

SPACE SYSTEMS SYMPOSIUM (D1)  
Interactive Presentations (IP)

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INCORPORATION OF KNOWLEDGE BASED SYSTEMS IN TRADESPACE EXPLORATION FOR  
SPACE MISSION DESIGN**Abstract**

Experience in systems design demonstrates that despite the fact that most of the costs are expended in the advanced phases of the life cycle, the majority of them is determined by choices made during the first design phases. Therefore, a poor conceptual study will lead to a worse and expensive system at the end of the design process. Furthermore, it is during the earliest design phases that the knowledge about the system is very low. For these reasons, alternative design approaches have been developed and applied extensively during the space mission conceptual and preliminary design. Among these, two of the main ones are the centralized and the concurrent design approach. In particular, the latter is effective in improving the design process of complex systems, in which many disciplines are involved, such as in the case of space mission design. In the concurrent engineering process, the specialists are not permanently and exclusively assigned to Concurrent Design activities, as this is just one of the several tasks they perform in a matrix-organization. This specialist turnover implies that a large amount of knowledge can vary in terms of good design practice and important knowledge from successful past missions. Concerning this flow of knowledge, it is important to avoid any loss of it, which implies the ability of manage and structure the knowledge of each expert. A good approach to manage the knowledge can be found in the knowledge based systems. This paper proposes a design methodology which takes into account a merge between knowledge based systems and Tradespace Exploration into the concurrent design approach. The proposed knowledge based system is adaptable and updateable, in terms that, the domains experts have the possibility to insert improved design solutions basing on their own experience and available technology whereas the older and with low utility design are deleted. This methodology, thanks to the queries to a structured database and via both expert systems and fuzzy case based reasoning, can be employed to propose to the different domains experts, a baseline decision for beginning a concurrent Tradespace Exploration session. Moreover integrated with the space system engineering shows an improving into the design process in terms of time and robustness of the decision making process in early design phases.