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A DIGITAL ENGINEERING APPROACH TO ASSESSING THE MOON TO MARS ARCHITECTURE

Abstract

NASA's Moon to Mars Architecture is complex and constantly evolving. It must be robust to accommodate new discoveries, evolving technology, and new partnerships, while also ensuring the achievement of the Agency Moon to Mars goals and objectives released in September 2022. This requires the oversight of an enormous amount of data across a wide and diverse range of efforts that are often closely linked together.

NASA's Moon to Mars Architecture and associated elements have historically been defined and reviewed through a variety of configuration managed documents. Each document is managed by a specific team within NASA and contains a large amount of interrelated data. In addition, data from one document is likely related to data from other documents managed by separate teams. This document-centric approach to managing an architecture risks providing an unclear flow of information, often fails to fully justify why certain systems are necessary, and makes it difficult to perform gap analysis. To ensure NASA's Moon to Mars Architecture remains robust and has a clear flow of data, NASA has developed a digital solution that uses MBSE linked with other tools to enable successful systems engineering. This approach brings all the disparate architecture information together into one place by linking and analyzing for gaps, redundancies, and discrepancies.

NASA's Digital Engineering approach consists of four main tools that provide unique capabilities and link together to form a digital thread: MagicDraw for Model Based Systems Engineering and architecture management, Cameo Collaborator for stakeholder review, Requirements for Human Exploration and Operations (RHEO) for requirements management and Change Management Workflow (CMW) for configuration management. These tools were selected based on their version control capabilities, user permissions, exportability, traceability, ability to connect with other tools, visual products, compliance with NASA's cybersecurity requirements, etc. With this tool framework, data from each disparate document source including goals, objectives, requirements, use cases, functions, operational activities, systems, and more was ingested into these tools. A metamodel was developed to establish a common language and ontology, providing guidance and structure to the modeling effort. Finally, using this metamodel, the data was traced together and manipulated to develop quick visual outputs for decision makers.

This paper will provide an overview of NASA's Digital Engineering approach to linking together disparate data from multiple different sources and how it can be used to assess an architecture.