



Software-Intensive Acquisition Programs: Productivity and Policy

**Naval Postgraduate School
Acquisition Symposium**

11 May 2011

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Software-Intensive Programs: Productivity and Policy

- **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



U.S. Navy-released photo

- 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

Standard Missile 6 (SM-6)



U.S. Navy-released photo

- **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)



U.S. Navy-released graphic

- 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**