

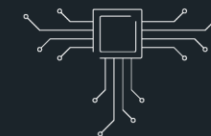
Leonardo Helicopters

From Automation to Autonomy, a path for safe flight to the future

Differences, advantages and major challenges of moving from automation to autonomy

Amsterdam

04/11/2024



Electronics



Helicopters



Aircraft



Cyber &
Security



Space



Aerostructures

AGENDA

- What is Autonomy?
- Automation and Autonomy – what's the differences?
- Leonardo Automation state of the art
- Automatic & Autonomy Functions – why the transition?
- Autonomous Aircraft Typical Mission
- Autonomy Levels
- Leonardo Current Autonomy Strategy
- Leonardo Autonomy Roadmap
- Automation & Autonomy – Benefits and Challenges



Autonomy is the ability of a system to achieve goals while operating independently of external control.

“Autonomy is not the same as artificial intelligence (AI), but may make use of AI methods”

“Autonomy is not the same as automation, but often relies on automation as a building block”

Reference: [Autonomous Systems Taxonomy NASA Autonomous Systems Capability Leadership Team]



Automation and Autonomy – what's the differences?

Increase **Automation** level is a mandatory step toward Autonomy.

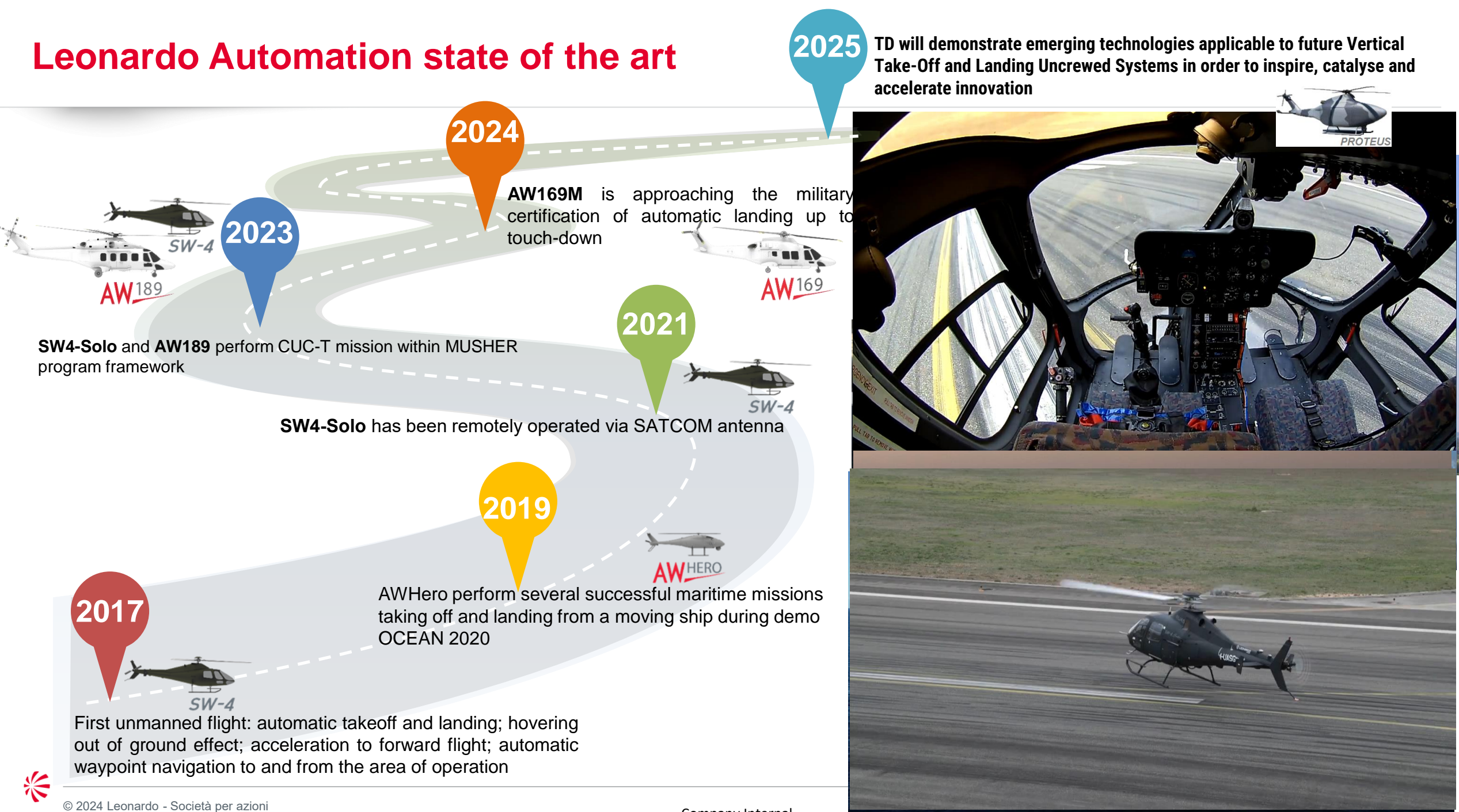
For Leonardo this means:

