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System Engineering		

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EIA ENGINEERING BULLETIN

System Engineering

SYSB-1

DECEMBER 1989

ELECTRONIC INDUSTRIES ASSOCIATION
ENGINEERING DEPARTMENT



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PREFACE

System Engineering is recognized as the central process by which a system/equipment is designed to meet a given set of User operational requirements. Many efforts have been conducted or are underway toward this end. The Air Force recently conducted a study on converting User Needs to Systems Options and has pursued methods aimed at Risk Analysis and Risk Abatement and of more recent date reviewed "Solution Set Sensitivity To Constraints". The Navy's "Transition From Development To Production Templates" is another example. These are all elements of the System Engineering Process.

Over the years we have seen many factors that have lead to a distortion and confusion in the implementation of the System Engineering Process. For example we have seen tremendous increase in complexity coupled with arbitrary contract constraints (e.g. emphasis on Initial Operating Capability, I.O.C., delivery date, sub-optimization of performance requirements, specification of "How To" as opposed to "Performance", utilization of wrong type of contract, etc.).

This document is intended to provide an initial clarification of the process and the terms used in order to promote greater recognition, more effective application and further development of this technical discipline that can be shared among system contractors, subcontractors, engineering institutions and process tool developers. The system engineering process applies to all systems whether they be for commercial/industrial, commercial/consumer, or government/Defense applications.

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This bulletin was prepared by the G-47 System Engineering Committee under the chairmanship of Robert Sorensen of Unisys Corporation. The document was drafted by a subcommittee with review and valuable inputs provided by all G-47 committee members during working sessions on this bulletin during the 1988-1989 period. Any comments related to improving this bulletin should be addressed to the G-47 System Engineering Committee via the EIA Staff Engineer, E. J. Nucci, Electronic Industries Association, 1722 Eye St. NW, Washington, D.C. 20006. Publication of this bulletin by the EIA does not constitute endorsement of any of the material contained within the document.

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A. PURPOSE

THE PURPOSE OF THIS EIA BULLETIN IS TO PROVIDE A CLEARER, MORE DEFINITIVE DESCRIPTION OF SYSTEM ENGINEERING IN ORDER TO PROMOTE GREATER RECOGNITION, MORE EFFECTIVE APPLICATION, AND THE FURTHER DEVELOPMENT OF THIS TECHNICAL DISCIPLINE THAT CAN BE SHARED AMONG SYSTEMS CONTRACTORS, SUBCONTRACTORS, ENGINEERING INSTITUTIONS, PROCESS TOOL DEVELOPERS AND DoD.

It is not important that everyone agree 100 percent with the exact words chosen, but rather that a person can read and understand what is meant by the words as used within the context of the bulletin.

The "system engineering process" is often referred to as the method used to develop systems. As such, everyone who participates in the process should understand what that process means.



B. SUMMARY OF DEFINITIONS

1. System -- A composite of equipment/material, computer software, personnel, facilities and information/procedural data that satisfies a user need.
2. System Engineer -- An engineer who analyzes requirements, performance and functions of the total system including hardware and software, partitions this system into elements showing requirements and functions allocated to these elements. He develops system concepts and synthesizes potential system solutions by integration of candidate elements, performs multi-tiered trade-offs, determines sensitivity to constraints, integrates inputs from various specialties to determine a preferred system solution, and documents this preferred system solution and all its interfaces. The system engineer is responsible for implementing and ensuring the technical integrity of the system engineering process used in developing the total system.
3. System Engineering -- The translation of user needs into an affordable, timely and operationally effective total system that best satisfies the user requirements (needs).
4. System Engineering Process -- The methodology of sequential and iterative application of selected scientific and engineering efforts to convert user needs into a system solution that will best satisfy the requirements and constraints in accordance with "agreed to" effectiveness measures reflecting the users needs. The process needs to be divided into the macro steps of System Requirements Analysis and System Design.
5. System Engineering Management-- The planning, monitoring and controlling required to manage the system engineering technical discipline, and ensure the efficient and effective implementation of the system engineering process including specialty integration as required by a project or program.