



NEWSLETTER 05

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PARTNERS' PROGRESS (M24-M30)

Air Liquide

The design of the tank has been finalized and mechanical calculations were performed. These calculations have required some modification to handle vibrations and other mechanical loads. Then, the manufacturing of the tank has started. All the components are now supplied and all the metallic parts that will form the inner and the outer tank as well. After Welder qualification, the welding has started and is currently on-going.

In parallel, the work on the control command keeps going. The electronic cards have been supplied and several tests have been performed. An electronic test bench has been designed to validate the card, including also the communication with the aircraft through CAN protocol. The software programming is also on-going.

Finally, during the last months, the conceptual design of the GSE that will be used to supply Heaven tank with LH2 has been frozen. The final design is on-going and the key components has been ordered.

DLR

During the last 6 months the laboratory work at DLR could be continued on a low level respecting the current constraints due to the still ongoing COVID situation. During this period the short stack testbench could be further improved concerning accuracy and reproducibility of the cathode gas conditioning system. Switching from a passive membrane humidification system to an evaporator-unit, led to the desired accuracy for the cathode inlet parameters. Additionally, the temperature control of the heat pipes was modified in order to reach a much more precise temperature control at the cathode inlet. On the anode side, some redesign of the recirculation piping and the installation of an additional water trap, showed less flooding of the cells and therefore led to a much more stable operation of the stack. An additional heating cartridge in the cooling circuit of the stack allows the operation of the stack at the recommended temperatures even at low power output.

Finally, a first test campaign with temperature variations at different load levels, in order to determine optimum operation parameters, could be finished successfully.

On the full stack testbench, the hardware for the testbench system controller was defined, commissioned and integrated. System control states, transition conditions and control algorithms have been defined, developed and implemented on the controller. The HMI-software and the stack-control software have been debugged and the test bench is now ready to be brought into service.

EKPO

Three milestones have marked EKPO's work in the last half year: the development of the NM5 evo endplate design, the characterization of dry operations and the test of the new cell configuration. Besides, FMEA was shared with DLR.

H2FLY

H2Fly Crosschecked FHA and aircraft FHA systems, started and finished qualitative FTA on Fuel Cell system level, continued LH2 Packaging for Hy4 and started FMEA for fuel cell and GH2 systems.

PVS

Pipistrel reviewed the hydrogen tank system and gave feedback to ALAT regarding the liquid H2 tank CDR. The company also worked on the integration of LH2 tank into airframe (new supporting brackets, new structural parts for the support), developed a new firewall that separates the APEX area away from the batteries compartment (searching also for special material suitable for this application), studied canopy modification and additional holes for fill/refill LH2 tank, proposed a new solution for vent lines position, reviewed Air Liquide's design of the tank and reviewed safety documentation to support ground testing in Sassenage.

INTERVIEW WITH EMILIO NIETO, DIRECTOR OF THE SPANISH CNH

"TO MEET THE GOALS OF THE EUROPEAN COMMISSION, BLUE HYDROGEN MUST ALSO BE FINANCED"

Emilio Nieto is the director of the National Hydrogen Center (CNH2 in its Spanish acronym), an organization created in 2007 with the idea of promoting scientific and technological research in all aspects of hydrogen and fuel cell technologies, as a service of the entire scientific, technological and business community, nationally and internationally.

Q: At what point is the energy transition that Europe is officially betting on?

A: My colleagues often tell me that it seems that I do not work in the field of hydrogen because **I talk about hybridization and the many possible combinations**. If we develop only hydrogen, we will not do well. We must go for a mix of mature technologies (both economically and commercially). Fortunately, it seems that we are going to see this transition and that we will join the trend of **decarbonization and zero emissions in 2050**. To achieve this goal there are only two options: batteries and hydrogen, and everything goes through electrification. We must start generating more renewable energy and do it even better, not only in Spain. **Germany or France are more annoyed by a geography where wind power is enough but photovoltaic is not.**



Q: What advantages and disadvantages does each technology bring to the table?

