Contribution ID: **19** Type: **Oral**

A liquid hydrogen, fuel cell electric plane: the future of aviation

Thursday 30 October 2025 09:30 (15 minutes)

AeroDelft is a student-led team working to demonstrate the potential of liquid hydrogen as a sustainable aviation fuel. To do this, the team is retrofitting a Sling-4 aircraft with a hydrogen-electric powertrain. Two hydrogen storage systems are under development: a 700-bar compressed hydrogen system, planned to fly in the 2025/26 academic year, and a cryogenic liquid hydrogen (LH_2) system, targeted for flight the year after.

This abstract focuses on the cryogenic system, which is being designed to store, condition, and deliver liquid hydrogen to a fuel cell onboard the aircraft. The system is divided into three main subsystems: storage, conditioning, and distribution.

The storage subsystem keeps hydrogen in its liquid state at around 20 K. The tank is vacuum-insulated with multilayer insulation (MLI) to reduce heat leak, which is expected to be in the range of 10–50 W, while maintaining a weight between 20 and 40 Kg. The design also ensures structural integrity under all flight conditions. Liquid-phase extraction was chosen over gas extraction, as it offers better scalability for future, higher-power systems.

The conditioning subsystem prepares the hydrogen for the fuel cell by bringing it to the right temperature and pressure. A plate heat exchanger, using the fuel cell's waste heat, is used to evaporate the LH_2 and heat the gas from 20 K up to around 323K. The heat exchanger has two stages: an evaporator to handle the latent heat of vaporization and a superheater to raise the gas temperature. The system is designed for a nominal mass flow of 3 g/s.

The distribution subsystem transports hydrogen to the fuel cell with minimal thermal losses and pressure drop. This is done using vacuum-insulated piping to avoid condensation and reduce heat ingress. Fitting the system within the tight space available in the aircraft, while keeping it efficient and reliable, has been one of the major design challenges. Integration of flow sensors, valves, and control components is especially difficult due to the lack of compact, lightweight components rated for cryogenic hydrogen.

Developing a liquid hydrogen system for an aircraft introduces several complex engineering problems, from thermal management to mechanical integration. This work presents a practical, student-built solution for small-scale aviation and aims to contribute to the growing field of hydrogen-powered flight.

This project is part of AeroDelft's ongoing efforts in hydrogen-electric propulsion and has been made possible thanks to the support of our advisors, industry partners, and partners

Submitters Country

Netherlands

Are you a student?

Yes

Author Affiliations & Email Addresses

I confirm that valid email addresses and affiliations have been added for all co-authors.

Co-Author Affirmation

By clicking here, I, the submitting author, affirm that all co-authors know of and concur with the submission of this abstract.

Author: MANGINI, Davide (AeroDelft)

Presenter: MANGINI, Davide (AeroDelft)

Track Classification: Liquid Hydrogen in Aviation