NORTHROP GRUMMAN

How to Get Contractors to Live Up to Their CMMI Ratings

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Background

- **There is much debate over the use of CMMI levels as a discriminator in DoD procurements**
- **Some of the confusion results from a perception that CMMI ratings do not provide sufficient guarantees of program performance**
- **Root causes:**
  1. Inaccurate CMMI ratings
  2. Over-estimating the benefits that CMMI provides a customer
  3. Contractors not living up to their CMMI rating

Addressing the Root Causes

1. **Inaccurate CMMI ratings**
   - Learn to read a CMMI appraisal report
   - E.g., R. Hefner, “How High Maturity Projects Fail”, 2006 SSTC
2. **Over-estimating the benefits CMMI provides a customer**
   - Understand what benefits CMMI compliance does and does not provide
   - E.g., R. Hefner, “Does CMMI Benefit the Customer?”, 2007 SSTC
3. **Contractors not living up to their CMMI rating**
   - The focus of this presentation

What Is the CMMI Trying to Achieve?

A model is a simplified representation of the world. Capability Maturity Models (CMMs) contain the essential elements of effective processes for one or more bodies of knowledge. These elements are based on the concepts developed by Crosby, Deming, Juran, and Humphrey.

-Introduction, CMMI

- **CMMI provides a model of industry best practices**
- **Following these practices has shown to produce software and systems faster, better, and cheaper, <u>when properly applied</u>**
- **The main benefits cited by CMMI users are:**
  - More predictable adherence to budgets and schedules
  - Reduced re-work (which can reduce cost and schedule)
  - Reduced risk

Background

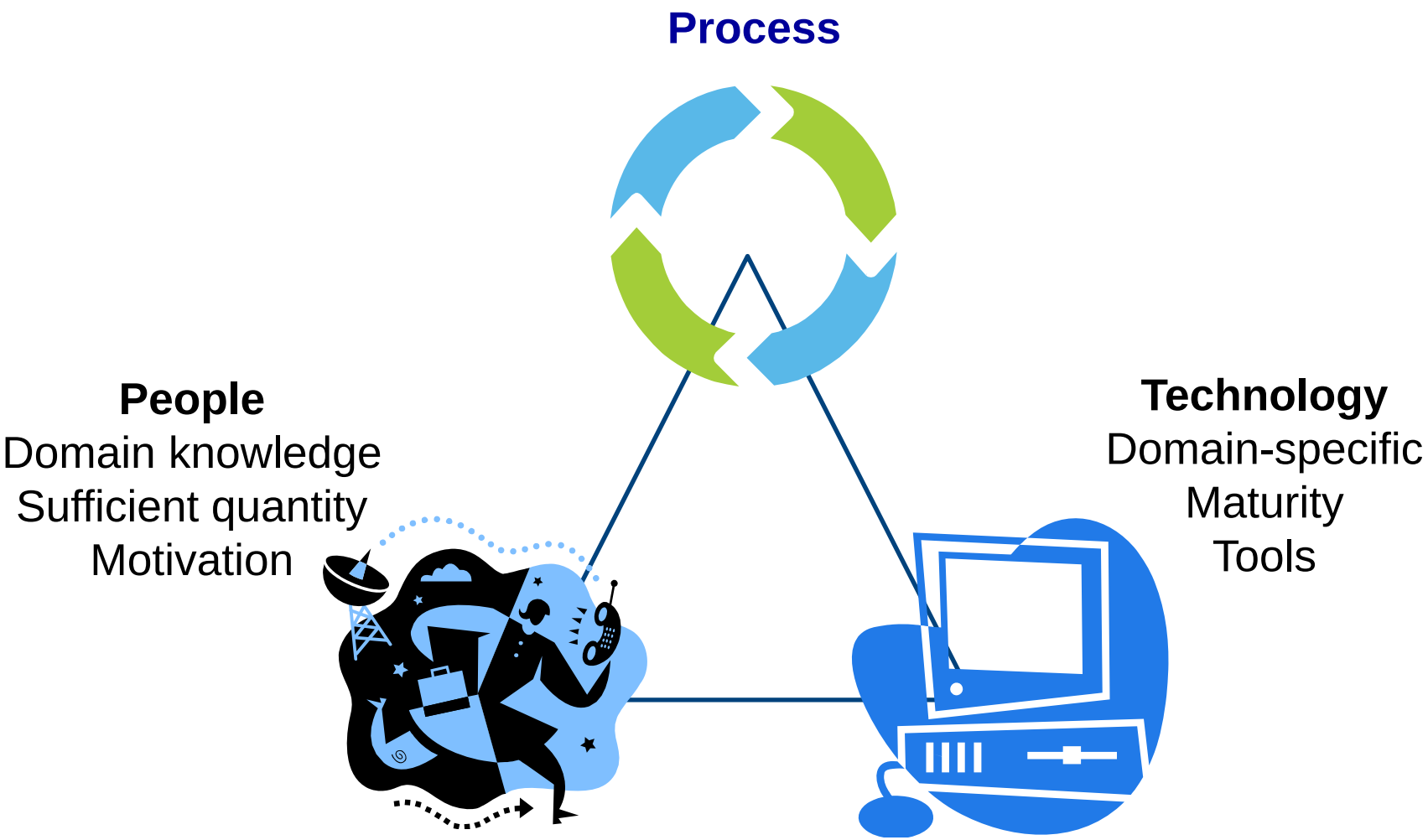
- **There is a marked difference between organizations that truly want to implement CMMI®, and those who simply want a "certificate"**
- **Contenders invest time and energy on understanding the industry best practices in the model, fitting them to their projects and organization, and improving their effectiveness and efficiency**
- **Pretenders simply do enough to convince an appraiser to give them the maturity level -- along the way, they de-motivate their staff with bureaucratic processes, disappoint their customers with inconsistent performance, and generally give the model a bad name**

