SPACE SYSTEMS SYMPOSIUM (D1)
Space Systems Engineering - Methods, Processes and Tools (2) (4B)

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USING A MODEL-BASED SYSTEMS ENGINEERING APPROACH FOR EXPLORATION MEDICAL SYSTEM DEVELOPMENT

Abstract

NASA's Human Research Program's Exploration Medical Capabilities (ExMC) element is defining the medical system needs for exploration class missions. ExMC's Systems Engineering (SE) team will play a critical role in successful design and implementation of the medical system into exploration vehicles. The team's mission is to "Define, develop, validate, and manage the technical system design needed to implement exploration medical capabilities for Mars and test the design in a progression of proving grounds." Development of the medical system is being conducted in parallel with exploration mission architecture and vehicle design development. Successful implementation of the medical system in this environment will require a robust systems engineering approach to enable technical communication across communities to create a common mental model of the emergent engineering and medical systems. Model-Based Systems Engineering (MBSE) improves shared understanding of system needs and constraints between stakeholders, offers a common language for analysis, and helps to facilitate identification of risk. The ExMC SE team is using MBSE techniques to define operational needs, decompose requirements and design, realize products and validated solutions, and deliver medical capabilities to support human exploration. System Modeling Language (SysML) is the specific language the SE team is applying, within an MBSE approach, to model the medical system functional needs, requirements, and architecture. Modeling methods are being developed through the practice of MBSE within the team, and tools are being selected to support meta-data exchange as integration points to other system models are identified. A series of stepping-stone testbeds aboard ISS, Cis-lunar missions, and flights beyond low-Earth orbit will be utilized for maturation of medical system products based on the development work currently underway. Use of MBSE is supporting the development of relationships across disciplines and NASA Centers to build trust and enable teamwork, enhance visibility of team goals, foster a culture of unbiased learning and serving, and be responsive to customer needs. The MBSE approach to medical system design offers a paradigm shift in program integration that will optimize vehicle and medical system design and directly supports the transition of Earth-reliant ISS operations to the Earth-independent operations envisioned for Mars.