Lesson the systems engineering process essay

Systems Engineering Involves design and management of a total system that Includes hardware and software, as well as other system life-cycle elements. The Systems Engineering Process is a structured, disciplined, and documented technical effort through which systems products and processes are simultaneously defined and developed. Systems Engineering is most effectively implemented as part of an overall PIPED effort using multidisciplinary teamwork. Feb. 2013 Science and Technology Science and Technology transitions technological developments for use by operational forces. Science and Technology programs:

Demonstrate new and emerging technologies that have a direct application to military systems. Are intended to be implemented into future military systems to support military needs, solve military problems, and provide a sound basis for acquisition decisions. Test and Evaluation is a process that compares a system or components against requirements and specifications through testing. The results are evaluated to assess progress of design, performance, supportability, etc. Developmental Test and Evaluation is an engineering tool used to reduce risk throughout the defense acquisition cycle.

Operational Test and Evaluation involves the actual or simulated employment, by typical users, of a system under realistic operational conditions. Acquisition Logistics Acquisition Logistics is a multifunctional, technical management discipline associated with the entire life cycle of a system. The principle objectives of Acquisition Logistics are to ensure that: Support considerations are an integral part of the system's design

requirements so that the system can be cost-effectively supported throughout its life cycle.

The infrastructure elements necessary for the initial fielding and operational support of he system are identified and developed and acquired. The majority of a system's life-cycle costs can be attributed directly to operations and support costs after the system is fielded. Because these costs are largely determined early in the system development period, it is vitally important that system developers evaluate the potential operational and support costs of alternative designs and factor these into early design decisions. Hardware/Software Engineering Hardware/Software Engineering is the application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of hardware and software. In general, engineering comprises all the activities performed to support the translation of a user need into a product. That product includes hardware and software. Production, Quality, and Manufacturing Management (Called Manufacturing and Production in Desktop) The goal of the Production, Quality, and Manufacturing Management discipline is to ensure the productivity of the system design.

Productivity is the relative ease of manufacturing an item or system. Designing in productivity reduces both schedule Technical Management Partnership The Government and Contractor work together as part of the PIT process to transform road operational capability needs into a fielded system. The Government is concerned primarily with: Managing the total program Meeting the Users Requirements The contractor is concerned primarily with: Designing and developing the system. Meeting the Government's contractual

needs. Comparison of Government and Contractor Activities The Government and Contractor may perform similar activities. However, each party has a distinct role Function Government Role Contractor Role Translate the Needs cited in the Actively engaged in translating Normally actively participates in abilities documents. ACID/CAD/CPA operational need into a system developing the system performance performance specification. Updates the specifications. Translates the system performance specification to system performance specification into technical design specifications.

Supports all performance specification development. Allocates performance requirements to lower level design specification. Define the Design Establishes system-level performance Allocates system-level performance thresholds and objectives. Thresholds and objectives to subsystems and lower. Monitor the Design Assure Design Quality Monitors program technical progress Manages and integrates technical through Pits, technical reviews, and design progress using internal periodic program reviews. Management standards.

Verifies contractor performance Validates internal and subcontractor through review and approval of technical performance through contractor technical deliverables. Standards. Test the Design Verifies system performance through Validates system performance conduct of development and/or through internal testing and operational testing. Participation in Government development testing. 4 Systems Engineering Process (SEEP) Integration Systems Engineering Disciplines and the Acquisition Life Cycle The various Systems Engineering activities must be progressively integrated across all phases of the life cycle.

These activities must be tailored to fit program needs. 5 Determination of User Needs All acquisition programs are based on identified, documented, and validated user needs. User needs may seek to: Establish a new operational capability. Improve an existing capability, or Exploit an opportunity to reduce costs or enhance performance. An Initial Capabilities Document (ACID) is developed when needs cannot be met wrought immaterial solutions. Materiel Solution Analysis Phase Materiel Solution Analysis is intended to refine the proposed materiel solution and Contractors are expected to employ a Systems Engineering Process (SEEP).

The SEEP translates viable concepts (whose functionality can be traced to the requirements) into designs. The primary inputs to the SEEP during Material Solution Analysis include capability needs in the form of: The Initial Capabilities Document (ACID), The assessments of technology opportunities and status, and The outputs from any efforts undertaken to explore potential solutions. Through an Analysis of Alternatives (AAA), an assessment is made of critical technologies, technology maturity, and technical risk to determine the best possible system solution.

