

IAF SPACE PROPULSION SYMPOSIUM (C4)  
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## VINCI UPPER STAGE ENGINE QUALIFICATION FOR ARIANE 6

**Abstract**

The Vinci engine development was initially intended for the application to the A5ME upper stage. Following the decision of the European Ministerial Conference in 2014, it is now re-directed towards the application for the new Ariane 6 upper propulsion module (ULPM). The Vinci engine concept utilizes the thermodynamic expander cycle without a gas generator, for which the heat pick-up of the regenerative cooling of the combustion chamber is of utmost importance. The chamber is designed based upon the highly successful HM7-B and Vulcain thrust chambers from Ariane 1 to Ariane 5-ECA and further experimental projects. New design features are incorporated for the two main objectives of Ariane 6: market-compatible costs and performance. In order to achieve the versatility for various different missions like MEO, GTO, constellations, etc., the chamber is re-ignitable by help of an electric igniter. Up to 4 ignitions during the mission are required for the variety of mission profiles. The nozzle extension is a radiatively-cooled ceramic material concept. New manufacturing technologies are utilized to reduce the manufacturing effort. The engine will use measurements at the injection head to precisely regulate the thrust and mixture ratio in a closed-loop control system to reduce the residuals in the stage tanks at final shut-down.

Tests of the dynamical behaviour of the structure were performed and demonstrated margins to the expected mechanical loads during the flight. Hot tests were performed to characterize the behaviour of the engine and its various components under simulated vacuum conditions in flight. Those tests demonstrate the correct function of the engine design.

The paper will present a brief history of the main development steps of the Vinci engine up to its qualification after the formal review planned mid-2019 and the further firing tests foreseen at stage-level that will pave the way to the first Ariane 6 flight planned on July 2020.