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DEFINING AN ARCHITECTURAL FRAMEWORK TO GUIDE ROBOTIC SPACE MISSION DESIGN
AND DEVELOPMENT AT NASA GODDARD SPACEFLIGHT CENTER

Abstract

Modern Systems Engineering activities for robotic science missions face increased complexity due to (1) evolving measurement requirements, (2) increased collaboration amongst stakeholders and (3) increased collaboration between human and robotic systems. While NASA has employed standard process frameworks for project management and systems engineering for years, it has not yet established an architecture framework (AF) by which its mission systems are defined. The current effort identifies an approach to establishing the Goddard Space Mission Architecture Framework (GSMAF), an AF with roots in ISO 42010 (Systems and Software Engineering-Architecture Description), ISO 15288 (Systems and Software Engineering), NASA Procedural Requirements (NPR) 7120.5 (NASA Space Flight Program and Project Management Requirements) and 7123 (NASA Systems Engineering Processes and Requirements). The heart of the AF lies in its work products, artifacts that each represent a set of information from the viewpoint of a particular stakeholder.

This effort articulates the needs, goals and objectives that the GSMAF addresses, as well as the approach to creating the framework and establishing the various work products. A full set of work products, sufficient to satisfy the Mission System reporting requirements of NPR 7120/7123 at Key Decision Point (KDP) A is identified in this paper. As representative examples, several of the work products are described in depth to illustrate how the work products satisfy both a stakeholder concern within the context of a viewpoint, as well as the specific KDP entrance criteria.

This paper will also present a cursory analysis of how the GSMAF could be used to develop a Model Based Systems Engineering (MBSE) approach for the Goddard Space Flight Center. While this, and any, architecture framework are not necessary components of MBSE, the value of a specified AF greatly enhances an organization's ability to define systems consistently and aid in communication across project and organizational boundaries.