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System Analytical Methods

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Editorial

When clearly defined and regularly applied, systems engineering, which is simply an application of systems analysis to the design and procurement of hardware systems to meet certain goals, can be a useful management tool. From a fundamental set of mission objectives, the systems engineering process involves the top-down development of a system's functional and physical requirements. The goal is to organize information and expertise so that individuals in charge of planning, development, and operation of the systems needed to complete the mission may do it more efficiently. The physical requirements of the system determine which hardware components must be purchased or produced to accomplish the defined functions. The systems engineering process should be carried out in such a way that different system configurations are considered. The result should be a collection of traceable requirements, a baseline description of the physical system, and a baseline description of the operational concept that can be used in design and procurement as well as system verification and validation. This should also include a set of specified interfaces to ensure that the system's various components are compatible as they are created. A glossary of words used in systems engineering is provided below for the reader's convenience. The interdependencies between physical and functional needs must be made explicit, and each requirement must be trackable longitudinally across the entire systems engineering process and throughout the life cycle of the system.

System verification is a two-step procedure that ensures that the system design captures all the system requirements and that the system hardware and software fully implement the design. System validation is the process of ensuring that the operational concept of a system meets the original system requirements after it has been developed. Once established, baseline descriptions of the physical system's architecture and the functions the system is meant to accomplish are critical to the process of altering the system as new knowledge or experience becomes available. Configuration management and change control are critical quality assurance activities that ensure baseline modifications are planned and thoroughly documented so that system performance implications are understood. Configuration control is used to specify the desired change's direction [1-3].

The systems engineering process adds value to the development, management, and implementation of large programs by ensuring the following: orderly definition of a system through top-down development of functions and requirements; clear distinction between design requirements developed by the program/project (potentially modifiable) and externally imposed constraints (not easily modifiable); top-down consideration and evaluation of alternative solutions and designs. A sound systems engineering approach improves the ability of managers of big engineering programs to deliver a solid design and operational concept with reduced risk of cost growth, even if it isn't done with the goal of lowering program costs. Consistency of approach throughout a company, as well as a smooth flow of information both up and down the management chain, are trademarks of a well-integrated program. Individual unit activity is compatible with the larger organization's aims and goals, and individual projects are clearly tied to the organizational units in which they occur in such a program (vertical integration). Individual units within organizational levels are aware of others' efforts in relevant domains and Endeavor to ensure that their own activity complements that of others (horizontal integration).

Unlike the disturbances to a system that are beyond the control of the system designer or user, there are some aspects of a system that are under the control of the user. Thus, the speed of a ceiling fan or a pump motor may usually be adjusted or modified at whim - to a degree, at least. A speed regulator is normally included with the ceiling fan; by rotating the regulator's knob or dial, one can change the speed - within restrictions, from a minimum, low speed to a maximum, full speed. Similarly, the pump motor can be modified to provide more or less power to the pump. These acts are known as the system's inputs or input actions, and they are linked to physical variables or signals that can be monitored and are known as the input variables. As a result, the ceiling fan motor has a related input variable, specifically the voltage across it, which may be measured with a voltmeter. The position of the knob on the speed regulator can affect the input voltage, hence the position of the knob could be considered an input to the speed regulator as a sub-system [4,5].

Conflict of Interest

None.

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