Box 10- The recent development of systems engineering

In August of 1990 a group of 35 individuals, recognized for their interest, knowledge, and expertise in systems engineering, met in Seattle to discuss the need for a professional organization to foster the definition and understanding of systems engineering. The cost of attendance was submission of the individual's concept or definition of systems engineering. The submitted definitions were categorized into four groups. The first group believed systems engineering to be a functional discipline of system engineers with the practice restricted to technical activities. The second group considered systems engineering to be a discipline of system engineers with practice including both technical and management activities. The third group expressed systems engineering as a set of technical activities practiced by any required discipline, not just system engineers. And, the fourth group believed systems engineering to be a set of technical and management activities practiced by any required discipline.

Thus, from the beginning, INCOSE has been composed of persons with differing views of what systems engineering is. It is because of these different views that INCOSE did not attempt to define the term. Doing so was considered as being counterproductive to the purpose and objectives of the new Council. The intent of the founders was to include all who shared the vision that systems could be developed and produced at a lower cost, delivered on schedule, and provided with expected performance attributes if more system qualified engineers and better processes, methods and automated tools were available.

Recognition of systems engineering

In the years since inception of INCOSE, enterprises have been found in which system engineers, systems engineering organizations, and the term systems engineering itself are not recognized as needed disciplines, organizations, or practices. To such enterprises, systems engineering is analogous to high overhead, too much unnecessary documentation, and other costly Department of Defense oversight practices. This is not to say that these enterprises do not accomplish systems engineering. They do, and in many enterprises with relative success. They could, however, like most enterprises with system engineers, systems engineering organizations and established systems engineering practices, accomplish the engineering of systems more efficiently and effectively if a disciplined, comprehensive systems engineering approach or process were utilized.

Enterprises that have shunned systems engineering because of perceived negative connotations, have adopted and fostered terms such as Concurrent Engineering and Integrated Product (and Process) Development. The trend lately is for enterprises with a history of embracing systems engineering, including the Department of Defense, to adopt these new terms to avoid the confusion related to systems engineering. Much of this can be directly attributed to a lack of appreciation of exactly what systems engineering is.

Commercial systems engineering standards

This confusion and the perceived need for other terms to describe the engineering of systems is unfortunate, but understandable. The animosity (often hostility) toward systems engineering is one reason new commercial systems engineering standards (EIA/IS 632 and IEEE 1220 – 1994) have not received wide acceptance, even within INCOSE.

Whereas system engineers look at these standards as much broader than what they do, non-system engineers look at the standard titles and come up with the conclusion that the standards are not relevant to their work; that they are only applicable to system engineers. The adage 'don't judge a book by its cover' is applicable in this case.

The intent of these two new standards is well denned in their respective forward and scope sections. The purpose of the EIA standard is to improve the engineering of systems in oversight or contractual instances. The IEEE standard purpose 'is to provide a standard for managing a system from initial concept through development, operations, and disposal.' It explains what any enterprise must do to engineer a system. Its focus is on commercial, non-oversight developments.

Neither standard restricts its tasks to what a system engineer does or for which a systems engineering organization is responsible. Specifically, teams and teamwork are called out to include personnel to ensure that quality factors related to predictability, testability/verifiability, deployability, operability, supportability, trainability, and disposability are designed into system products. Additionally, both standards call for inclusion, as appropriate, of customers/users, subcontractors, and other non-engineering personnel such as marketing, legal and contracting on interdisciplinary teams.

Two processes important to engineering a system are the central focus of the IEEE systems engineering standard. These are the life cycle development process and the systems engineering process. The systems engineering process is the engine, recursively applied, that drives the evolution and maturity of the system through successive stages of development.

Systems engineering in relation to concurrent engineering and integrated process and product development

When the systems engineering envisioned in the standards is compared with the explained concepts and scope of Concurrent Engineering and Integrated Product and Process Development one finds that the purpose and scope of life cycles tasks are essentially the same, that the focus on downstream specialities in upstream design activities is the same, and that the utilization of automated tools is the same. The essential difference, which

could lead one to consider the systems engineering approach described in the IEEE and EIA standards as being more comprehensive, is the inclusion of a comprehensive systems engineering process utilized recursively to mature the system solutions, attain customer satisfaction, and satisfy organizational commitments and public expectations.

So, the problems associated with acceptance of systems engineering appear to be based on lack of understanding on just what systems engineering is and what its purpose is.

Source: Lake (1996)