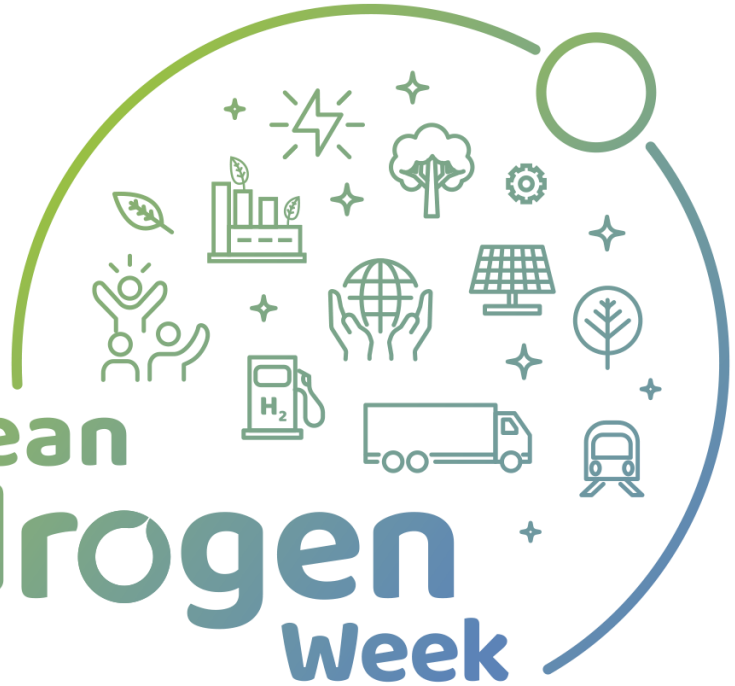
FLHYSAFE

Fuel CelL HYdrogen System for AircraFt Emergency operation



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Project Overview

FLHYSAFE - Fuel CelL HYdrogen System for AircraFt Emergency operation

Call year:
2017

Call topic:
FCH-01-1-2017
Development of fuel cell system technologies for achieving competitive solutions for aeronautical applications

Project dates:
01/2018 - 09/2022

Total project budget:
7,311 M€

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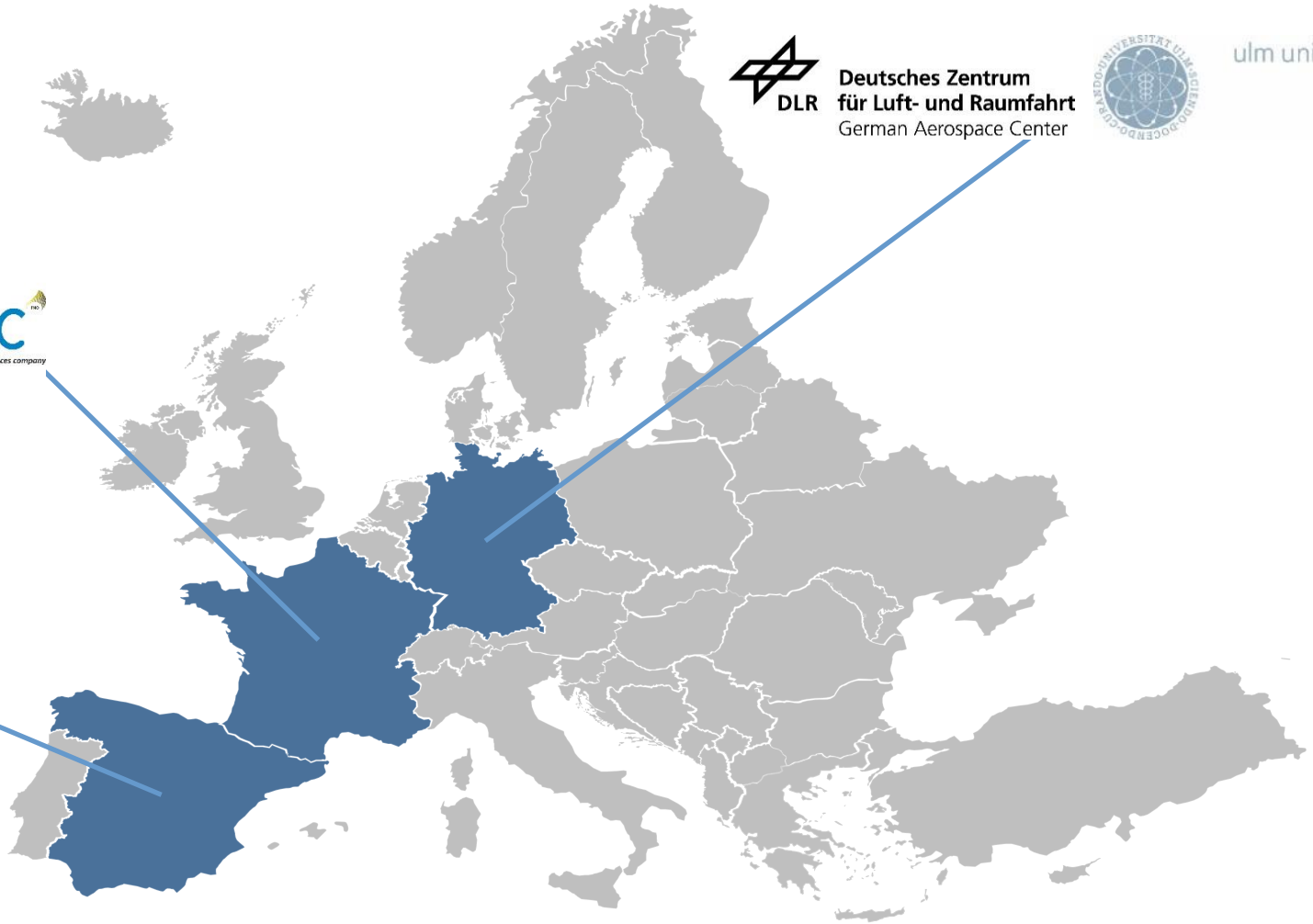
% stage of implementation
30/11/2021: 60 %