- ☐ **Pilots** are in the loop (onboard or remotely on a GCS)
- ☐ **Pilots** can always keep authority and control of the aircraft to ensure its safe operation
- ☐ **Machine** suggests options, whereas pilot can always override
- ☐ **Normal & Emergency Procedure** are incrementally automated but monitoring and recovery is still on pilots

An Autonomous Aircraft will accomplish all its defined tasks without operator interaction and **Machine** will be in charge for all functions: aviate, navigate, communicate and mitigate. Human will act as a supervisor.



Leonardo Automation state of the art



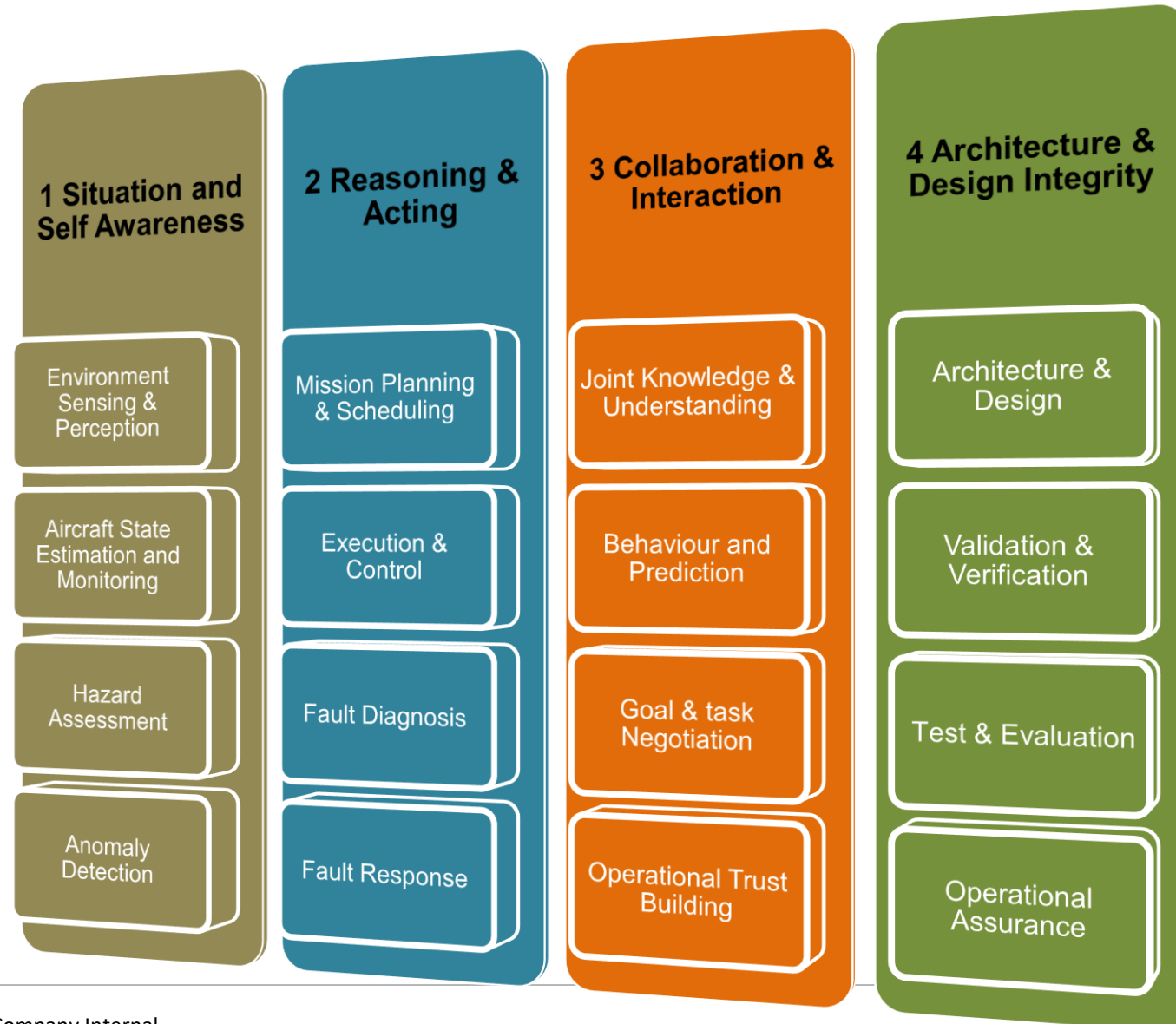
Automatic & Autonomy Functions – why the transition?

