

## NASA HUMAN SYSTEM RISK ASSESSMENT PROCESS

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NASA utilizes an evidence based system to perform risk assessments for the human system for spaceflight missions. The center of this process is the multi-disciplinary Human System Risk Board (HSRB). The HSRB is chartered from the Chief Health and Medical Officer (OCHMO) at NASA Headquarters. The HSRB reviews all human system risks via an established comprehensive risk and configuration management plan based on a project management approach. The HSRB facilitates the integration of human research (terrestrial and spaceflight), medical operations, occupational surveillance, systems engineering and many other disciplines in a comprehensive review of human system risks.

The HSRB considers all factors that influence human risk. These factors include pre-mission considerations such as screening criteria, training, age, sex, and physiological condition. In mission factors such as available countermeasures, mission duration and location and post mission factors such as time to return to baseline (reconditioning), post mission health screening, and available treatments. All of the factors influence the total risk assessment for each human risk.

The HSRB performed a comprehensive review of all potential inflight medical conditions and events and over the course of several reviews consolidated the number of human system risks to 30, where the greatest emphasis is placed for investing program dollars for risk mitigation. The HSRB considers all available evidence from human research and, medical operations and occupational surveillance in assessing the risks for appropriate mitigation and future work. All applicable DRMs (low earth orbit for 6 and 12 months, deep space for 30 days and 1 year, a lunar mission for 1 year, and a planetary mission for 3 years) are considered as human system risks are modified by the hazards associated with space flight such as microgravity, exposure to radiation, distance from the earth, isolation and a closed environment. Each risk has a summary two-page assessment representing the state of knowledge/evidence of that risk, available risk mitigations, traceability to the Space Flight Human System Standards (SFHSS) and program requirements, and future work required. These data then can drive coordinated budgets across the Human Research Program, the International Space Station, Crew Health and Safety and Advanced Exploration System budgets to provide the most economical and timely mitigations.

The risk assessments were completed for the 6 DRMs and serve as the baseline for which subsequent research and technology development and crew health care portfolios can be assessed. The HSRB reviews each risk at least annually or when new evidence/information is available that adds to the body of evidence. The current status of each risk can be reported to program management for operations, budget reviews and general oversight of the human system risk management program.