Fundamentals of System Engineering Management: Volume III - Planning, Organizing and Managing

An Online Continuing Education Course for Engineers

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Fundamentals of System Engineering Management: Volume III – Planning, Organizing and Managing

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Introduction

This course series provides a basic, conceptual-level description of the development and life cycle management of a system. It provides a basic framework for planning and assessing system development.

The course series is divided into three volumes: Systems Engineering Process; Systems Analysis and Control; and Planning, Organizing, and Managing. This introduction establishes the basic concept and introduces terms that will be used throughout the series.

Volume I introduces the systems engineering problem-solving process and discusses in basic terms some traditional techniques used in the process. An overview is given, and then the process of requirements analysis, functional analysis and allocation, design synthesis, and verification is explained in some detail. This volume ends with a discussion of the documentation developed as the finished output of the systems engineering process.

Volume II discusses analysis and control tools that provide balance to the process. Key activities - such as risk management, configuration management, and trade studies - that support and run parallel to the system engineering process are identified and explained.

This course, Volume III, discusses issues integral to the conduct of a systems engineering effort, from planning to consideration of broader management issues.

Basic terms defined below are the foundation for the following definitions. Key systems engineering ideas and viewpoints are presented, starting with a definition of a system.

Simply put, *System Engineering* is an interdisciplinary approach for developing a large, complex system to meet a defined set of requirements.

A System Is…

> *Simply stated, a system is an integrated composite of people, products, and processes that provide a capability to satisfy a stated need or objective.*

Systems Engineering Is…

> *Systems engineering consists of two significant disciplines: the technical knowledge domain in which the systems engineer operates, and systems engineering management. This course series focuses on the process of systems engineering management.*

Systems engineering is an interdisciplinary engineering management process that evolves and verifies an integrated, life-cycle balanced set of system solutions that satisfy customer needs.

As illustrated by Figure 1, systems engineering management is accomplished by integrating three major activities:

1. *Development Phasing* that controls the design process and provides baselines that coordinate design efforts,

2. A *Systems Engineering Process* that provides a structure for solving design problems and tracking requirements flow through the design effort, and

3. *Life Cycle Integration* that involves customers in the design process and ensures that the system developed is viable throughout its life.

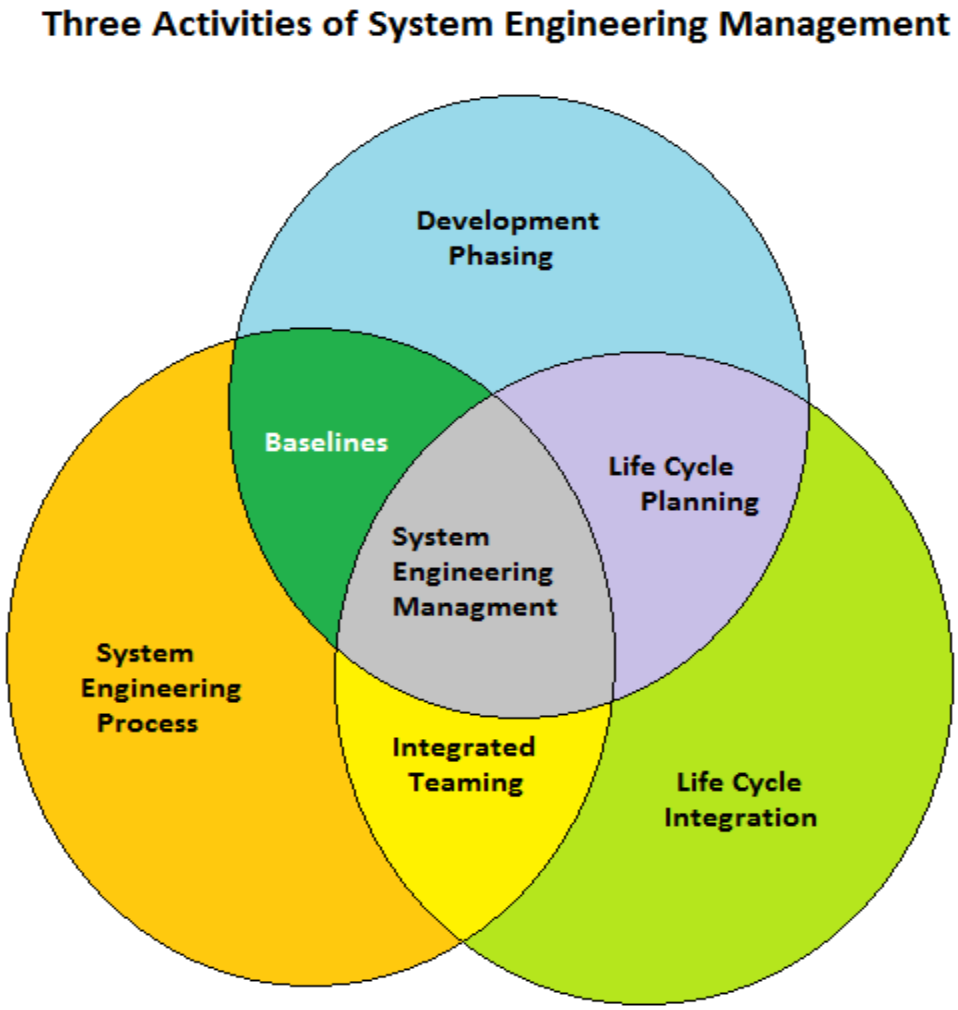


Figure 1

Each one of these activities is necessary to achieve proper management of a development effort. *Development Phasing* has two major purposes: it controls the design effort and is the major connection between the technical management effort and the overall acquisition effort. It controls the design effort by developing design baselines that govern each level of development. It interfaces with acquisition management by providing key events in the development process, where design viability can be assessed. The viability of the baselines developed is a major input for acquisition management decisions. As a result, the timing and coordination between technical development phasing and the acquisition schedule is critical to maintain a healthy acquisition program.

