

# TOPIC DESCRIPTION SUPPLEMENT for the SYSTEMS ENGINEERING SURVEY

TOPIC		DESCRIPTION
1	Systems Engineering	An interdisciplinary, structured, disciplined, and documented technical effort to evolve and verify an integrated, total life-cycle-balanced set of systems, people, and processes that satisfy the customer's needs
2	Objectives of Systems Engineering	The Systems Engineering discipline coordinates and integrates technical activities throughout the system life cycle. It ensures sound decision-making and implementation of solutions. It balances capability needs, design considerations and constraints, as well as limitations imposed by technology, budget, and schedule.
3	DoD Policies, Regulations, & Guidance on Systems Engineering	The DoD and individual Military Departments (MILDEP) provide substantial guidance on Systems Engineering. DoD sources includes DoDD 5000.1; DoDI 5000.2; the Defense Acquisition Guidebook, the OSD (ATandL) Policy Memo dated 20FEB04 and the DAU Systems Engineering Fundamentals Handbook. Individual MILDEP resources include Air Force Policy Memos 03A-005 and 04A-001, Army AR 70-1, and SECNAVINST 5000.2C, as well as multiple Component Guidebooks and Handbooks.
4	Roles of Systems Engineering in an Acquisition Program	Functional roles of individuals supporting the Systems Engineering Process may include: Chief (Systems) Engineer, Technical Manager, Requirements Manager, System Designer, System Analyst, Technology Evaluator, Systems Integrator, Configuration Manager, Developmental Tester (Verification), Operational Tester (Validation), Risk Manager, Customer Liaison, Process Engineer, Quality Manager, Safety Engineer, Logistics Engineer, Reliability Engineer, Survivability Engineer, Operations Engineer, Security Engineer, and Information (Data) Manager.
5	Who performs Systems Engineering on an Acquisition Program	Every organization and program should have designated positions and personnel with the authority and responsibility for Systems Engineering tasks. - Do you know what positions in your organization perform or are responsible for systems engineering tasks in your organization? - Do you know who has the authority and bears responsibility for the various system engineering roles within your organization? - Do you know who executes the day-to-day systems engineering activities in your organization?
6	Commercial Versions of the Systems Engineering Process	Various engineering process models and standards exist and may use different terms to describe the processes, activities, and tasks within systems engineering and other life cycle processes. Commercial examples include ISO/IEC 15288, IEEE 1220, EIA-632, EIA-731, and the INCOSE SE HANDBOOK
7	Tailoring the Application of the Systems Engineering Process	Each organization, program, and project applies Systems Engineering uniquely depending on its size, complexity, and degree of risk tolerance. The degree of insight needed by stakeholders also influences how the Technical Activities are accomplished. "Tailoring" addresses What Technical Functions have to be done; Who is responsible for them; How Each Technical Function is to be done; What Products will be produced; and When these Technical Activities and Products will be provided.
8	Integration of Technical & Business Specialties into SE Process	Systems engineering integrates the development of the system and all system-related processes and provides a common basis for communication among IPT members. All team members apply the systems engineering process in their respective areas of expertise. This integration of technical and business knowledge ensures that systems are developed to perform the missions in the intended operational environments and provides the information needed to make best-value decisions. Common technical and business specialties include reliability, maintainability, human integration, transportability, safety, cost analysis, quality assurance, standardization, interoperability, producibility, occupational health, and environmental protection.

