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ARCHITECTURAL AND PSYCHOLOGICAL ASPECTS IN OPTIMIZED RADIATION SHIELDING DESIGN FOR SPACE APPLICATIONS

Abstract

NewSpace bears all the hallmarks of past revolutions in technology. Since we have other examples of exponential growth of specific technologies, we should maximize the economic and engineering potential of this movement by expanding the envelopes for long term crewed habitats in deep space. We should also take an approach that minimizes waste in both design and fabrication as these bases expand. This paper provides a systematic approach to habitats optimized for volume, radiation protection, crew psychology, reusability, affordability, crowd-sourced subsystem design, and expansion. These habitats and systems are designed to be as "future proof" as possible to allow rapid and safe technological advancement within the structures.

One of major "showstoppers" of human space exploration is cosmic and solar events radiation. It is a serious problem that may cause cancer and other types of tissue damage and equipment malfunction. It has to be addressed in space vehicles design especially for long-term space exploration missions and future Moon or Mars surface settlements. This paper discusses a unique layered system incorporated into a habitat structure, which may help to reduce the radiation hazard to the crew and interior equipment and systems. The paper also argues that a successful mitigation of radiation impact on human health should be based on a multidisciplinary methodology that also includes psychophysiological approach to the problem. Multiple techniques and practices to minimize psychological stress that may suppress immune system and reduce resistance to cancer, are presented and compared.

Conclusions are drawn upon results of those comparisons and a multidisciplinary design concept is proposed to be applied both in long-duration human space exploration missions and in radioactive environment on Earth.