SPACE POWER SYMPOSIUM (C3)
Small and Very Small Advanced Space Power Systems (4)

Author: Dr. Lewis Fraas
United States

Dr. Geoffrey Landis
NASA Glenn Research Center, United States
Dr. Paul Jaffe
Naval Research Laboratory, United States
Dr. Art Palisoc
L'Garde, Inc., United States

SPACE SOLAR POWER, MIRROR DEVELOPMENT, & THE INTERNATIONAL SPACE STATION

Abstract

Lightweight mirrors have been proposed in geosynchronous orbit for the generation of Space Solar Power 24 hours per day [1]. Alternatively, lightweight space mirrors have been proposed in sun-synchronous polar orbits for illuminating terrestrial solar fields at dawn and dusk for additional terrestrial solar electric power in the early morning and evening hours [2]. In any case, the trade offs between lightweight, stiffness, and optical quality for low cost space mirrors need to be explored. These trade-offs can be explored by developing and demonstrating a lightweight mirror on the International Space Station. The astronauts on the ISS will see dawn and dusk 15 times per day. Herein, it is noted that a first step in a space mirror development road-map could be the construction of a 12 square meter space mirror to demonstrate full moon intensity illumination in Disney Parks in the evenings. The 400 km altitude of the ISS is an advantage in that a small 12 sq m mirror can produce full-moon intensity on a 4 km diameter spot on the ground provided that the mirror is flat to within 0.5 degrees, i.e. the sun disc size. There are multiple websites to allow one to locate the ISS in the evening [3] demonstrating that the ISS is visible for up to 6 minutes routinely in the evenings at any ground location between +/- 52 degrees latitude. How might one mount a mirror on the ISS? The ISS has potential external mounting locations [4]. As one possibility, a mirror could be attached at the bottom of a nadir pointing beam with the top end of the beam attached to the ISS ELC4 or ELC1 locations. An elevation and azimuth pointing mechanism could be located at the bottom of this beam and attached to the center body of the space mirror. While a space mirror concept for space solar power may be in the very distant future, in addition to providing a space mirror development opportunity, mounting a mirror on the ISS could also have a public relations benefit in that it will make the ISS and the NASA and ESA space development activities more visible for the public. Demonstrating a flat pointing moonbeam space mirror on the ISS would be a significant accomplishment. [1] J. Mankins, Case for Space Solar Power, , Amazon Digital Services, ASIN: B00HNZ0Z96 [2] L. Fraas, Low Cost Solar Electric Power Chapter 12, Springer (2014).