Paper ID: 73972
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IAF SPACE POWER SYMPOSIUM (C3)
Wireless Power Transmission Technologies and Application (2)

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REMOTE POWER SERVICES: FREQUENCY AGNOSTIC SOLUTIONS FOR THE TRANSMISSION OF POWER AND PROVISION OF ANCILLARY SERVICES

Abstract

The availability of power and ancillary services (e.g., communications, data, navigation, time) is essential to all aspects of space operations. The unbundling of space electrical power systems (i.e., separation of power generation, transmission, distribution, control, and loads) affords opportunities for mass redistribution, overall volume, surface area, and complexity which can be mission enhancing/enabling.

Remote Power Services (RPS) is a mission to demonstrate the technical and economic feasibility of providing commercial remote power and ancillary services on an incremental basis for different venues. The objective is to build the first scalable building blocks of a wireless utility service (e.g., power, data, communications, navigation, time, heat, etc.) that fields the best available transmission solutions to customers with space-to-space, surface-to-surface, space-to-lunar/asteroid surfaces, and space-to-Earth venue requirements. Initial RPS space-to-space customer services will address meeting customer requirements for an additional leg of power, emergency power, and augmented power.

The RPS mission's first flight increment will be a testbed consisting of two free-flying three-axis stabilized small satellite spacecraft bus systems equipped with repackageable payload constituents.

The spacecraft and payloads will provide the ability to transmit and receive some combination of millimeter-wave, microwave, near-infrared, and optical frequencies to meet future customer requirements.

The transmission and reception apertures will use phased array and reflectarray technology combining instrumented photovoltaic, antenna, rectenna, and mechanical support layers, miniaturized, and converged electro-optics. The apertures will be driven by a combination of a frequency agnostic cognitive Software Define Radio transceiver and a tunable optical network terminal. In addition, an unlocked multi-channel Geospatial Navigation Satellite System (GNSS) receiver, Laser Retro-reflector Array, synchronized precision time base, and a general-purpose computational capability will be integrated.

This paper will focus on the efforts to understand both the problem space and the potential solution space that can allow for the systems engineering of providing remote power services to be reduced to practice.