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## STATUS REPORT SWAN SANDWICH NOZZLE PROGRAM FOR ARIANE 6

**Abstract**

The SWAN sandwich nozzle for Vulcain 2.1 Engine in Ariane 6 launcher is under development and has entered qualification engine testing. The paper aims to show the experience learned in the SWAN (SandWich Advanced Nozzle) flight development program for Vulcain 2.1 engine in Ariane 6 application. Challenges in design and manufacturing for the new nozzle extension are shown with results gained up to spring 2019.

The Paper will report on the following activities: • Results of development and qualification test campaigns performed 2018-2019 • Challenges in design and manufacturing of the first SWAN NE's • Status report on SWAN maturation for flight on the Vulcain 2.1 engine

GKN Aerospace has for almost two decades continuously improved and verified its patented manufacturing method for actively cooled nozzle extensions, i.e. the "Sandwich" laser welded channel wall technology. The GKN Aerospace Sandwich nozzle technology shows clear customer benefit in liquid rocket propulsion applications. Its technological maturity as well as cost saving potential has been demonstrated for gas generator and closed cycle engine applications in collaboration with several customers. Together with Ariane Group, the ETID – Expander Technology Integrated Demonstrator – Nozzle Extension demonstrator have also been tested in the recent year, with great success. Both the SWAN and the ETID significantly contribute to the verification and maturation of the GKN sandwich wall technology for both regeneratively cooled and dump cooled Nozzle designs.