
— *Working Group Outbrief* —

Challenges in Developing and Acquiring Systems with Evolving Requirements

Session 10F

Session Chairs

Nancy Kern
Senior Project Lead, SED
The Aerospace Corporation

Mary Jo Gura
Associate Director, CSD
The Aerospace Corporation



Invited Speakers/Panelists

❖ **Suellen Eslinger**
Distinguished Engineer
The Aerospace Corporation

❖ **Brian Gallagher**
Director, Acquisition Support Program
Software Engineering Institute

❖ **Linda Martz**
Engineering Director
Raytheon IIS Rocky Mountain

❖ **Asya Campbell**
Systems Director, AEHF
The Aerospace Corporation



Acquiring Software-Intensive Ground Systems with Evolving Requirements – Suellen Eslinger

Requirements Creep *IKIWISI*

Description:

Requirements creep describes the activity of evolving the system to be what the user/customer/SPO desires it to be. This most often is witnessed during the development of an unprecedented system applying new technology. As the system definition evolves, the technical knowledge of the people involved also increases, providing opportunities for “improvement” in the initial system vision.

Red Flag: Many conflicting stakeholders; many unknown requirements

Scenario Summary:

- Increasing requirements and requirements changes
- Increase in code estimates
- Additional personnel needs cannot be met due to unavailability
- Quality activities are reduced in an attempt to make up schedule
- Milestone slips occur as reduced productivity and rework show up
- More personnel are added, further reducing productivity
- Cost increases are experienced
- Schedule slip is experienced
- Finally, a contract breach occurs



Identifying Acquisition Patterns of Failure Using Systems Archetypes - Brian Gallagher

There are many recurring patterns of behavior in software acquisition and development that have been modeled using Systems Archetypes

- **Sacrificing Quality**
- **Firefighting****
- **The “Bow Wave” Effect ****
- **Underbidding the Contract**
- **Shooting the Messenger**
- **Robbing Peter to Pay Paul**
- **Longer Begets Bigger**
- **The 90% Syndrome**
- **Requirements Scope Creep**
- **Feeding the Sacred Cow****
- **Brooks’ Law**
- **PMO vs. Contractor Hostility****
- **Staff Burnout and Turnover**
- **The Improvement Paradox**

