

## Large-Product General-Purpose Design and Manufacturing Using Nanscale Modules

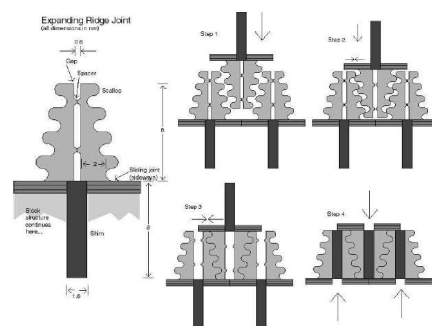
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Several major problems in space flight could be mitigated by improved manufacturing. Compact general-purpose manufacturing could allow fabrication of new equipment during long-duration missions, reducing risk and weight. Large-scale rapid prototyping could substantially aid the development of new designs. Several micro- and nanoscale general-purpose manufacturing systems have been proposed, but it is currently unclear how they would produce large products.

Molecular manufacturing, with vacuum mechanosynthesis one of several options, is a leading candidate for nanoscale manufacturing. Previous work by the PI has outlined a kg-scale manufacturing system integrating large numbers of nanoscale mechanosynthesis systems. Each system would fabricate a sub-micron cube with nanoscale features; cubes would then be combined to make larger cubes and ultimately a compressed product. That work only touched on product design issues, though it indicated the potential for extremely high performance in several areas.

A molecular manufacturing system may be expected to be compact, high-throughput, efficient, clean, cheap, and automated. If it could build flight hardware, it could serve as a substitute for spare or redundant components on long-duration missions, as well as supplying new products resulting from post-launch research. With product recycling, it could also be used to reconfigure spacecraft. It appears plausible that entire spacecraft could be built by the technology, allowing much faster, cheaper, and more aggressive design cycles and production.

I propose to investigate the design, fabrication, and performance of human-scale products constructed from aggregates of nanoscale functional units. The goal is to demonstrate that such units can be combined to form useful products, and that such products can be designed and constructed with approaches familiar to current engineering practice. Phase 1 would investigate issues such as large-scale structures, curved sliding interfaces, fractal networks, and automated construction of awkwardly shaped products.



<sup>16</sup> Phoenix, C. Design of a Primitive Nanofactory, J. Evol. and Technol. 13(October 2003); <http://www.jetpress.org/volume13/Nanofactory.htm>