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"An Earthling to an Astronaut: Medical Challenges"

Humans can travel safely into space in low Earth orbit (LEO) or to near-Earth objects if several medical, physiological, environmental, and human factors issues risks are mitigated. Research must be performed in order to set standards in these four areas, and current NASA standards are contained in the Space Flight Human System Standards volumes 1 and 2, and crew medical certification standards. These three sets of standards drive all of the clinical, biomedical research and environmental technology development for the NASA human space flight program. These standards also drive the identification of specific risks to crew health and safety, and we currently manage 65 human system risks within the human space flight program.

Each risk has a specific program of research, technology development, and development of operational procedures to mitigate the risks. Some of the more important risks tat will be discussed in this talk include exposure to radiation, behavioral health due to confinement in a closed cabin, physiological changes such as loss of bone, muscle and exercise capability, reduction in immune system capability, environmental threats of maintaining an adequate atmosphere and water for drinking, avoidance of toxic or infectious material, protection of hearing, and human factors issues of equipment and task design. A nutritious and varied food supply must also be provided. All of these risks will be discussed and current strategies for mitigating these risks for long-duration human space flight.

In mitigating these 65 human system risks, novel approaches to problem solving must be employed to find the most appropriate research and technology based applications. Some risk mitigations are developed internally to NASA while others are found through research grants, technology procurements, and more recently open innovation techniques to seek solutions from the global technical community. Examples and results will be presented from all of these approaches including the more recent use of prizes to stimulate innovation.