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Achieving MBSE Benefits amid Multiple Government Program Office System-of-System Challenges

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Abstract
Robust interface requirements are required for successful integration and test at the System of Systems (SoS) level. Existing interfaces were either undefined or archived within varied program management configuration methodologies. Although systems were both purpose built and "come as you are," the taxonomy across each stakeholder was unaligned. There were no overarching process or product expectations for modeling mission packages. Modeling end-to-end mission threads as well as the mission system end-points allows a more robust understanding of system context helping define previously misunderstood information flows and identifying undocumented interaction points. Uniting a complete development of interface requirements involving all stakeholders with previously undefined instantiations empowers future development and validation, identifies risk and provided a shared paradigm for mitigations.

The MBSE approach provides a common structure and multiple-level traceability of these interface requirements to Mission System Requirements and Technical Performance Measures (TPMs), subsystem requirements, and CI requirements, providing a solid foundation for change analysis. With some additional development, the structure of the model can be used to manage Engineering Change Proposals (ECPs) tracking change responsibility in a multiple Program Acquisition Resource Manager (PARM) environment, determining the impact that a recommended TPM improvement will have on a mission systems, the impact that a mission system change will have on a TPM, and technology insertion change to better manage an incremental acquisition strategy

In August of 2012, PMS 420 piloted the use of a Model Based Systems Engineering (MBSE) approach at the SoS level to define the Remote Minehunting (RMH) Mission Module architecture and associated interface requirements with end-to-end (multiple PARM) data concordance as well as with PARM-centric views. The "LCS Interface Model" was developed to provide an integrated system model, requirements model, and operational model to manage the SoS Systems Engineering (SE) baseline data for the system definitions, interface requirements, and tactical operations respectively. The model, based on the recently approved Systems Modeling Language (SysML) 1.3 standard, provides (1) support for associating interface requirements to the interfaces (vs. the interface end-points), (2) a means to synchronize the interface requirements hierarchy with the system/interface decomposition, (3) a means to

correlate CONOPS/Operational activities with interface performance requirements and (4) the ability to auto-generate standard interface specifications without the need for any tech writing/publication labor.

The LCS interface model and use of MBSE techniques resulted in efficient and complete documentation of MM interface requirements and also the early discovery of tactical risks and issues within various mission threads when correction is cheapest. The SoS-level MBSE process and technique coordinates change management, improves LCS-wide organizational efficiency, and automates multiple-PARM/OEM data sharing. As a result, SoS level MBSE streamlines MM development and integration to ensure the Initial Operational Test and Evaluation (IOT&E) schedule, cost, and technical performance of the LCS mission packages are more predictable.

Author Biography

Mr. Tyreman has 31 years of experience in the systems architecture, engineering, integration and at sea testing of large complex Navy combat systems. Experience includes 2009 Model Based Systems Engineering (MBSE) prototype for the Submarine Warfare Federated Tactical Systems (SWFTS) program with successful production deployment of the submarine model in 2012, and transition for use on the Remote Minehunting (RMH) Mission Module via the RMS LCS-Integration program.