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AN EVALUATION OF SOLAR ENERGY SYSTEMS FOR DEEP SPACE APPLICATIONS.

Abstract

Future space travel, from interplanetary exploration to interstellar missions, require next generation spacecraft designs with reliable, innovative and ideally sustainable energy systems. Since the 1950s, space agencies have actively investigated solar powered designs for both manned and unmanned spacecrafts.For example, the International Space Station (ISS) functional architecture utilised solar cells to directly convert solar radiation into electricity, successfully powering operations of the ISS for more than 20 years since the orbit launch. In the spacecraft design of the DART (Double Asteroid Redirection Test), the low-cost and low mass Roll Out Solar Array technology was selected to power its propulsion system. Juno, the planetary orbiter investigating Jupiter and the Jovian system, also utilises solar arrays and is currently the farthest spacecraft from the Sun to operate on solar power.The present study performs a review and comparative analysis of the current solar power technologies with focus on deep-space applications. The essential criteria for evaluation of these solar energy systems are reliability, performance, feasibility, cost, longevity and ease of maintenance. Finally, this paper forecasts the optimal application modes of the current solar energy systems, identifies the most promising technologies, makes recommendations and discusses the follow-up research work. This research project is part of the Andromeda research program of the Deep Space Initiative, a non profit space research organisation based in Colorado, USA.