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Interactive Presentations - 26th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (IP)

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IRAS: PROGRESS IN DEVELOPMENT OF THE DIGITAL CONCURRENT ENGINEERING PLATFORM, SOFTWARE TOOLS AND INNOVATIVE TECHNOLOGIES

Abstract

Progress of the Digital Concurrent Engineering Platform (DCEP), the respective software tools and technologies for satellite cost reduction in development at the Institute of Space Systems of the University of Stuttgart (IRS) as part of the Integrated Research Platform for Affordable Satellite (IRAS) is presented. The DCEP will provide a decentralized engineering platform to support fast and flexible satellite design. This platform incorporates data and software tools of different stakeholders. The number of DCEP stakeholders shall be extended in future application. A central node serves as the interface between integrated software and allows a user accessing stakeholder contributions for spacecraft design. The basis of the process is the Common Parametric Satellite Configuration Scheme (CPSCS), which is based on the aviation variant CPACS. The CPSCS data set stores relevant information of spacecraft/mission and is interface able with tools and databases. For the protection of intellectual property distributed immutable ledger technology (e.g. blockchain) is being evaluated for feasibility. Two tools are currently in development at the IRS for extending the DCEP functionality. First, the Evolutionary System Design Converger is a systems engineering software tool, that considers selection and scaling of (sub-)system components to generate optimal spacecraft configurations. This is achieved through an evolutionary algorithm. Random mutation of permitted design degrees of freedom is defined in a generic model. Scaling is derived from a database containing hardware performance data. Non-random selection is implemented by defining optimizing criteria such as minimal or maximum system masses. Second, a software tool for constellation design and evaluation is being development. Here worst-case design criteria of the individual constellation satellite are produced. Determining an overall best solution of constellation orbital parameters, while considering optimal constellation satellite design to achieve cost effectivity. Additive manufacturing is an innovative technology with significant potential for cost and mass reduction

in spacecraft. To this end, the utilization of additively manufactured tungsten nozzles with integrated cooling channels is evaluated with advantages to conventionally cooled arcjet nozzles. This marks the first step in developing a compact, lightweight, and low-cost deorbit module for constellation satellites at IRS. Further, the utilization of alternative nozzle inserts to assess the work function and potential anode fall reach and voltage relationship is assessed. Two technology demonstration missions are currently in development: The CubeSat SOURCE as a precursor mission, and a small satellite to demonstrate enhanced on-board autonomy and data processing, while also featuring novel propulsion systems.