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AN INTERACTIVE MODEL FOR SPACE MEGASTRUCTURE CONSTRUCTION

Abstract

We have created an interactive software model to explore the economic and technological conditions needed for the construction of space megastructures, including fuel depots, orbital habitats, space-based solar power satellites, and planetary sunshades. Incorporating logistics, space resource utilization, and in-space manufacturing and assembly, it allows the user to explore how cislunar megastructures might be built by scaling up present and near-future technology. The goal of this project is to assess the technological and economic feasibility of space megastructure construction and produce a roadmap for the most efficient technology development necessary for the construction of ambitious, transformational space structures.

The model is a time-driven state machine that virtually transforms various cislunar raw materials into useful resources and finished products, as well as modeling their transportation throughout cislunar space. With a simplified web-based interface, it provides a way for the public to interact with megastructure construction, but is also rooted in validated research and engineering and can be used for serious architectural analysis integrating time, space, technologies, and materials and analyzing the joint trades between them.

In this paper, we show the model's architecture and demonstrate its use. We also present preliminary results for time-, mass-, and cost-efficient construction of space megastructures. With further development, this model can be used to create a "digital twin" of space megastructure construction.