HEAVEN

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

Project ID	826247
PRR 2024	Pillar 3 – H_2 end uses: transport
Call topic	FCH-01-4-2018: Fuel cell systems for the propulsion of aerial passenger vehicle
Project total costs	EUR 6 903 128.81
FCH JU max. contribution	EUR 3 995 305.00
Project start - end	1.1.2019–30.9.2023
Coordinator	H_2FLY GmbH, Germany
Beneficiaries	Air Liquide Advanced Technologies SA, Deutsches Zentrum für Luft- und Raumfahrt EV, EKPO Fuel Cell Technologies GmbH, Fundación Ayesa, Air Liquide SA, Pipistrel Vertical Solutions d.o.o. Podjetje Za Napredne Letalske Resitve, Elringklinger AG

https://heaven-fch-project.eu/

PROJECT AND GENERAL OBJECTIVES

The overall objective of this project was to address the gap between the research and product stages of a zero-emission fuel-cell-based propulsion technology to achieve emission reduction and noise reduction scenarios and meet the 2050 environmental goals for aviation. To that end, a high-efficiency, high-power-density, fuel-cell-based serial hybrid-electric propulsion architecture was combined with the high energy density of cryogenic hydrogen storage. It was advanced up to technology readiness level 6.

NON-QUANTITATIVE OBJECTIVES

- Heaven aimed to increase the credibility of the solution for the propulsion of passenger aircraft and unmanned aerial vehicles.
- The project also aimed to advance towards zero-emission hydrogen-powered regional commuter airliners.

PROGRESS AND MAIN ACHIEVEMENTS

- Manufacturing of cryogenic systems and development of the ground support equipment.
- Testing and verification of the cryogenic system.
- Integration of the powertrain into the aircraft.
- Modification of aircraft system to couple a cryogenic fuel system with the GH2 fuel system.
- Procurement of a permit for flight testing.
- Ground and flight demonstration of HY4 aircraft with liquid hydrogen on board.
- Fuel cell and hydrogen fuel system coupling and testing with liquid hydrogen (March 2023).
- Ground tests (June 2023).
- Flight test (September 2023).

FUTURE STEPS AND PLANS

The project has finished.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?
Project's own objectives and AWP 2018	Power mass density of FC stack	kW/kg	2	2.7 (stack, including end plates)	✓
	Power volume density of FC	kW/l	3.5	4.1 (stack, including end plates)	✓
	Air subsystem	%	> 50	Preliminary results in compliance with this value but not achieved yet	⚙
	Power converter	kW/kg	8	Preliminary results in compliance with this value but not achieved yet	⚙
	System lifetime	hours	500	N/A	⚙
	Hydrogen system	wt%	> 5.5	115	✓

Clean Hydrogen Partnership
Co-funded by the European Union