Software-Intensive Acquisition Programs: Productivity and Policy

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**Software-Intensive Acquisition Programs: Productivity and Policy**

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Software acquisition: a well-publicized problem across the Department of Defense (DoD),
- General Accounting Office (GAO) (2009): large-scale software acquisitions falling short of cost, schedule, and performance goals

With sophisticated tools and capabilities shouldn't the work be getting easier?

Development: much more than writing code

Complicating factors:
- Lack of formal requirements definition
- Misunderstandings between user and developer
- Requirements creep
- Technology insertions and upgrades
- Inspections and testing
- Volume of scrap and rework
- Policy changes
Software-Intensive Programs: Current Policy

- MIL-STD-498: Uniform requirements for development and documentation (22 data item descriptions)
- DoDI 5000.02 and DoD 5000.04-M-1: Software Resources Data Report reporting (via Defense Cost and Resource Center)
- Software process improvement initiatives, driven by Section 804 of National Defense Authorization Act (2003), and promulgated by ASN(RDA)
- Some apply solely to Acquisition Category (ACAT) I programs; most are implemented at contract level

**Complex web of policy, regulations, instructions, and best practices**
Software-Intensive Programs: Research Questions

- How can the DoD adjust its acquisition processes to improve developers’ productivity?

- How can the DoD effectively reward desired behaviors?
Software-Intensive Programs: Study Overview

- Criteria for sample: ACAT I and software intensive
- Stratify programs by level of success
- Identify best practices
  - Literature review
  - Subject-matter expert inquiries
- Consider “success” metrics (cost, schedule, performance) in light of
  - Development approaches
  - Management styles
  - Organizational policy and best practices
  - DoD policy and best practices
- Findings and recommendations
Methodology: Successful Programs

- Extracted data on Navy and Marine Corps Major Defense Acquisition Programs from Defense Acquisition Management Information Retrieval service
  - Filter #1: ACAT I or special interest
  - Filter #2: No Nunn-McCurdy breaches
    - Unless Average Procurement Unit Cost breach driven by changes to quantity
  - Filter #3: Currency—active program (April 2011)
  - Filter #4: History—at least three years into development
  - Filter #5: Software intensive (> $20M in software)

_Data on “successful” programs gathered from interviews and public domain sources_
Successful Software-Intensive Programs

EA-18G ("Growler") Electronic Warfare Aircraft

Navy Multiband Terminal

AGM-88E Anti-Radiation Guided Missile

P-8A Multimission Maritime Aircraft

Standard Missile (SM)-6

Cooperative Engagement Capability (CEC)
P-8A Multimission Maritime Aircraft

- Replaced P-3C Orion capabilities
- Open architecture approach
- Detailed planning phase; robust Analysis of Alternatives (AoAs)
- Well-balanced package of cost, schedule, and performance (Independent Cost Estimate added funds for software development)
- Good relationship with requirements community; program could speak in unison and maintain executability
- Heightened sense of immediacy

U.S. Navy-released photo
Standard Missile 6 (SM-6)

- Next-generation SM with extended range and active missile-seeker homing capabilities; capable of responding to various threats
- Urgent need for successful program
- Thorough pre-Milestone B planning
- Strong ASN, RDA, support: full funding based on a realistic, risk-based cost estimate
- Prior experience helped manage anticipated pitfalls
- Positive relationship with industry helped ensure quality staffing
Cooperative Engagement Capability (CEC)

- Integrated battle-force combat systems and sensors; data distribution for a common composite track database; enhanced ship self-defense capability
- Classic acquisition processes through mid-1990s, when acquisition reform impacted strategy
- Strong mission focus and leadership
- Well-balanced, experienced team
- Adapted to changing labor market (Ada -- > C++)
Successful Programs: Findings

- Experience to identify and mitigate risks
- Leadership continuity (including senior engineers)
- Communication skills (candor and honesty)
- Empowerment of program managers to make good decisions
- Sound knowledge-based business plan at outset
- Clear, well-defined requirements
- Used mature technologies and/or production techniques
- Established realistic, risk-based cost and schedule
- Disciplined execution with resistance to new requirements
- Stabilization of funding and resources
- Contractual incentives and stalwart government review team
- Holistic approach to contracting (system -> platform ->)
Environmental Factors (Future Research)

- Technology levels
- Stability of requirements
- Available time and approach (incremental vs. one shot)
- Personnel and/or developer attributes
- Capabilities of analysts and programmers
- Application domain experience
- Continuity of personnel and/or learning curve
- Modern practices and tools
- Team organization and communication
Concluding Thoughts: Weapon Systems Acquisition Reform Act (WSARA) and Beyond

• WSARA aspires for more executable programs ...
  – Supplant risk with knowledge
  – Milestone A cost estimate with confidence levels
  – Competitive prototypes
  – Enhanced requirements for AoAs
  – Pre-Milestone B review of technology maturity and integration risk
  – Pre-Milestone B Preliminary Design Review
  – Renewed emphasis on systems engineering and testing
  – Configuration steering boards to stabilize requirements
  – Post-Critical Design Review assessment of progress

• GAO (2010: modest improvements; increased knowledge at key decision points

• GAO (2011): “meaningful steps” taken to reprioritize and rebalance portfolio, but still a factor on GAO High-Risk List