IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Manufacturing and industrialization for Launch Vehicle and Space Vehicle Structures and components (High volume production, industrialization, automatization and digitalization) (7)

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COSMIC CRAFTSMANSHIP CHRONICLES: NAVIGATING SCHOLARLY FRONTIERS IN ADVANCEMENTS OF ADDITIVE FABRICATION AND SWIFT PROTOTYPING FOR INTRICATE SPACECRAFT STRUCTURES

Abstract

This investigation represents an innovative exploration of the profound impact that state-of-the-art technologies can have on the aerospace manufacturing sector. The endeavor, which places principal emphasis on rapid prototyping and additive manufacturing (AM), seeks to revolutionize spacecraft structure production by addressing pivotal challenges related to mass production, material utilization, and process enhancement. The primary objectives include integrating advanced technologies to reduce material waste, enhance manufacturing precision, and shorten production schedules. A comprehensive examination of innovative materials suitable for spacecraft structures will be conducted, with particular emphasis on characteristics such as exceptional strength, durability, and resistance to harsh environmental conditions. Additionally, the project will investigate strategies for process optimization that streamline high-volume production through the use of automation, digitization, and smart manufacturing concepts. The integration of robotic systems aims to increase manufacturing efficiency and reliability. Furthermore, the research will evaluate and implement rapid prototyping methodologies to expedite the process of iterating designs. Anticipated outcomes include accelerated validation and refinement of spacecraft structural components, contributing to a more agile and adaptable manufacturing ecosystem. A substantial increase in production efficiency is expected through the implementation of cutting-edge manufacturing technologies and process optimization. Novel materials and manufacturing methods are anticipated to enhance the structural soundness, longevity, and operational efficiency of spacecraft components under severe environmental conditions. The project emphasizes smart manufacturing principles, automation, and digitization to reduce production expenses and material wastage, aligning with sustainability goals in the aerospace industry. Additionally, rapid prototyping techniques hold the potential to accelerate design iteration, enabling more expeditious validation and adjustment in response to evolving mission demands. The significance of this project lies in its contribution to continuous endeavors within the aerospace sector to enhance materials applications, additive manufacturing, and rapid prototyping, guaranteeing a future for spacecraft structure manufacturing that is more streamlined, robust, and environmentally sustainable.