Starefos, Joelle

From: Poslusny, Chester [cposlusny@babcock.com]
Sent: Tuesday, October 18, 2011 4:31 PM
To: Starefos, Joelle
Cc: Arnholt, Brian K; Childerson, Michael T; Fisher, Charles L (Contractor)
Subject: Info. for Tomorrow's Phone Call
Attachments: Effectiveness of CMMI in Support of BTP 7-14.docx

Joelle:

Please replace previous email attachment with this one.

As discussed, you will provide a call in number for tomorrow's call scheduled for 2:00 p.m.

Thanks.

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The Effectiveness of CMMI® in Support of Software Reviews For Digital Computer-Based Instrumentation And Control Systems.

Study Objectives

The purpose of this white paper is to explore the effectiveness of the Capability Maturity Model Integrated (CMMI®) to conform with the guidance contained in the U.S. Nuclear Regulatory Commission Branch Technical Position (BTP) 7-14, *Guidance On Software Reviews For Digital Computer-Based Instrumentation And Control Systems.* Specifically, if an organization or project has been appraised at CMMI® maturity level 3, what aspects of BTP 7-14 would it comply with?

BTP 7-14 provides guidelines for evaluating software life-cycle processes for digital computer-based instrumentation and control (I&C) systems relative to system safety. Acceptance is based upon (1) confirmation that acceptable plans were prepared to control software development activities, (2) evidence that the plans were followed in an acceptable software life cycle, and (3) evidence that the process produced acceptable design outputs.

CMMI® is a model and de-facto industry standard that consists of best practices that address the development and maintenance of products and services. It covers the lifecycle of a product from conception through delivery to maintenance. The CMMI® for Development (CMMI®-DEV) model encompasses industry best-practices for developing products, including project management, engineering, and supporting functions such as quality assurance. Given the similar nature of the two standards, there is considerable potential for overlap.

CMMI® Overview

The CMMI®-DEV model encompasses industry best-practices for developing products. These practices are organized into process areas, which in turn are organized into maturity levels (See Figure 1 below).

Maturity Level 2 - Managed
- CM - Configuration Management
- MA - Measurement and Analysis
- PMC - Project Monitoring and Control
- PP - Project Planning
- PPQA - Process and Product Quality Assurance
- REQM - Requirements Management
- SAM - Supplier Agreement Management

Maturity Level 3 - Defined
- DAR - Decision Analysis and Resolution
- IPM - Integrated Project Management
- OPD - Organizational Process Definition
- OPF - Organizational Process Focus

Maturity Level 3 – Defined (cont.)
- OT - Organizational Training
- PI - Product Integration
- RD - Requirements Development.
- RSKM - Risk Management.
- TS - Technical Solution.
- VAL - Validation.
- VER - Verification.

Maturity Level 4 - Quantitatively Managed
- OPP - Organizational Process Performance
- QPM - Quantitative Project Management

Maturity Level 5 - Optimizing
- CAR - Causal Analysis and Resolution
- OPM - Organizational Performance Mgmt.

Figure 1 – CMMI® Process Areas by Maturity Level

Each process area listed is further composed of *goals* and *practices.* Goals identify the characteristics that must be present to satisfy the process area, and come in two types, *specific* (unique to a process area) and *generic* (common to all process areas). Practices identify activities considered important in achieving the goals, and are correspondingly specific or generic. The practices serve as a model of industry best-practices for the process areas. As an example, the goals and practices of the Project Planning process area are shown in Figure 2 below.

An organization who wishes to benchmark themselves against the model conducts a formal appraisal to determine whether all the projects in that organization comply with the best-practices contained in the CMMI model. This formal appraisal process is termed a SCAMPI-A (Standard CMMI Appraisal Method for Process Improvement, Class A). This is a multi-week process involving a team of trained appraisers, led by an independent, certified lead appraiser, following a rigorously defined methodology. The appraisal results are reviewed and audited by the Software Engineering Institute, which acts as the certification body.

Figure 2. Project Planning Goals and Practices

SG 1 Establish Estimates
Estimates of project planning parameters are established and maintained.

SP 1.1 Estimate the Scope of the Project
Establish a top-level work breakdown structure (WBS) to estimate the scope of the project.

SP 1.2 Establish Estimates of Work Product and Task Attributes
Establish and maintain estimates of work product and task attributes.

SP 1.3 Define Project Lifecycle Phases
Define project lifecycle phases on which to scope the planning effort.

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Define project lifecycle phases on which to scope the planning effort.

SP 1.4 Estimate Effort and Cost
Estimate the project's effort and cost for work products and tasks based on estimation rationale.

SG 2 Develop a Project Plan
A project plan is established and maintained as the basis for managing the project.

SP 2.1 Establish the Budget and Schedule
Establish and maintain the project's budget and schedule.

