Paper ID: 79680
oral

IAF SPACE POWER SYMPOSIUM (C3)
Solar Power Satellite (1)

Author: Haroon B. Oqab
Space Canada Corporation, Canada

Dr. Andrew Ross Wilson
University of Strathclyde, United Kingdom
Prof. Nobuyuki Kaya
Kobe University, Japan
Mr. George B. Dietrich
Space Canada Corporation, Canada

# MORPHEUS: A SANDWICH TYPE SOLAR POWER SATELLITE CONCEPT BASED ON THE ECO-DESIGN APPROACH

**Abstract**

Given the latest findings contained within the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report, space-based solar power (SBSP) has received renewed international attention in recent years, in view of the growing climate crisis. As such, national governments, space agencies and other stakeholders are beginning to conduct fresh studies into the general feasibility of different SBSP concepts to provide renewable baseload power, with an overall objective of having a practical solar power satellite (SPS) in operation in the next couple of decades. At this early stage of the decision-making process, it is important that all SPS concepts are put onto the table for consideration.

This paper will outline the technical details of a novel Sandwich Type SPS concept publicly for the first time. The Multi-domain Operations using Rapidly-responsive PHased Energy Universally Synchronized (MORPHEUS) SPS concept presents an elegant alternative SBSP option, which is currently being pursued commercially by Metasat. It is composed of identical recyclable satellites, each of which have sandwich panels consisting of a microwave transmitter on one side and solar cells on the other, between CD to RF convertors. Solar cells generate electricity from sunlight, which is concentrated by reflectors to the sandwich panels. The satellites can act as separate entities in orbit or be conjoined to realise a larger receiver as well as transmitting antenna. The larger transmitting antenna can transport the transmitting power to the rectenna on the ground in higher efficiencies, to realise a practical SPS with large concentrators of solar arrays. The microwave beam is controlled by a retrodirective antenna system to direct microwave power accurately to the rectenna.

The concept has been developed based on the eco-design approach, to ensure that the system is both able to scientifically quantify its environmental footprint and lower adverse impacts as far as practically possible, whilst still achieving its technical objectives. This process allows the impacts to be compared against terrestrial energy options to benchmark the environmental performance of the system per kilowatt-hour of electricity generated, thereby demonstrating its environmental credentials. It is intended that the design will continuously change and evolve in the future as it is further optimised as part of the eco-design approach.