SOLAR POWER SATELLITES

Session Chairs: Ranvir Dhillon, K. Hashimoto, Wim van Driel, R. J. Pogorzelski

Session **HBDGJK**

Type **Oral Presentation**

Schedule **Saturday, August 16, 08:00-10:40**

Room **Grand F**

08:00 **HBDGJK.1** *PROSPECTS AND CHALLENGES FOR SOLAR POWER SATELLITES IN THE EARLY 21ST CENTURY*
J. C. Mankins, Managed Energy Technologies LLC, Ashburn, VA, United States

During the past three decades, the energy technologies that powered the 20th Century have been increasingly challenged--by growing global populations, by surging economic growth, by emerging climate change issues and as a result of increasing costs resulting from finite supplies. Space-based Solar Power -- by means of Solar Power Satellites -- has been discussed for 40 years, but have only recently come to represent a technically and economically viable alternative to meet future energy needs. This paper will review the challenges and opportunities of Solar Power Satellites during the coming years, emphasizing the current status of this promising area.

08:20 **HBDGJK.2** *CONCEPT OF SPACE SOLAR POWER SYSTEMS (SSPS) IN JAXA*
T. Fujita, Japan Aerospace Exploration Agency, Tokyo, Japan

Japan Aerospace Exploration Agency (JAXA) has been conducting studies on Space Solar Power Systems (SSPS) using microwave and laser beams for years.JAXA is proposing a roadmap that consists of a stepwise approach to achieve SSPS.In case of microwave based SSPS (M-SSPS), the solar energy must be converted to electricity and then converted to a microwave beam. The on-ground rectifying antenna would collect the microwave beam and convert it to electricity to connect to commercial power grids.This paper presents the results of study effort of JAXA and the most promising SSPS concepts.

08:40 **HBDGJK.3** *MICROWAVE POWER TRANSMISSION FOR SOLAR POWER SATELLITES*
G. D. Arndt, P. H. Ngo, NASA-Johnson Space Center, Houston, Texas, United States

In the years 1978 1981 and 1998 1999, a microwave power beaming system for a Solar Power Satellite (SPS) was analyzed, simulated, and partially demonstrated. These microwave system studios were a collaboration effort with NASA, the Department of Energy (into the environmental and societal impacts of a power beaming system), multiple aerospace/electronic companies, and universities. This paper reviews the simulations for S-band and C-band frequencies, discusses the relative importance of the microwave error parameters and their degradations to the system, the environmental impacts, what advancements have been achieved since 1981, suggestions for demonstrations, and lessons learned.

09:00 **HBDGJK.4** *IMPACT TO THE RADIO ASTRONOMY BY THE INTERFERENCE CAUSED BY THE SOLAR POWER SATELLITE SYSTEMS*
M. Ohishi, National Astronomical Observatory of Japan, Tokyo, Japan

Interference with radio astronomical observations, which have several protected bands near the planed SPS frequencies (2.45 or 5.8 GHz) or their harmonics, is of particular concern for the radio astronomers. Radio astronomy has historically increased its sensitivity, and in the next decade, major initiatives will enhance the sensitivity by a factor of 100. All possible measures need to be taken to protect the radio astronomical observations. Furthermore, the thermal radiation of the solar cells of a large number of SPS units is expected to make a substantial zone of the sky unusable for astronomical observations at all frequencies.

09:20 Tea/Coffee Break

09:40 **HBDGJK.5** *TRANSIONOSPHERIC PROPAGATION, ABSORPTION AND SCATTERING OF HIGH-POWER MICROWAVES*
L. M. Duncan, Rollins College, Winter Park, FL, United States

Solar power satellite energy transmission from space to ground has been proposed using high-power microwave beams. The associated beam power density is sufficient to excite nonlinear interaction effects in both the collisionless F-region and collisional D-region ionospheric plasmas. Prospective effects in the F-region ionosphere include thermal self-focusing, beam filamentation and induced scattering, resonant plasma instabilities, stimulated Langmuir turbulence, and anomalous beam absorption. Possible D-region effects include thermal runaway electron heating. Excitation thresholds will be reviewed, and past experimental results and new research opportunities described. Techniques for moderating unwanted nonlinear effects also will be discussed.

10:00 **HBDGJK.6** *A LOW POWER DENSITY CONCEPT FOR BEAMING MICROWAVE POWER*
R. J. Pogorzelski, J. Venkatesan, Jet Propulsion Laboratory - Caltech, Pasadena, CA, United States

A system for wireless power transfer is described which minimizes the required power density to obviate the need for high power microwave components. In addition, the potential for interference with other local electronic devices is minimized. The radio frequency power is generated by a distribution of low power solid state devices and the power transfer is achieved via spatial power combining in the aperture of the transmitting antenna. Beam control is implemented by mutual injection locking of the rf sources. A modular approach to the construction of large apertures is suggested involving triangular subarrays controlled by arrays of coupled oscillators.

10:20 **HBDGJK.7** *WIRELESS POWER TRANSMISSION SYSTEM FOR A MICRO AERIAL VEHICLE*
T. Komaru[1], E. Shimane[2], A. Diallo[2], K. Komurasaki[2], Y. Arakawa[1]; [1]The University of Tokyo, Tokyo, Japan; [2]The University of Tokyo, Chiba, Japan

Wireless power transmission system for a Micro Aerial Vehicle using a microwave beam has been studied. It consists of three sub-systems. In the transmitter system, a microwave beam of 5.8GHz is formed and steered using a phased array antenna. In the rectenna system, the microwave power received by an antenna is converted to DC power by an in-house rectifier and used to drive an electric motor on a MAV model. In the tracking system, the position of the MAV is detected using a software-retro-directive mechanism.

10:40 End of the Session