



AI-based testing pyramid towards virtual certification of next-gen composite aerostructures

The pAlramid project aims to transform aerostructure design, development, and certification by harnessing AI-driven virtual testing. This innovative approach replaces costly, time-intensive physical tests with a cutting-edge digital framework of high-fidelity virtual tools.

Challenge

The aerospace industry faces substantial challenges in certifying composite aerostructures, a process that relies on extensive physical testing under the traditional pyramidal framework.

This sequential, resource-intensive approach hampers innovation, increases costs, and extends time-to-market for new designs.

Additionally, current methods fail to provide insights into the interactions between testing levels, limiting the ability to predict and adapt to changes in materials or processes.

To achieve Europe's ambitious climate- neutral aviation targets, a more efficient and sustainable certification process is urgently needed.

13

partners

7

countries

€5M

budget

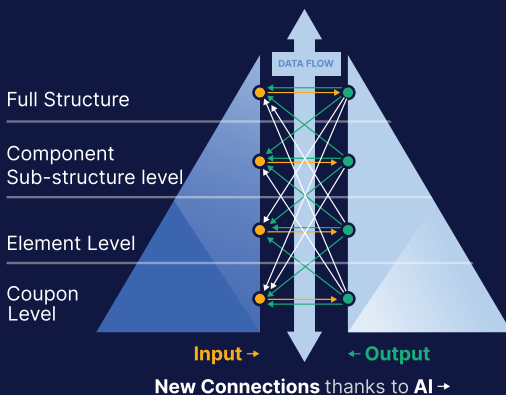
45

months

Project Aim

pAlramid aims to revolutionise aerostructure design, development, and certification by introducing an AI-powered digital framework that integrates virtual testing across all levels of the certification pyramid (from base to top: material, coupon, element, aerostructure).

This approach replaces costly and time-intensive physical testing with high-fidelity simulations and data-driven insights, transforming certification into a streamlined, interconnected process.



The project also advances sustainable and functionalised thermoset and thermoplastic composites, along with innovative Liquid Resin Infusion (LRI) and Fused Deposition Modelling (FDM) manufacturing processes.

By project's end, pAlramid will deliver a comprehensive solution to enhance efficiency, safety, and sustainability in aerostructure certification and production, driving progress towards Europe's climate-neutral aviation goals.

Main results

pAlramid will deliver an AI-driven decision-making tool that integrates virtual testing with unprecedented accuracy, reliability, and speed.

Alongside this, the project will develop sustainable functionalised thermoset and thermoplastic composites tailored to aerospace needs, and cutting-edge LRI and FDM manufacturing processes.

These innovations will be validated in four industrial use cases, providing a roadmap for scalable implementation and market adoption.

Impact

The project aims to transform aerostructure certification by making it faster, more cost-effective, and environmentally sustainable.

By its end, the project will deliver:

40% decrease in physical testing

20% cost savings in FDM-based manufacturing

30% increase in reliability evaluation accuracy

50% reduction of assemblies through one-shot LRI

pAlramid supports the transition towards lightweight, environmentally friendly aerostructures, setting new standards in aerospace innovation. These advancements align with Europe's climate and innovation goals, fostering leadership in aerospace innovation.

Use Cases

pAramid will validate its innovations through four real-world industrial use cases, demonstrating the flexibility and scalability of its tools across different materials, processes and aerostructure applications:



Vertical stabiliser box fairing:

Demonstrating Fused Deposition Modelling (FDM) with thermoplastic and glass fibre for enhanced electromagnetic interference (EMI) shielding, and radar transparency and lightning protection.



Aircraft door structure:

Showcasing one-shot Liquid Resin Infusion (LRI) with thermoset and carbon fibre, incorporating embedded sensors for process monitoring (PM) and structural health monitoring (SHM), ensuring EMI and lightning protection.



Wing leading edge (thermoplastic):

Combining FDM with thermoplastic and carbon fibre, embedding de-icing systems, and ensuring EMI shielding.



Wing leading edge (thermoset):

Using one-shot LRI with thermoset and carbon fibre, embedding de-icing and SHM systems for enhanced functionality.

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Visit pairamid.eu to explore our journey towards sustainable aviation and discover the latest project developments, insights, and news.



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