

IAF SPACE SYSTEMS SYMPOSIUM (D1)  
Space Systems Engineering - Methods, Processes and Tools (2) (4B)

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COMPREHENSIVE AND COMPARATIVE STUDY OF MBSE APPLIED TO SPACE SYSTEMS  
ENGINEERING

**Abstract**

The space sector is well known for its passion for working on ambitious projects, which help humanity advance its scientific knowledge and expand its technological capabilities thanks to the innovative engineering approaches required to develop space technologies. To this day, the space sector is an essential contributor to systems engineering, continuously developing and improving systems engineering practices helpful in designing space and non-space technologies.

During the last decade, model-based systems engineering (MBSE) approaches have been under evaluation by the space sector to support systems engineering activities through digital tools, methods, and processes. Unfortunately, only a few actors have successfully deployed MBSE across their organization, creating an MBSE infrastructure that complements their system engineering capabilities. In addition, since each organization has different needs and constraints, parallel growth on adopting MBSE practices is practically impossible. Nevertheless, the space community is attempting to create standards for common practices shared within entities, allowing everyone to continue collaborating within an MBSE framework, transitioning to a new era of systems engineering digitalization.

This investigation will consist of a breakdown of MBSE to define the best manner to use MBSE tools and methods to manage system complexity, increase system understanding and improve collaboration. The chosen approach is to identify the main complications when applying MBSE to space projects, studying examples from the use of MBSE to support the design and development of CubeSats, small and large satellites, launchers, and rovers. After, we would separate their challenges according to their cause (limited tool capabilities, incomplete methodology, and others). This work would allow us to identify problem and mistake patterns that we can use to develop and improve procedures for using MBSE tools and methods properly according to the needs of the project and the user. Another purpose of this research is to identify the best way to introduce MBSE across different organizations (space agencies, private companies, research entities, and educational institutions) and determine their respective roles within a global roadmap for deployment of MBSE across the space industry.

This paper describes the main results of our investigation on MBSE and their effect on the research outcomes (proposed MBSE procedures and practices). Also, the research paper will highlight multiple space projects that have applied MBSE and active initiatives to advance the deployment of MBSE across the space sector.