Embedded Life-Cycle Management for Smart Multimaterials Structures: Application to Engine Components

MORPHO FINAL CONFERENCE

DEsigning, Manufacturing and Operating Quantification of Uncertainties to increase Aviation Safety

A project overview

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Challenges

The use of disruptive technologies based on hybridization/electrification and alternative fuels increases the number of components comprising the propulsion system;

➔ Increase in the number of potential failure cases.

How can we link together information (including its uncertainty) emerging from all stages of a product's lifecycle?

Project Goal and Ambition

Goal: **Develop an uncertainty quantification (UQ) framework** that will provide to holistic aircraft/engine design tools, the capability to become 'UQ-enhanced'.

Ambition: Provide **UQ guidelines** to enhance decision and policy making of unknown technologies' development, support virtual certification and achieve high level of safety and improved risk management.

Project Main Objectives (MO)

MO1: Perform detailed characterization of life cycle uncertainties for components and systems of components developed for a turboprop aircraft based on a hybridized, liquid H_2 configuration.

MO2: Employ and further develop UQ methods in a multi-layered manner: **[Lifecycle]** design, manufacturing/measuring, operations, **[Scales and fidelities]** sub-systems, systems, system-of-systems.

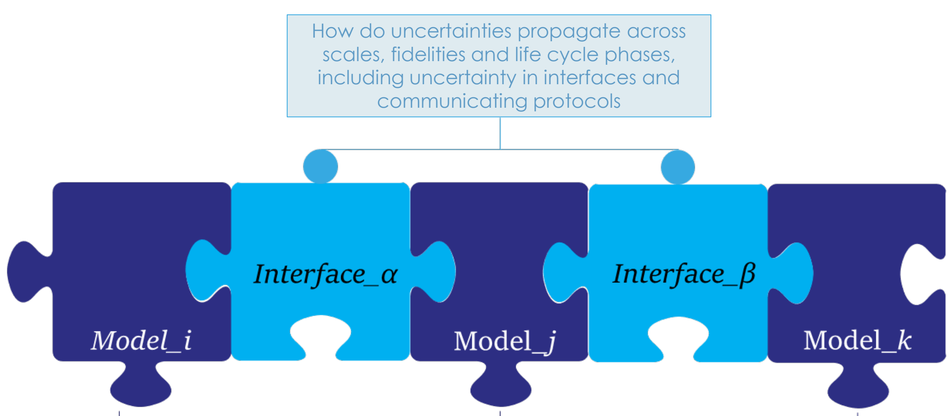
MO3: Deliver an 'as open as possible' framework that will allow holistic aircraft/engine design with the capability to become 'UQ-enhanced'.

MO4: Verify and validate the new UQ methodologies up to TRL5, through a dedicated set of industrially relevant cases.

MO5: Promote the project's solutions via dedicated DEC activities, including targeted synergies (Horizon Europe Cluster 5, JUs such as Clean Aviation/Clean Hydrogen/SESAR 3 etc.).

Methodological approach

How do uncertainties propagate across scales, fidelities and life cycle phases, including uncertainty in interfaces and communicating protocols



Which are the main sources of uncertainty that put each technology at risk?

➔ Industrially relevant test cases

Hydrogen storage tanks
Safety for composite-based structures

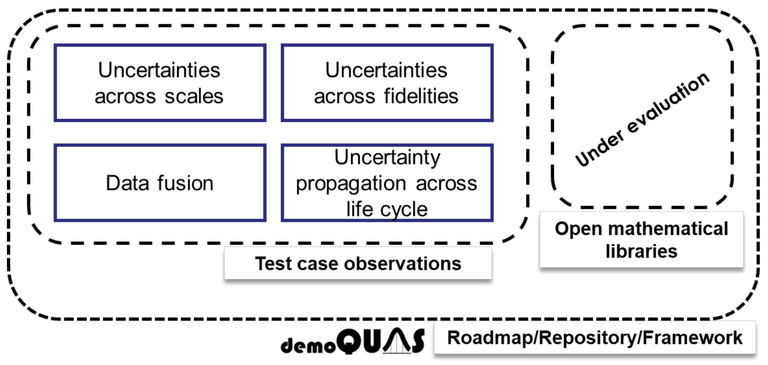
Compact heat exchangers
Safety for thermal management of H_2 & electrical components

