SPACE POWER SYMPOSIUM (C3)
Wireless Power Transmission Technologies, Experiments and Demonstrations (2)

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SEA-BASED RECTENNAE FOR EARTH AND TITAN

Abstract

Receiving antennas (rectennae) have been proposed for wireless power transfer (WPT) from orbiting or lofted energy assets to loads on planetary surfaces. Sea-based rectennae can offer advantages in siting however the engineering challenges are greater. On Earth many countries lack the land area for a WPT rectenna fed from a GEO powersat. On Saturn's moon, Titan WPT can be used to deliver power from a power system based on aerial platform (e.g. Titan Montgolier) to multiple loads such as daughter craft (small aerial vehicle) or floating science platforms thereby increasing their range and durability. The proposed study seeks to bring a systems engineering focus to the large issue of receiving power on rectennae in harsh physical and chemical environments, including cases where components move relative to each other or relative to the microwave power transmitter. Trade studies include over-sizing the transmit antenna to reduce the footprint of the rectenna. Rectenna elements exposed to corrosion, deposition, bio-fouling, liquid immersion, weather, heave, and (on earth) shipping or recreational craft must consider materials and methods of construction which fulfill mission requirements with a minimum of engineering complexity and cost. Two specific environments are studied, a South Pacific rectenna nearby a landmass, and a floating rectenna on Titan as the base. From these disparate but related applications are drawn system-level requirements, and from there are derived test vectors for validation of a system ready for fielding. Considerations include retro-directive beam formation, phasing across the array, electrical shorts due to conductive liquid spanning gaps in the antenna, communications disruption, wildlife compatibility, safety, and overall system cost. These results are intended to help define a foundation for further detailed study of specific mission designs, and also to apply recent technology advances to an important consideration in the area of space solar power.