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SPACE POWER SYMPOSIUM (C3)
Small and Very Small Advanced Space Power Systems (4)

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CONSTRUCTING A CONSTELLATION OF 6U SOLAR POWER CUBE SATELLITES

Abstract

A constellation of 6U CubeSats is planned to collect power from the sun and utilize it to power other spacecraft. This allows the power generation and regulation capabilities to be moved from being onboard each consumer craft to a centralized collection of nodes that can be replaced, as needed, as their solar cells efficiency diminishes overtime (or craft fail, etc.). This paper presents the construction of a 6U Solar Power Cube Satellites (SPCS) with deployable super-scale solar panels for use in low-Earth orbit (LEO). The capabilities of the spacecraft are detailed as are several prospective constellation deployment scenarios possible for their use.

The paper discusses each onboard subsystem (attitude determination and control, power, communications, sensors and bus, onboard computing, etc.) detailing the requirements needed for the proposed mission and how they are fulfilled. The microwave transmitter architecture used for the 10 GHz power transmission is also described in detail. The cost of the spacecraft is estimated, based on its construction with low-cost, highly available parts and freely available designs being utilized for most subsystems. The longevity of the constellation is predicted based on historical spacecraft operations data; from this the cost-per-kilowatt produced is determined.

The paper concludes by considering the possible impediments to deployment of this system. This includes technical / implementation considerations such as ensuring the safety of other non-participating spacecraft that may cross the path of the power transmission. It also includes an analysis of the legal and regulatory framework applicable to deployment of the SPCS constellation. Licensing and coordination requirements are considered. Also considered is the potential for international concern due to the prospective use of the system for purposes other than power generation. The paper concludes by assessing the current state-of-the art and demonstrating that this is sufficient for conducting test missions and a limited deployment. A pathway to system completion is detailed.