Paper ID: 48537
oral

IAF SPACE PROPULSION SYMPOSIUM (C4)
Propulsion Technology (1) (3)

Author: Ms. Li Forsberg
GKN Aerospace Engine Systems, Sweden

Mr. Johan Andersson
GKN Aerospace Engine Systems, Sweden

DEVELOPMENT AND QUALIFICATION OF TURBINES FOR THE VINCI UPPER STAGE ENGINE FOR ARIANE 6

Abstract

The Vinci upper stage engine, developed for the Ariane 6 launcher, is in the final phase of development, including qualification testing. Vinci is a cryogenic, liquid hydrogen (LH2) and liquid oxygen (LOX) expander cycle engine with the two turbines powering the turbopumps arranged in series. GKN Aerospace has the responsibility for the design and manufacturing of both turbines.

This paper gives an overview of the successful development of the LH2 and LOX turbines, from technology development and validation through analysis and tests, and concludes on the status of the turbines at the end of the qualification tests.

The turbine design has been challenging from the beginning, with low cost and robustness balanced with high performance requirements and extreme operating conditions. Key technologies developed and used in the Vinci program are rotor blisks (blade integrated disks) on both turbines, as well as brazed shrouds on the stators. Validation of the design was made by analysis as well as measurements and evaluation in component and engine tests. For the rotor blisks, with the inherent risk of HCF due to low mechanical damping, validation of high frequency characteristics was made by measurement of individual blade vibrations by a laser system during engine operation. This instrumentation design was particularly challenging due to the small size of the turbine, the high blade tip speed, as well as extreme environmental conditions.

Throughout development and qualification engine tests, in total more than 130 engine tests, the turbines have operated as expected without any malfunctions, demonstrating the success of the development program at GKN.