“Definition of a Model Based Mission Assurance Methodology”

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Abstract

The shift from a "document-centric" to a "data-centric" and "model-centric" approach to information is a key aspect of ongoing digital engineering transformations in both industry and government. Most engineering disciplines already possess well-established modelling methodologies and tools within their respective fields. However, the efficient and systematic exchange, sharing, and coordination of information across disciplines remains a significant challenge.

Leaders of the Safety and Mission Assurance (SMA) communities from ESA, JAXA, and NASA recognize the importance of addressing the transformative opportunities available to our broader community. To this end, a dedicated trilateral Model Based Mission Assurance (MBMA) task force has been commissioned to adapt the Reliability, Availability, Maintainability, Safety (RAMS) field to a model-centric approach. The goal is to introduce a new MBMA methodology by developing common guidelines and offer extensive resources to transition RAMS activities into existing Model-Based Systems Engineering (MBSE) methodology.

Since 2019, the task force has made significant progress exploring the development of the MBMA methodology. Their initial work has resulted in the auto-generation of several RAM analysis products, including Fault Trees, FMEA/FMECA, and RBDs, using a SysML-based toolchain. Currently, the Task Force aims to improve the quality and efficiency of engineering processes by further developing the MBMA methodology to encompass all RAMS-related activities.

This study evaluates the compatibility of the MBMA methodology with ECSS requirements to assess its readiness. The presentation begins with a brief overview of the context and the selected MBSE Cubesat demonstrator, then details the MBMA methodology's application for automatically generating from our demonstrator an FMECA with a SysML toolchain. In the second part, it discusses the constraints identified during the study, first with respect to the MBSE/RAMS terminology, and the challenges posed by a multi-disciplinary model-based engineering approach. Lastly it will highlight limits and potential workaround identified during the study.