

MATERIALS AND STRUCTURES SYMPOSIUM (C2)  
Space Structures I - Development and Verification (Space Vehicles and Components) (1)

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KEY CRYOGENIC TECHNOLOGIES ENHANCEMENT AND VERIFICATIONS WITHIN HXG  
MACRO DEMONSTRATOR

**Abstract**

Since several years, CNES has initiated a technological demonstration programme HX addressing key technologies for cryogenic reignitable upper stages, especially insulation technologies for reaching high performances during long ballistic phases. The first target and main driver for HX programmatics is the A5ME programme that is an ARIANE 5 evolution voted in late 2008 at the ESA Ministerial Council.

HX is a technological programme that includes:

1) HXT: Technologies development and testing at component and subsystem level in order to reach TRL up to 4.

2) A macro demonstrator HXG, integrating HXT enhanced technologies and aiming to demonstrate TRL 6 for these technologies as well as interactions between each others. HXG is under development: CDR held in mid 2009; testing is expected in late 2010. It is based on 2 elongated Ariane ECA LOX tanks separated by an insulated orthogrid common bulkhead which is a part of the demonstration. These tanks of 2.6 m in diameter will be filled with LH2 for the upper one, whereas the lower one will receive both LH2 and LN2 cryogenic fluids. The total height of the 2 tanks is about 4.5m leading to a total height of more than 10 m when installed in the vacuum test chamber. HXG is expected to test about 12 innovative technologies in representative environment on ground and in altitude simulation with solar fluxes simulation. System aspects through interstages cavities introduced in HXG configuration and Functional aspects will be also part of the test objectives. Up to 300 measurements are installed on the demonstrator and test bench. Also cryogenic as well as ambient cameras, and level gauges new technologies are implemented.

The HX programme is managed by the Centre National d'Etudes Spatiales (CNES). The industrial team is led by AIR LIQUIDE and involves CRYOSPACE. HXG on ground macro demonstrator is assembled and tested in AIR LIQUIDE facilities.

This paper will address briefly the main results obtained during HXT technologies maturation programme in LH2 environment up to 1/4th scale, and will concentrate on the current status of the HXG demonstrator development: objectives, definition, updated test configuration as well as test logic.