HYTAZER: TOWARDS THE QUALIFICATION AND CERTIFICATION OF (LIQUID) HYDROGEN TANKS IN AVIATION AND SHIPPING

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Abstract

The project Hytazer is the first to bundle the developments of hydrogen tanks within the DLR. On the one hand, its goal is to enable a broad usage of hydrogen in various transportation systems such as aviation, space, rail, automotive and ship building. On the other hand, with liquid, compressed, cryo-compressed hydrogen and metal hydride, a broad range of hydrogen storages and energy carriers are under consideration. In the project, for selected hydrogen storage systems in the specific context of the application in a transportation system, the current state of the certification specification is reviewed and the need for tailoring, extension or the deduction of new specifications will be identified.

This talk is structured in two parts. Firstly, it presents an overview of the project. It focuses on selected challenges in the design, manufacturing and qualification of hydrogen storages. The talk covers an overview of the simulation and test strategy for the disciplines structures (CFRP and metal), insulation and crashworthiness to show compliance against certification requirements. Next, manufacturing processes under consideration for CFRP storages with a reproducible quality and material fulfilling permeation boundary conditions are shown. Lastly a test pyramid for the qualification of liquid hydrogen storages is presented. From this, existing test setups, possible extensions and future test stands are discussed. They are used to define appropriate means of compliance for certification but also validate simulation based approaches to reduce test effort.

Secondly the qualification strategy for the CFRP structures is shown in more detail as an example fulfilling the qualification strategy. The necessary simulation models are presented and illustrated along the qualification strategy at the various levels of the test pyramid. This results in the set of characteristic material properties and other test results required from physical tests both for the inputs of the simulation models and for the validation of the models. In the final step, these characteristic values are supplemented with the tests on the highest scales of the test pyramid.

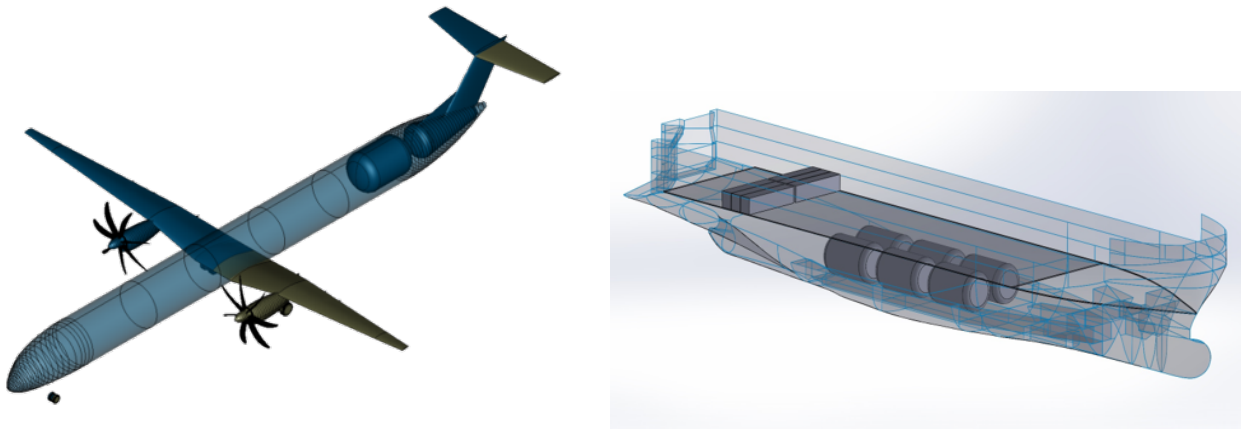

FIG 1. Turboprop aircraft configuration with rear fuselage hydrogen storage (left) and liquid H2 Ro-Ro-ship configuration (right)