Why Autonomy? Pilot “Market” demand

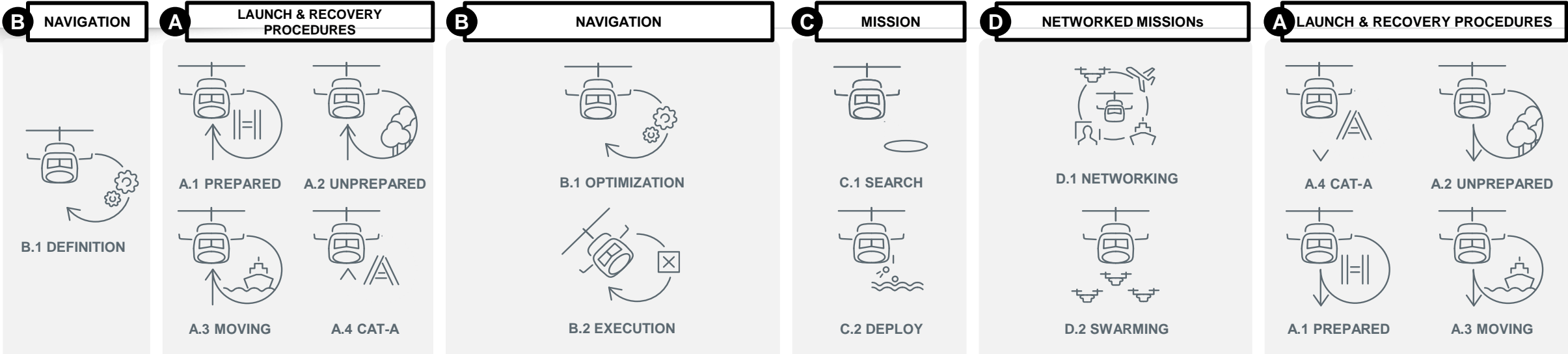
- ❑ The global market currently faces a high demand for helicopter pilots, reflecting growing needs across various sectors. Boeing's study has projected a potential helicopter pilots shortage of about 60,000 through 2038.
- ❑ Many missions can be automated to perform defined path, search, rescue and delivery tasks, in high risky environment or segregated areas

How to build Autonomy? Which Functions to increase Automation level towards Autonomy? NASA Level framework

