

2023 ARTEMIS CREW HEALTH AND PERFORMANCE SYSTEM MODEL DEVELOPMENT

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ABSTRACT

While the NASA Human Research Program (HRP) utilizes a Crew Health and Performance (CHP) System to represent all the Agency's efforts to ensure the health and performance of NASA astronauts, there is no shared mental model of a CHP system at NASA. Some groups may consider a CHP system to be only a medical kit, while others may not be using the concept at all. To facilitate the integration of functions and capabilities to ensure astronaut health and performance during vehicle development, HRP has proposed a CHP Shared Mental Model derived from the NASA Human Health, Medical, and Performance Spaceflight Standards (NASA-STD-3001 Vol.1/Vol.2). [1]

Even though many vehicle, ground, and communication systems as well as mission operations are modeled for the Artemis Campaigns, no mission level CHP system model was created to achieve the intent of the HRP CHP Shared Mental Model. The lack of this model renders it difficult to visualize and understand how the many programs work together to provide the necessary cross program functions and capabilities to ensure the health and performance of the crew throughout an Artemis mission. For this purpose, the Exploration Medical Capability (ExMC) element of HRP developed a CHP system model for the Artemis III and IV missions to provide a view of how each program contributes to and interacts with the overall CHP system.

To develop the 2023 Artemis CHP system model, ExMC leveraged existing data and models from the Moon to Mars Program Office, the Office of the Chief Health and Medical Officer (OCHMO) and the Orion, Gateway, Extravehicular Activity and Human Surface Mobility (EHP) and Human Landing System (HLS) programs. By using a Model-Based Systems Engineering (MBSE) approach, existing requirements, functions, and concepts of operations were combined to create a single system model focused on representing CHP from the launch to the return to Earth segments of the Artemis III and IV missions. Additionally, by incorporating the HRP Systems Platform for Aggregating and Relating Capabilities, or SPARC tool, the data from the programs was also related back to the 2nd volume of the NASA Human Health, Medical, and Performance Spaceflight Standard (NASA-STD-3001, Vol.2) and the human system risks identified by the Human System Risk Board (HSRB).

The first version of the 2023 Artemis CHP system model was baselined in Fall of 2023 after the model was demonstrated to be a potentially useful tool for systems engineers integrating CHP capabilities in vehicle development as well as members of the Health and Medical Technical Authority providing oversight of those programs. The model may also be useful to any stakeholder of astronaut health and performance by providing insights on how an Artemis mission satisfies the NASA Human Health, Medical, and Performance Spaceflight Standards as well as how they mitigate the HSRB Human System Risks. This presentation highlights how the model was developed and the possible benefits of the model.

[1] NASA HRP (2022), Crew Health and Performance System Whitepaper