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DEVELOPMENT AND EVALUATION OF SYSTEM ENGINEERING SOFTWARE TOOLS FOR THE SPACE STATION DESIGN WORKSHOP

Abstract

In early spaceflight project phases top priority is given to the derivation of mission objectives, defining technological as well as political and economical requirements and constraints. Since all mission and system elements are highly interdependent, even small design changes can have a significant impact on the entire system. This network-type problem requires a methodological, multi-disciplinary approach, i.e. all mission and system elements must be considered simultaneously down to a subsystem level in an iterative process. Following this approach, conflicting requirements can be eliminated and fundamental mission and system parameters can effectively be concretized, optimized, and fixed while allowing risks and costs to be limited. The Space Station Design Workshop (SSDW) at the Institute of Space Systems (IRS) provides exceptional capabilities, methodologies, and tools for conceptual space systems engineering and mission design. The intense, five-day workshop offers hands-on education in systems engineering and project management for international students and young professionals. They are guided by the SSDW staff and consulted by experts from industry and academia. In addition, they are given workstations which are assigned to subsystems (e.g. life support), and dedicated software tools supporting the conceptual design process. This paper focuses on two of these software tools. COSMICS (Concurrent System and Mission Conceptualization Software) is a top-level engineering software tool that was developed at the IRS especially to be applied at the SSDW. It helps the participants to deal with the complex system and to control the process flow by collecting the overall concept budgets and by mapping design progress and maturity. Its basic functionalities are to collect and distribute information in order to provide an updated and coherent data set to all workstations at all time. It was successfully tested during past workshops and proofed to greatly facilitate documentation and communication. Current developments aim on a more flexible design of the graphical user interface and the implementation of interfaces which shall allow data distribution between several software tools. ELISSA (Environment for Life-Support Systems Simulation and Analysis) provides a set of life support system component models allowing the time-discrete simulation of complex systems. Since 2010 the software tool was further developed now also allowing the simulation of energy system components as well as the analysis of reliability on a system level. Both software tools will be applied and evaluated during the upcoming SSDW 2015. The software development and the results of the workshop evaluation will be presented in this paper.