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UTILIZATION OF SPACE SOLAR POWER FOR THE MOON

Abstract

While Mars often receives the attention for future manned missions, many advocate establishing a base on the Moon prior to attempting manned interplanetary travel. One example is the European Space Agency's (ESA's) proposed Moon Village. While building an outpost poses a variety of challenges for engineers, one particular concern deals with power, as a steady, reliable source of power will be needed for life support systems, research equipment, rovers, etc. Given that the Moon is tidally locked with the Earth and experiences approximately 14 days of constant sunlight followed by 14 days of relative night, the issue is largely tied to making it through the extended night with ample energy. To date, proposals often deal with utilizing enough storage (batteries) to make it through the 14 days or having a small nuclear power plant to provide continuous power. While these are both potential options, the former faces issues with size, weight, and constant charging and discharging while the latter presents the issue of dealing with the radioactive waste produced in the process. A large solar power satellite (SPS) offers the opportunity to provide constant power, as the Sun offers a constant, green, and renewable source of energy. In order to achieve optimal exposure to sunlight, the proposed SPS would be placed at either of the stable Earth-Moon Lagrange points: L4 or L5. This location would also provide the SPS with a constant view of approximately half of the Moon and the selection between the two Lagrange points would be determined by the outpost's location. The SPS would have a similar design to several that have been proposed for Geostationary orbit (GEO), utilizing large reflectors to converge sunlight onto panels of photovoltaics. However, this SPS will take advantage of multiple modular laser wireless power transmitters aimed at a ground receiving station on the surface of the Moon. This provides an advantage over microwave transmission as the size of the transmitter and receiver will be significantly smaller. The use of laser transmission to the Moon will not encounter the same restrictions as it does for Earth and the receiver will be located a safe distance away from the outpost. Additionally, this SPS offers the ability to provide power to several different locations by repointing one of the transmitters should additional outposts be built.