Scaling the Cryogenic Barrier for Sustainable Aviation Propulsion with Hydrogen: Vanzetti Engineering tests at DLR

• LH2 pump testing and System Digital Twin achievement
• Reducing the gap toward LH2 Conditioning of a distribution system

As the aerospace industry accelerates its transition towards climate-friendly air transport and propulsion technologies, the challenge of handling liquid hydrogen (LH2) has moved to the forefront of engineering priorities. To meet this challenge, research collaborations funded by the German aviation research program (LuFo) and the European Clean Aviation, generate the necessary impetus to achieve airworthy and climate-compatible technology by 2050.

DLR and Vanzetti Engineering accelerate the way towards hydrogen-powered engines

In a significant move to bridge the gap between industrial cryogenic expertise and aeronautical requirements, the Italian Vanzetti and the German Aerospace Center (DLR) have successfully completed a research cooperation focused on LH2 pumping technology. For over 40 years, Vanzetti has operated as a leading OEM for cryogenic pumps, securing a leadership position in LNG Dual Fuel maritime market with its pumps for fuel gas systems. With the cooperation, Vanzetti is leveraging its "dual use" industrial expertise in designing the entire submerged pumps with the DLR's research and testing capabilities for hydrogen technologies. The DLR's Institute of Propulsion Technology (AT) contributes decades of experience in GH2 combustion and fuel systems and forms a consortium of engine and aircraft manufacturers to transform engine research for hydrogen technology.


© DLR

LH2 component technology research at Future Propulsion Test Facility

Within the framework of UpLift, and financed by the Federal Ministry for Economic Affairs and Climate Action, the DLR transformed one of its test rigs into the Future Propulsion Test Facility (FPT), which is operating since October 2025. For this, gas manufacturer MESSER also contributed its expertise in process engineering experimental design for LH2 and handling cryogenic gases. The Institute's research regarding disruptive component technology enables the FPT to test key LH2 components, such as tanks, distribution networks, pumps, heat exchangers and combustion chambers, for the full fuel distribution system. The modular design enables cross-industry innovation exchange from aviation to energy and marine applications. In cooperation with industry partners experiments are planned for the PoC of components with gaseous hydrogen at ambient temperature. A heat exchanger test for H2 conditioning systems was already successfully carried out last year.

Proving the concept with successful tests of LH2 pump

Building on this, DLR and Vanzetti aimed at the development of a PoC for a specialized LH2 pump test bench. The primary objective was to demonstrate the feasibility of adapting cryogenic pumping solutions for the "Green Aviation" market and reduce technical hurdles associated with testing complete distribution systems. In January, tests were carried out at the FPT to validate the function and performance of the pump under LH2 conditions. The tests focused on a submerged cryogenic pump housed within its own cryostat. The technical specifications of the unit are tailored for research with mass flow rate up to 180 g/s. "The test was successfully completed by confirming Vanzetti's pump performance modelling and by building experience on its material behaviour, electrical motor thermal insulation, tolerances and the pump instrumentation set up under LH2 conditions" said Andrea Capuani, Chief Commercial Officer of Vanzetti.

Advancing the Digital Twin of development component technology

"Besides optimizing the LH2 infrastructure with the collected data, the tests provided a valuable opportunity to start developing a digital twin for LH2 components in aviation", said Christian Fleing, Head of Combustor Testing of DLR. The data supports the adaptation of AT's "tool-box" for advanced simulations to allow transient performance modelling which is essential for developing technology in the future. This creates new paths for further joint development with industry partners, by aiming for licensable software tools and in the long run licensable technology for LH2 conditioning.


© DLR

Carving the path towards hydrogen engines propulsion systems

The cooperation between Vanzetti and DLR is an important step towards further research with LH2 technology and the development of technology to support hydrogen propulsion systems. Furthermore, it presents an opportunity to establish a LH2 conditioning supply chain in the EU, with the ambition to test the entire LH2 distribution system, evaluating the performance and interaction of both low and high-pressure pumps with the gas turbine.