BRAVA

BREAKTHROUGH FUEL CELL TECHNOLOGIES FOR AVIATION

Project ID	101101409
PRR 2024	Pillar 3 – H_2 end uses: transport
Call topic	HORIZON-JTI-CLEANH2-2022-03-06: Development and optimisation of a dedicated fuel cells for aviation – from dedicated stack (100 s kW) up to full system (MWs)
Project total costs	EUR 19 986 841.75
FCH JU max. contribution	EUR 19 986 841.75
Project start - end	1.12.2022–30.11.2025
Coordinator	Airbus Operations GmbH, Germany
Beneficiaries	Airbus Operations SL, Aerostack GmbH, Centre national de la recherche scientifique, Université de Montpellier (affiliate of Centre national de la recherche scientifique), Heraeus Deutschland GmbH & Co. KG, Liebherr-Aerospace Toulouse SAS, Madit Metal SL, Morpheus Designs SL, Rhodia Laboratoire du Futur, Rhodia Operations, Stichting Koninklijk Nederlands Lucht- en Ruimtevaartcentrum, Solvay Specialty Polymers Italy SpA, Technische Universität Berlin

http://brava-project.eu/

PROJECT AND GENERAL OBJECTIVES

- Defining fuel-cell-based power generation system architecture and safety requirements based on the higher-level fuel cell propulsion system requirements (considering balance of weight).
- Designing, developing, testing and validating a two-phase cooling system for fuel cell stacks.
- Designing, developing, testing and validating compact and form-flexible (air to liquid) heat exchangers through additive manufacturing.
- Developing, optimising, testing and validating a high-performance fuel cell stack.
- Developing, testing and validating an air supply subsystem for a fuel cell system for aviation
- Design a fuel cell power generation system with high efficiency and high gravimetric power density compatible with aeronautical specifications and constraints based on the integration of developed subsystems.

NON-QUANTITATIVE OBJECTIVES

Within the scope of BRAVA, we will embark on a preliminary design phase, conceptualising a complete power generation system that seamlessly integrates the various subsystems. While the project's focus remains on subsystem-level advancements, we acknowledge that further integration into a power propulsion system and eventual aircraft-level integration lie outside the project's immediate purview.

The underlying concepts, models, assumptions and methodologies for the fuel cell stack that forms the bedrock of our project work in harmony with developments in the other subsystems (air supply and thermal management systems) to ensure the realisation of BRAVA's overall objectives.

PROGRESS AND MAIN ACHIEVEMENTS

Within BRAVA, the fuel cell subsystems will deliver a range of pivotal project results, revolutionising the future of aviation.

- **2-PC based thermal management system.** Our pioneering thermal management system embraces a 2-PC design, incorporating a newly engineered fuel cell stack. By prioritising compactness and weight reduction, we aim to significantly minimise fuel consumption and maximise efficiency.
- **Advanced head exchangers.** We introduce advanced heat exchanger technology, optimising heat rejection while ensuring seamless integration, reduced weight and minimal aerodynamic drag. This breakthrough innovation contributes to enhanced performance and fuel efficiency.
- **Advanced stack cell catalysts and membranes.** BRAVA pushes the boundaries of stack cell catalysts and membranes, unlocking higher levels of performance and durability, and better operational temperature capabilities. These advancements facilitate the integration of new membrane electrode assemblies that deliver unparalleled efficiency, compactness, reduced weight and extended lifetimes.
- **Innovative air supply architecture.** Our team has meticulously designed and optimised a state-of-the-art air supply architecture, bolstered by components specifically tailored to aviation requirements. This forward-thinking approach minimises parasitic power, reduces weight and ultimately lowers fuel consumption and the cost of equipment.
- **Optimised fuel cell system architecture.** Embracing a holistic approach, BRAVA presents an optimised fuel cell system architecture that encompasses innovative concepts such as anode and cathode path recirculation. These advancements promote compactness, lightweight design and elevated operational reliability, propelling aviation power systems to new heights.

FUTURE STEPS AND PLANS

In our pursuit of excellence, we will utilise a reference system – a robust MW fuel cell power generation system – developed, constructed and tested independently from the BRAVA project. This reference system will serve as the benchmark against which we measure our progress and accomplishments in subsystem development. By surpassing the achievements of the reference subsystems and meeting the key performance indicators defined at an early stage of the project, BRAVA will position itself to carry out a follow-up project, such as in phase 2 of the Clean Aviation programme.

The follow-up project will focus on the development of an integrated fuel cell propulsion system, encompassing both ground and flight testing. This ambitious endeavour will elevate the product specifications and performance of future aviation power generation systems to unprecedented heights. The result will be a revolutionary fuel cell system designed specifically for aviation applications, paving the way for a new era of high-performance, decarbonised flight through hydrogen fuel cell technology.