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**An Architecture for Unmanned Self-Replicating Lunar Factories**

The goal of this proposal is to analyze the feasibility of a fully automated robotic factory system for the development of lunar resources, and the transportation of those resources to low-Earth orbit. The key issue that will determine the feasibility of this approach is whether or not an autonomous robotic factory can be devised such that it is small enough to be transported to the moon, yet complete in its ability to self-replicate with no other inputs than what is available on the lunar surface. Self-replication leads to exponential growth, and would allow as few as one initial factory to spawn lunar production of materials and energy on a massive scale. Such capacity would dramatically impact man's ability to explore and colonize space, as well as to deliver hydrogen and oxygen to fuel the fledgling industries that will develop in low-Earth orbit over the next few decades.

Our architecture for a self-replicating robotic factory system consists of four subsystems: 1) multifunctional robots for digging and transportation of material, and assembly of components during the replication process; 2) materials refining and casting facility; 3) solar energy conversion, storage and transmission; 4) Electromagnetic rail guns for long-distance transportation (e.g., for sending materials to low-Earth orbit, or transporting replicated factories to distal points on the moon).

Many technological hurdles must be overcome before self-replicating robots can become a reality, and current knowledge from many diverse disciplines must be recombined in new ways. In the proposed feasibility study we will examine what lunar resources can be exploited, and how each subsystem of a robotic factory (motors, electronic components, sensors, smelting vessels, molds, etc.) can be constructed from lunar materials, and will determine what minimal functionality each subsystem must possess.

By the end of Phase I, we will also demonstrate: 1) a computer-controlled physical prototype (i.e., a "self-replicating robot") which has the capability of assembling modular mechanical components to form an exact replica of itself and 2) devise simple circuits (i.e., "self-replicating electromechanical intelligence") with the ability to command mechanical systems to produce copies of circuits. These objectives have never been achieved by others, despite substantial theoretical interest in self-replicating systems over the past fifty years. Over the past two years, the PI's research group has established the infrastructure necessary to begin the proposed work. If the focused objectives of this Phase I proposal are successfully met, it will be followed by a Phase II proposal in which aspects of the broader architecture will be implemented as model subsystems.

