Paper ID: 44499
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25th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Generic Technologies for Small/Micro Platforms (6A)

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IRAS: LOW-COST CONSTELLATION SATELLITE DESIGN, ELECTRIC PROPULSION AND CONCURRENT ENGINEERING

Abstract

This paper presents the contribution of the Institute of Space Systems (IRS) to the Integrated Research Platform for Affordable Satellites (IRAS), which is the designated supplier of an optimized satellite design and a dedicated suitable propulsion system. IRAS aims for capability building of the production of low-cost function integrated components. A satellite constellation shall serve as technology demonstration, with an estimated satellite count of approximately 100. This constellation in a circular 800 km orbit will enable a truly global Internet of Things, where signals of various globally distributed sensors (e.g. tracking, security, monitoring ...) are received from low-power transmitters in near-real time. The low-cost satellite requirement will be met by considering innovative production processes like additive manufacturing to be able to consistently rapid prototype components of arbitrary complexity. The utilization of components with strong heritage in the automotive industry will be considered to achieve better in space performance when compared to conventional space components. It can be expected that mass and volume budgets will decrease, while simultaneously a higher performance is possible. A comparison between a conventional satellite design and one based on an additive manufacturing approach in addition to high performing automotive components will be given. The propulsion system of the typical IRAS satellite is assigned to multiple tasks. It shall be able to raise its orbit to the designated circular 800 km orbit; it shall be able to perform space debris collision avoidance maneuvers as well as perform station keeping tasks and it shall be able to deorbit the satellite after 5 years. To this end the strong heritage of the IRS with respect to electrical propulsion systems is utilized. An arcject is generally capable of producing relatively high

thrust and a sufficient specific impulse in comparison to other electric propulsion. A 150 to 300 W arcjet fed by Ammonia is recommended for an IRAS satellite, which will be partly 3D printed. To be able to cope with changes of the satellite baseline an automated parametric design tool of the electric propulsion system is currently in development and will be presented. This tool will be integrated into the Digital Concurrent Engineering Platform (DCEP) of IRAS, which will allow for an agile and rapid development process as design information are exchanged with the DCEP and remote use of external tools is permitted. A technology demonstration precursor mission on a CubeSat is currently in the planning stage.