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Set-Based Design in Requirements Development

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Abstract

Set-Based Design (SBD) is increasingly being used in product development. The U.S. Navy for example, employed SBD during the preliminary design of the Ship-to-Shore Connector. Considerable research has been conducted in SBD for product development as well. However, SBD has not traditionally been employed prior to product development during the requirements development process. This presentation presents an approach to using SBD principles during concept exploration where the product is a set of requirements and associated costs for acquiring an end item, and not specifically the end-item itself. Variations of this approach have been used since 2013 in USMC and USN concept exploration studies. In a traditional concept exploration, a few “point designs” are created, iterated, and compared to develop a limited understanding of the trade space; solutions are chosen and modified until they “work.” In a traditional concept exploration, each point design is interpreted to be representative of the solution space for a set of capabilities called a capability concept. The cost and risks of the point design are linked to the capability concepts, yet little work is done to ensure that the point design selected is truly representative of the solution space for that capability concept.

In SBD, many design configurations are generated for each capability concept. These design configurations are examined by different subject matter experts. Those design configurations shown through analysis to NOT be a good solution are eliminated. As analysis eliminates more and more of the solution space, feasible solutions become apparent. The collection of feasible solutions is used to develop an aggregate cost estimate and risk assessment for the given capability concept. Using a collection of feasible points provides a more robust estimate for costs to achieve a given capability concept. In this way the costs and risks of capability concepts can be confidently compared. SBD enables a better understanding of the costs and risks associated with achieving a given capability costs, thereby enabling better budgeting and requirements development.

Biography

Dr. Norbert Doerry is the Technical Director of the NAVSEA SEA 05 Technology Office. Recent assignments include Design Manager of the USMC Amphibious Combat Vehicle and Design Manager for the Small Surface Combatant Task Force. He retired from active duty in the United States Navy in 2009 as a Captain with 26 years of commissioned service, 23 years as an Engineering Duty Officer. In his final billet, he served for nearly six years as the Technical Director for Surface Ship Design. Dr. Doerry is a 1983 graduate of the United States Naval Academy and a 1991 graduate of MIT. He is the 2008 recipient of the ASNE Gold Medal. He is a member of ASNE, IEEE and the Naval Institute; is a SNAME fellow; has published over 40 technical papers and technical reports; and has participated in the development of over nine technical standards.