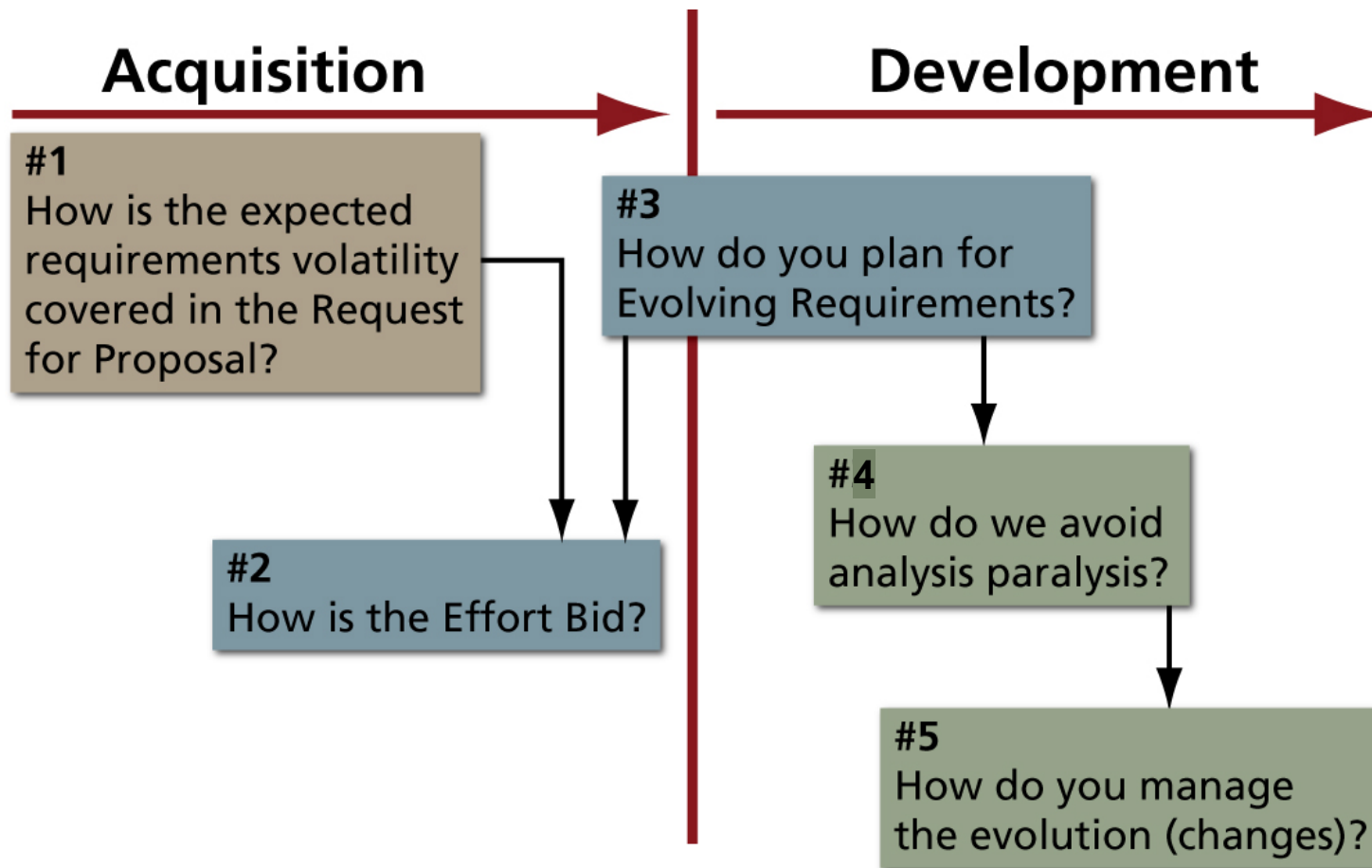
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**Concept briefs, analyzing recurring patterns in actual acquisition programs, and recommending interventions and preventative actions, are available



How Raytheon Meets the Challenge of Developing Systems with Evolving Requirements – Linda Martz



Advanced Extremely High Frequency (AEHF) Program, Mission Control Segment (MCS) – Asya Campbell

AEHF MCS Startup Strategy

- *Establish Business Rhythms*
- *Leadership Assessment Template*
- *Smooth Staffing Ramp-up, “Best Athlete”*
- *Core Team Firm Fixed Price Training & Mindset*
- *Proactive Program Planning & Mgmt During Transition & Start-up Focused on Execution Plan*
- *Prime Integration Approach (Deputy on-site, TDY’s)*
- *Definitize Major Subcontracts at Award & Treat as Teammates*
- *Customer Engagement & Communication*
- *Senior Mgmt Review & Commitment*
- *Baseline Change Control Process*
- *Schedule Management Approach*
- *Employee Awards Program*



Focus on Startup Process Provides Basis for Successful Program

Panel Discussion - Issues Related to Evolving Requirements

- **Key Topics – The Challenges**
 - ❖ **Unrealistic schedules/budgets**
 - ❖ **Lack of clear requirements & requirements volatility**
 - ❖ **Incentivizing the Contractors**
 - ❖ **COTS Insertion**
- **Key Points – How to Address the Challenges**
 - ❖ **Get “the right stuff” on contract**
 - Emphasize the risks in the RFP, explicitly and implicitly
 - Have adequate Risk \$\$ allocated to (and protected for) the predictable problem areas
 - Get realistic and complete cost estimates based on applicable historical data, especially for reuse
 - Prepare for evolving requirements with processes that handle those uncertainties
 - ❖ **Manage COTS throughout the lifecycle**
 - Have adequate schedule/budget associated with all COTS effort: Glue code, interfaces, upgrades and fixes during development and maintenance, system impact, recertification
 - Make sure the COTS mgmt plan is for the entire team – prime & subs
 - Address 2nd & 3rd tier COTS
 - ❖ **Work as a team**
 - Define incentives carefully and encourage open communication
 - Strive for a good working relationship between Contractors, Government Team, & Users



Summary – Acquiring Systems with Evolving Requirements

- **Contractor Perspective:**
“You can’t always get what you want....
You get what you need!”