1. Situation and Self awareness
2. Reasoning & Acting
3. Collaboration & Interaction
4. Architecture & Design Integrity



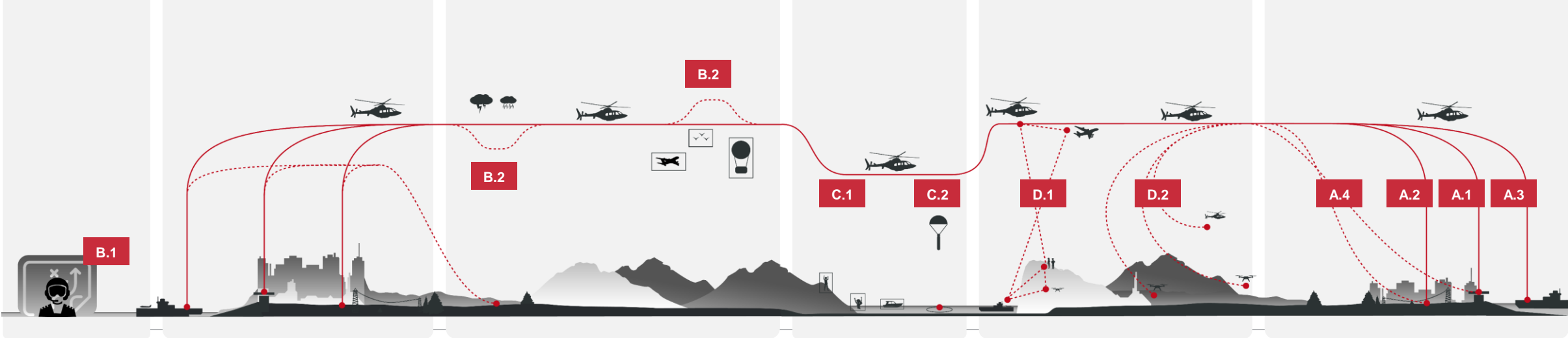
Autonomous Aircraft Typical Mission



VFR, GNSS

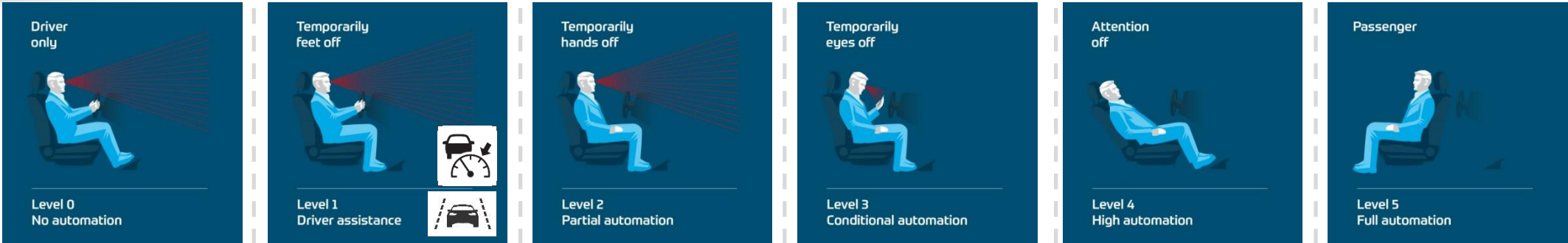
GNSS DENIED