FCH JU max. contribution: 5,063 M€
Other financial contribution: -

European Hydrogen Week

Partners



SAFRAN

cea

ARTTIC
a PNO international management services company

INTA

DLR Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center

ulm university universität ulm

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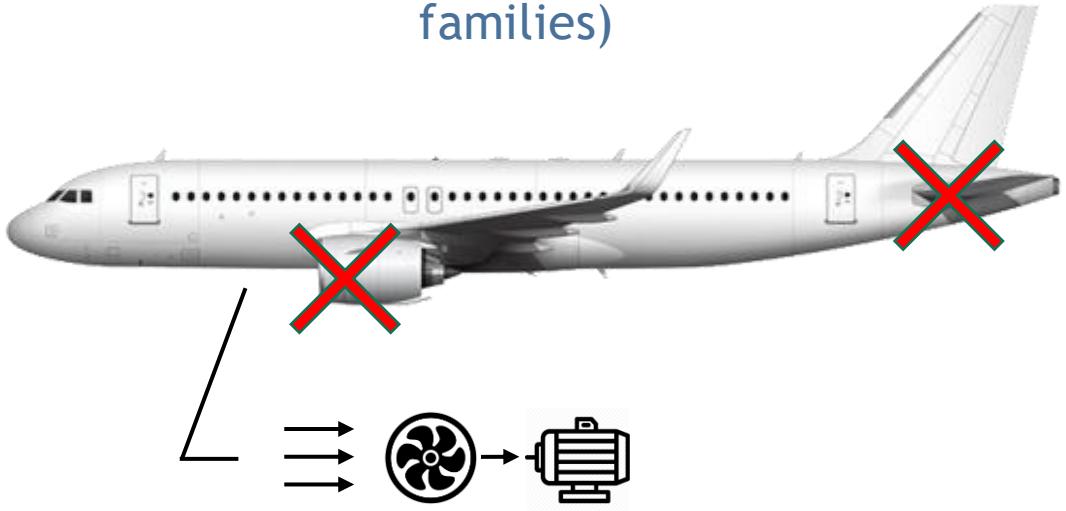
Project overview

International SoA: No similar other product / project known

Context:
Single aisle aircraft (mainly A-320 and B-737 families)



