Paper ID: 45055
oral

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

Author: Dr. Thomas Fuhrmann
ArianeGroup, Germany

FLPP ETID: HOT-FIRE TEST RESULTS OF FUTURE EUROPEAN EXPANDER TECHNOLOGIES

Abstract

Within ESA-Launchers, the Future Launchers Preparatory Programme (FLPP) Expander Technology Integrated Demonstrator (ETID) project focusses on the full-scale demonstration of cost-effective and low-weight expander liquid rocket engine technologies. The overall goal is to reach TRL 5-6 for the chosen technologies by hot-fire testing in fullscale at P3.2 in Lampoldshausen, Germany, starting first half of 2018. The selection of the technological content is based on full-expander engine level trade-offs in order to identify the most promising engine architecture and a subsequent stringent down-flow of requirements expressing the customer needs to the sub-system and component levels.

The paper will present the variety of identified technologies incorporated in ETID and the overall programme status with the fullscale hot-fire testing at P3.2, Lampoldshausen ongoing during 2018 up to December.

The test configuration (ID1) consists of a thrust chamber assembly (TCA) and three different electro-driven valve types. The technologies linked to these products are as follows. For the thrust chamber assembly the heat pick-up functionality is allocated to the Combustion chamber (CC) and the nozzle extension (NE). The sandwich nozzle, developed by GKN, provides a portion of the overall required heat-pick up to the hydrogen to close the expander cycle. This architectural change on TCA level leads to weight reduction potential. A reduction of the cylindrical length of the CC and a lower interface area ratio for the interface position between CC and NE is achieved capitalizing the lower area specific weight of the NE structure. In contrast to other engines the injector head design is based on a cost efficient forged stainless steel raw part. The internal injector head layout design is simplified significantly. To lower the manufacturing cost and lead time even further the application of additive manufacturing (ALM) is foreseen. One variant of the injector head will incorporate fluid functional parts manufactured with a powder bed based additive manufacturing process. The investigated engine valve designs are electrically actuated with a supply voltage of 55V/DC. In the frame of FLPP ETID project AGG designs and manufactures demonstrators for the chamber valves (HCV and OCV) and the regulation valves (TCV and RGV). The valve development logic foresees that the technologies that are required for the 4 different valve types will be demonstrated with two specific demonstrator valves i.e. a HCV demonstrator with a bore of 75mm and an OCV demonstrator with a bore of 35mm.