Paper ID: 70617
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20th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Technologies (2B)

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SUPER PRESSURE BALLOON DEPLOYABLE STRUCTURE FOR THE MOON

Abstract

This paper studies the specifications of a deployable Moon habitat with a background on scientific balloons for the exploration of bodies with different atmospheric conditions. This construction is intended to design and simulate a future station to live and work as if they were on the moon. To achieve an airtight space Super Pressure Balloons were consider because of their high resistant to internal pressure, SPB are a potential candidate because of its lobed shape. This design analysis considers the optimized Lobed pumpkin with lobed cylinder shape for the FEM simulation. First, the development of a simulation tool is described, which was used for analyzing the stress behavior of the membrane for a Moon Habitat and for the exploration and survival of human crews on extreme environment unexplored areas mission, Next, the with the results we use an multi objective simulation software for selecting the shape by comparing its FEM output with the data Based on the simulation results, recommendations are given to choose the shape that can handle most pressure and is less stress. The multi-objective search is performed in the frame of the Pareto theory of non-domination, implemented in the NSGA-II algorithm. The research focuses on the way a designer can interact with the search computational procedure, driving it towards the desired solution. Diversely from pure optimization techniques, search strategies as Multi Objective search produce sets of feasible solutions, that the designer can know, evaluate, and use in is work, accordingly with other architectural requirements and purposes. These contributions can help future space habitats by using different balloon types and shapes for operation on the moon.