

BUSINESS INNOVATION SYMPOSIUM (E6)
New Space and New Science (3)

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A SUSTAINABLE COMMERCIAL MICROGRAVITY PROGRAM TOWARDS SPACE
MANUFACTURING

Abstract

Research performed in the microgravity environment of space has furthered our understanding of fundamental physical, chemical and biological processes and generated a wealth of results in areas such as material science, combustion science, fluid physics, fundamental physics and life science/biotechnology. The microgravity environment of space provides a unique opportunity to further our understanding of various materials phenomena involving the molten, fluidic and gaseous states as well as life science applications where, contrary to earlier beliefs, microgravity induces changes in single cells or simple organisms not only in large, complex organisms with a complex overall response to gravity. There are three major categories in which the value of long-term exposure to the microgravity environment can be extracted: 1. New insights into systems behavior and response to variations in their environment and identifying new final states of systems. This knowledge is captured in LEO through a series of targeted experiments. A technology is then developed on ground that is able to mimic the newly observed state of the system that is superior to its Earth counterpart. This technology is then commercialized. 2. Processing/reprocessing in space of products manufactured on Earth. This approach seeks improvements in the ultimate properties and performance of the product by having it undergo a processing cycle in space. 3. Manufacturing in space. This is the process in which a product is built in the reduced gravity environment, usually from its compound elements. Examples in this arena are scarce – probably the best so far is the promising case of exotic optical fibers. 4. Technology Demonstrations – situations where a technology is developed for some specific purpose in space, but then turns out to be of value on the Earth. Taking any new knowledge through commercialization and to the market is an interesting journey and it has its own specifics and characteristics. Usually the Technology Readiness Level scale is employed where by definition the purpose is to mature a technology. Additionally, prospecting emerging markets is challenging especially being hard to predict in terms of their growth. This paper describes the concept of Economic Readiness Level (ERL): to advance an ERL, the technology itself may not necessarily need to mature but the understanding of its economic potential does. Building upon ERL, a model that ultimately leads to the creation of pathways for infusion of private capital and ultimately of a sustainable commercial microgravity LEO-Earth economy will be discussed.