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Space Resources, the Enabler of the Earth-Moon Econosphere (5)

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REVISITING THE HIGH FRONTIER: HOW SPACE RESOURCES CAN HELP REVERSE GLOBAL WARMING

Abstract

In 1976, physicist Gerard O'Neill published The High Frontier, which outlined a technically feasible and economically sound plan to solve the greatest problems facing humanity at the time by opening the "high frontier" of space to human activity. In the 1970s, these concerns centered around the limited supply of resources on Earth. Against the backdrop of Malthusian fears of overpopulation, industrial pollution of Earth's environment, and the lingering effects of the energy crisis, O'Neill proposed the construction of space-based solar power satellites that would supply Earth with all the clean, cheap power it would ever require. Unfortunately, the era closed without O'Neill's vision coming to fruition. The reasons for this were financial; the Space Shuttle never achieved its cost goals, and new oil extraction technologies, such as fracking, reduced energy costs to below that with which space-based solar power could compete. The revolution in oil exploration caused a new problem on our finite planet: anthropogenic climate change. While there is no moral or practical substitute for reducing greenhouse gas emissions, we must also contemplate how to reduce the consequences of an already altered atmosphere. One way to minimize the catastrophic effects of global warming is through solar radiation management, which increases the amount of solar energy reflected back to space. This can be accomplished through atmospheric geoengineering, but the more sustainable, O'Neillian option is a planetary sunshade. A planetary sunshade is a large constellation of thin film structures that sit between the Earth and the Sun near Sun-Earth Lagrange Point 1. These structures reduce the solar constant to a variable; the exact level of reduction depends on how long it takes to cease carbon emissions, how quickly carbon can be removed from the atmosphere, and the level of cooling desired. While the initial generation of sunshades will likely be built on and launched from Earth, deploying an entire sunshade from Earth would take hundreds of thousands of rocket launches, spread over decades of sunshade deployment time. While terrestrially-produced shades are an expedient pathfinder architecture for the sunshade, it is likely that a more efficient, greener solution will be developed to complete a full deployment. This is where the use of space resources becomes crucial, and where the sunshade begins to fulfill O'Neill's vision of using space resources to solve Earth's problems. This paper will present initial findings of a space resources architecture to support sunshade construction.