

SPACE SYSTEMS SYMPOSIUM (D1)
Space Systems Engineering - Methods, Processes and Tools (1) (4A)

Author: Dr. Fabrizio Stesina
Politecnico di Torino, Italy, fabrizio.stesina@polito.it

Ms. Sara Cresto Aleina
Politecnico di Torino, Italy, sara.cresto@polito.it

Mr. Davide Ferretto
Politecnico di Torino, Italy, davide.ferretto@polito.it

Dr. Nicole Viola
Politecnico di Torino, Italy, nicole.viola@polito.it

DESIGN OF SPACE MISSIONS THROUGH THE EFFECTIVE COOPERATION OF SYSTEMS
ENGINEERING TOOLS

Abstract

Space missions and systems complexity have strongly increased in the last years highlighting the importance of dening tools improving the design, verification and validation process: eectiveness and costs reduction without loss of condence in the nal product are the objectives that have to be pursued. System Engineering (SE) shall ensure that any kind of requirement is satisfied avoiding that some aspects prevail on other. However, critical issues are the interaction and integration of the design and verification phases due to the lack of tools able to cover the entire product-life cycle. This often generates discontinuities into the project usually due to the loss of information and misunderstanding between consecutive phases. Model Based System Engineering (MBSE) seems a promising strategy that can reduce the wasted resources within the modern SE context. The paper proposes an eective tools chain that puts together the main elements of MBSE and the Model and Simulation based approach that simplifies the verification. First, well-known SE instruments drive the requirements denition. Taking into account the stakeholders' needs, regulations and constraints, Functional analysis, Concept of Operations evaluation and architecture denition are the main activities that shall be completed. The adoption of dedicated software improves this process by producing a set of data to be shared among different platforms. Notably, DOORS generates, hosts and manages the requirements list, providing a main reference hub for the specification; Rhapsody provides the model based system architecture in terms of attributes and blocks that can be translated to standard formats and made available for specific verification tools. Moreover, being synchronized with the DOORS database, it supports requirements traceability and mapping features aimed at creating matrices and tables views for coverage, impact analysis and verification. Matlab/Simulink and dedicated environments take the Rhapsody outputs and perform different types of verification campaigns. Indeed, Matlab/Simulink allows simulation during the conceptual, preliminary and detailed design phases while an in-house developed platform, called STARSIM, perform "in the loop" verifications useful during the production, qualification and acceptance phases. The outputs of the verification campaigns are directly referred to requirements (managed by DOORS), analysing autonomously if and how they are satisfied and, potentially, negotiating them. The paper presents the results obtained thanks to the first release of the tools-chain. Its capabilities and the integration among all the parts are shown highlighting the advantages with respect to the traditional approaches.