

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)  
Future Space Transportation Systems Technologies (5)

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VULCAIN X AND HX TECHNOLOGICAL DEMONSTRATION TEST RESULTS

**Abstract**

The intent of this paper is to provide an overview of the Power Pack technological demonstration (GPX) progress at mid of 2009, including manufacturing results and first sub-systems tests achievements. The GPX frame is a LOX/LH2 modular and evolutive ground demonstrator for new propulsion technologies, based on a VULCAIN 2 engine, and defined to perform both systems and sub-systems technological demonstration on test-bench, whose principal targets are cost reduction, robustness, reliability and reusability. The different Demos X that are under manufacturing and for most of them achieved. The most important demonstrators part of GPX are a new Hydrogen Turbo-Pump TPX, a gas generator GGX and its injection high bandwidth regulation valves VRR, the electrical hot gas valve VGC-X and the sandwich nozzle extension NE-X. A new evolved Health Monitoring System has been also developed and deployed at the PF-52 test bench. On another hand, the manufacturing of a new Vulcain Nozzle Extension Demo based on sandwich technology will be achieved. The test completion during firing test is planned during ARTA 8 campaign to be completed before mid 2009.

The VULCAIN X program is managed by the Centre National d'Etudes Spatiales (CNES) and Swedish Space Agency SNSB in cooperation with European partners. The industrial team is led by SNECMA. The publication will focus on the major achievement of this 2009 year, meaning Sandwich Nozzle Extension hot firing test and start of the GPX campaign for which the GGX hot firing test will be achieved at PF52, followed by TPX cold gas test before the Power Pack test itself. The other main demonstrator under development is the HX that addresses key technologies for cryogenic re-ignitable upper stage. The first target and main driver for the HX Demo programmatic 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: Technology development and testing at component and subsystem level in order to reach a TRL up to 4 2) HXG: A macro demonstrator that is under development for testing in late 2010. It is based on 2 elongated Ariane ECA RLOX tanks separated by a common bulkhead part of the demonstration. It will allow testing of HXT technology in representative environment on ground and in altitude simulation with solar fluxes simulation. System aspects and Functional aspects will be also part of the test objectives. The goal is to reach TRL 6 by end of 2010. This paper will address the current status and main results obtained during development and test of cryogenic insulation concepts in LH2 environment up to 1/4th scale in the frame of HXT. The test logic will be described with the key issues addressed (performance, life cycle, operations) in the perspective of A5ME. Relevant results will

be presented as the HXT tests are achieved as well as the HXG updated test configuration.