

57th IAA SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE  
ACTIVITIES (D5)

Interactive Presentations - 57th IAA SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE  
MANAGEMENT IN SPACE ACTIVITIES (IP)

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AN INNOVATIVE APPROACH TO DEVELOPING FUEL CELLS FOR SPACE APPLICATIONS  
USING THE SIX SIGMA DMAIC FRAMEWORK.

**Abstract**

Developing new space technologies involves significant costs, particularly during the experimental testing phase, where theoretical concepts are validated in real-world scenarios. The inherent variability of results often necessitates extensive traditional testing, contributing to escalating expenses. Addressing this challenge requires effective management strategies to reduce sample sizes and streamline the development process while maintaining high quality standards.

This paper focuses on optimizing a pivotal component of fuel cell technology for space missions: the xerogel. Employing Six Sigma DMAIC (Define, Measure, Analyze, Improve, Control) principles for efficient management and Response Surface Methodology (RSM) for quantitative analysis, we aim to enhance the efficiency, reliability, and quality of the development process. Despite the dynamic nature of the industry, a universally accepted approach to technology development within the space sector remains elusive, primarily due to its competitive landscape and emphasis on innovation, which can hinder standardization, particularly for nations entering the space race later.

Our study seeks to bridge this gap by exploring the potential of implementing Six Sigma DMAIC to accelerate Brazil's space sector development, potentially establishing it as a national standard. Additionally, leveraging RSM will refine experimentation stages, resulting in robust models that accurately represent technology behavior and facilitate future enhancements while ensuring high-quality outcomes.

In pursuit of these objectives, our research endeavors to devise a management-based framework tailored to xerogel development for space applications. By offering a systematic approach to enhance efficiency, competitiveness, and quality in Brazil's space endeavors, we aim to contribute to the advancement of space exploration and technology.

Moreover, the successful implementation of Six Sigma DMAIC methodology as a management framework, coupled with the application of RSM for quantitative analysis, presents a reproducible model for expediting the development of diverse space technologies on a global scale. This collaborative approach not only facilitates knowledge dissemination but also stimulates innovation, thereby propelling advancements in space exploration.