Technology Development Phase Once the preferred solution is determined in Materiel Solution Analysis, key technologies are matured in the Technology Development Phase. The fundamental objectives of Technology Development are to reduce technology risk and to determine the appropriate set of technologies to be integrated into a full system through competitive prototyping activities. The goal of Technology Development is to identify an affordable increment of militarily-useful capability, demonstrate the technology in a relevant environment and Identify manufacturing risks.

A PDP and PDP-A is conducted to ensure that a system can be developed for production in a short time frame. The PDP/PDP-A pre-MS is mandatory for all Madams. 6 Engineering & Manufacturing Development Phase Entry into the Engineering and Manufacturing Development (MED) phase represents program initiation, the formal beginning of a system acquisition effort. Entry into MED requires mature technology, approved capability needs, and funding. At this mint, the program must have an approved Capability Development Document (CAD) that describes specific program capability needs.

MED consists of two major efforts: Integrated System Design (SD) System Capability & Manufacturing Process Demonstration (SCAMP) Integrated System Design Integrated System Design applies to systems that have not yet demonstrated the integration of subsystems at the system level. System Integration also involves completion of detailed design and reduction of system-level risk. Activity will continue the work begun in Technology Development. However, the effort owe becomes oriented to system-level engineering development, rather than the development of individual technologies.

The engineering focus is on the establishment, and agreement on system-level technical requirements. These system-level requirements are: Stated so that designs based on those technical requirements will meet the intent of the operational requirements. Stabilized and documented in an approved system-level requirements specification. System level detailed designs will then be developed based on the system-level needs. 7 System Capabilities & Manufacturing Process Demonstration There is no hard and fast guidance

that stipulates precisely how the systems engineering process is to intersect with the DOD acquisition process.

However, the typical SEEP activities completed during the System Capabilities & Manufacturing Process Demonstration effort include: Elaboration of preliminary and detailed designs, Fabrication of Production Representative Articles, Demonstration of the system in operationally intended environments, and Develop and Demonstrate manufacturing processes. In addition, successful developmental test and evaluation, operational assessments, ND modeling and simulation (where appropriate) are critical; providing necessary feedback within the SE process and to support the MS C decision.

Production and Deployment Phase The Production and Deployment (P) phase is divided into the following activities: Low-Rate Initial Production (LORI) Full-Rate Production and Deployment Low-Rate Initial Production Low-Rate Initial Production (LORI) focuses on final development of the manufacturing capability has the following purposes: Produce the minimum quantity of articles necessary for Initial Operational Test and Evaluation (TOT) and Live Fire Test and Evaluation (LEFT). Permit an orderly increase in production rate for the system. Establish an initial production base for the system.

Manufacturing rates are ramped upward toward the rates intended when manufacturing is fully underway. 8 Full-Rate Production Full-Rate Production begins after: Completion of formal testing (TOT), Submission of required beyond-LORI and Live Fire Test Reports, and Milestone Decision Authority makes the decision to proceed to full-rate production. The SEEP is used to

refine the design based on findings from the independent operational testing, direction from the Milestone Decision Authority, and feedback room deployment activities. Any configuration changes are incorporated into the full-rate production system.

Follow-on Operational Test and Evaluation (FOOT) is performed after the production system is stable. FOOT results are used to further refine the production configuration. After production becomes stable again, detailed audits are held to confirm that the Product Baseline documentation correctly describes the system being produced. The Product Baseline is then put under formal configuration control. Deployment As the system is produced, individual items are delivered to the field units that will actually employ and use them in their military missions.

Integrated planning is absolutely critical to ensure that the training, equipment, and facilities that will be required to support the system is delivered. During deployment, the systems engineering function involves integrating the various functional specialties to ensure system effectiveness. Achieving the user's required initial operation capability schedule demands careful transition planning 9 Operations and Support Phase As the system is delivered and operational capability achieved, the system transitions to the Operations and Support (O&S) phase of the system life cycle.

There is no separate milestone decision required for a program to enter into the O&S phase. O&S is the longest and most expensive phase and includes the following efforts: Statement Disposal During Statement, systems engineering activities are focused on maintaining the systems' performance

capability relative to the threat the system faces. If the military threat changes or a technology opportunity emerges, then the system may require modification. These modifications must be approved at an appropriate level based on the proposed change. The change then drives the initiation of new Systems

Engineering Processes, starting the cycle (or parts of it) all over again. In an evolutionary development environment, there will be a continuing effort to develop and refine additional operational needs based on the experience of the user with the portion of the system already delivered. As new needs are generated, a new development cycle begins, with technology demonstrations, risk reduction, system demonstration and testing ? the same cycle just described. The process is tailored to the specific needs and demands of the technology to be added to the core system already delivered.