

IAF SPACE SYSTEMS SYMPOSIUM (D1)
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A MODEL BASED SYSTEM ENGINEERING (MBSE) TOOL TO SUPPORT EARLY DESIGN OF A
RVD CUBESAT MISSION

Abstract

Model-based Systems Engineering (MBSE) is a turning point for companies in the manufacturing and engineering sectors. In recent years, the space industry has increasingly understood the need of satisfying the growing demand for new technologies, quality products, and services in a short time at low costs. MBSE would bring benefits especially to the development of small satellite missions, which has so far continued to rely on document-based approaches, even though the key features of such projects would fit perfectly within a model-based approach. This paper aims to support the design of a space product, in particular addressing the problems that are related to later project phases (e.g. Assembly, Integration, and Verification, and even Operations) but can be traced back to the early design of the product or the mission. Recent specific cases studies for application of MBSE are then presented, beginning with a 12U CubeSat for the inspection of an orbital vehicle in LEO. In the first place, this contribution focuses on the construction of models to describe a few critical technical areas in the conceptual and preliminary design of space missions. Secondly, attention is drawn to the creation (through reverse engineering) of some MBSE guidelines for similar missions. To achieve this goal, an overview of the MBSE state of the art was initially outlined, researching the main methodologies, languages and tools, to understand what potential advantages or challenges could derive from this approach. The proposed solution is built into the Valispace data-driven tool, which is interfaced with the Capella MBSE tool, where the mission is modelled and analysed. The latter software implements the Arcadia (Architecture Analysis and Design Integrated Approach) methodology that was used to create models related to stakeholders and needs analysis, functional analysis, and the construction of logical and physical architecture. At the same time, the requirements management, the mission architecture definition, and the main system budget were entrusted to Valispace. By also including a Concurrent Engineering approach into the design process, the system engineer will be able to rapidly assess the value of the mission/system under study, thus achieving many improvements regarding cooperation and a multidisciplinary approach to the project(s).