MATERIALS AND STRUCTURES SYMPOSIUM (C2)
New Materials and Structural Concepts (4)

Author: Mr. Bernd Szelinski
MT Aerospace AG, Germany, bernd.szelinski@mt-aerospace.de

Dr. Ralf Becker
MT Aerospace AG, Germany, ralf.becker@mt-aerospace.de
Mr. Rudolf Forster
MT Aerospace AG, Germany, rudolf.forster@mt.man.de
Mr. Ulfert Block
European Space Agency (ESA), The Netherlands, ulfert.block@esa.int
Dr. Thomas Hornung
Airbus DS GmbH, Germany, thomas.hornung@airbus.com

A5 ME (MIDLIFE EVOLUTION) UPPER STAGE TANK COMMON BULKHEAD OPTIONS TRADE-OFF

Abstract

In the context of ESA's Ariane 5 Midlife Evolution (ME) programme which is aiming to raise the payload capacity of Ariane 5 from 10 to 12 tonnes the main focus is set on the development of an entirely new upper stage for the launch vehicle. Amongst other things like a re-ignitable Vinci engine the evolution/redevelopment/redesign of the upper cryogenic tank is foreseen. The envisaged advancement for a new upper stage for the Ariane ME will also lead to an improved reliability and safety. Astrium was awarded a contract by ESA to re-develop and enhance the cryogenic tank for this new upper stage. MT Aerospace was assigned with the development of the metallic bare tank. One of the major changes compared to the former version is that the oxidiser and the propellant is no longer stored by two independent tanks. For the A5 ME Upper Stage Cryogenic Tank it is envisaged to separate the two compartments containing the oxidiser and the propellant by a Common Bulkhead (CB). The main challenge of this concept is to design a thermal barrier necessary due to the dissimilar liquefaction temperatures of the fluids and therefore the thermal imbalance over the CB. In a first stage studies are foreseen to analyse different options how to design this CB. This initial phase is referred to as Phase 1.1. This Phase will finish with an assessment of the different concepts. Currently several concepts are under investigation incl. design options from a wetted insulation, over a foam/honeycomb stiffened CB up to a vacuum version. Additionally the new upper cryogenic tank has to cope with a changed/increased load spectra to suit the new mission requirements. This changed environment has an impact on the dimensioning of the structure. All participating parties will perform analyses and design optimisation to obtain data and to be in a position to assess the different concepts against mutually agreed Trade-off criteria. These criteria contain e.g. structural margin, mass budget, volume, manufacturing effort, technology maturation level. The results of this study (Trade-off) will contribute directly to an SSCR (Stage System Concept Review) data package building amongst others the baseline for the new upper stage design decision. Following Phase 1.1 the chosen most promising concept will be pursued for further development and industrialisation.