IFR / DVE

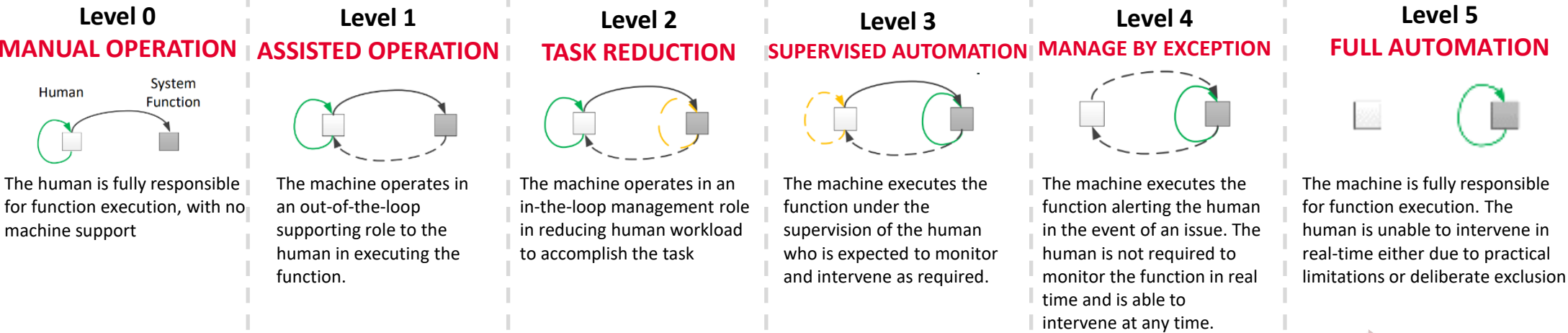


Autonomy Levels

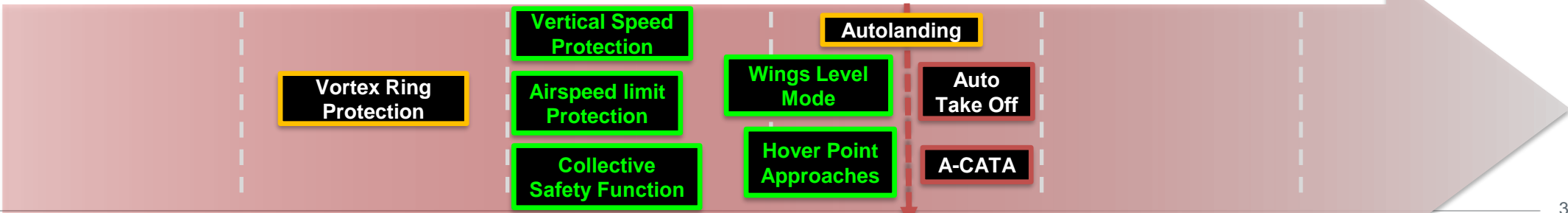
AUTOMOTIVE



Joint Authorities for Rulemaking of Unmanned Systems

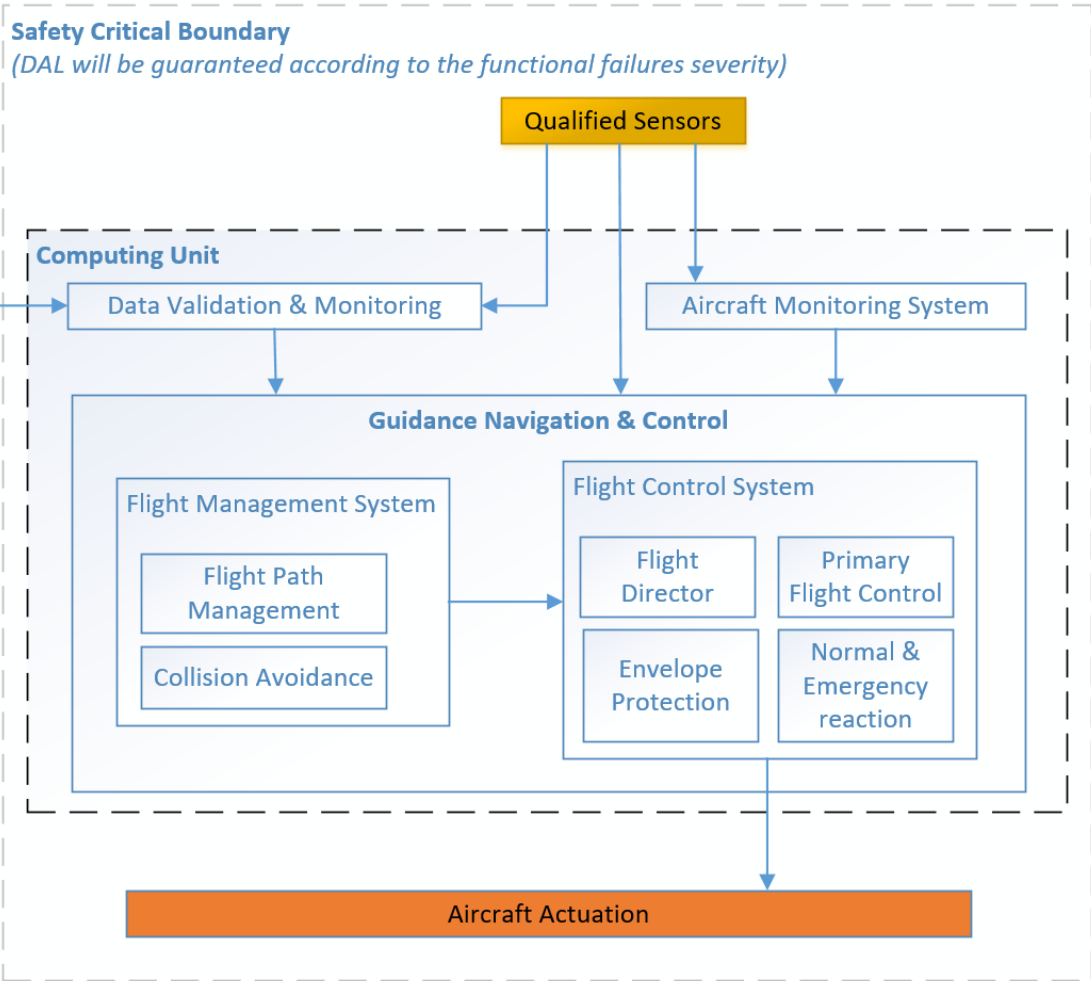
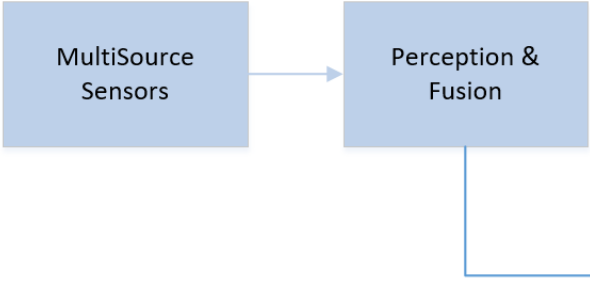


