



EXFAN



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TURNING HEAT
INTO THRUST



NOVEL RECUPERATION SYSTEM TO
MAXIMIZE EXERGY FROM ANERGY FOR
FUEL CELL POWERED GEARED ELECTRIC
AIRCRAFT PROPULSION SYSTEM

ABOUT THE PROJECT

exFan investigates how **heat dissipation and recovery** can be integrated into a **hydrogen-electric aircraft propulsion system**.

The project's key innovation lies in embedding a **heat exchanger (HX)** within the propulsor flowpath to recover waste heat and generate additional thrust through the **Meredith effect**.

This novel approach aims to:

- Improve propulsion efficiency,
- Support the transition to zero-emission aviation technologies, and
- Advance the concept to **Technology Readiness Level 3 (TRL 3)**.

OBJECTIVES

- Integrate a novel additively manufactured heat exchanger into the flow path of a geared electric fan engine.
- Develop a recuperation concept that converts fuel-cell waste heat into useful thrust.
- Implement system-level thermal management and performance simulations.
- Ensure active knowledge exchange with the Clean Aviation and Clean Hydrogen partnerships, and the Climate Friendly Aviation Technologies (ClimAvTech) cluster.

MID-TERM ACHIEVEMENTS

At the 24-month stage, exFan has achieved major milestones across design, modelling, and materials.

Mechanical Powertrain

It provides the main performance values required: Shaft power, efficiency, mass, volume and power density.

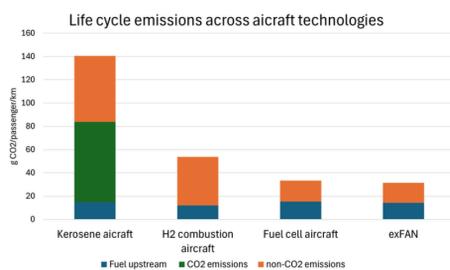
Energy System

A fuel cell-battery concept that minimizes power losses using power-split, oxygen injection, and internal regeneration.

Life-Cycle Assessment

A best compromise between productivity and environmental performance is aimed. The exFan aircraft concept exhibits the lowest overall life-cycle climate impact among all evaluated aviation fuel and propulsion options.

When direct CO₂ emissions, non-CO₂ climate effects, and fuel-production-related emissions are considered together, exFan emerges as the most promising pathway for reducing aviation's climate footprint.

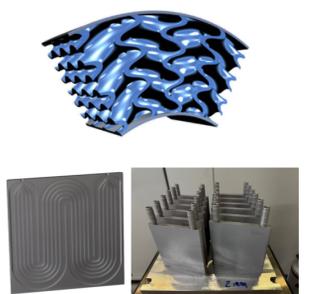


Heat Propulsor

Concepts for intake, fan stage, diffuser, heat exchanger, and nozzle investigated in 1-D simulations. Fan, diffuser, and heat exchanger identified as critical components for detailed design.

Material & Surface Work

CIDETEC has initiated coating tests for the HX, applying chemical polishing and electroless NiP coatings on additively manufactured samples. These coatings aim to enhance corrosion resistance, reduce fouling, and improve heat rejection.



- **Surface polishing:** Roughness reduced by nearly 50% (Ra 11 μm \rightarrow 4-5 μm).
- **NiP coatings:** Thicknesses 9-30 μm , improved adhesion, corrosion, and erosion resistance.
- **Innovative designs:** TPMS-inspired geometries with novel tunnel shapes for better airflow.

Project Coordinator



Project Partners



Technical Coordinator



Research Coordinator



CONNECT WITH EXFAN

GA: 101138184

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