

IAF SPACE SYSTEMS SYMPOSIUM (D1)
Systems Engineering Modeling and Analysis (5)

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THE EUROPEAN SPACE AGENCY MBSE METHODOLOGY

Abstract

The European Space Agency (ESA) has been developing an MBSE (model-based systems engineering) Methodology to address the increased digitalization of systems engineering and facilitate the complex system development in ESA projects and other European space projects. The methodology is based on the European Cooperation for Space Standardization (ECSS) standards for Systems Engineering, and feedback from projects using the methodology. By using the ECSS standards as the starting point, the processes, terminology and expected outputs are familiar to the engineers, lowering the usage barrier within the Agency. This presentation describes the background of and effort for establishing the MBSE methodology and a description of the methodology.

The Methodology consist of three parts: process, method, and tool. The process refers to the system engineering process used in space projects and compliant with ECSS. The method represents the techniques for performing the process in a model-based way, with a number of ESA-specific concepts, relationships and views that will be captured in the modelling tool. A more detailed method description will be provided during the presentation. The tool implementation of the ESA MBSE Methodology has been performed using SysML and the commercial modelling tools Cameo Systems Modeler and Enterprise Architect.

The first version of the ESA MBSE methodology was published in the European Space Software Repository (ESSR) in February 2022 under an ESA Community License under the name 'ESA SysML Solution'. As of this first version, processes covered include requirement definition, Mission specification, System of Interest specification and functional and physical designs. The ESA MBSE Methodology is currently in use in several mission projects at the Agency, including Argonaut, Mars Sample return –

Earth Return Orbiter (MSR-ERO), GENESIS, Laser Interferometer Space Antenna (LISA) and Sentinel 3 Next Generation Topography (S3NG-T). These missions are spread among the main ESA domains: exploration, science, Earth observation and navigation.

The next major evolutions of the ESA MBSE Methodology include its extension to cover the verification phase, and its migration to SysML v2 when that becomes available.