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DESIGNING A MARTIAN GREENHOUSE AS A HABITABLE SPACE: FEASIBILITY STUDIES AND
DESIGN APPROACH**Abstract**

Current models of greenhouse design primarily focus on enabling a means for water recycling, air revitalization, and food production. However, the great potential of using interior landscaping for positive psychological effect on the crew has been neglected. An indoor garden impacts living conditions within a confined environment of surface habitats in active and passive ways. Actively, from the human factors perspective, it diversifies the crew's diet and adds the enjoyment of on-site gardening to routine activities. Passively, it brings colors, textures, and aromas into otherwise mundane interior environment. This research takes its objectives and major design requirements from NASA's Big Idea Challenge competition and begins by discussing a series of research investigations that collect systems and plants requirements, analyze them and synthesize the results into a greenhouse design. This research by design process starts with plant selection based on their nutritional values using recipes from different cultures. Next, environmental requirements are considered for a hydroponic planting system for selected plants such as temperature, pH and pollination methods. Afterward, sizes of mature plants are reviewed to generate structural measurements of plant beds. Since architectural elements and design principles are linear, planar and three-dimensional (3D), the integrated result is characterized into four categories: Plant Bracket, Plant Wall, Plant Trellis, and Plant Box. Finally, this paper concludes by proposing the criteria for feasibility studies pertaining to the construction of a greenhouse on Mars' surface at different stages of infrastructure development. Using a greenhouse as a habitable space that enhances the quality of life during a long-duration mission is also taken into considerations. Design factors for the evaluation of greenhouse module proposals (Figures of Merits) are presented and categorized by the level of their impact on overall mission planning and success.