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THE APPLICATION OF MODEL BASED SYSTEMS ENGINEERING (MBSE) FOR KNOWLEDGE MANAGEMENT OF FUTURE OPERATIONAL SPACE SYSTEMS AND ORGANIZATIONS

Abstract

Model Based Systems Engineering (MBSE) is an organizational culture, mindset, and a practical implementation of knowledge across a multidisciplinary team for an objective system through model development. This technique is the capture, management, and transfer of the knowledge base within an organization applying lessons learned from previous experiences. Thus, value is added to ongoing and future efforts within the organization. The MBSE approach may provide an alternative for creating new design solutions, Validation & Verification (V&V) activities, managing collaborative programs, and creating sustainable value across generational knowledge barriers for traditional long term space programs. Therefore, it may increase the validity of the rapid space development. The direct application of lessons learned can reduce the development phase resource consumption while enhancing the operational phase of the product life cycle. Additionally, the correct application of MBSE tools and processes in the early development phases onto new space concepts can provide the facilitating function of documenting the mission requirements, and direct flow down of the requirements, within the space vehicle required for success. The application of MBSE in developmental space vehicles can potentially reduce the quantity of space vehicle failure modes by reducing the number of program unknown risks. Subsequently, "11th hour" systemic deficiency discoveries that plague traditional Systems Engineering (SE) will decrease. Traditional SE contends with program unknowns by implementing margins at various phases of the product life cycle. These SE implemented margins ultimately can lead to system driving constraints limiting the functionality and performance of on-orbit small spacecraft. Thus, the issue of limited launch resources for small space is exacerbated. The author is investigating the real-world implementation of a MBSE culture complete with processes and practical implementation for space organizations. The investigation will be bounded but will thoroughly seek clarification on implementation strategies including impacts of the application of lessons learned, program risk impacts, product life cycle schedule compression, team communication architecture, and team efficiency improvements from reduced misinformation and consensus impacts. Additional efforts focus on the range of project size applicability, MBSE tool selection criteria, and transition costs for a mid-size company. The desired MBSE implementation approach should complement a shorter system life cycle and enhance the space community through the collaborative inclusive data rich model environment. MBSE is the future, as specified by the International Council of Systems Engineering (INCOSE), and strategic adaptation of MBSE for the space industry could result in quantifiable dividends for stakeholders and practitioners alike.