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SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Strategies & Architectures as the Framework for Future Building Blocks in Space Exploration and Development (1)

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DEFINING A SUCCESSFUL SPACE COLONY

Abstract

Continued growth in world's GDP depends on continued access to affordable energy and technology development. Both are endangered by future shortages. The world currently depends on fossil fuels for 81Our technology development is endangered for the same problem, i.e. the rising cost of key rare earth elements in near future. Many of the critical metals required were deposited on the Earth's crust by meteor impacts after the crust cooled, so the supply is limited. These elements are primarily: gold, cobalt, iron, manganese, molybdenum, nickel, osmium, palladium, platinum, rhenium, rhodium, ruthenium,and tungsten. Logic says that at some time in the future, space resources will become competitive with ground-based resources as nonrenewable earth resources are depleted. The purpose of our study is to project how soon that might happen. To do that, we designed space transportation architectures specifically aimed at putting mining equipment on the lunar near-side and on selected near earth asteroids for the lowest Life Cycle Cost (LCC) possible. We then looked at candidate colony sites, specifically Low Earth Orbit, High-Earth Orbit (L5), Lunar Near-side, Mars, and Deep Space (at the asteroid mines), and analyzed how those mines and colonies could support one another synergistically and enhance profitability of the entire architectures. We fully expect some of the candidate mines and colonies to drop out for financial reasons. The planning horizon for this project is 25 years starting in about 2015, so the mines and colonies will be fully operational by 2040. The goals of this project are to trade major transportation elements to minimize both nonrecurring and recurring costs, and show that the full-up architecture can deliver critical metals to world manufacturers cheaper than the same metals produced from the depleted ores available on earth in 2040. The scenario we are using assumes that the hypothetical World Space Council has agreed to provide ownership of lunar holdings and individual asteroids and guaranteed loans to an industrial consortium to build and operate the transportation system, the colonies, and the mining operation.