The *systems engineering process* is the heart of systems engineering management. Its purpose is to provide a structured but flexible process that transforms requirements into specifications, architectures, and configuration baselines. The discipline of this process provides the control and traceability to develop solutions that meet customer needs. The systems engineering process may be repeated one or more times during any phase of the development process.

Life cycle integration is necessary to ensure that the design solution is viable throughout the life of the system. It includes the planning associated with product and process development, as well as the integration of multiple functional concerns into the design and engineering process. In this manner, product cycle-times can be reduced, and the need for redesign and rework substantially reduced.

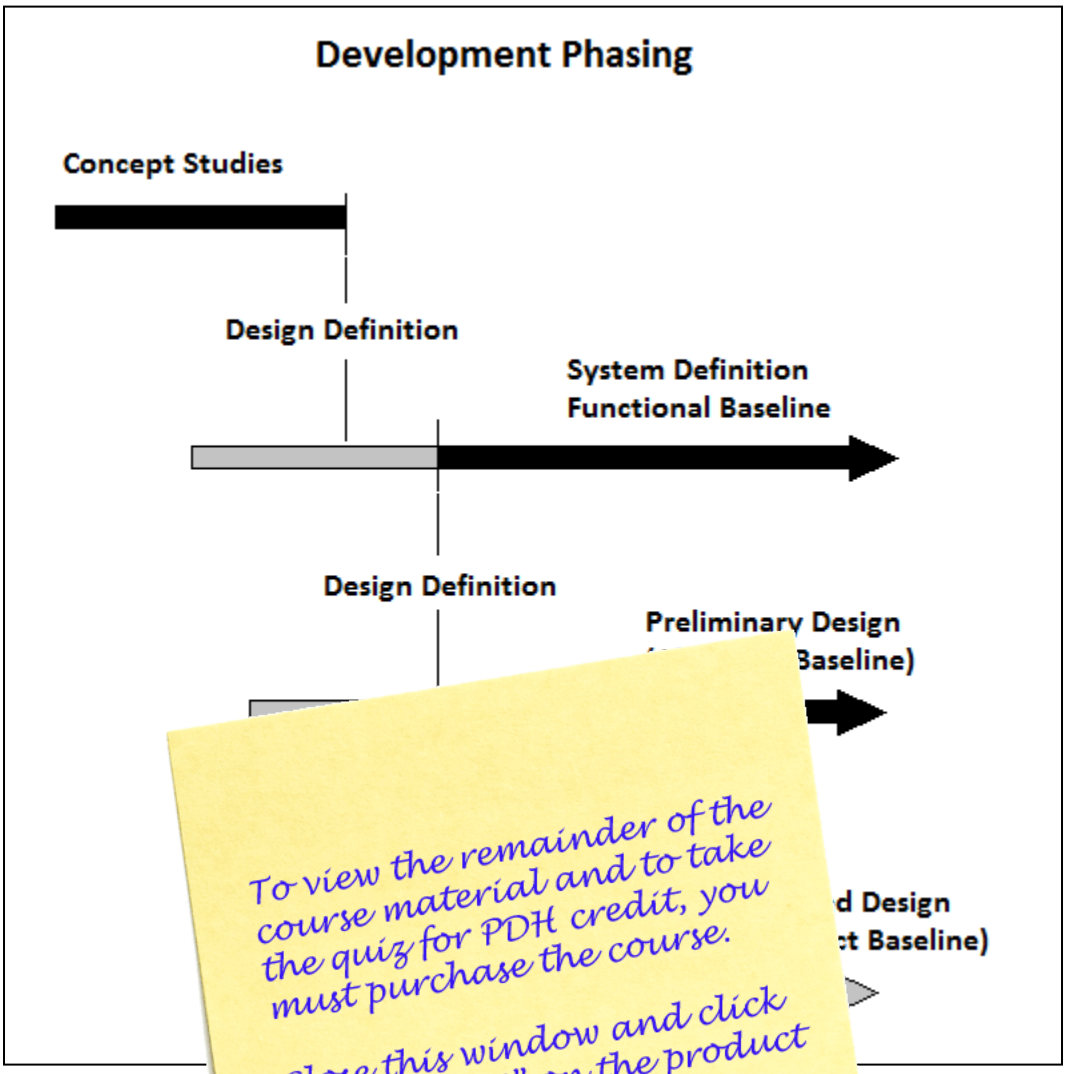
Development Phasing

Development usually progresses through distinct levels or stages:

- *Concept level*, which produces a system concept description (usually described in a concept study);
- *System level*, which produces a system description in performance requirement terms; and
- *Subsystem/Component level*, which produces first a set of subsystem and component product performance descriptions, then a set of corresponding detailed descriptions of the products' characteristics, essential for their production.

The systems engineering process is applied to each level of system development, one level at a time, to produce these descriptions commonly called *configuration baselines*. This results in a series of configuration baselines, one at each development level. These baselines become more detailed with each level.

Figure 2 shows the basic relationships between the baselines. The triangles represent baseline control decision points and are usually referred to as technical reviews or audits.



Significant deve chy should not occur until the configur red complete, stable, and controlled. at the baselines are ready for the next level