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Objective Demonstration of Process Maturity Through Measures

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Agenda:

- Concept
- Background
- Alternative Evaluation Technique
- Recommendations
- Summary

Concept

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- An acquirer should be able to authenticate a supplier's process maturity and capability through the use of measures
- A mature organization (acquirer and supplier) should have in place a measurement program that provides objective insight into an organization's and a project's issues and a project's requirements
- A mature organization routinely uses these measures to manage its projects and can demonstrate their use to control process performance

An organization that does not have an effective measurement program is not SEI SW-CMM Level 3

Background

5000.2 Final Draft
June 2000
Section 1

1.1.2 Defense Acquisition System

The outcome of systems acquisition is a system that represents a judicious balance of *cost, schedule, and performance* in response to *user's expressed need*; that is *interoperable* with other systems; that *uses proven technology, open system design, available manufacturing capabilities or services, and smart competition; that is affordable; and that is supportable.*

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Background

Current DoD Policy:

Software systems be designed and developed based upon *software engineering principles*. This includes the selection of contractors with *domain experience in developing comparable software systems, a successful past performance record, and a demonstrable mature software development capability and process.* It also requires a *software measurement process* to plan and track the software program, and to assess and improve the development process and associated software product.

At a minimum *full compliance with SEI CMM Level 3, or its equivalent level* in an approved evaluation tool, is the Department's goal.

J.S. Gansler

"In addition, I request your assistance in defining a single recommended evaluation technique so these tools will provide *consistent results and will not burden* our contractor community with multiple evaluation types."

Delores M. Etter

Background

Current Evaluation Practices:

- Software Capability Evaluation (SCE) - provides empirical evidence of the contractor's ability to create a software product that meets technical requirements and the program's cost/schedule. The SCE provides the government information to determine the risk associated with the contractor's development process.

- Software Development Capability Evaluation (SDCE) - The SDCE is a methodology for assessing a contractor's capabilities in software and software-related systems engineering disciplines. SDCE is based on the premise that if contractors have defined their software development plans and identified the software engineering processes, tools, and technologies they will use on a given program and if they have past experience in the use of the identified processes, tools, and technologies, they present a lower risk to the program than contractors who have not.

This presentation will focus on SCE's

Background

Current Evaluation Practices:

Software Capability Evaluation (SCE) -

- Based on the SEI SW-CMM
- Uses a variant of the CBA-IPI assessment model
- Usually part of the source selection process
- SCE team performs the evaluation by reviewing contractor provided information and conducting interviews
- Includes sites visits and interviews with candidate contractors
- A subset of a contractor's projects are evaluated (based on similarity to the proposed project)
- The evaluation should reveal specific strengths and weaknesses associated with the proposed project

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Background

Source Selection Criteria - Determining Best Value:

- Best Value Award - "the expected outcome of an acquisition that, in the Government's estimation, provides the greatest overall benefit in response to the requirement." FAR 2.101
- Other allowable actions:
  - Full Tradeoff Process
  - Performance Price Tradeoff Process
  - Lowest Price Technically Acceptable Process

- Evaluation Process - used to validate and confirm the offeror's written proposal
- Evaluation Notices are used to identify deficiencies and allow offers to revise their proposals
- Objective - to maximize the government's ability to obtain best value, based on the requirements and the evaluation factors in the solicitation

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Background

Source Selection Criteria - Determining Best Value:

Evaluation Factors - The factors are of equal importance

1. Mission Capability

   Sub-Factor 1 : Management

   Sub-Factor 2 : System Development

   Sub-Factor 3 : Software

   Sub-Factor 4 : Production and Installation

   Sub-Factor 5 : Small Business Subcontracting

2. Cost/Price
3. Past Performance
4. Proposal Risk

In descending order of importance

Background

SCE Issues:

- Does the SCE provide the PM the information needed to make the right acquisition decision?
- Significant Cost of SCE's - Government and Contractor
  - $60k - $80k per government evaluation team
  - $50k - $300k for contractor preparation/support
- Team preparation and evaluation period
- Evaluation model - data intensive
- Reuse of SCE results by other programs and agencies

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Similar problems with CMM software process assessments:

- Cost -
  - $94k - $271k internal
  - $40k - $137k external
- Data intensive
- Information for the decision maker

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Alternative Evaluation Technique

Goal:

To establish an equivalent Level 3 evaluation technique that -

- provides credible information on process and technical capability, product quality, cost/schedule realism, past performance, etc.
- reduces the cost of on-going evaluations with minimum disruption to the program
- provides reliable and objective information to decision makers at the right time
- reuses information that has significant utility to management at little or no additional cost
- supports the acquisition and the supply of best value

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Alternative Evaluation Technique

Purpose is to change the evaluation technique:

The current CBA-IPI based evaluation technique is too expensive for on-going use and does not provide adequate information about the contractor's ability to satisfy the Defense Acquisition requirements.

To provide useful objective evidence at little or no additional cost.

Need to provide the evaluation team the ability to observe the performance of the process and how the process influences the success of the project.