A: In the simplest possible way, **batteries have their niche and hydrogen is the best solution in more niches**. The different parts of the chain involved in hydrogen have to be unfolded. **The existing manufacturers of electrolyzers do not have the capacity to meet all the potential demand**. We will need consistent and reasonable technologies with all possible green solutions towards zero emissions. **It is logical that the European Commission puts all the effort on green hydrogen. They do not want to finance blue hydrogen, but in order to meet the goals set, blue hydrogen will have to exist the same as methane**, which is a molecule that also emits CO2 although to a lesser extent as fossil fuels. In the future, cars will be electric, some with batteries and others with fuel cells. If you're short-shifting, I'd buy the small, rechargeable battery. If you do more kilometers, I would opt for the fuel cell. Each technology must be positioned where it belongs and where it brings all its advantages.

The fundamental disadvantage of hydrogen now is the cost. The gray, black or brown is between 1-2 euros per kilo; making it green with electrolysis hardly costs 6 euros, with 5.5 as the best price. Also, water is needed to process hydrogen, and water is a finite element. It is true that there is a talk of the closed cycle of the famous circular economy, but **unfortunately hydrogen is not manufactured where it is consumed**. The normal thing is that there is a hydrogen-station and a car that vaporizes the water wherever it goes. Osmosis to use seawater is an extra cost. Another sensitive issue is security. Hydrogen is safer than any gas or fossil chain, but it must be a very normalized sector so that nothing goes off the script. All in all, I think we have 10-15 years of diesel and gasoline left. They are much cleaner engines than before.

Q: What role is Spain playing in this race towards green energy?

A: For now, **there is no other national hydrogen and fuel cell center in Europe like ours**. And there is also the Hydrogen Aragon Foundation. Germany is preparing something similar to the CNH and Siemens is funding the entire thing. It will be operational in early 2022. We Spanish technicians are widely recognized, but there was a clear disconnection between what we developed and what companies need to generate employment. Germany and France were 8-10 years ahead of us; the Nordic countries the same. We gave conferences, but there was no business network. This has already changed. **Public-private partnerships are being developed and Spain's goals for 2030 are in some cases far more ambitious than Germany's**, for example.

RELEVANT EVENTS

Below is a list of some of the most relevant events on hydrogen and fuel cells held in Europe and the world during the first half of 2021, regardless of whether one or more of our partners have participated in them. Events appear in chronological order.

13/05/2021 ILA Berlin

"ILA Berlin is the hub for the international aerospace industry. With over 1.000 exhibitors from all over the world, ILA Berlin showcases the industry's very best in terms of high-tech products as well as research and development projects".

<https://www.ila-berlin.de/en>

22/06/2021 International Partnership for Hydrogen and Fuel Cells in the Economy

"This Forum will provide information on hydrogen safety and the safety resources available. This includes the institutions that are leading on hydrogen safety issues, international collaborative initiatives sharing information on hydrogen safety measures, and where one can go to get information on the latest developments related to all aspects of hydrogen safety".

<https://www.iphe.net/>

28/06/2021 International Conference on Electric and Hybrid Aerospace Technology

"The International Research Conference is a federated organization dedicated to bringing together a significant number of diverse scholarly events for presentation within the conference program. Events will run over a span of time during the conference depending on the number and length of the presentations. With its high quality, it provides an exceptional value for students, academics and industry researchers".

29/06/2021 European Fuel Cell Forum 2021

"The EFCF 2021 addresses issues of low-temperature fuel cells and electrolyzers including CO2 reduction. These technologies are also strongly linked to hydrogen and its Processing. The conference topics will range from fundamental understanding of the relevant materials as well as of the kinetics and mass/heat/water transport processes, H2 purification, compression, storage and distribution, all the way to the implementation in real-world devices, requiring optimized engineering designs".

<https://www.efcf.com/lobby>



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