SP 2.2 Identify Project Risks
Identify and analyze project risks.

SP 2.3 Plan Data Management
Plan for the management of project data.

SP 2.4 Plan the Project's Resources
Plan for resources to perform the project.

SP 2.5 Plan Needed Knowledge and Skills
Plan for knowledge and skills needed to perform the project.

SP 2.6 Plan Stakeholder Involvement
Plan the involvement of identified stakeholders.

SP 2.7 Establish the Project Plan
Establish and maintain the overall project plan.

SG 3 Obtain Commitment to the Plan
Commitments to the project plan are established and maintained.

SP 3.1 Review Plans That Affect the Project
Review all plans that affect the project to understand project commitments.

SP 3.2 Reconcile Work and Resource Levels
Adjust the project plan to reconcile available and estimated resources.

SP 3.3 Obtain Plan Commitment
Obtain commitment from relevant stakeholders responsible for performing and supporting plan execution.

SG – Specific Goal
SP – Specific Practice
GG – Generic Goal
GP – Generic Practice

Figure 2 *Project Planning Goals and Practices*

GG 1 Achieve Specific Goals
The specific goals of the process area are supported by the process by transforming identifiable input work products into identifiable output work products.

GP 1.1 Perform Specific Practices
Perform the specific practices of the process area to develop work products and provide services to achieve the specific goals of the process area.

GG 2 Institutionalize a Managed Process
The process is institutionalized as a managed process.

GP 2.1 Establish an Organizational Policy
Establish and maintain an organizational policy for planning and performing the process.

GP 2.2 Plan the Process
Establish and maintain the plan for performing the process.

GP 2.3 Provide Resources
Provide adequate resources for performing the process, developing the work products, and providing the services of the process.

GP 2.4 Assign Responsibility
Assign responsibility and authority for performing the process, developing the work products, and providing the services of the process.

GP 2.5 Train People
Train the people performing or supporting the process as needed.

(Cont.)

GP 2.6 Control Work Products
Place selected work products of the process under appropriate levels of control.

GP 2.7 Identify and Involve Relevant Stakeholders
Identify and involve the relevant stakeholders of the process as planned.

GP 2.8 Monitor and Control the Process
Monitor and control the process against the plan for performing the process and take appropriate corrective action.

GP 2.9 Objectively Evaluate Adherence
Objectively evaluate adherence of the process and selected work products against the process description, standards, and procedures, and address noncompliance.

GP 2.10 Review Status with Higher Level Management
Review the activities, status, and results of the process with higher level management and resolve issues.

GG 3 Institutionalize a Defined Process
The process is institutionalized as a defined process.

GP 3.1 Establish a Defined Process
Establish and maintain the description of a defined process.

GP 3.2 Collect Process Related Experiences
Collect process related experiences derived from planning and performing the process to support the future use and improvement of the organization's processes and process assets.

BTP 7-14/CMMI® Alignment

To determine the value of CMMI-DEV in meeting the requirements of BTP 7-14, a large trace table will be constructed between the BTP 7-14 acceptance criteria (section B.3) and the CMMI practices, in the format shown in Figure 3. The Coverage entry will note the extent to which the CMMI practice requirement meets the BTP requirements (fully, partially, none). The Notes entry will discuss how any gaps would be addressed by a program.

BTP Ref.	Requirement	CMMI Ref.	Practice	Coverage	Notes
BTP 3.1 (1)	Purpose - Each plan should state the purpose of the plan, and should be reviewed in accordance with that purpose.				
BTP 3.1 (2)	Organization - Each plan should identify the organizational entities responsible for implementing the plan.				
BTP 3.1 (3)	Oversight - Specific references, which may include the Verification and Validation program and the Quality Assurance program, should be made if appropriate.				
BTP 3.1 (4)	Responsibilities - All planned activities are assigned to a responsible organizational entity.				
BTP 3.1 (5)	Risks - Clause 5.3.6, "Software Project Risk management," of IEEE Std 7-4.3.2-2003.				
BTP 3.1 (6)	Security - Regulatory Guide 1.152, Revision 2. Additional guidance on security is provided in Subsection 9 of SRP Appendix 7.1-D. Regulatory Guide 1.168, Revision 1, Section C.7.3, "Security Assessment," provides guidance on security.				
Etc.					

Conclusions

Based on a preliminary review:

- Many of the BTP 7-14 requirements will be addressed by CMMI-DEV practices.
- Some BTP 7-14 requirements are outside the scope of CMMI-DEV and will need to be addressed by program-specific procedures and work product standards (i.e., plan templates).
- The use of CMMI-DEV as a pre-condition will save considerable time and effort in the acceptance of digital computer-based instrumentation and control (I&C) systems relative to system safety.