- **Government Perspective:**
“You can’t always get what you want.
But if you try, sometimes you just might find -
You get what you need!”*



* The Rolling Stones

Working Group Chairs and Speakers

Bios and Abstracts



Session Chairs

Nancy Kern

Senior Project Lead

Systems Engineering Division

The Aerospace Corporation

Ms. Kern has over 30 years experience in software and systems engineering for software-intensive space and ground systems. She has been involved in numerous acquisitions of complex systems and is highly experienced in all phases of the acquisition lifecycle. As the Director of Software Engineering in ETG's Northern Virginia office, she provided support to NRO, SMC, and CCO programs. Since returning to El Segundo, she has continued to support East and West Coast customers, leading engineering teams and participating in special studies and reviews. She is currently performing research in software estimation and works with various government cost organizations. She is also involved in the development and presentation of software acquisition training for The Aerospace Institute. She graduated from Purdue University with Highest Honors in Mathematics & Computer Science.

Mary Jo Gura

Associate Director

Computers and Software Division

The Aerospace Corporation

Ms. Gura joined The Aerospace Corporation in August 2005, after 27 years of experience as a software engineer and software manager at Hughes/Raytheon Company. In June 2007, she became the Associate Director of the Software Architecture Engineering Department. Her areas of expertise include all aspects of the software development lifecycle. At Aerospace she divides her time providing software management and technical oversight support to SMC, NRO and CCO programs. She also supports numerous Concept Design Center studies in the role of Software Lead. She earned a BS in Mathematics from the University of Illinois.



Acquiring Software-Intensive Ground Systems with Evolving Requirements

Suellen Eslinger

Ms. Eslinger is a Distinguished Engineer at The Aerospace Corporation with over 40 years experience in software engineering and the acquisition of software-intensive systems. During her 23 years at Aerospace, she has supported ground systems for numerous Air Force and NRO space programs. She is the Principal Investigator for software acquisition research and also leads curriculum development and delivery of software acquisition training courses for The Aerospace Institute. Previously, she worked at Computer Sciences Corporation (CSC) and General Research Corporation (GRC), where she developed software and managed ground software development projects for DoD and NASA ground systems. Ms. Eslinger is widely published and has given numerous conference presentations and tutorials in the fields of software engineering and software acquisition. She has B.S. and M.S. degrees in mathematics, from Goucher College and University of Arizona, respectively.

Abstract:

The acquisition of large, complex software-intensive ground systems is fraught with risk, and when requirements are evolving throughout the system acquisition, the risk increases dramatically. This presentation focuses on methods for reducing software acquisition risk due to evolving requirements throughout the acquisition life cycle. During the early acquisition phases (pre-system acquisition), it is critically important to define the program to accommodate evolving requirements. Software acquisition best practices for accomplishing this will be discussed, including best practices for developing the system architecture and cost and schedule baselines and defining the program life cycle and executables evolutions. During the system acquisition, it is critically important to manage requirements change throughout the system development life cycle. The presentation will discuss using failure scenarios to help recognize and manage volatility during system development.



Identifying Acquisition Patterns of Failure Using System Archetypes

Brian Gallagher

Mr. Gallagher is the Director of the SEI's Acquisition Support Program. He builds teams from across the Software Engineering Institute to support the needs of DoD and other government acquisition programs. Brian was previously employed with the Aerospace Corporation where he worked as a software acquisition and engineering advisor for several Air Force and NRO projects. During his Air Force career, he was the Deputy Chief of Software Engineering with an Air Intelligence Agency remote site, Chief Engineer on the Range Operations Control Center Project at Cape Canaveral AFS, FL, a Software Project Manager for the Titan IV Program Office, and a Software Engineer with Strategic Air Command. He received his B.S. in MIS from Peru State College, and M.S. in CS/Software Engineering from Florida Institute of Technology.

