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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RADIATION SHIELDING DESIGN MODEL DEVELOPMENT

Abstract

Methods for optimal reconfiguration of spacecraft equipment and optimal augmentation of the mass shielding to reduce the radiation levels to acceptable levels are now being developed. Computational models of spacecraft modules and equipment are being developed in conjunction with computational procedures that model the near and deep space radiation environments, to be used with both parametric and organizational optimization procedures. Current analyses are focusing on the crew quarters where the astronauts sleep and the exterior of the station where the astronauts will receive protection from the surrounding modules and their spacesuits, in LEO, Lunar, Mars and Jupiter scenarios. The models developed allow for reconfiguration, to accurately reflect various and subsequent spacecraft and modules assembly configurations. Currently, users may also interactively change the location and the shape of equipment racks within modules and immediately evaluate the impact of the changes on the internal radiation environment. These tools have been designed to exploit numerical optimization procedures capable of analytically determining configurations that will result in the lowest crew radiation exposures. Additionally, software is being developed which will analytically fit optimally sized panels of lightweight shielding materials to areas like crew quarters in order to augment the shielding provided by the surrounding structure and equipment. These tools will allow the mass of the shield augmentation to be minimized while reducing predicted crew exposures to required levels. The optimization process has been integrated into the NASA Langley Research Center's Immersive Design and Simulation Laboratory and will rely on High Performance Computing and Communication (HPCC) for rapid evaluation of shield parameters and their gradients. A review of the techniques is given.