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NASA's Approach to Critical Risks for Extended Human Space Flight

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Abstract

Humans are exposed to a great variety of hazards in the space environment. These include the effects of weightlessness, radiation, isolation and confinement, altered day-night cycles, and others. These inherent hazards have both physiological and behavioral consequences. The adaptive capabilities of humans in these situations is remarkable, and often exceed our expectations. However, the demanding environment and challenging operational pace can push some of these adaptive processes to their limits.

The NASA Human Research Program (HRP) is tasked with mitigating the most serious of these effects on human health, safety, and performance, in long-duration space flight. This can involve the development and deployment of physiological countermeasures, better understanding of the physiological alterations and avoidance of exacerbating situations, inputs to the design of future spacecraft to minimize risks, and in some cases the awareness that some level of risk might have to be accepted based on the resulting consequences and their likelihood.

HRP has identified a few areas that are of special concern due to their severity, lack of understanding of underlying causes, or potential for negative impact on health or performance. Some of these areas are visual impairment possibly due to increased intracranial pressure, behavioral and performance problems due to sleep deficits and isolation, and acute and chronic effects of radiation. These problems can, if not addressed, be expected to increase on longer and more distant missions.

The evidence from spaceflight, laboratory, and analog studies that supports the selection of the most critical risks will be discussed. Current and planned research programs that address these risks, and their anticipated outcomes, will also be described.

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