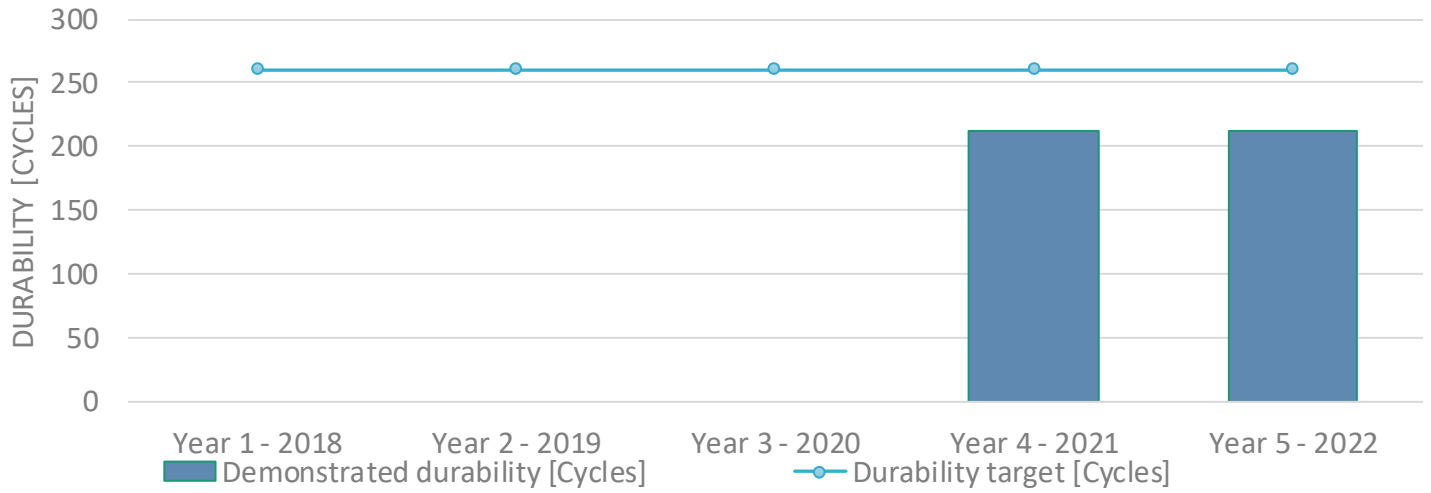
Objective:
To evaluate whether the current Ram Air Turbine of a commercial aircraft can be replaced by a fuel cell based modular system

Ram Air Turbine (RAT) : wind turbine deployed in case of main electric supply failure, as an emergency system

Project Progress/Actions - Durability

Achievement to-date: 212 cycles → 260 cycles

25% 50% 75%



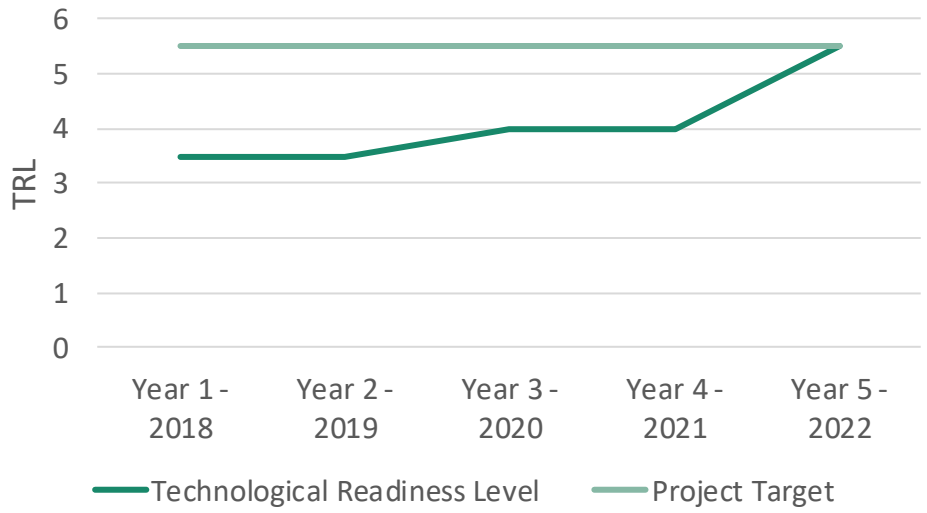
Project Progress/Actions - Technological Readiness level

