



What Functional Groups Are Included in the CMMI[®]-SE/SW/IPPD/SS Model?

**Software Engineering Process Group Conference
March 9, 2004**

Roland G. Weiss

Joan Weszka

Lockheed Martin

Systems & Software Resource Center

© Copyright Lockheed Martin Corporation 2004

[®]Capability Maturity Model and CMMI are registered in the
U.S. Patent and Trademark Office by Carnegie Mellon University



Agenda

- Statement of the Problem
- Context
- Organizational Scope Questions
- Specific Examples
- Considerations for Deciding What's Included
- Appraisal Implications
- Conclusions



Statement Of The Problem

- The CMMI[®] has a broader enterprise scope than many expect, including
 - Engineering disciplines outside software and systems engineering
 - Functional groups outside of systems and software engineering groups
- This presentation includes examples and considerations for deciding the organizational scope for process improvement and appraisal

Context



- Lockheed Martin experiences and lessons learned from:
 - Process improvement
 - Process appraisals
 - Lockheed Martin Continuous Appraisal Method (CAM)
 - SCAMPISM

SMSCAMPI is a service mark of Carnegie Mellon University

Organizational Scope Questions



- What functional groups outside of systems and software engineering are currently included in the scope of the CMMI[®]-SE/SW/IPP/SS Model?
 - Hardware engineering (electrical, mechanical)?
 - Manufacturing, production or logistics engineering?
 - Information technology?
 - Contracts?
 - Human resources?
- The answer is “to some degree”

Is Hardware Engineering Included?



- The informative matter for a number of engineering practices uses examples related to hardware engineering
- These examples are often contained within the “systems engineering” discipline amplifications

Examples* Of Hardware Engineering - 1

- RD SP 2.3-1 Identify Interface Requirements
 - “Requirements for interfaces ...electrical and mechanical interfaces for hardware”
- TS SP 2.2-3 Establish A Technical Data Package
 - “Determine the number of levels of design and the appropriate level of documentation for each design level.”
 - “e.g., subsystem, hardware configuration item, circuit board...”
- TS SP 2.3-3 Design Interfaces Using Criteria
 - “Interface designs include the following:”
 - “Electrical, mechanical, and functional characteristics for hardware”

*Capability Maturity Model® Integration, Version 1.1 CMMI®-SE/SW/IPPD/SS

Examples Of Hardware Engineering - 2



- TS SP 3.1-1 Implement the Design
 - “Example characteristics of this implementation are as follows:”
 - “Electrical and mechanical parts are fabricated.”
 - “Examples of appropriate fabrication methods include the following:”
 - “Casting, molding, forming, joining, machining, tooling, welding, extruding”
 - “Note that unit testing is not limited to software. Unit testing involves individual hardware or software units or groups of related items prior to integration of these items.”

Examples Of Hardware Engineering - 3



- PI SP 2.1-1 Review Interface Descriptions for Completeness
 - “For mechanical and electronic components, the interface data should include the following:”
 - “Mechanical...Noise...Climatic...Thermal...Fluid ...Electrical...Electromagnetic...Human-machine...”

So Hardware Engineering Is Included!



- If the organization designs and/or fabricates hardware, the functional groups that perform the practices are included
- “Systems engineering” is implemented differently across organizations
 - In some organizations, the CMMI[®] practices cited are performed by a “systems engineering” functional group
 - In other organizations, the CMMI[®] practices cited are performed by hardware or systems and hardware engineering groups performing what CMMI[®] considers “systems engineering”

Is Manufacturing, Production Or Logistics Included? - 1



- Manufacturing, production, or integrated logistics functional groups may provide relevant services to the engineering development group
- PI SP 3.4-1 Package & Deliver the Product or Product Component
 - Subpractices discuss a wide range of activities
 - “Use effective methods to package and deliver the assembled product.”
 - “Prepare the operational site for installation of the product.”
 - “Deliver the product and related documentation and confirm receipt.”
 - “Install the product at the operational site and confirm correct operation.”

