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SPACE WEATHER MITIGATION: A MULTIDISCIPLINARY PROPOSAL FOR ENHANCED ASTRONAUT RADIATION PROTECTION

Abstract

Introduction: Space weather, propelled by solar activity, presents substantial health hazards to astronauts venturing beyond Earth's protective magnetosphere. While current radiation monitoring on the International Space Station (ISS) employs environmental detectors and individual dosimetry, it lacks real-time personalized response capabilities. This study aims to bridge this gap by proposing an integrated pathway from radiation detection to risk stratification and subsequent implementation of appropriate countermeasures. A multidisciplinary working group at the SGAC ESGW 2023 workshop aimed to bridge the gap with a novel, integrated pathway to link real-time radiation level assessment to risk stratification and proactive autonomous astronaut response with a 'track and trigger early warning system'.

Methods: Radiation assessment on the ISS currently involves both environmental monitoring and individual astronaut dosimetry. This multi-layered approach offers both real-time feedback and long-term analysis crucial for safeguarding astronaut health and mission safety. The study investigates the feasibility of a multidisciplinary approach to develop an effective early warning system for astronaut radiation exposure, mitigating adverse health impacts, and enhancing mission success. Potential countermeasures for monitoring astronaut radiation exposure and subsequent management pathways were developed by an interdisciplinary working group during an iterative workshop.

Results: The working group identified three core components for monitoring and reacting to space weather events: radiation level assessment, risk stratification, and proactive response. Radiation level assessment encompasses a multi-faceted approach, including real-time hazard assessment through a Traffic Light Warning System, personalized dose management via Personalized Exposure Cards, and predictive

and proactive response facilitated by the Track and Trigger System. This integrated approach offers real-time awareness, personalized dose management, and predictive response, providing a comprehensive pathway for navigating and mitigating the risks posed by space weather events.

Discussion and Conclusion: These proposed methods offer potential benefits in providing intuitive danger assessments, promoting individual accountability, and enabling proactive and optimized responses. Future research should focus on refining and validating these systems through simulations, user feedback, and data analysis. Collaboration across diverse disciplines is crucial for optimizing system accuracy, usability, and astronaut well-being, thereby enhancing astronaut safety in the face of expanding space exploration endeavours.