

## IMPROVEMENTS TO THE IONIZING RADIATION RISK ASSESSMENT PROGRAM FOR NASA ASTRONAUTS

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To perform dosimetry and risk assessment, NASA collects astronaut ionizing radiation exposure data from space flight, medical imaging and therapy, aviation training activities and prior occupational exposure histories. Career risk of exposure induced death (REID) from radiation is limited to 3 percent at a 95 percent confidence level. The Radiation Health Office at Johnson Space Center (JSC) is implementing a program to integrate the gathering, storage, analysis and reporting of astronaut ionizing radiation dose and risk data and records. This work has several motivations, including more efficient analyses and greater flexibility in testing and adopting new methods for evaluating risks. The foundation for these improvements is a set of software tools called the Astronaut Radiation Exposure Analysis System (AREAS). AREAS is a series of MATLAB<sup>®</sup>-based dose and risk analysis modules that interface with an enterprise level SQL Server database by means of a secure web service. It communicates with other JSC medical and space weather databases to maintain data integrity and consistency across systems. AREAS is part of a larger NASA Space Medicine effort, the Mission Medical Integration Strategy, with the goal of collecting accurate, high-quality and detailed astronaut health data, and then securely, timely and reliably presenting it to medical support personnel.

The modular approach to the AREAS design accommodates past, current, and future sources of data from active and passive detectors, space radiation transport algorithms, computational phantoms and cancer risk models. Revisions of the cancer risk model, new radiation detection equipment and improved anthropomorphic computational phantoms can be incorporated. Notable hardware updates include the Radiation Environment Monitor (which uses Medipix technology to report real-time, on-board dosimetry measurements), an updated Tissue-Equivalent Proportional Counter, and the Southwest Research Institute Radiation Assessment Detector. Also, the University of Florida hybrid phantoms, which are flexible in morphometry and positioning, are being explored as alternatives to the current NASA computational phantoms.