35th IAA SYMPOSIUM ON SPACE AND SOCIETY (E5)
Interactive Presentations - 35th IAA SYMPOSIUM ON SPACE AND SOCIETY (IP)

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SUSTAINABLE LIFE BEYOND THE EARTH. HOW TO ENHANCE HABITAT COMFORT FOR SPACE TRAVELLERS.

Abstract

In the coming decades, the human presence in Space will expand from low Earth Orbit to the Lunar Orbit and its surface, as well as commercialized space stations and habitats will be built. This trend will require the rethinking of the Architecture and Design of habitats, their overall structure and internal layout. The associated challenges will involve how to customize and shape these internal spaces and ensure the well-being of astronauts on long-duration missions, as well as the comfort and efficiency of the use of private spaces for the commercial/space travellers who may undertake the off-Earth exploration.

In this context, the role of Space Architecture is fundamental, which as we know, is the theory and practice that focuses to integrate the disciplines and their relevant activities for designing and building human environments and habitation in Outer Space. The aspects of habitability and human factors thus require a deeper attention and investigation for the well-being and living/working conditions for the end-users. Moreover, the versatile approach to Human System Integration (as referred to NASA standard), has been evolved according and based on the global heritage of applied methodologies, design processes, requirements and specifications developed throughout various space missions, as well as the progress of frontier technological development that led to improved analyses and related necessary experimentations, simulations, etc.

Hereby, this paper describes the innovative solutions in the design of space habitats and, thus, Space Architecture and Habitability, which are aiming to improve the psychophysical well-being of astronauts/space travellers, and their activity efficiency during the missions in space. In particular, this multidisciplinary approach integrates the expertise in advanced architectural design, applied frontier tech-

nologies, environmental psychology and aerospace engineering. This synergy aims to go beyond the mere 'functionality' of a space habitat and improves the overall experience of multiple users.

The adoption and implementation of this interdisciplinary approach in the design of space habitats, in the context of Space Economy and related to its applications, aims to integrate the multifaceted concept of Made in Italy with its manufacturing excellency and expressions of outstanding lifestyle for the users' wellbeing. The project includes the novel approach of sustainability enhancing the tangible and intangible aspects of circularity.

As an expected outcome, this paper will demonstrate design proposals that deal with the psychophysical challenges and the optimal use of spaces, linked to Life in Space, outlining an innovative path for the future exploration of Space.