Generic**	**Generic physiological signature** **Specific pilot behaviors**	**Aircraft type specific**

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