SPACE SYSTEMS SYMPOSIUM (D1)
System Engineering Tools, Processes & Training (I) (3)

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COSMICS – A WEB-BASED APPROACH TO MULTI-USER CONCURRENT ENGINEERING

Abstract

At the beginning of the conceptual design process, the mission and system requirements are rather vague and have to be translated into objectives, defining technological as well as political and economical requirements and constraints. In addition, mission and system elements of a spaceflight project are strongly interdependent. All local interferences could yield significant consequences to the entire system. Therefore, within this early project phase of conceptual design, all mission and system elements must be considered simultaneously down to a subsystem level. Conflicting requirements must be dispelled and fundamental mission and system parameters have to be concretized, optimized, and fixed in a baseline concept following an iterative process. These strong interdependencies preclude the separate, sequential definition of individual elements, but instead require a multi-disciplinary, methodological approach to this network-type problem that enables the designers to see (and deal with) the system as a whole. The design environment of the Space Station Design Workshop (SSDW) at the Institute of Space Systems, University of Stuttgart provides exceptional capabilities, methodologies, and tools for conceptual space systems engineering and mission design. Its newest update, the COncurrent System and MIssion Conceptualization Software (COSMICS), features an approach to facilitating the complex conceptual design process as well as the system analysis. As a top-level systems engineering tool, it integrates subsystems and their interdependencies, accounting for all critical subsystem parameters required for the preliminary design phase. By controlling the process flow and collecting the overall concept budgets, COSMICS maps design progress and maturity. Through intelligent management of reading and writing authorization, this web-based software supports simultaneous multi-user inputs into one mission and system parameter database. It distributes parameters between subsystems, implements changes made to one subsystem and notifies all other subsystems affected by the change, which greatly facilitates documentation and communication among subsystem engineers. The SSDW provides the backdrop for an international workshop based on hands-on education for participants in systems engineering, project management, and team organization. During the SSDW, students and young professionals with interdisciplinary backgrounds work in two competitive teams and in a concurrent design environment to create different mission and spacecraft concepts. COSMICS accelerates the iteration and thus, the design process. COSMICS showed great potential and was successfully tested during its applications to the SSDW 2009 and 2010 for the design of a lunar base and a crew transfer vehicle for deep-space missions, respectively.