Achievement to-date: TRL 4

25%

TRL 5 - 6

25% 50% 75%



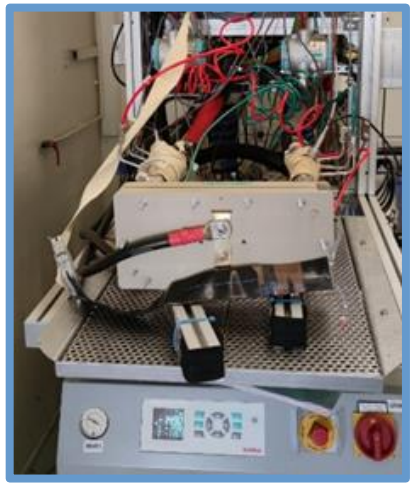
"FLHYSAFE's objective is to conclude the project with a maturity level of TRL 5 for the components of the sub-system, and partially TRL 6 at system level starting with available technologies at TRL 3 and TRL 4."

Risk mitigation

Technological risks are mitigated with 5 main test campaigns:

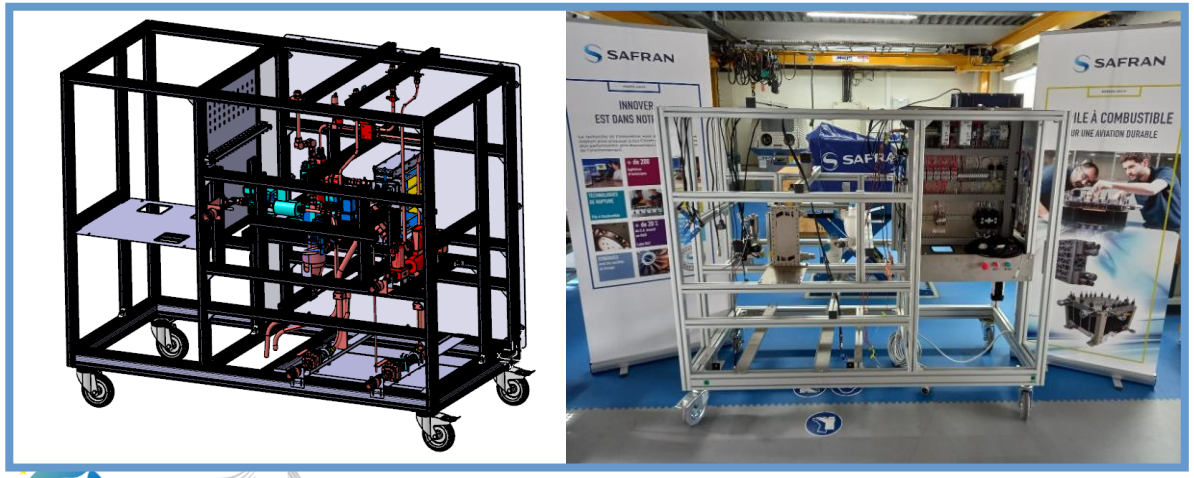
At sub-system level

- Start / stop short stack tests
- Durability short stack tests
- H_2/O_2 short stack tests



At system level

- Anode / cathode performance tests on a system test rig
- Control and regulation tests on a system test rig



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Exploitation Plan/Expected Impact

Exploitation

Main exploitation objective: to bring the PEM Fuel Cell technology to TRL5-6 for the EPU application

Safran PU: Develop and market an industrial Emergency Power Unit (retrofit and new A/C)
DLR: Improve a modular testing framework for time-effective analysis of FCS for aerospace and automotive applications
Improve the Model Based Safety Analysis for the use in systems engineering projects for safety critical systems
UULM: Power converter technology improvement for aerospace application (compact, multi-channel and high efficient design, increased power density)
CEA: FC technology improvement (lifetime, durability, power, weight, cost, etc.)
INTA: Improve test facilities and become a European/world-wide reference in environmental tests of fuel cell systems for A/C applications

Impact

Main impact: maturing the technology and paving the way towards applications

Impact on FC and H_2 sectors: contributing to the development of technologies that reduce costs and improve efficiencies and performance of FCH applications
Impact on environment: fuel cells are a promising solution for generating electrical power on aircraft, providing solution to minimise the environmental impact
For aeronautic industry: FLHYSAFE will raise and partially answer questions about:
- Certification and corresponding regulations
- Aeronautical integration constraints, business models, …
- Environmental regulations at the airport level

