Systems Engineering Research Center
Research Topic #34 (RT-34)
Expedited Systems Engineering

Research Topic and Questions for Site Visits, September 2011

RT-34 Problem Statement

The Defense Science Board (DSB) Task Force on the Fulfillment of Urgent Operational Needs (July 2009) identified more than 20 rapid-reaction programs and organizations addressing DoD urgent warfighter needs. A subsequent DSB study found that urgent needs programs spent more than $50 billion between 2005-2009, and that urgent needs should be considered a critical, ongoing DoD institutional capability. In other words, "urgent" is becoming more "normal." In March 2011, the GAO report, "DoD's Urgent Needs Processes Need a More Comprehensive Approach and Evaluation for Potential Consolidation," found that DoD has taken steps to improve fulfillment of urgent needs, but it needs a common approach for addressing urgent needs. The GAO report refers to at least 31 entities that manage urgent needs and expedite the solutions to address them.

This SERC project will examine expedited systems engineering as applied to rapid capability and urgent needs as developed in response to changing threats. Lifecycle of urgent needs programs is driven by "time to market" as opposed to complete satisfaction of static requirements, with delivery expected in days/months versus years/decades. The processes and practices applied to urgent needs must add value and not require an excessive bureaucratic oversight to implement, while at the same time address, understand, and manage risk such that programs can understand better where to include, truncate, or eliminate systems engineering (SE) practices and processes. The hypothesis is that by defining, identifying, testing, and ultimately implementing expedited SE processes and practices, capability that results from urgent needs may be more effective, efficient, and longer lasting in the field. Potential second order effects are that expedited SE as applied to urgent needs could streamline specific future SE practices, as urgent becomes "normal," and findings could eventually improve SE processes for traditional programs as well.

The purpose of the research is to explore and develop a scalable expedited SE framework for hybrid programs, i.e., those utilizing rapid acquisition procurement but with the intent to have a more traditional lifecycle for deployment, maintainability, reliability, adaptability and sustainment. The framework will examine scaling of SE activities in response to different development constraints, such as reduced development time.

RT-34 is a 9-month research task, from September 1, 2011 – May 31, 2012.

> Phase 1: Short planning phase to identify organizations practicing expedited systems engineering, including visiting selected organizations and incorporating input from the SERC Research Council.

> Phase 2: Analyze current state of the art in expedited systems engineering within DoD and commercial sector, developing a framework for scaling SE activities in response to different development constraints, such as reduced development time.

> Phase 3: Prepare a plan for validating the framework on a DoD acquisition program.

> Phase 4 (Future, Separate Funding): Execute the plan from Phase 3, with research to analyze the framework in action and iterate it based on observations and results as applied to a real program.

1. What systems engineering methods, processes, and tools do you use
   a. What is considered "standard" in your organization
   b. If processes are tailored, which ones are tailorable and why; how do you capture this knowledge
   c. What rationale is used to follow a standard process or not
   d. What is the role of the project manager, chief engineer, chief architect, senior leadership, customer
   e. What level of risk is acceptable and how do you determine
   f. What level of documentation do you use and why
   g. What types of meetings do you hold, who attends, who makes decisions, and why
   h. How replicable / transferable are your processes from one project to another and why
2. Scope
   a. How long is the lifecycle of the product
   b. How many units are you supporting
   c. What different MPTs do you employ based on scope
3. Team
   a. What types of teams do you use (e.g., domain, functional, IPT, etc)
   b. How do you select the team
   c. Who selects the team members and why
   d. What skill mixes are the best
   e. How homogeneous (or not) are the skills, people, and personalities
   f. How do you bring in the government sponsor
   g. How do you bring in the user perspective
   h. How do you manage people and teams that are not co-located
   i. How do you network across these boundaries
   j. How do you handle round-the-clock work and burnout, what is the maximum timeframe that people can withstand the stress (role of stress)
4. Decision Analysis
   a. How are systems engineering decisions made
   b. Who makes the decisions
   c. At what level are decisions made
   d. Who is empowered, how do they know it, how are they supported
   e. Is there a chain of command and how is it used
   f. How do you know when and where to take risks
   g. To what extent are these decisions documented, formalized, communicated
   h. How do you prepare for decisions
   i. How quickly do you need to make decisions
   j. How is decision making in the critical path
5. Product Use
   a. How do you translate prototypes to operational use
6. Scalability
   a. How are your responses above dependent on size of the project (scope, cost, timeline, risk, # of people)
   b. What systems engineering tasks are tailorable or scalable?
7. Collaboration and Communication
   a. What role does collaboration play…in general, in management, in team building, in problem solving, in systems engineering processes, in communication, in knowledge transfer
   b. How do you facilitate collaboration (internal, external)
   c. What collaborative tools do you use, which are most effective in which situation and why

RT-34 Points of Contact

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