

SPACE PROPULSION SYMPOSIUM (C4)  
Propulsion System (1) (1)

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## VINCI® , THE EUROPEAN REFERENCE FOR ARIANE 6 UPPER STAGE CRYOGENIC ENGINE

**Abstract**

The intent of this publication is to provide an overview of the development of the VINCI® engine over the 2014-2015 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®. VINCI® will power the cryogenic upper stage engine of the future ARIANE 6 European Launcher. 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, and is also an answer to the need of the new legal requirements concerning avoidance and reduction of space debris.

The VINCI® preliminary design was initiated in the frame of the Ariane 5+ program managed by CNES under delegation of ESA. Between 2006 and 2008, its engineering and testing were conducted under the ESA Future Launcher Preparatory Program (FLPP). Since 2009 until end 2014, VINCI® was developed as the upper stage main propulsion system for the next evolution of the ARIANE 5 launcher developed by AIRBUS Defense Space as launcher prime contractor. VINCI® is now the engine of AIRBUS SAFRAN LAUNCHERS Ariane 6 Upper Liquid Propulsion Module.

The engine overall system design and integration is under responsibility of AIRBUS SAFRAN LAUNCHERS. The major subsystem contractors are GKN (Trollhättan, Sweden) for the turbines of the turbopumps, AVIO (Turin, Italy) for the oxygen turbopump and SAFRAN - Techspace Aero (Liège, Belgium) for the valves. AIRBUS SAFRAN LAUNCHERS is responsible for the thrust chamber (Ottobrunn, Germany), for the hydrogen turbopump (Vernon, France) and for the composite nozzle (Bordeaux, France).

The engine hot fire testing have been performed at DLR P4.1 test facility (Lampoldshausen, Germany) and will be conducted both in DLR and Snecma (PF52 engine test cell under finalization) in the future, in order to shorten the development schedule and to qualify the production phase test stand for engine acceptance.

At the end of 2014, the VINCI® passed the Critical Design Review that was held after the major sub-system (combustion chamber, fuel and oxygen turbopumps) had passed their own Critical Design Review all along the second half of 2014.

In December 2014, a Ministerial Conference at government level gave priority to the ARIANE 6 program as European future launcher. In the framework of this decision VINCI® was confirmed as the

engine to equip ARIANE 6 cryogenic upper liquid propulsion module. This publication shows how the VINCI® development is progressing toward qualification whereas incorporating the requirements of the new ARIANE 6 configuration.