SPACE SYSTEMS SYMPOSIUM (D1)
Innovative and Visionary Space Systems Concepts (1)

Author: Mr. Rahul Suresh
India

Dr. Andrew Meulenberg
Universiti Sains Malaysia, Malaysia

A LEO-BASED SOLAR-SHADE SYSTEM TO MITIGATE GLOBAL WARMING

Abstract

The development of a Low-Earth-Orbit (LEO) based solar-shade/solar-power system, as part of a technically- and financially-viable multipurpose system (IAC-08-B2.5.2) to provide long-term solutions to global warming and the energy crisis, is discussed in this paper. The proposed solar-shade/power system would be enabled by the development of a previously-proposed less-expensive, environment-friendly, space-elevator system to lift masses into space (IAC-08-D4.1.5).

The initial phase would involve the deployment of solar shades (consisting of massive areas of thin sheets of possibly reflecting material) in LEO to block a small percentage of the incoming solar radiation. In order to truly understand the effect of deploying shades selectively with different orbital inclination, latitude versus temperature curves will have to be modeled as a function of orbit. Various factors including local insolation changes and the global effect of atmospheric/oceanic currents must be considered.

The solar shades, even during early deployment would provide benefits such as reduction of space-debris and depletion of the Van-Allen radiation belts. Ultimately some shades will be used as visible light reflectors for extending twilight. A portion of the solar shades would, over time, be converted into solar farms, which could, by 2100, become the primary energy-provider to the Earth. These solar-farms, consisting of many thousands of concentrator/sterling-engine/TWT/antenna modules, would tap energy from the sun, convert it to electrical energy, and store it (using electrodynamic tethers and conductive rings) for later use, or for use in space and beam it to the ground (through wireless microwave-power transmission).

An overview of the concepts underlying the above LEO systems and their economic/technological feasibility in comparison to other large-scale, space-based, geo-engineering systems are discussed in this paper. The effect of solar-shades on global temperature patterns is modeled and analyzed.