

## Fabrication in Microgravity Using “Wet Processes”

M.N . Nabavi, Imperial College of London and Royal College of Art (36 Clissold Rd. Toronto, ON, Canada. M8Z 4T5. maryam.nabavi@network.rca.ac.uk)

This research explores the possibility of using “wet processes” to produce objects in microgravity that are impossible or extremely difficult to produce here on Earth. Taking weightlessness as an opportunity, and focusing on liquids as materials that are strongly affected by microgravity, computer simulations were executed to analyze the behavior of fluids and the way they interact with other objects (i.e. moulds, membranes, etc).

With increasing number of space travelers every year, there will be a higher demand for facilities and services that would accommodate the future travelers. This not only brings challenge for the private sector in facilitating them, but also creates a lot of opportunities for researchers, engineers, craftsmen and people in many other areas to question and examine their work in a new environment.

Benefiting from some of the physical properties of the liquids in microgravity such as surface tension and mixing properties,  $G^{\circ}$  pouring and blowing processes were tested using resins that solidify relatively quickly.

$G^{\circ}$  blow molding was suggested in order to produce lightweight structures in various scales. The result demonstrated potentials for production of porous volumes with some degree of randomization in the distribution of air pockets.

The outcome of this research resulted in generating methods to produce low-weight structures using blow-moulding, and so-

lidifying inflatables using fast cure epoxy resins and pouring processes over the surface of the membrane.

This research outlines a number of production techniques that would benefit from microgravity, discusses the feasibility of executing them in weightlessness and outlines the potential applications in future scenarios. Prospective utilization of the findings might vary from architecture to product scale. While the membrane rigidization could favor the production of large-scale structures for future settlers, the blowing process can be applied to fabrication of products and tools.

### References:

- [1] C.L.Stong (2003) Blowing Plastic Bubbles. Scientific American's: The Amateur Scientist
- [2] S.Jessen, E. Choi. (2004) Development Of A Space Manufacturing Facility for IN-SITU Fabrication of Large Structures. IAC.06-D3.2.
- [3] Z. Zhang (1998) New Product Development Using Experimental Design. University of Groningen Grauate School Research Institute System Organization



**Figure 1** Blowing inside a sphere of resin in microgravity. What could be the future's space souvenir?