Aircraft engine performance and operational health
Safety for maintenance & certification

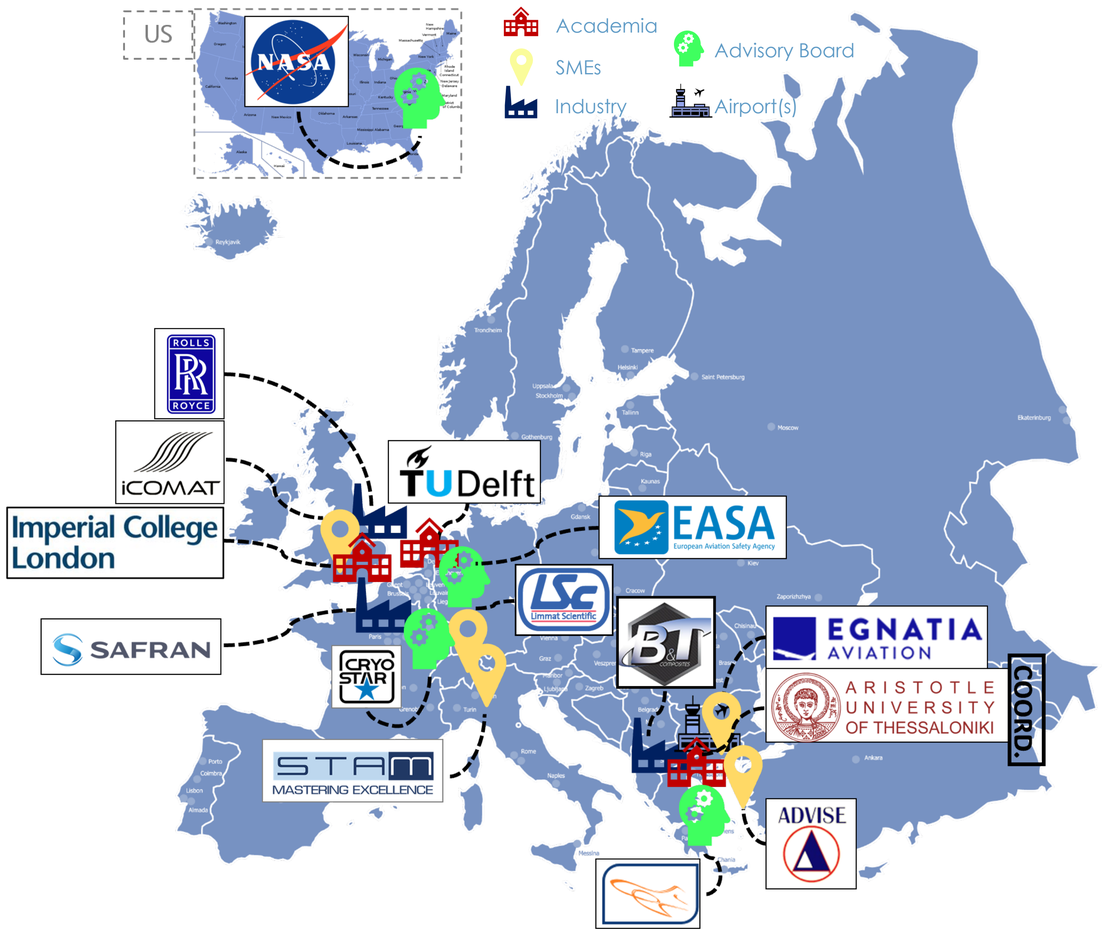
Combustion
Safety in operation and the environment

Airport and pilot operations including safety risk assessment
Safety in human factors and airport operational environment

The need for a unified uncertainty quantification framework to increase aviation safety



The Consortium of DEMOQUAS



About the project

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