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Space Structures I - Development and Verification (Space Vehicles and Components) (1)

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ASSEMBLY AND QUALIFICATION OF A MODULAR SATELLITE STRUCTURE

Abstract

Extending the lifetime of future satellite systems to reduce overall mission costs is going hand in hand with the need for on-orbit servicing capabilities. By repairing, modifying or refueling satellites in space reasonable sustainability can be achieved. Driven by this paradigm the project iBOSS (intelligent Building Blocks for On-Orbit Satellite Servicing) develops a full modular satellite architecture where building blocks called iBLOCKs are combined to build up the satellite bus. The bus is assembled by choosing from a catalogue of standardized and prequalified iBLOCKs. These distinct modules host certain satellite components or even full subsystems and can be linked to each other via a multifunctional interface, which transfers mechanical loads, electrical and thermal energy and data. Once in space the satellite can be serviced by means of robotic manipulation, by replacing, removing or adding new iBLOCKs to the satellite.

This paper focuses on the design and testing of the BLOCK's primary structure. A cubic shaped structure assembled from a CFRP frame structure and sandwich side panels which are mainly bonded adhesively to one another. Design driving parameters for the iBLOCK are a standardized load bearing design featuring a high thermal stability and flexible mounting positions for components and payloads. This leads to standardized hard point patterns, which facilitate integrating components, subsystems and payload into the modules.

The paper describes the underlying standardization concept and presents the manufacturing steps, used tools and processes during the structure's assembly. In the subsequent step, the iBLOCK's integration using mass dummies for its standard components and interfaces is presented, leading up to the qualification of the iBLOCK's structure according to ECSS specifications. The qualification is performed based on an a-priori load envelop for LEO missions and includes mechanical and thermal testing like static load, random vibration, sinusoidal vibration and thermal vacuum respectively. The paper gives an overview of the performed test result and their discussion.