Abstract:

Acquisition problems such as managing evolving requirements, technology maturation and insertion, and transition into operational use are pervasive. In large part, this is because the interactions between the SPO, sponsors, contractor, subcontractors, and users all involve feedback, a mechanism that introduces complexity that defies traditional analysis. The resulting system behavior can seem unpredictable and unmanageable. "Systems thinking" is an approach that allows us to recognize systems archetypes that characterize problematic behavior patterns that occur repeatedly across many organizations. When brought to bear on the problems of software acquisition, the systems archetypes can be used to describe specific patterns of counter-productive behavior observed in practice across many programs. This presentation introduces a set of acquisition-specific archetypes to describe and analyze common patterns of failure in software-intensive acquisitions and to develop interventions to correct and prevent these behaviors.



How Raytheon Meets the Challenge of Developing Systems with Evolving Requirements

Linda Martz

Ms. Martz is the Raytheon IIS Rocky Mountain Engineering Director. She has over 30 years experience in management of software development, including software management and program management. Experience at Raytheon includes management of software developments since 1986 for classified and unclassified programs. Software program leadership includes successful projects using leading edge technology insertion of object-oriented technologies; web-based technologies; mission management technologies; management through metrics (including IMP, IMS, and earned value); SW costing; and process definition and implementation. Led Raytheon programs through successful CMMI assessment in 2004. Supported NPOESS as the Ground Software Lead (2002-2005) and as the NPOESS IDPS IPT Lead (2006).

Abstract:

Many of today's developments for the government include risks related to evolving requirements. Contractors, including Raytheon, deal with this on a daily basis. The recent NPOESS Ground Segments, as well as other Raytheon programs, have been able to meet the needs of the acquisition organizations within cost and schedule. This presentation will describe some best practices and lessons learned in meeting these challenges.



Advanced Extremely High Frequency (AEHF) Mission Control Segment (MCS) Development Program Software Maturity Assessment as part of Mission Assurance

Asya Campbell

Ms. Campbell is a Systems Director, EHF Systems MILSATCOM Division at The Aerospace Corporation. In that position Ms. Campbell is responsible for the design and development of the ground segment for the Advanced EHF System, a secure, satellite-based, military communications system. The ground segment includes command and control, communication planning support, test and training simulators, and the development/sustainment environment. Ms. Campbell joined The Aerospace Corporation in 1989 as a Member of the Technical Staff and has held numerous technical and management positions with increasing degree of responsibilities throughout the Corporation. These included the Manager of the Database Engineering Section in the Software Engineering Subdivision, Technical Lead of the corporate-wide development and deployment of Lotus Notes Infrastructure, and the Senior Project Leader, Communication Management in MILSATCOM Division supporting Milstar and Advanced EHF ground development. Ms. Campbell's technical interests are in the areas of software development, ground systems, and software architecture. Ms. Campbell holds a B.S. degree in Mathematics and Computer Science and a M.S. degree in Computer Science from the University of California, Los Angeles.

Abstract:

The Advanced Extremely High Frequency (AEHF) program is a new generation of highly survivable communications capability for the US Military. The ground control segment of this program is the Mission Control Segment (MCS) which is a critical aspect of the \$6.7B AEHF Program. The MCS ground-based fixed and mobile stations will command and control both AEHF and Milstar satellites on orbit, monitor satellite health, coordinate worldwide communications networks, deliver high-fidelity training and simulation, and enable software sustainment. The AEHF MCS program has been underway since 2000. The MCS products are being deployed throughout the world to support the warfighter's mission. The first deliverable increment is now fielded to 8 locations through out the world while the second deliverable increment is currently in system test. The program has been extremely successful in meeting and exceeding all of its cost, schedule and technical targets. The AEHF MCS program was a 2006 recipient of the Top 5 DOD Program Award presented by OSD and NDIA.

