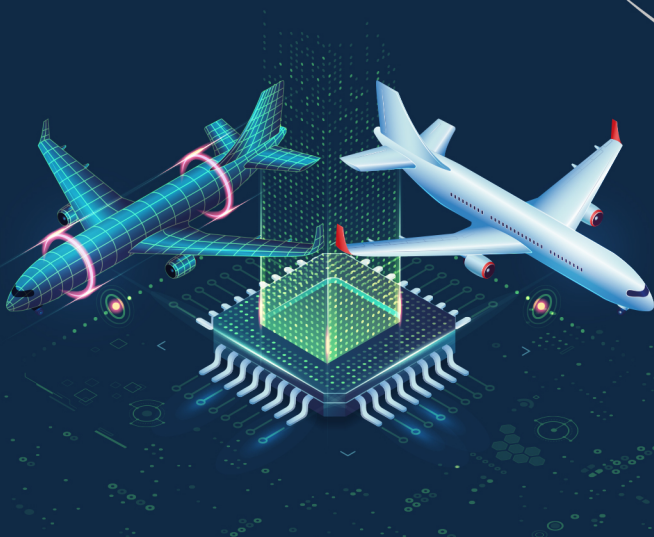


GENEX

New end-to-end digital framework for optimized manufacturing
& maintenance of next generation aircraft composite structures



Funded by
the European Union

ABOUT GENEX

GENEX is an EU-funded collaborative research project targeting at a multi-disciplinary digital twin-driven framework for optimized aircraft composite manufacturing and Operation & Maintenance (O&M) processes for ensuring aircraft's safety and airworthiness.

Without drastic measures, aviation related CO₂ emissions will become, by 2050, ten times higher than in 1990. For that purpose, **efficient** and **sustainable manufacturing**, **robust repairing processes** and **operationally upgraded aircraft lifecycle** are necessary to achieve the environmental goals set by the EU.

GENEX commits to develop:

- » Advanced and efficient manufacturing of recyclable composites
- » New structural health and usage monitoring and management systems
- » Digital-assisted repair processes and tools

“When the physical world meets, uniquely, the virtual world for a premium manufacturing, maintenance, and repair approach of the next generation aircraft composite structures”

GENEX OBJECTIVES



To produce **eco-efficient materials** and processes, monitoring systems and numerical models supporting **advanced manufacturing** of composite aircraft components.



To invent a methodology built on **coupled physics and data-based algorithms** to improve the assessment of fatigue damage and residual life estimation of the aircraft structure under variable usage scenarios.



To develop **pioneering digital-based processes** and **tools** to optimize **maintenance** and **repair** operations while assisting the digital transformation of composite repair.



To create **a multi-disciplinary digital twin** of the aircraft component rendering feasible a continuous updating model of the aircraft lifecycle.

A multi-disciplinary digital twin enabling data management across the entire lifecycle of the next generation aircraft composite structures



GENEX CONCEPT

Advanced & efficient manufacturing of recyclable composites



Recyclable 3R composite tapes with embedded Fiber Optic Sensors (FOS)

Development of optimized MFC piezoelectric sensors



Embedded MFC sensors



ATL of 3R tapes for in-situ consolidation



On-line control of manufacturing parameters



On-line THz Terahertz Spectroscopy (TDS) for curing monitoring

End-to-end bidirectional data flow



In-line manufacturing quality

Integral health & Usage Monitoring system of aerostructures

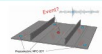
Structural monitoring FOS & Ultrasonic GW



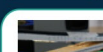
Wireless communication node



Piezoelectric MicroFiber composite - Interdigitated Transducers (MFC-IDT) & sensors



Ultrasonic Guided Waves (UGW) monitorization simulation



ML for damage detection



Damage location & characterization



Reduced Order Model (ROM) based on FE fatigue damage modeling



Remaining useful life prediction



Performance based strategy

Fatigue damage assessment

Digitally-assisted repair processes & tools



Visual assistance system for manual composite scarf repair



Novel laser-induced breakdown spectroscopy for cleaning and control of surface preparation for bonding



Digital twin for improved design of the composite repair heating blanket



Smart composite repair patch for detecting and stopping cracks

Prognostic based maintenance

Repair process data

Life extension & bonded composite repair certification of primary structures

Lab-scale digital twin framework and prototype realization



Data based model



Digital twin



IIoT-Platform

Environmental Impact & Maintenance, Repair and Overhaul (MRO) guidelines

As part of this holistic view, an environmental assessment of the potential benefits of the project will be performed, together with MRO guidelines for next aircraft generation.





OUR TEAM



CONNECT WITH GENEX

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