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ONTOLOGY ENGINEERING FOR SPACE MISSION DESIGN: A CASE STUDY OF A SUBORBITAL
HUMAN SPACEFLIGHT MISSION**Abstract**

Space missions are traditionally characterized by highly conservative approaches to subsystems changes and embodiments of new technologies into real systems. At the same time, the NewSpace paradigm changes the perspective, as many new space design teams enter the space sector. These teams are not necessarily affiliated with big industrial enterprises. Rather, they inherit the so-called “entrepreneurial dynamism” defined and discussed by Jeff Bezos in the 70th International Astronautical Congress - IAC 2019.

In this paper we propose the ontology engineering approach for such innovative space teams. Such approach is based on the best practices of integration of the Model-Based Systems Engineering (MBSE) and Product Lifecycle Management (PLM) methods. The core idea of the proposed approach is that it facilitates the space system design all the way from conceptual design to detailed design stages. This is achieved through the usage of core entities (objects, processes, and attributes) and their relationships (formal and functional ones). We argue that any design team member uses these constructs during the design process, however, very often this is happening in an unstructured way. In this case the space system design-related data and process management could be lost and needed to be re-established for the next project.

Our work proposes the ontology engineering approach and the model-based means to shift the paradigm to a structured mission design perspective. This would support the perseverance of design knowledge and its re-use across the projects and across the teams. We demonstrate the utility of the approach on a truly NewSpace case study – suborbital human spaceflight mission.

The utility of the method is that it can integrate different systems developed by different teams using the same modeling and natural language. Using this approach, the systems development will be shifted towards inclusion of “entrepreneurial dynamism” into space mission design practice.