NASA System Engineering Design Process

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What is System Engineering

♦ Systems engineering is a methodical, disciplined approach for the design, realization, technical management, operations, and retirement of a system.

♦ A “system” is a construct or collection of different elements that together produce results not obtainable by the elements alone.

♦ The elements, or parts, can include people, hardware, software, facilities, policies, and documents; that is, all things required to produce system-level results.

♦ The results include system-level qualities, properties, characteristics, functions, behavior, and performance. The value added by the system as a whole, beyond that contributed independently by the parts, is primarily created by the relationship among the parts; that is,
  • how they are interconnected.1 It is a way of looking at the “big picture” when making technical decisions.
  • It is a way of achieving stakeholder functional, physical, and operational performance requirements in the intended use environment over the planned life of the systems.

♦ In other words, systems engineering is a logical way of thinking
One of the fundamental concepts used within NASA for the management of major systems is the program/project life cycle.

- Decomposing the project life cycle into phases organizes the entire process into more manageable pieces.
- Each phase terminates with a Key decision point (KDP).
- KDP are supported by major reviews, (SDR, PDR, etc)
Project Phases

Project is divided into two major life cycle phases
  • Formulation
  • Implementation

Each major phases are divided into project life cycle phases
  • Pre-Phase A
  • Phase A-E

Each phase has a purpose and a goal to achieve at the end of cycle
At the end of each phase a major review is performed to determine the completion of the phase
Each major review has a purpose and a goal

- An entry and exit criteria are defined before the review is performed to assess the acceptance of the review.
- Typically this reviews are performed by the team/project presenting to a board.
- The Board is the entity that determine the success of the review and approving the completion of the current life cycle phase and approving to move into the next phase.
- The board is composed of experts, managers, etc.
Documents

- NASA Space Flight Program and Project Management Requirements, NPR 7120.5D
  - http://nodis.hq.nasa.gov/npg_img/N_PR_7120_005D_/N_PR_7120_005D_.pdf

- NASA System Engineering Process and Requirements, NPR 7123.1A

- NASA System Engineering Handbook, SP-2007-6105,