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DESIGN AND REALIZATION OF AN ADDITIVE MANUFACTURED MULTIFUNCTIONAL SPACECRAFT STRUCTURE THROUGH A SYSTEMS AND CONCURRENT ENGINEERING APPROACH

Abstract

In the next decades Additive Manufacturing (AM) will be the key enabling technology for new space missions, bringing humans on Moon and on Mars. To reach these goals present and future designers must adopt a new Additive-thinking, where Design for Additive Manufacturing (DFAM) must be adopted within a rigorous systemic and systematic approach from the very early design phases. With this mindset-shift it will be possible to get the best from this disruptive technology in terms of final product performances improvement, lead-time and costs reduction. In fact, starting from a simple component re-design would generate only marginal improvements. On the contrary reshaping the current space systems design methodology by injecting in the process the innovative DFAM logics and rules would produce truly disruptive advantages, in terms of merging functions and innovative architectures. This permits to leverage the usual AM-improvements twofold, on the equipment itself on one side and for the entire system on the other, permitting in such a way to strongly affect and improve the traditional spacecraft configurations. Objective of this paper is to demonstrate how the introduction of advanced systems engineering methodologies, in particular concurrent design processes, methods and tools, including a system life-cycle perspective, should be adopted in order to allow significant improvement at system performance level. To reach the optimal level of integration with concurrent engineering processes the Through-life Integrated Concurrent Engineering approach has been selected for the development of the case-study. In order to demonstrate the effectiveness of the method, a multifunctional integrated spacecraft lateral panel has been chosen as a representative benchmark of a spacecraft system. Thanks to this case-study it has been possible to completely address two main goals within the established time frame: to rethink, introduce and validate the design methodology and to realize an innovative system with increased technical and programmatics performances.