Systems Engineering (glossary)

systems engineering

The definition of systems engineering has evolved over time. The current accepted definitions are found below:

> (1) *Interdisciplinary approach governing the total technical and managerial effort required to transform a set of customer needs, expectations, and constraints into a solution and to support that solution throughout its life.* (ISO/IEC/IEEE 2010)

> (2) *An interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and system validation while considering the complete problem:*
>
> - *Operations*
> - *Performance*
> - *Test*
> - *Manufacturing*
> - *Cost & Schedule*
> - *Training & Support*
> - *Disposal*
>
> *Systems engineering integrates all the disciplines and specialty groups into a team effort forming a structured development process that proceeds from concept to production to operation. Systems engineering considers both the*

> *business and the technical needs of all customers with the goal of providing a quality product that meets the user needs.* (INCOSE 2012)

> (3) *A transdisiplinary and integrative approach to enable the successful realization, use, and retirement of engineered systems, using systems principles and concepts, and scientific, technological, and management methods.* We use the terms "engineering" and "engineered" in their widest sense: "the action of working artfully to bring something about". "Engineered systems" may be composed of any or all of people, products, services, information, processes, and natural elements. (INCOSE Fellows 2019)

Source

(1) ISO/IEC/IEEE. 2010. *Systems and Software Engineering - System and Software Engineering Vocabulary (SEVocab)*. Geneva, Switzerland: International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC)/Institute of Electrical and Electronics Engineers (IEEE). ISO/IEC/IEEE 24765:2010.

(2) INCOSE. 2012. *INCOSE Systems Engineering Handbook*, version 3.2.2. San Diego, CA, USA: International Council on Systems Engineering (INCOSE), INCOSE-TP-2003-002-03.2.2.

(3) INCOSE Fellows, Briefing to INCOSE Board of Directors, January 2019.

Discussion

There are many definitions of systems engineering. The SEBOK presents three of those definitions. Two come from foundational documents.

Note that both stress the interdisciplinary nature of systems engineering and its application throughout the life of the system.

In the Systems Engineering Overview article, the authors modified the INCOSE definition, saying traditional definitions of SE have emphasized sequential performance of SE activities, e.g., "documenting requirements, then proceeding with design synthesis ...". (INCOSE 2012) The SEBoK authors depart from tradition to emphasize the inevitable intertwining of system requirements definition and system design in the following revised definition of SE:

> *Systems Engineering (SE) is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on holistically and concurrently understanding stakeholder needs; exploring opportunities; documenting requirements; and synthesizing, verifying, validating, and evolving solutions while considering the complete problem, from system concept exploration through system disposal.*

Definition (3) was created by the INCOSE Fellows Initiative on System and Systems Engineering Definitions. This was established in 2016, to review current INCOSE definitions of SYSTEM and SYSTEMS ENGINEERING and to recommend any changes necessary to align the definitions to a) current practice, and b) the aspirations of INCOSE's 2025 Vision. At the January 2019 INCOSE Board of Directors meeting, a new INCOSE definition for "system" was approved and is given above.

The Fellows Initiative on System and Systems Engineering Definitions was established in 2016, to review current INCOSE definitions of SYSTEM and SYSTEMS ENGINEERING and to recommend any changes necessary to align the definitions to a) current practice, and b) the aspirations of INCOSE's 2025 Vision. The INCOSE Fellows elaborated this definition by stating: We use the terms "engineering" and "engineered" in their widest sense: "the action of working artfully to bring something about". "Engineered systems" may be composed of any or all of people, products, services, information, processes, and natural elements.

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