Dissemination activities

Presentations at conferences:

ESREL 2019 (DLR) *"Towards Standardizing the Generation of Component Fault Trees through the Engineering Life Cycle"*

SDWES 2019 (INTA) *"FC technology onboard aircrafts"*

FCH JU Programme Review Days 2019 (Safran PU) *"Emergency Power Unit system for aircraft applications using Fuel-Cell technology"*

ESREL 2021 (DLR) *"A Seamless Functional Hazard Analysis for a Fuel Cell System Supported by Spreadsheets"*

MEA 2021 & IHAC 2021 (Safran PU) *"Emergency Power Unit system for aircraft applications using Fuel-Cell technology"*

Publications:

A Berres, T Bittner, M Zeller (2019). *"Towards Standardizing the Generation of Component Fault Trees through the Engineering Life Cycle"*. 10.3850/978-981-11-2724-3_0043-cd.

A Berres, T Bittner (2021). *"A Seamless Functional Hazard Analysis for a Fuel Cell System Supported by Spreadsheets"*. 10.3850/978-981-18-2016-8_114-cd.

S Bhattacharya, C Willich, P Hoenicke, J Kallo (2021). *"A Novel Re-configurable LLC Converter for Electric Aircraft"*. IEEE 12th Energy Conversion Congress & Exposition - Asia (ECCE-Asia), 2021, pp. 32-37.

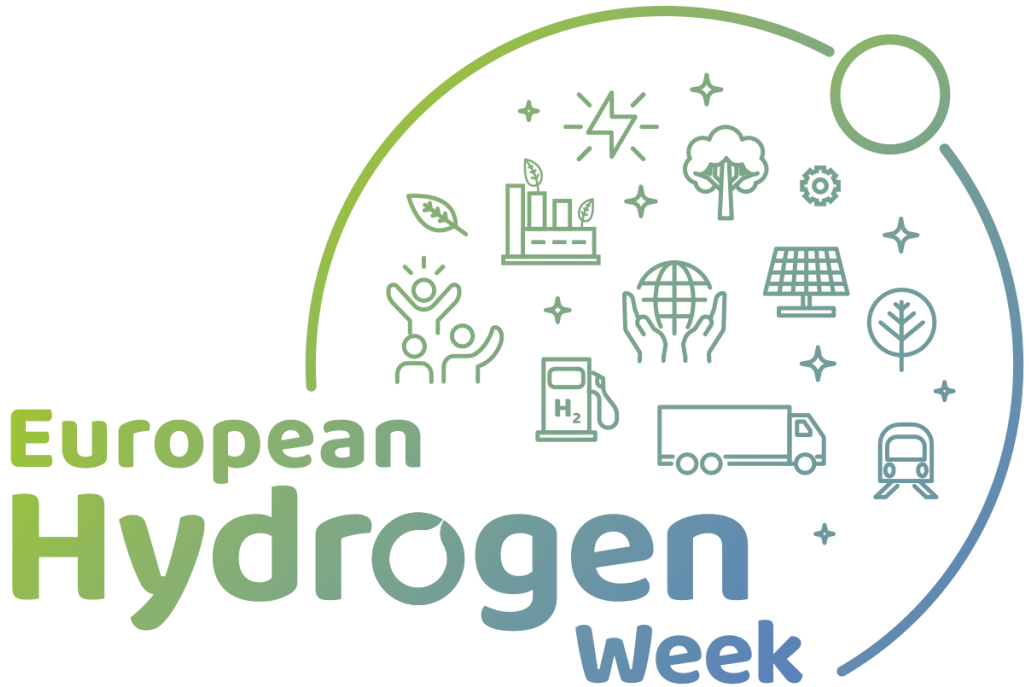
G Gómez, P Argumosa, A Correro, J Maellas (2021). *"Proposal of a New Technique to Obtain Some Fuel Cell Internal Parameters Using Polarization Curve Tests and EIS Results"* Energies 14, no. 21: 7161.

Communication: project website and social media presence

FLHYSAFE project website: https://www.flhysafe.eu/

FLHYSAFE Twitter account: https://twitter.com/flhysafe

FLHYSAFE LinkedIn page: https://www.linkedin.com/in/flhysafe-project-2608301b5/



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