Purpose is not to replace contractor evaluations - but to provide an objective basis for evaluating a contractor's software process and product capability/maturity and its ability to satisfy requirements.

Alternative Evaluation Technique

Proposed Alternative:

- Establish process and product measures that represent the institutionalization of Level 3 behavior, i.e.,
  - The organization's standard software process is routinely used across the projects
  - The use of the process as indicated by measures and other objective evidence to provide organization and project management insight into the project's progress
  - Measures are used to plan, control and assess
- Perform contractor evaluations based on this measurement set
- Contractors that do not satisfy the level 3 criteria are high risk

Alternative Evaluation Technique

Candidate Approach:

- Start with a set of processes and objective evidence
- Use the contractor's existing product and process measures
- Ensure the current measurement program provides insight into
- the project's cost, schedule, progress, quality, etc. on all programs
- Analyze the measures for gaps to ensure the applicability of these measures and objective evidence to the achievement of Level 2 and 3 SW-CMM KPA Goals
- Obtain acceptance of these measures through an agreed to criteria
- Develop training for analyzing and interpreting the measures
- Provide training materials
- Implement on pilot organizations/projects
- Update measures
- Document and release

Alternative Evaluation Technique

Example of Goal/Measurement Analysis:

CMM KPA	Key Measures	Implementation Objective Evidence	Why does this measure/OE meet the goal?	Gaps
Requirements Management Goal 1: System requirements allocated to software are controlled to establish a baseline for software engineering and management use. Goal 2: Software plans, products and activities are kept consistent with the system requirements allocated to software.	Number of Requirements Number of Requirement Changes Number of Configuration Change Board Meetings	Inspection (peer review) records (G1, A1) Document review sign-off records (G1, A1) Software Requirements Specification (G2, A2) Requirements Traceability Records (G2, A2) Program Management Plan (G2, A3) Baseline Change Requests (G2, A3) Baseline Change Board minutes (G2, A3)	Peer reviews or document review sheets demonstrate that software engineering has reviewed the requirements before being incorporated in the program. Baseline change requests and board meetings demonstrate that changes to requirements necessitate a change to plans, products, and activities. The SRS and PMP demonstrate the effect of changes.	NONE
Software Project Planning Goal 1: Software estimates are documented for use in planning and tracking the software project. Goal 2: Software project activities and commitments are planned and documented. Goal 3: Affected groups and individuals agree to their commitments related to the software project.	CPI/SPI Size: number SLOC/FP, requirements, test cases plan vs. actual TPM plan vs. actual Granularity: # of WBSID elements, number of CSCs Risks: number open closed, mitigated, accepted Quality: number of QA audits plan vs actual; number of non compliances open, closed, escalated; % compliance	Plans Basis of Estimate Reviews Approvals/signatures on plans, estimates Project's defined software process	Many of these measures (CPI, SPI, size, TPM) are directly specified in activities that support the goals. Goals 2 and 3 are more directly supported by the OE rather than the metrics	Commitment is difficult to measure directly. It can be inferred (perhaps) by CPI/SPI and non-compliances (assuming process requires commitment)
Software Project Tracking and Oversight Goal 1: Actual results and performance are tracked against the software plans. Goal 2: Corrective actions are taken and managed to closure when actual results and performance deviate significantly from the software plans. Goal 3: Changes to software commitments are agreed to by the affected groups and individuals.	Size, cost, schedule, computer resources	Software Development Plan (G1, Act 1,13) Planned vs actual data (G1, Act 5, 6, 7, 8, 11) Samples of project replanning data (G2, Act 11) Meeting minutes, memos (G3, Act 3)	Documents means for tracking progress & conducting reviews Sample tracking metric data collected during project performance Samples of senior management reviews of changes to commitments to external organizations.	

Alternative Evaluation Technique

Going Forward:

- Obtain Government endorsement for the concept
- Establish a Joint Government/Industry Team
  - Government - Acquisition and Users
  - Industry - Level 4 and 5 Organizations
  - V&V - PSM Users Group
- Project span - 6 months
  - Detailed project planning to follow

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Alternative Evaluation Technique

Benefits of this approach:

- This evaluation technique uses a contractor's routine measurement process and existing objective evidence - with extensions to provide information on defense acquisition and DoD policy requirements
- Measures provide an objective basis to predict and determine the contractor's on-going satisfaction of project requirements
- Measures are agreed to by the Acquirer and the Contractor
- Measures provide real information (observations) that are actionable by decision makers
- Level 3 is required to demonstrate organizational implementation of this evaluation technique

Recommendations

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- Initiate the project
- Solicit government and industry measurement expert participation
- Form a team with the right people
- V&V to ensure satisfaction of project requirements
- Report back in three months to demonstrate proof of concept

Summary

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- Both Government and Industry need a practical approach to authenticate process maturity
- Current methods are expensive and do not provide decision makers instant and continuous objective information
- The results will improve improve the SCE process and are extensible to CMMI

This measurement based technique has practical application for:

- DCMA's CMM Based Insight (CBI)
- OSD's Program Analysis and Evaluation Measurements