Is Manufacturing, Production Or Logistics Included? - 2



- These Product Integration activities may be performed by functional groups other than development engineering
 - Co-located production, manufacturing, or integrated logistics functional groups may provide these services to the engineering development group
- If so, these functional groups are included for PI SP 3.4-1

Is Manufacturing, Production Or Logistics Included? - 3



- An integrated logistics functional group often develops user manuals
 - TS SP 3.2-1 Develop Product Support Documentation
- If so, the integrated logistics functional group is included for TS SP 3.2-1

Are IT Or Human Resources Included?



- The information technology (IT) and human resources functional groups typically provide services which implement Organizational Environment For Integration (OEI) Practices
 - Information technology functional group
 - OEI SP 1.2-1, Establish An Integrated Work Environment
 - Human resources and/or functional management of a matrix organization
 - OEI SP 2.2-1 Establish Incentives for Integration
 - OEI SP 2.3-1 Establish Mechanisms to Balance Team And Home Organization Responsibilities



Is Contracts Included?

- Contracts and procurement, along with the engineering, program management, and quality assurance (QA) functional groups often perform activities which implement the practices for
 - Supplier Agreement Management (SAM) and
 - Integrated Supplier Management (ISM)

Sample Enterprise Involvement In SAM -1

SAM	Specific Practice	Eng	Program Mgt	Contracts	QA
SP 1.1-1	Determine Acquisition Type	X	X	X	
SP 1.2-1	Select Suppliers		X	X	
SP 1.3-1	Establish Supplier Agreements			X	

Sample Enterprise Involvement In SAM - 2



SAM	Specific Practice	Eng	Program Mgt	Contracts	QA
SP 2.1-1	Review COTS Products	X			
SP 2.2-1	Execute the Supplier Agreement	X	X	X	X
SP 2.3-1	Accept the Acquired Product	X		X	X
SP 2.4-1	Transition Products	X	X		

Sample Enterprise Involvement In ISM - 1



ISM	Specific Practice	Eng	Program Mgt	Contracts	QA
SP 1.1-1	Analyze Potential Sources of Products	X			
SP 1.2-1	Evaluate & Determine Sources of Products	X	X	X	X

Sample Enterprise Involvement In ISM - 2

ISM	Specific Practice	Eng	Program Mgt	Contracts	QA
SP 2.1-1	Monitor Selected Supplier Processes				X
SP 2.2-1	Evaluate Selected Supplier Work Products				X
SP 2.3-1	Revise the Supplier Agreement or Relationship		X	X	



The Impacts Broaden

- Remember that the Generic Practices also apply
 - For the Process Areas and Practices identified in this presentation, the functional groups that perform the Practices must also satisfy the Generic Practices
- Integrated Product and Process Development (IPPD) adds relevant stakeholders from all disciplines or functional groups

Considerations For Deciding What's Included



- Current CMMI[®] practices describe activities that may be implemented by a number of functional groups
- Decisions on practice implementation and organizational scope should not be based on staff titles or group names
- The practices apply regardless of what functional group performs them

Process Improvement & Appraisal Implications



- These issues affect
 - Organizational scope
 - Objective evidence and interviewee selection
 - Costs and benefits from process improvement
- Implication
 - One must work closely with the organization to understand who implements the practices

Conclusions & Recommendations



- The CMMI[®] has a broader enterprise scope than many expect
- The degree of involvement outside of software engineering and systems engineering functional groups currently varies by Specific Practice
- One must
 - Define organizational scope carefully to include all functional groups performing the practices
 - Communicate these issues early with the enterprise

The difficulties will lessen as the model is better understood and the model scope is expanded



Acronyms

- CAM - Continuous Appraisal Method
- CMMI[®] - Capability Maturity Model[®] Integrated
- IPPD - Integrated Product and Process Development
- ISM - Integrated Supplier Management
- IT - Information Technology
- OEI - Organizational Environment For Integration
- PI - Product Integration
- RD - Requirements Development
- SAM - Supplier Agreement Management
- SE - Systems Engineering
- SP - Specific Practice
- SW - Software Engineering
- TS - Technical Solution



Contact Information

- Roland G. Weiss
Lockheed Martin
Systems & Software Resource Center
(301) 240-5346
roland.g.weiss@lmco.com
- Joan Weszka
Lockheed Martin
Systems & Software Resource Center
(301) 240-7013
joan.weszka@lmco.com