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9	Evaluating a Contractor's Systems Engineering Approach	A contractor should have a demonstrated Systems Engineering process capability and a demonstrated level of Systems Engineering maturity across all organizations that affect system design, development, production, deployment, operations, and support. Key evidence needed for evaluation should include such attributes as (1) the established Systems Engineering processes that comply with an accepted standard; (2) proof that work adheres to these processes; and (3) an improvement effort that continually maintains currency of these processes.
10	DoD Architecture Framework (DoDAF)	The DoDAF (current Version 1.0) provides a common approach for DoD architecture description, development, presentation, and integration for both warfighting operations and business processes. An integrated architecture consists of multiple views or perspectives [Operational View (OV), Systems View (SV), Technical Standards View (TV) and All View (AV)] that facilitate integration and promote interoperability across capabilities and among related integrated architectures.
11	Systems Engineering Process (SEP) used in DoD	The primary elements of the DoD SEP, as described in the Defense Acquisition Guidebook, are : Requirements Development, Logical Analysis, Design Solution, Implementation, Integration, Verification, Validation, and Transition.
12	Requirements Development Element of a DoD SEP	The Requirements Development function gathers all inputs from relevant stakeholders and translates them into technical requirements. It encompasses the definition and refinement of system, subsystem, and lower-level functional and performance requirements, and interfaces to facilitate the design of systems that meet the customer needs. (This has traditionally been called Requirements Analysis.)
13	Logical Analysis Element of a DoD SEP	The Logical Analysis function defines and refines candidate sets of logical solutions that clarify the understanding of the requirements and their inter-relationships. It includes the allocation of all performance requirements and constraints. (This has traditionally been called Functional Analysis and Allocation)
14	Design Solution Element of a DoD SEP	The Design Solution function transforms the requirements and logical solutions sets into alternative design solutions. It involves selecting a final design that results in the design or physical architecture (Hardware and Software) that identifies the basic system elements or components (This has traditionally been included in a process called "Synthesis")
15	Implementation Element of a DoD SEP	The Implementation function encompasses the making, buying, and/or reusing of the basic elements that comprise the system design. It includes any testing and documentation at the element level. (This has traditionally been included in a process called "Synthesis")
16	Integration Element of a DoD SEP	The Integration function is the combining of lower-level system elements into higher-level elements of the design or physical architecture in an iterative fashion until the system-level is realized. (This has traditionally been included in a process called "Synthesis")
17	Verification Element of a DoD SEP	The Verification function confirms that each system element at every level in the design or physical architecture meets the design-to or build-to specifications. It answers the question "Is it built right?" by examining the system elements against their defined requirements.
18	Validation Element of a DoD SEP	The Validation function confirms that the system performance meets stakeholder requirements in the intended operational environment. It answers the question "Was the right thing built?"

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19	Transition Element of a DoD SEP	The Transition function moves a system element from one acquisition phase to the next or from one level in the physical architecture to the next so that proper use, performance, configuration, interfaces, etc are ensured. (This is sometimes separated into "iteration" and "recursion" where "iteration" refers to acquisition phases and "recursion" to design levels.)
20	Planning the Technical Effort	The Technical Planning function defines the scope of the technical effort required to develop the system. The basic questions of "who will do what" and "when" are addressed. Normally, a technical plan (Systems Engineering Plan) is prepared that describes what must be accomplished, how systems engineering will be done, how the effort will be scheduled, what resources are needed, and how the total technical effort will be monitored and controlled.
21	Decision Analysis	The Decision Analysis function is the formal method for analyzing, evaluating, and selecting alternatives to support decision-making. It includes selecting the criteria and methods used to conduct the analysis.
22	Cost Estimating & Analysis	The Cost Estimating function is a management tool used to help decision makers evaluate resource requirements at key management milestones and decision points in the acquisition process. A cost estimate, as either a single value or range of values, is usually based on judgment or historical data regarding the cost of an object, commodity, or service and is the result of an estimating procedure which specifies the expected dollar cost required to perform a stipulated task or to acquire an item. The Cost Analysis function produces cost estimates for materiel systems, automated information systems, force units, training, and other DoD programs and projects. Cost Analysis is the act of developing, analyzing, and documenting cost estimates using analytical approaches and techniques.
23	Technical Assessment	The Technical Assessment function measures technical progress and the effectiveness of plans and requirements. It often leads to the discovery of deficiencies and anomalies that usually result in the application of corrective actions. Technical Assessments allow confirmation of accomplishments and demonstrate readiness to proceed to the next phase or step. It often is associated with Technical Performance Measurement and Technical Reviews.
24	Technical Reviews & Audits	Technical Reviews and Audits are key technical assessment tools that measure the progress and maturity of technical efforts and technology by assessing development at key event-driven points in the schedule. Technical efforts and technology risks are compared to pre-established exit criteria for the particular event to determine if the appropriate degree of progress and level of maturity have been achieved. Technical Reviews and Audits confirm the outputs of the technical efforts for each major phase, provide a view of technical risks and development choices, and assess the readiness to proceed to the next technical phase.
25	Requirements Management	The Requirements Management function establishes and controls the identification, allocation, and flowdown of technical and non-technical requirements. These requirements flow from customers and stakeholders to system elements to form the agreed-to basis for estimating, planning, performing, and tracking activities throughout a program's life cycle. This process includes maintaining the traceability of the pedigree of every requirement. It establishes, verifies, and manages changes to requirements, and documents the requirements baseline.
26	Risk Management	The Risk Management function identifies, assesses, mitigates, and continuously tracks, controls, and documents program risks. It examines all aspects of a program, from conception through disposal, including inherent program risks and the risks of deviating from the planned program.

