Software Intensive System Acquisition - Best Practices

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Problem

- Defense development and acquisition programs continue to experience “software problems” resulting in significant cost overruns, schedule slips and performance difficulties.

- ESC made significant progress to reform software acquisition processes in the early 90’s and was seen as an enlightened leader.

- New environment emphasizes evolutionary spiral acquisition models.

- Are we using the best software acquisition practices for this new environment?
Software Program Findings

Programs with software difficulties exhibit *fundamental* problems:

- Requirements are too complex or too rigid
- Developer lacks software skills and experience
- Poor software management practices
- Lack of effort up front on system architecture
- Lack of system engineering trading hardware/software
- Adherence to policy & directives at expense of system performance & functionality
- No real financial incentives
- Program management does not anticipate or cannot fix the problems

Average cost growth exceeds 89%

53%

Late and over budget

16%

On time and on budget

31%

Projects canceled before completion

Average final product contains 61% of originally specified features

Ref: CHAOS Study, Standish Group Summer 1999
Project Work Plan

- FY03
  - Develop a framework for assessing projects
  - Baseline ESC’s
    - software acquisition status
    - software acquisition best practices
    - software acquisition concerns

- FY04
  - Examine options for software acquisition process improvements
  - Develop plan to implement reengineering
  - Pilot programs
Project Assessment

● Goal: to leverage existing materials in this area
  - Capability Maturity Model (CMM)
  - Capability Maturity Model Integration (CMMI)
  - Tri-Service Assessment Initiative
  - MITRE Program Assessment Toolkit
  - OSD Equivalency Core Criteria and Questions
  - Airlie nine practices
  - Software Program Managers Network 16 Critical Software Practices™
  - Defense Science Board (DSB) reports

  - Triage (rather than in-depth)
  - Based on proven industry practice
Assessment Framework

Project Management

- Adopt a Program Risk Management Process
- Estimate Cost and Schedule Empirically
- Use Metrics to Manage
- Track Earned Value
- Track Defects against Quality Targets
- Treat People as the Most Important Resource
- Improve Software Skills of Acquisition Managers
- Adopt Effective Contract Incentives
- Stress Past Performance and Process Maturity
- Exploit Independent Expert Reviews

Product Construction

- Adopt Life Cycle Configuration Management
- Manage and Trace Requirements
- Use Systems Based Software Design
- Ensure Data and Database Interoperability
- Define and Control Interfaces
- Design Twice, Code Once
- Assess Reuse Risks and Costs
- Use Executable Architectures
- Employ Iterative Design/Development Cycles
- Maintain a Strong Technology Base

Product Stability & Integrity

- Inspect Requirements and Design
- Manage Testing as a Continuous Process
- Compile and Smoke Test Frequently

Source:
Software Program Managers Network 16 Critical Software Practices™
DSB Report on Defense Software (Nov 2000)
Example

4. Track earned value

Top level question:
Do you use earned value to track progress on your program?
   a) Yes
   b) No
If no – skip to Practice 5
If yes – continue

Who on your staff understands the entry and exit criteria for each task the contractor has defined?

_________________

How is earned value credit given?
   a) Binary with zero percent given before task completion and 100% when completion is validated
   b) Partial credit allowed

How often is earned value reported, collected and reviewed?
   a) Less frequently than once a month
   b) Between once a month and every two weeks
   c) Every two weeks or more frequently

Does the cost reporting system segregate the software effort from the non-software related tasks?
   a) Yes
   b) No
Related Efforts

- A Study of Best Practice Adoption by Defense Acquisition Programs (CrossTalk May 2002)
  - Dr. Richard Turner, The George Washington University
  - Measured best practice adoption in defense acquisitions
  - Found widespread awareness (85%) but little actual implementation (avg 25%)

- Software Process Improvement at SPAWAR PMW 163 (May 99)
  - Frank Doherty (http://www.spmn.com/Pmw163/)
  - Developed a variant of the SPMN 16 Point Plan™ for all program managers to implement
  - Provided manuals, training
  - Baseline assessment 388 questions, all weighted, answers rated on a 5 point scale
  - Goal was to have an effectiveness score of 4 out of 5 in 12 of the 16 areas within 8 months
  - Results unpublished
Process

- Develop a short list of questions that can be used to evaluate the health and performance of a software development project / program office
  - More detailed questions for identified problem areas
- Conduct the survey for all of the programs under a PEO
  - Interview format allows observations to be captured
  - Also capture what is working
- Provide each SPO with a confidential report of results for her/his project
  - Results most useful to those in position to best correct deficiencies
- Provide the PEO with a report showing aggregate data
  - Support identification of overall trends
  - Support setting of performance goals
- Repeat periodically (every 6 months) to evaluate process improvement
Next Steps

**FY03**
- Complete baseline survey
- Analyze results
  - Look for trends: by acquisition phase, by program type (e.g. networking, radar), by software challenge (e.g. COTS integration, real-time), etc.
- Update assessment framework
- Provide reports to program managers, PEO

**FY04**
- Identify process improvement options with most “bang for the buck”
- Create/Refine software Tactics, Techniques and Procedures (TTPs) for selected options
- Develop plan to implement reengineering
- Identify candidate programs
- Pilot selected TTPs on candidate programs
Impact

- Baseline of PEO program software acquisition practice
- Identification of best practices in evolutionary, spiral acquisition environment
- Specification of software acquisition Tactics, Techniques and Procedures (TTPs)
- Pilot experience with TTPs
- Recommendations for integration within ESC business practices