

SPACE POWER SYMPOSIUM (C3)

Space-Based Solar Power Architectures – New Governmental and Commercial Concepts and Ventures (1)

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SUNBEAMS FROM SPACE MIRRORS IN DAWN DUSK POLAR ORBIT FEEDING SOLAR FIELDS
ON THE GROUND FOR LOW COST ELECTRICITY

Abstract

A Space Power Satellite capable of providing solar electric power economically for 24 hours per day has been a dream for decades. However, the SPS concept is very complex since it assumes multiple energy conversion steps and includes specially constructed ground microwave receiver stations. The 5 km by 15 km Integrated Symmetric Concentrator SPS concept employs light weight mirrors in a GEO orbit at an altitude of 36,000 km. Herein, it is proposed to use a constellation of 10 km diameter mirror arrays in a sun synchronous orbit at an altitude of 1000 km deflecting sunbeams down to terrestrial solar power fields at dawn and dusk. The key is that larger and larger terrestrial solar fields, photovoltaic or trough concentrated solar power, are already being built all around the world. Mirrors deflecting sunbeams down to earth is a much simpler concept. A surprising convergence of two technologies under development is now possible, i.e. lower cost access to space and the ongoing construction of larger and larger solar power fields. Further analysis of mirrors in space in a dawn dusk orbit combined with future solar power fields has shown this idea to be actually a potentially viable economical proposition [1, 2]. However, while this idea is very intriguing, the magnitude of its implementation is daunting. Nevertheless, the idea is intriguing enough to proceed with a first order design for the required mirror satellites. A mirror satellite design will be presented here. It builds from mirror technology for solar sails at L'Garde as well as technology developed for the International Space Station. It appears that the technology is available to implement this mirror satellite design and at least go to a detailed design and test stage. Given all of the above, there is still another non-technical difference between the dawn dusk space mirror concept and the initial SPS concept and that difference is in perspective. The dawn dusk space mirror concept requires a global perspective and international cooperation whereas the SPS concept is based on a traditional national perspective. In this regard, the International Space Station does provide hope for future international cooperation.

[1] L. Fraas, "Mirrors in Space for Low Cost Terrestrial Solar Electric Power at Night", 38th IEEE PVSC, (June 3-8 2012). [2] L. Fraas, A. Palisoc, B. Derbes, "Mirrors in Dawn Dusk Orbit for Low Cost Solar Electric Power in the Evening", AIAA ASM Technical Conference, January 10. 2013.