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27	Configuration Management	The Configuration Management function plans and implements the technical and administrative directive and surveillance actions taken to identify and document the functional and physical characteristics of Configuration Items (CI), to control changes to a CI and its characteristics, and to record and report change status. It provides a complete audit trail of decisions and design modifications. Configuration Management includes Data Management and Interface Management
28	Technical Baselines	There are 3 primary baselines associated with milestones in the life cycle of a system: (1) Functional; (2) Allocated; and (3) Product. Each of these baselines is designated when the configuration documentation is deemed to be complete and correct, and needs to be formally protected from unwarranted and uncontrolled change from that point forward in its life cycle.
29	Work Breakdown Structure (WBS)	A WBS is an organized method to break down a program into logical subdivisions or subprojects at lower and lower levels of details. It includes hardware, software, services, data, and facilities that comprise all work to be done on a program. It is a key tool in planning, scheduling, cost estimating, budget formulation, interface control, configuration management, and status reporting. Military Handbook (MIL-HDBK) 881A has examples of WBSs.
30	Technology Maturity Analysis	The Technology Maturity Analysis function assesses a technology to determine its readiness for incorporation into an acquisition program and for fielding to warfighters. This may involve predicting the time and money that an immature technology will need to become ready for such acquisition program incorporation or fielding.
31	Modeling & Simulation	Modeling and Simulation is used to virtually duplicate products and processes to reduce the cost and risk for all life cycle activities from requirements definition, through design and development, to production and sustainment. A model is a physical, mathematical, or logical representation of a system entity, phenomenon, or process. A simulation is the implementation of a model over time that brings a model to life and shows how a particular object or phenomenon will behave. It is useful for testing, analysis, and training where real-world systems or concepts can be represented by a model.
32	Test & Evaluation (T&E)	The T&E function exercises a system or components and analyzes the results to provide performance-related information. T&E provides a means to identify levels of performance and specifications attained and to acquire data for identifying and correcting defects and/or deficiencies, making decisions, determining system maturity, determining readiness to advance to the next stage of acquisition, and determining whether systems are operationally effective, suitable and survivable for intended use.

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<b>RESPONSES TO QUESTIONS</b>	
NONE	I may have heard of and recognize the Topic. However, I have no knowledge or experience with the fundamental features, benefits, or application of the Topic in any circumstances, situations or efforts, either within DoD or with other organizations.
BASIC / NOVICE	I recognize the Topic and am familiar with its fundamental theory and principles at an elementary level. I understand the benefits of applying the Topic to DoD or other situations. I have worked on programs or for organizations that applied the Topic principles. I have less than 2 years of direct, personal experience using or applying the Topic under the direction of a Journeyman or an Expert, or as a member of a team that has extensive experience with its application.
JOURNEYMAN	I have enough knowledge of and experience with this Topic to apply it effectively in a routine, conventional manner if the situation is similar to previous circumstances and efforts. I do not require regular direction by an Expert for such routine applications. I am not knowledgeable or experienced enough to apply the Topic to new or novel situations without direction or oversight from an Expert. I have at least 5 years of direct, personal experience on multiple efforts using or applying this Topic under the direction of an Expert, or as a member of a team.
EXPERT	I have prolonged and broad experience with this Topic, achieved through both practice and education. I am recognized as a reliable source of knowledge, skills, and techniques on this Topic. I am considered an authoritative source whose judgment and services are sought out by others. I have at least 10 years of direct, personal experience applying the Topic to a variety of circumstances and efforts, including new or novel situations.
<b>TYPES OF EXPERT ASSISTANCE</b>	
INDIVIDUAL DEVELOPMENT	A course of instruction or training that leads to enhanced information (knowledge) and skills for the individual. It is designed to improve weaknesses, build on strengths, improve job performance, and support career goals. The enhanced knowledge and skills may or may not directly benefit the Team, Project, or Program to which the individual is currently assigned, but are considered beneficial to the enterprise that the individual supports.
TEAM TRAINING	A course of instruction or training that is focused on common and shared information, concepts, principles, processes, procedures, and skills. This training is designed to enhance the communications, decision-making, and performance of the Team, regardless of the task or goal assigned.
WORKSHOP	An intense session, or series of sessions, that emphasizes hands-on problem-solving for a specific task, objective, or project by a relatively small number of participants, usually a designated Group, Team, or IPT. The session(s) is usually facilitated by someone who helps the participants reach a consensus solution(s) without taking any side of the discussions. The facilitator encourages interaction among participants, aids the exchange of information, tracks assignment of roles and responsibilities, and keeps the participants focused on the objectives.
CONSULTING	A Source of "Honest Broker" advice and opinions. Assistance from an authoritative Expert(s) that helps identify and analyze problems. The Expert(s) may provide suggestions or comments on what needs to be done, or how best to achieve an optimum solution. The Expert(s) may also critique proposed solutions, and/or evaluate candidate solutions.