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Space Systems and Architectures Featuring Cross-Platform Compatibility (7)

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SYSTEMS CONCURRENT ENGINEERING PICO-SATELLITES

**Abstract**

This paper aims to describe a template containing all elements for systems engineering pico-satellites. The template aims to be generic for accomplishing the needs of university Cubesats development programs and to be reused by such programs. It is implemented in a commercial systems engineering software environment called Cradle ® and it was developed based on the experience of the University of Wurzburg, in Germany, where three satellites of the UWE series have already been developed since 2005. It covers: mission definition which includes stakeholder analysis, concept of operations and operational concept architecture; system requirements analysis; system architecture that shows the functional structure and behavior of the system and systems elements and the physical or implementation architecture of the system; the detailed design that provides the system component specifications; the plans for all life cycle processes of the system such as development, manufacturing, assembly, integration, testing, launching, operations and disposal. The template was developed with a life cycle process perspective, using concurrent engineering principles of anticipation of life cycle process requirements to the early stages of product development. Therefore, the models constructed in the template capture the satellite in every scenario along its life cycle. For example, the models describe the context of the satellite during operations but also during thermal vacuum testing or during launch and launch preparation. The template aims to be an instrument for teaching and learning space systems engineering and to ease the documentation burden necessary to develop a space product. It offers a solution to university satellite programs where, in general, the students do not have enough systems engineering background nor the university has a professional structure for systems engineering and project management. The paper also provides an example of the use of the template with the Cubesats currently under development in Brazil at INPE (Brazilian Institute for Space Research) and ITA (Aeronautics Institute of Technology).