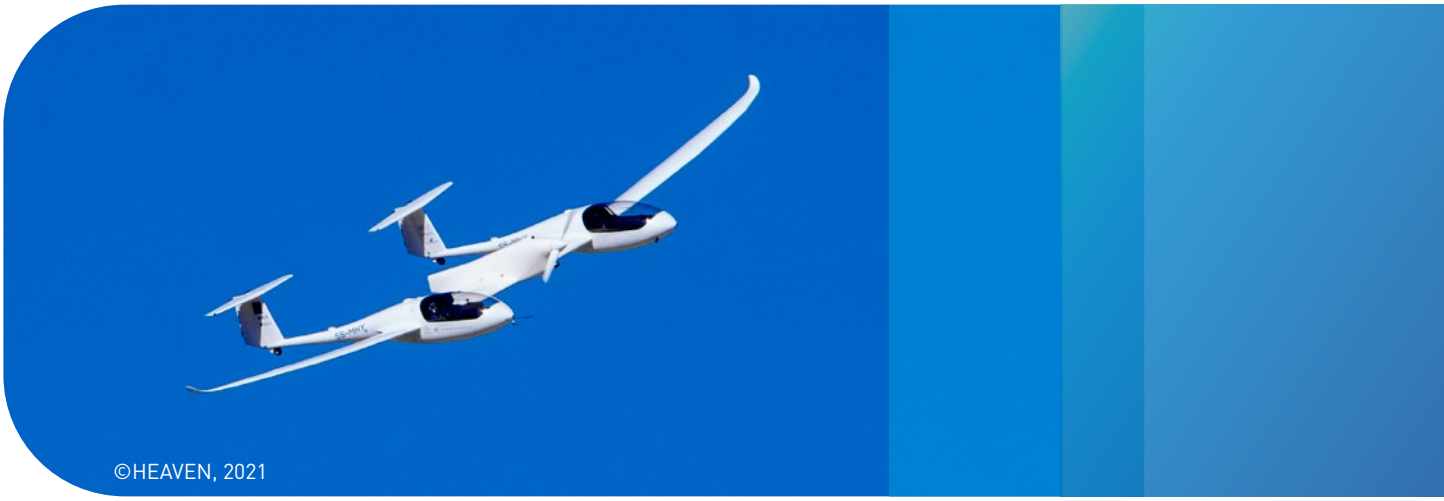
Making an impact on the clean energy transition

TRANSPORT

# FUEL-CELL BREAKTHROUGHS FOR HYDROGEN AVIATION



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## Innovations for low-carbon flight

Aviation needs to decarbonise as part of the EU vision for low- or zero-carbon transport by 2050. Aircraft fuelled by hydrogen, which would produce no in-flight $CO_2$ emissions, could help Europe to achieve this goal. However, first there is a need for high-energy fuel cells that meet the specifications of the aeronautic sector and for tanks that can store hydrogen efficiently as part of an aircraft fuel system.

A PEM-based aeronautic-grade fuel cell system is being developed in FLHYSAFE to replace current turbine-based back-up power systems for aircraft. Components are being optimised to reduce the weight of the system, to make it easy to install and maintain, and to give it a cost-effective lifetime. Meanwhile, HEAVEN is developing liquid hydrogen tanks that can produce almost double the energy of existing compressed-hydrogen storage systems. This storage system, which is being fine-tuned for an existing small hydrogen aircraft, will be joined by a 90-kW high-power fuel cell currently under development in the project.

## Adaptable comfort and power

Building on the achievements of the FCH JU project HYCARUS, the modular FLHYSAFE fuel cell is intended to reduce costs and to be sufficiently flexible to be included in existing and innovative future aircraft designs. It could also provide a quiet, low-emission alternative to aircraft power unit (APU) systems that currently run in-flight services from aircraft engines. The HEAVEN system brings zero-carbon flight even closer. The high-energy fuel system is being designed for the experimental HY4 2-4-seat aeroplane but could contribute to future regional, small and medium hydrogen aircraft as the technology progresses.

**Low-emission flight is taking off thanks to two FCH JU projects. A commercially viable fuel cell for zero-carbon emergency and in-flight power is being developed in FLHYSAFE, while HEAVEN is designing compressed-fuel tanks and a high-power fuel cell for fully hydrogen planes.**

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FCH JU Success Stories >

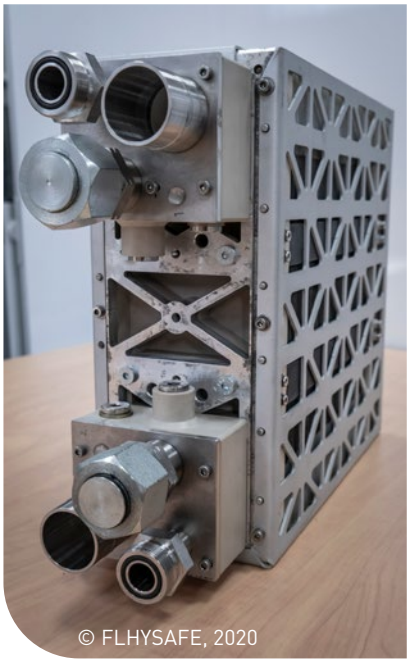
# FUEL-CELL BREAKTHROUGHS FOR HYDROGEN AVIATION

## PIECES FOR THE AIR-TRAVEL PUZZLE

Critical aircraft components are still needed for hydrogen flight to take off as a greener form of air travel.

## CLEAN-ENERGY COMMERCIAL AIRCRAFT

Projects are developing hydrogen fuel cells, storage tanks and power systems for hydrogen passenger aircraft. **The goal?** European aeronautics manufacturers, SMEs and researchers are joining forces under the FCH JU umbrella to design and demonstrate solutions for piloted hydrogen flight. **Key results?** Promising steps towards commercially viable emergency hydrogen-power generation and more electrical aircraft, and towards the first demonstrations of a liquid hydrogen storage and fuel cell propulsion system for passenger aircraft.




## KEY ACHIEVEMENTS

### FLHYSAFE

**3 HOURS**
target operating time

**150 kg**
APU weight

**60 dBA**
APU noise

### HEAVEN

**5 000 HOURS**
stack lifetime

**90 kW**
system power

**15 %**
storage-system gravimetric density

**2.7 kW/kg**
stack power density

## IMPACT

### FLHYSAFE

**HYDROGEN EMERGENCY POWER UNIT**
foreseeable for commercial aircrafts

**SAFE, RELIABLE**
system for existing and future aircraft designs

**LOWER $CO_2$ EMISSIONS**
from in-flight services

**MEETING COMMERCIAL DEMAND**
for a greater share of electric power generation in aircraft

### HEAVEN

**AERONAUTIC-GRADE LIQUID-HYDROGEN TANK**
close to trials in a piloted aircraft

**FIRST TIME**
a fuel cell and a liquid hydrogen tank combined in a piloted platform

**PAVES THE WAY**
for low-temperature, high-density hydrogen storage for passenger flights

**EUROPEAN LEADERSHIP**
in emerging technology to reduce climate impacts of flying

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FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

A partnership dedicated to clean energy and transport in Europe

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