

Using CMMI® Effectively for Small Business — Panel —

(With interactive discussion from panel and audience recorded in slides)

NDIA CMMI® Working Group
NDIA Systems Engineering Division
2010 CMMI Technology Conference

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Is CMMI for Small Business?

The NDIA CMMI Working Group was tasked to investigate common questions on the applicability of CMMI to small business

- Is CMMI appropriate for small businesses?
- Is CMMI a barrier to competition in the defense market?
- What data substantiates the adoption of CMMI by small business?
- What challenges do small businesses face for adoption?
- How can acquirers use CMMI to manage their acquisition risks with small suppliers?



Reference: 'CMMI for Small Organizations', NDIA CMMI Working Group, CMMI Conference, Nov 2010.

Panel discussions will be recorded in this slide set, as applicable.

Panelists – Using CMMI Effectively for Small Business



Lynn Penn
Lockheed Martin

Girish Seshagiri
Advanced Information Services (AIS)

Rosalind Singh
Raytheon Company

Dr. Rick Welch
Northrop Grumman

What advantages and obstacles do small businesses face relative to CMMI adoption?

Small Business Advantages	Small Business Obstacles
<ul style="list-style-type: none"> •Innovation, speed, agility •Commonality across projects, tailoring? •Fewer communication paths •Simpler process/tools (low tech solutions)? •Easier institutionalization across projects? 	<ul style="list-style-type: none"> •CMMI: too big, too complex? Sometimes more perception than reality – usually appears in plans •Fewer dedicated resources (staff, \$). Everybody is a shared resource, sharing time with competing demands. •Roles, responsibilities - multiple hats (QA, Test, Process Group, training, ...) •Infrastructure/overhead costs, amortization? •Cultural resistance or bias?
<ul style="list-style-type: none"> •Fewer people filling multiple roles allows easier to connect the dots •Able to be more nimble, react to changes more quickly •Fewer approvals and needed, greater coverage. •Less documentation needed for fewer people – 1 page descriptions can suffice. Set thresholds, entry/exit criteria, etc. •Alignment and communication of objectives is straightforward. Clear rationale for process changes. 	<ul style="list-style-type: none"> •Small project, site, organization •Run out of people to provide objective input. Must procure external resources to provide feedback. •Can be difficult to restructure existing working relationships – doing things differently. “Culture eats process for lunch”

Improving Processes in Small Settings (IPSS)



Just enough process, just in time to support the needs in small settings

Obstacles were outweighed by the advantages – similar to the prior slide

Integrating best practices, listening, facilitating

Defining the process tolerance

Supporting Small Suppliers

Acquirers (such as prime contractors) often use CMMI practices to select, manage, and support their small suppliers.

Typical uses of CMMI within larger companies when working with smaller suppliers:

- CMMI maturity level requirements rarely specified to subs unless levied by external customer
- Use CMMI practices in key areas to evaluate supplier risks
- Checklists or tools used for supplier selection
- May require suppliers to follow prime contractor's processes
- Provide direct support to suppliers – training, mentoring, tools, etc.
- Customize areas of interest per the situation.
- Subcontracting, partnering
- Find gaps that need to be filled (e.g., EVMS, federal contracting)
- Smaller companies may not have in-house expertise in some CMMI PAs (e.g., HiMat)

Alignment of Processes with Subs

CMMI Process Areas			Prime	Subs	CMMI Process Areas			Prime	Subs
Level 2									
Requirements Management	✓	✓			Organizational Process Definition	✓			(4)
Project Planning	✓	✓			Organizational Training	✓			(4)
Project Monitoring & Control	✓	✓			Integrated Project Management for IPPD	✓			(1)
Supplier Agreement Management	✓	✓			Risk Management	✓			(1)
Measurement & Analysis	✓	✓			Integrated Teaming	✓			(1)
Product & Process Quality Assurance	✓	✓			Integrated Supplier Management	✓			(4)
Configuration Management	✓	(1)			Decision Analysis & Resolution	✓			(1)
Level 3									
					Organizational Environment for Integration	✓			(4)
Requirements Development	✓	(2)			Level 4				
Technical Solution	✓	✓			Organizational Process Performance	✓			(5)
Product Integration	✓	(3)			Quantitative Project Management	✓			(5)
Verification	✓	(3)			Level 5				
Validation	✓	(3)			Organizational Innovation & Deployment	✓			(5)
Organizational Process Focus	✓	(4)			Causal Analysis & Resolution	✓			(5)