- Certified
- Under Certification
- Under Development

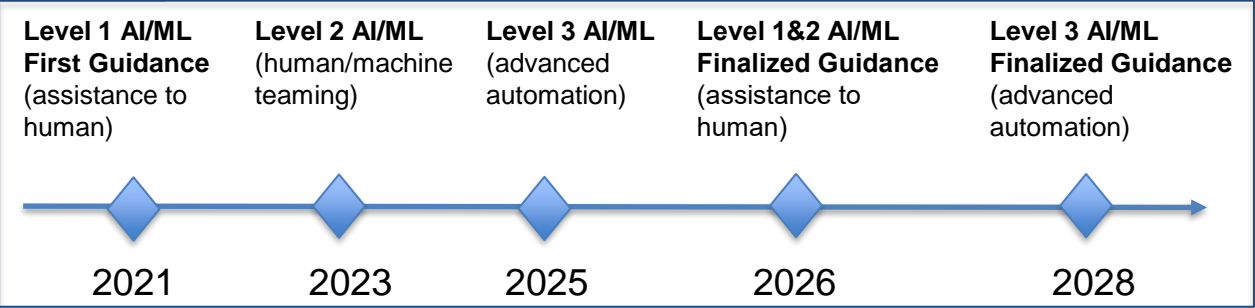


Leonardo Current Autonomy Strategy

In the short term ML/AI will be used to improve performance while deterministic software based algorithm will be used to validate and monitor data provided by ML/AI.



EASA ARTIFICIAL INTELLIGENCE ROADMAP 2.0



Leonardo Autonomy Roadmap

	Today	2025 - 2030	2030+
Functions	Automation LEVEL 2 / 3 Autopilot + HMI provide standard Task Reduction, envelope protection and full flight path control (MOT, SAR-Patterns) under crew supervision.	Automation LEVEL 3 / 4 Full Envelope Protection, Automated Take Off & Landing, Automatic Emergency Procedures, In-Air Collision Avoidance.	Automation LEVEL 3 / 4 / 5 Level 5 tested under specific ConOps. Infrastructure Evolution to support Level 5.
Architecture	Systems Building Blocks Aircraft's architecture based on systems building blocks providing stability, primary flight parameter control and flight path management to pilots.	Aircraft Building Blocks Modular & Scalable Hardware Architecture. Usage of MultiCore and GPGPU to increase throughput and perform complex tasks.	Integrated Aircraft Preliminary Integrated Aircraft Design leveraging on Automation.
Certification	Existing Cert Rules Deterministic Software very well bounded (DO178B/C). AI Suppliers with non «certifiable» items, tested under specific ConOps.	Design Assurance Process Design Assurance Assessment Process for «objective based» Software (e.g. ML/AI).	Certification Rules Certification Subject for Autonomy Civil application.
Crew & Training	Pilots Highly Complex Systems require highly trained crews for Vehicle Management and Flight Operations.	Operator and Pilots Enhanced Automated Aircraft Control to assist the crew in operating the aircraft.	Fleet Manager, Operator, Pilot Pilots still involved in complex mission. Operator (remote/onboard) sends mission obj. Fleet Manager acts as multi-aircraft supervisor.



Automation & Autonomy – Benefits and Challenges

Benefits for Customers:

Crew workload reduction mainly in IFR/DVE conditions and/or for single pilot operations

Operational safety improvement due to the increasing level of automation up to level 3 and 4

Growing pilots demand alleviation relying on autonomy for repetitive missions and tasks



Challenges for OEMs:

Business sustainable “Transition” (Costs&Time) to ML / AI development and maturity

Increasing need of open platforms for OEMs to incorporate edge technologies

Development of functions and architectures with evolving guidelines and infrastructures





THANK YOU
FOR YOUR ATTENTION

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