Paper ID: 49312
student

IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
Interactive Presentations - IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM (IP)

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FROM SPACEFLIGHT HARDWARE TO UNIVERSITY STUDENT DESIGNS: HOW IMPLEMENTATION OF NASA METHODOLOGIES AND PROCESSES ENSURE PROJECT SUCCESS IRRESPECTIVE OF SCALE

Abstract

The United States (US) National Aeronautics and Space Administration (NASA) first developed the NASA Systems Engineering (SE) Handbook in 1995, with two revisions ensuing. The Handbook has been a standard used in the design and development of major aerospace systems, and has enabled government and industry to ensure the realization of high quality, durable, and reliable systems. From various spaceflight systems to university student research projects, the tools, methods, and processes identified in the Handbook have proven to be effective regardless of project scale. The present paper will describe how the NASA SE Handbook can be successfully utilized in the design and development of small-scale university projects, while also enabling engineering students to become acclimated to the methodologies employed by major aerospace engineering entities. NASA's SE Handbook defines a design process, beginning with the initiation of requirements to final product delivery and beyond, formally known as NASA's Systems Engineering Engine. The SE Engine divides the design-to-product journey into three major processes–system design, product realization, and technical management. These three overall processes were implemented by a team of Mechanical and Aerospace Engineering (MAE) students in the design and development of a tabletop wind tunnel for Science, Technology, Engineering, and Mathematics (STEM) outreach through the University of Alabama in Huntsville (UAH). The present paper will correlate specific SE Engine processes to project success, as established by the UAH student design team. Additionally, issues and solutions will be identified, as well as lessons learned, in order to convey this knowledge to future design teams. Beginning with the requirements definition process, to functional decomposition, technical solution definition, design realization, evaluation, product transition, and the numerous technical management processes used throughout the year-long UAH design effort, the present paper will provide a guideline for small-scale project success.Additionally, it will be shown that engineering students benefit from use of the established practices detailed in the NASA SE Handbook, as it enables accelerated readiness and understanding of engineering practices prior to entering the workforce. Specific metrics assessing the learning impact on UAH CDC students will be presented.