Notes:

- (1) Subcontractor internal processes and IPT operations integrate with prime's processes.
- (2) System requirements are allocated by prime; subcontractors develop requirements at the configuration item (CI) level.
- (3) All subcontractors integrate, verify and validate their products to the CI or subsystem level; this includes integration of software CIs into hardware CIs or line replaceable units (LRUs). Prime integrates, verifies and validates at the system level
- (4) Subcontractors follow their own CMMI-compliant business processes.
- (5) Prime is responsible team's process control and optimization.

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ISER-MLB-PR-07-143

Reference: "High Maturity System/Software Cost Estimation", Richard L. W. Welch, PhD., Northrop Grumman Integrated Systems CMMI Technology Conference, November 2007.

<http://www.dtic.mil/ndia/2007cmmi/Wednesday/4pmWelch.pdf>

Risk Based Subcontractor Assessment

Lockheed Martin Corporation

Developed Resources

- ▶ Created Risk-Based Subcontractor Assessment Guidebook:
 - Includes initial and on-going evaluations
 - Defines assessment team roles and responsibilities
 - Explains how and who to interview during a subcontractor evaluation
 - Provides information on how to generate a risk management plan based on the results of the evaluation
- ▶ Created a Risk-Based Assessment Tool (RBAT)
 - Comprehensive questionnaires
 - Scoring/Weighting
 - Tailoring (adding / deleting)
 - Summary roll-up

The screenshot displays the RBAT interface. The top section is a form for entering subcontractor details, including Company, Address, City, State, Zip, Phone, and Fax. Below this is a section for the 'Subcontractor Part of Contract (POC)' with fields for Name, Title, Email, and POC. The 'Assessment Form' section includes fields for Assessment Type, Assessment Date, Date, and Assessment Manager. The bottom section shows a table of 'Overall Results' with columns for 'Area', 'Score', 'Weight', 'Total Score', and 'Weighted Score'. The table lists various assessment areas such as 'Management', 'Quality Control', 'Safety', 'Environmental', 'Financial', 'Legal', 'Insurance', 'Risk Management', and 'Personnel'. The 'Score' column is highlighted in green, and the 'Weighted Score' column is highlighted in blue.

Area	Score	Weight	Total Score	Weighted Score
Management	100	10	1000	1000
Quality Control	100	10	1000	1000
Safety	100	10	1000	1000
Environmental	100	10	1000	1000
Financial	100	10	1000	1000
Legal	100	10	1000	1000
Insurance	100	10	1000	1000
Risk Management	100	10	1000	1000
Personnel	100	10	1000	1000

Screen Shot of Summary Sheet of RBAT

Pre-Award Subcontractor Assessment

2.2 12/20/2004 This spreadsheet relies on Macros. Enable Macros! first opening for functionality.

Subcontractor:

Company:

Address:

Assessment Date:

State: Country:

Zip: Province:

Enter the Contact Data relevant to this particular Subcontractor & Assessment in these boxes

Hide these annoying boxes

Contact (POC):

Name: Phone:

Title: Fax:

Email:

Assessment Team:

Assessor POC: Phone:

Title: Fax:

Email:

Assessor Names: Notes:

Data from here on down are automatically calculated on the Risk Area worksheets. See the **Introduction** worksheet for

Overall Results	0	0	Weighted:	
------------------------	---	---	-----------	--

Click to jump to that Risk Area Worksheet				Penetration		Weight Factor	Weighted Score
x to include	Risk Area	Topic	Score	Actual	Max Possible		
x	1	Requirements Management		0	0		
x	2	Project Planning		0	0		
x	3	Project Monitor and Control		0	0		
x	4	Requirement Management		0	0		
x	5	Analysis		0	0		
x	6	Test QA		0	0		
x	7	Management		0	0		
x	8	Requirements Development		0	0		
x	9	Technical Solution		0	0		
x	10	Product Integration		0	0		

