IAF SPACE POWER SYMPOSIUM (C3)
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WIPTHERM: A NOVEL ENERGY HARVESTING PARADIGM FOR CUBESATS

Abstract

Given the fact that CubeSats are becoming an alternative for accessible, reduced-risk development for space applications within an emergent technological market and that the power demand of these type of nanosatellites is increasing due to the complexity of the defined missions, an alternative solution to traditional energy harvesting systems (i.e., solar panels and batteries) is proposed within the WiPTherm project.

Being a high-risk category (FET- Future and Emerging Technologies) project within the H2020 European funding scheme, it aims to provide a Wireless Energy Transfer solution via a photo-thermoelectric plasmonic (HPTP) generator array device that can convert photonic energy to electrical energy via thermal gradient. In order to create it, a long-range, continuous-wave (CW) laser source targets the cells of the HPTP generator, forming, as such, the photo-thermoelectric plasmonic system. Two possible scenarios were taken into account and presented in terms of mission requirements: the laser source charging the satellite from Earth, or a laser system mounted onto a master satellite charging a CubeSat orbiting Mars/Jupiter, within the context of a deep space mission.

The development of such WET system implies an improvement of the current technology in different research fields, among them: nanomaterials, photonics, electronics, and space systems. For the success of the project, all of them shall be developed considering the different interfaces as well as the assembly principles, to be compatible with the support structure: a 3U CubeSat.

From the Assembly, Integration and Verification (AIV) plan point of view, a testing philosophy involving different models is presented: an STM of the complete 3U CubeSat for the development of higher-fidelity tests when evaluating both structural and thermal HPTP baseplate capabilities; an Engineering Model, where all the subsystems will be assembled on the CubeSat platform and all its functionalities tested; development models for all spacecraft subsystems that are new developments and are not off the shelf: HPTP, the CubeSat electrical module and the laser generator.

As a conclusion, this work presents the concept beyond the technology herein purposed, its applicability, and, from the systems engineering point of view, the challenges faced on the AIV plan.

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