

SPACE ACTIVITY AND SOCIETY (E5)

The Architecture of Space: New Frontiers of 21st Century Space Architecture and Entrepreneurship for a New Generation of Explorers. (3)

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GREENHOUSE DESIGN INTEGRATION CONCEPTS FOR EXTENDED SPACEFLIGHT

Abstract

It is demonstrated that plants can be grown in microgravity, and almost every past space station mission has included experimental greenhouses to investigate not only the technical and biological feasibility, but also possible psychological benefits of plant growing activities in space. In view of long-term space missions, such as a future mission to Mars, the need to grow plants as supplement to nutritional provision and oxygen production and to provide psychological and health care support of the crew will become a critical issue. Aside from serving as life science experiment, the benefits of onboard greenhouses are manifold. Fresh herbs and greens grown in the greenhouse can upgrade food on a continuous basis and thus not only offer nutritional benefit in form of provisions of vitamins and fiber, but also to increase the variety and composition of meal options on the menu. The restorative properties of plants – their change through growth, their addition to the interior color scheme and materials, and their dependency on human care in this context – can enhance an isolated and confined environment, in which previously popular past-times can no longer be carried out (i.e. window gazing, communication with ground). The tending to plants provides regular occupation and interaction of the crew with living material in a technologically mediated habitat. The integration of a greenhouse infrastructure into the life support system of the craft can support oxygen production and increase air quality. Finally, certain medicinal plants offer potential in supporting healing processes or prevention of ailments and can thus be incorporated into flight surgery. Following a review of greenhouses and plants grown on past missions and referencing conceptual greenhouse developments, the paper outlines the benefit of a space greenhouse design for extended missions and presents concepts for its integration. It highlights the nutritional, social and psychological benefits and presents the design of a space garden gently integrated into the interior of the spaceship.