

IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Radiation Fields, Effects and Risks in Human Space Missions (5)

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ASTRORAD RADIATION PROTECTIVE EQUIPMENT EVALUATIONS ON ORION AND ISS

Abstract

The Comfort and Human factors AstroRad Radiation Garment Evaluation (CHARGE) is scheduled to begin on-board the International Space Station (ISS) this summer. The Center for the Advancement of Science in Space (CASIS) aids ISS integration. AstroRad is radiation personal protective equipment for astronauts beyond low Earth orbit. StemRad and Lockheed Martin developed this equipment to protect crew from unpredictable solar particle events (SPE) with intense radiation dose rates. For CHARGE, crew will wear an AstroRad on ISS for variable durations while doing nominal tasks. They will assess ease of donning the equipment, ergonomics, freedom of motion, comfort and general user experience. Another task that will be explored is showing compact vest stowage during launch and when not in use. Crew will use the iQA iPad application (used on ISS in recent studies) to record feedback. The application offers an easy crew interface to answer standard surveys as well as provides the ability to attach photos and videos. AstroRad uses passive shielding in an efficient manner. The vest maximizes the solid angle of coverage with a proprietary selective shielding strategy. The design optimizes protection factors for specific radiosensitive organs, tissues and stem cell concentrations. This feature has the potential of reducing the probability of radiation exposure induced death in thinly-shielded spacecraft as well as diminishing long-term, adverse health effects. Selective tissue protection is achieved through variable thickness shielding, augmenting self-shielding of human body. AstroRad is also scheduled for experimental radiation testing with the Matroshka AstroRad Radiation Experiment (MARE) on Orion Exploration Mission-1. NASA, the Israel Space Agency (ISA) and the German Aerospace Center (DLR) will take measurements and perform analysis on MARE. MARE will characterize the radiation environment beyond low Earth orbit in the Orion module. MARE will also quantify AstroRad protection factors for both Galactic Cosmic Radiation (GCR) and Van Allen Belt transit – serving as an analog for an intense SPE. Since crew radiation exposure should be As Low As Reasonably Achievable (ALARA) – a guiding principle in radiation protection, the AstroRad must provide crew protection and not impede crew activities. Preliminary CHARGE results will be presented at IAC 2019. AstroRad designers will apply human factors evaluation feedback to improve garment ergonomics and function. CHARGE complements MARE, and designers need data from both tests to define operational use-cases.