

HEAVEN IMPACT

HEAVEN will improve and accelerate the development and commercialization of fuel cell-based components for aerial vehicles in Europe by means of the generated results, contributing to boost hydrogen mobility.

Apart from delivering new insights to technical aspects of fuel cell and cryogenic hydrogen storage systems in the aeronautic application, HEAVEN will increase the visibility of fuel cell research, as well as the chances and advancements into next generation of zero emission aircrafts with the flight tests as a showcase.

HEAVEN will also focus on reducing costs and demonstrating the economic viability of a fuel cell and hydrogen-based solution for the propulsion of passenger airships, defining the path towards a sustainable and environmentally responsible transport.



Fundación Ayesa Spain
www.fundacionayesa.org



Air Liquide Advanced Technologies S.A.
www.airliquide.com



ElringKlinger AG
www.elringklinger.de



Deutsches Zentrum für Luft- und Raumfahrt e.V.
www.dlr.de



H2Fly GmbH
www.h2fly.de



HIGH POWER DENSITY FC SYSTEM FOR AERIAL PASSENGER VEHICLE FUELED BY LIQUID HYDROGEN



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MODULES OF THE PROJECT

HEAVEN OBJECTIVE

HEAVEN's ambition is to address the gap between research and product stage of a zero-emission fuel cell-based propulsion technology for aircrafts to meet the environmental goals of the next generation of sustainable transport.

To that end, HEAVEN makes use of the deep expertise of the consortium members towards

- a modular 90 kW fuel cell system with high power density for aircraft propulsion.
- a novel hydrogen fuel system based on cryogenic technology, previously used in space applications, to supply the fuel cell with a high mass efficiency.
- the coupling of the developed systems with an already existing aircraft drivetrain.

To ensure the overall success of the project, HEAVEN includes in-flight demonstrations to test performance and controllability in relevant environments.

1 OPTIMIZED HIGH POWER FUEL CELL

Pressurized FC system is demonstrated to increase the system power density by a factor of 2-3 and can operate at higher temperature, leading to fewer cooling efforts needed and thus a reduction of weight, power consumption and volume of the thermal management system.

2 ADAPTED BALANCE OF PLANT COMPONENTS

Adapted Balance of Plant Components. Compressor, humidifier, pumps and the rest of components are adapted for the specifications of an operated passenger aircraft.

3 CRYOGENIC HYDROGEN STORAGE

Cryogenic technology, by means of a vacuum insulated storage tank for hydrogen, will be applied to aeronautical applications for the first time, since this technology has been previously used in space rockets but never in passenger aircrafts.

4 BATTERY HYBRIDIZATION

The combination of fuel cell, hydrogen fuel system and a battery bank will allow to increase power and energy density up to the requirements for flight operations.

5 SAFETY FOR FLIGHT DEMONSTRATION

Protocols based on safety analysis, redundancy of the powertrain, auxiliary systems, tests and simulations will improve the reliability of the aircraft to operate in normal and emergency situations with the final goal of a flight demonstration.

6 FUEL CELL CONTROLLERS FOR AIRCRAFT DEMONSTRATIONS

Specific software and hardware controllers are designed for airship applications, considering changing ambient conditions and different operation scenarios.

7 TOTAL COST OF OWNERSHIP

Deep economic assessment of the cost of ownership of the technology, enabling and facilitating its deployment in market applications..

