Paper ID: 9765
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SPACE PROPULSION SYMPOSIUM (C4)
Propulsion Systems I (1)

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PROGRESS OF THE VINCI ENGINE SYSTEM DEVELOPMENT

Abstract

The intent of this publication is to provide an overview of the progress of the VINCI development over the 2010-2011 period.

The VINCI is a cryogenic expander cycle engine combining the required features of this cycle, i.e. high performance chamber cooling and high performance hydrogen turbo-pump, with proven design concepts based on the accumulated experience from previous European cryogenic engines such as the HM7 and the Vulcain.

The Vinci engine has been selected as the base of the future Ariane 5 evolution (so called A5ME) powering a new cryogenic upper stage. Additionally, the high performance of this engine and its restart capability offer potential applications on various future launcher upper stages as well as orbital spacecrafts.

This publication represents the continuation of a series of publications which showed how the first four engine test campaigns relying on two engines, M1 and M2 and their refurbishments, led to a reference system configuration with reliable transients and steady state operation.

The current phase of the VINCI development is focused on confirming the system design maturity through additional engine test campaigns with the M3 and M4 engines. The main objectives of the M3 campaign which took place in 2010 were the following: - to complete a more extensive coverage of the operating domain with margin tests beyond the flight domain - to operate with inlet thermodynamic conditions representative of the future upper stage - to test design modifications of the sub-systems (fuel turbo-pump, turbine by-pass valves, thrust chamber,...) which provide increased performance and reliability - to perform tests with the complete deployed nozzle

In 2011, the M4 engine test campaign will be implemented with the objective to test the engine improvements necessary to comply with the requirements of the new A5ME launcher, preparing the extensive test program to be performed in a second phase of development aiming at qualifying the engine for flight.

Along with the M3 and M4 campaign, a dedicated combustion chamber test campaign is performed in 2010 at the P3.2 test bench in Lampoldshausen (Germany). It provided detailed knowledge of the regenerative circuit temperature, heat flux and flow conditions, wall temperature.