Place an 'x' in this column to include this Risk Area in the Assessment; make it **blank** to hide that worksheet

Click on the Risk Area number or Topic to jump to that worksheet

Assign a Weight Factor to each Risk Area which can increase/decrease it's significance in the overall results

Screen Shot of Risk Sheet of RBAT

Risk Area 1: Requirements Management

Description:

The purpose of Requirements Management (REQM) is to

1. **Developing an understanding of the requirements** from project participants.
2. **Obtaining commitment** from project participants.
3. **Managing changes** to requirements - as they evolve.
4. **Maintaining traceability** between requirements and plans.
5. **Identifying inconsistencies** between those requirements and the project's plans and work products.

Hide these annoying boxes

Hide Hints

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Navigation

- < Jump to previous Worksheet
- Main Jump to the Summary Worksheet
- > Advance to next Worksheet

View Risk Area questions

Help for this worksheet

Spell Check
Evaluator
Notes

#	Question	Listen For	Objective Evidence	x	Evaluator Notes	Result
1.0	Describe how projects.	Change control, meeting with "customer" to understand intent, templates for inclusion of primary/supplementary requirements data, relationships established and maintained.	1. Meeting minutes from working group or technical exchange meetings 2. Requirements management policy 3. Tools used, sample templates reports			
	Listen For What to listen for in the Subcontractor's response to the question. Not included in the Pre-Assessment workbook.					
	Questions What to ask the Subcontractor. High-level probing questions end in .0 with a yellow background. Subsequent questions that are right aligned are for follow-up. Only Probing questions will be included in the Pre-Assessment workbook.	Internal reviews with effort	1. Sign off sheets from meetings with list of "organizations" represented - not just names (need an Org. chart to track)			
		Objective Evidence What to look for from the Subcontractor when assessing how well they answer the question. Optionally included in the Pre-Assessment workbook.				
		documents & other work products	1. Checklists that include documents to be reviewed changes from requirement changes 2. Group reviews / minutes			
1.3	Describe your change control process.	A process or procedure, a "formal" review, placing under configuration management control, existence of a Change Control Board or eq	1. Procedure or documented process 2. Signoff sheet form (request change) 3. Change Control Board minutes reports			
		Notes Room to detail their response. Only the first 1000 characters will show when you click on the cell. 32000 max				
1.4	What tools are utilized to support the requirements management activities during the engineering development life cycle?	To MS				
	At what point are requirements placed under formal	Re	requirements baseline report			

Completion column

'x' To signify when a question is completed
'n' No result is attached to this type of item used to introduce a high-level probing question
blank Question has not been resolved. Use dropdown box to choose

Results

Final Score given for question. Use dropdown box to choose:
5 Fully compliant
3 Partially compliant
0 Deficient
'n/e' Not Evaluated
Lefthand side is a Probing Question, righthand side is a follow-up. An underlined Probing value means it is the average of all related follow-up questions.

What risks or issues do acquirers see from working with small suppliers?

Risks / Issues	Acquirer Mitigation Approach?
<ul style="list-style-type: none">•Processes: completeness, integration?•Product reqts, interfaces, integration?	

How do you approach integrating prime/supplier processes and products?



Process/product integration techniques

- Common processes/tools? Integrated processes/tools? Separate processes/tools?

What recommendations do you have for small businesses interested in adopting CMMI?



Recommendations

- Look at your teams – PSP, TSP. Within 2 years planning processes will be in place. Do gap analyses to improve. Achieve ML3 in 36 months, Level 5 using PSP/TSP.
- Use the company's culture and terminology to communicate in their terms – not CMMI.
- Appraisals used to be discovery oriented – appraisal did the evaluation and mapping to CMMI. Now, the emphasis is on preparing artifacts and evidence, with little value to the business.
- Top management buy-in – important in companies of all sizes.
- Language used in CMMI can be difficult to relate to – more in the context of a large defense contractor. Translation to a small company can be very difficult.
- Treat process improvement like a project – project plans, etc.

For More Information....



