IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Technologies for Future Space Transportation Systems (5)

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CMC/METALLIC TECHNOLOGY FOR THE REUSABLE SPACE RIDER BODY FLAP ASSEMBLY

Abstract

After the success of the IXV re-entry mission in 2015, the ESA Space Rider Program has significantly raised the bar with the objective to develop a Space Transportation System capable to perform up to 6 missions with a minimum refurbishment, each of them with an in orbit permanence target of 2 months. Among the sub systems and technologies that require new development effort with respect to the IXV application there are the vehicle control surfaces made of Ceramic Matrix Composites. In this case the utilization of a newly developed Italian ceramic composite material, named ISiComp, has been implemented The material manufacturing process is based on Liquid Silicon Infiltration of pyrolized phenolic based carbon fiber pre-preg fabric. The applied process, inherited from high-end automotive sector for braking disc production, offers significant advantages in terms of costs and production time over other CMCs manufacturing techniques (e.g. CVI, PIP). ISiComp, initially developed in the frame of the Italian National Aerospace Research Program, PRO.RA.-SHS, has demonstrated its effectiveness for the manufacturing of hot structures for re-entry application through a successful plasma wind tunnel test campaign performed in SCIROCCO test facility on a flap demonstrator in April 2018. The paper presents the status of the activities that are being carried out by CIRA, in partnership with PETROCERAMICS, for the design and development of the Space Rider Body Flap Assembly. The design of the assembly is based on the coupling of a CMC stiffened panel with metallic supports for the interface with the spacecraft structure and the adoption of high temperature OTS bearings. Plasma wind tunnel tests for reusability demonstration, successfully performed in October 2018, catalysis/oxidation material characterization;

mechanical and thermal material characterization; full scale manufacturing demonstration, dynamic and static full scale testing, hinge bearing thermo-mechanical testing have been defined and planned in order to validate the design of the assembly.