NDIA CMMI Working Group

http://www.ndia.org/Divisions/Divisions/SystemsEngineering/Pages/CMMI_Working_Group.aspx

Jim Armstrong
Stevens Institute

Steve Austin
Lockheed Martin

Dan Blazer
SAIC

Michael Campo
Raytheon Company

Geoff Draper
Harris Corporation

Jeffrey L. Dutton
Jacobs Technology

Nancy Fleischer
Raytheon Company

Kathy Smith
Hewlett Packard EDS

Wendell Mullison
*General Dynamics,
Land Systems*

Rick Welch
Northrop Grumman

With special appreciation to our panelists:

Lynn Penn, *Lockheed Martin*
Rosalind Singh, *Raytheon Company*

Rick Welch, *Northrop Grumman*
Girish Seshagiri, *AIS*

Risk Based Subcontractor Assessment

Lockheed Martin Corporation

Risk Based Subcontractor Assessment Topics

- Issues
- Identification of Risk Areas
- Developed Resources
- Initial and On-going Evaluations
- Risk Areas for Evaluation
- Risk Area Questionnaire
- Risk Report
- Summary

Issues – Impacts to Mission Success

- ▶ Analysis has shown that engineering subcontractors may impact Lockheed Martin Company program success
 - Subcontract content and design responsibility on programs continues to grow
 - Lack of diligence in subcontract management can be a primary cause of program failure
- ▶ Issues become more obvious when the subcontractor is:
 - A major program contributor (greater than 10% of the total contract value)
 - A Sole Source supplier
 - On the program critical path
 - Considered a medium to high risk to program performance
 - New to Lockheed Martin with no performance history
 - A past supplier to Lockheed Martin with problematic performance history

Identification of Risk Areas

- ▶ Multiple studies conducted to identify key risk areas
 - Multiple recurring problem themes
 - Results were consistent with the Software Engineering Institute's CMMI for Development model
- ▶ Adopted the framework of CMMI-DEV to focus on the likelihood of a subcontractor's success

Developed Resources

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Overall Results	Pass	Fail	Weighted	Weighted
Overall Results	100%	0%	100%	100%
Subcontractor Information	100%	0%	100%	100%
Subcontractor Point of Contact (POC)	100%	0%	100%	100%
Assessment Form	100%	0%	100%	100%
Assessment Date	100%	0%	100%	100%
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Initial and On-Going Evaluations

▶ Differences in two types of Evaluations

	Initial	On-Going
When	Prior to Contract Award	Anytime after Contract Award: Regular intervals or on demand
Duration	1 – 2 days	1 day
Emphasis	Generalized Fact Finding	Project implementation and risk
Quantitative Results Important	Yes – for multiple Subcontractor Evaluation No – for sole source	No
Scope of Review	Subcontractor	Subcontractor, Lockheed Martin Prime, Customer
Risk Areas	Potentially all	Can be more focused, depending on the lifecycle phase

Risk Area – Starter Set

17 key Risk Areas, but what constitutes a good “starter set”?

- **Requirements Management**
- **Risk Management**
- **Verification**
- **Validation**
- **Measurement and Analysis**
- **...and perhaps Supplier Agreement Management, if next tier suppliers exist**

Tool allows for tailoring, prioritizing, and custom probing

Risk Area Questionnaire

Probing a Risk Area – Best Practices

- Keep it simple
- Limited number of good questions
- Backup questions (for added clarity)
- Review objective evidence if available
- Be mindful of expected responses
- Look for integration themes (threading)
- Tailor/add/delete/prioritize questions for effectiveness
- Note risks as they are uncovered
- Keep Subcontractor grading feedback to a minimum during evaluation
- Limit evaluation duration (within a day in most cases)
- Generate a risk report and execute to it

Risk Reports

- No Subcontractor is a perfect match
- Using a standard evaluation strategy and querying multiple potential risk areas should
 - Provide a more accurate portrayal of Subcontractor capability earlier in the lifecycle
 - Enable risk management kickoff, when necessary
 - Ultimately strengthen the LMC/Subcontractor relationship



Summary

- ▶ Guidebook and Tool provide our LM companies with information that enables:
 - More confident source selection
 - On-going review / risk management during a program's development cycle
 - More sharing of subcontractor evaluation data across the corporation
- ▶ Process and tool can be used with any size Subcontractor

Completing an assessment AND proactive risk management compose the solution framework