Where Could Problems Arise?

Assuming the contractor's CMMI® rating is accurate, and applicable to the team doing the work, where could problems arise?

- **Areas outside of the CMMI®**
- **Start-up problems**
- **Back-sliding**

Areas Outside of the CMMI®



Top Five System Engineering Issues

1. **Lack of awareness of the importance, value, timing, accountability, and organizational structure of SE on programs**
2. **Adequate, qualified resources are generally not available within Government and industry for allocation on major programs**
3. **Insufficient SE tools and environments to effectively execute SE on programs**
4. **Requirements definition, development and management is not applied consistently and effectively**
5. **Poor initial program formulation**

"Top Five Systems Engineering Issues In Defense Industry", NDIA Systems Engineering Division Task Group Report, Jan, 2003

Top Software Engineering Issues

1. **The impact of requirements upon software is not consistently quantified and managed in development or sustainment**
2. **Fundamental system engineering decisions are made without full participation of software engineering.**
3. **Software life-cycle planning and management by acquirers and suppliers is ineffective.**
4. **The quantity and quality of software engineering expertise is insufficient to meet the demands of government and the defense industry.**
5. **Traditional software verification techniques are costly and ineffective for dealing with the scale and complexity of modern systems.**
6. **There is a failure to assure correct, predictable, safe, secure execution of complex software in distributed environments.**
7. **Inadequate attention is given to total lifecycle issues for COTS/NDI impacts on lifecycle cost and risk.**

"Top Software Engineering Issues In Defense Industry", NDIA *Systems Engineering Division and Software Committee,* ***Sep 2006***

Start-Up Issues

- **Project Planning starts in the proposal phase, is refreshed at contract start, and re-occurs throughout the project lifecycle**
- **Contenders extend their CMMI practices to proposal teams and re-planning efforts**
- **Pretenders focus on contract start**
  - Costs and schedules defined at proposals may be immature and overly-aggressive
  - Re-planning may be ad hoc
- **Mature estimates may also be overruled by business interests**

CMMI® Project Planning - Goal 1

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 the attributes of the work products and tasks.
SP 1.3 Define Project Lifecycle Define the project life-cycle phases upon which to scope the planning effort.
SP 1.4 Determine Estimates of Effort and Cost Estimate the project effort and cost for the work products and tasks based on estimation rationale.

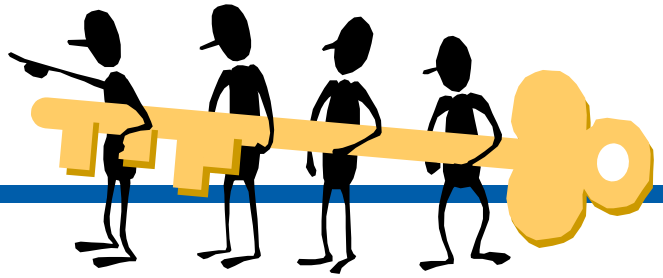
CMMI® Project Planning - Goal 2

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 for Data Management Plan for the management of project data.
SP 2.4 Plan for Project Resources Plan for necessary resources to perform the project.
SP 2.5 Plan for 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 content.

CMMI® Project Planning – Goal 3

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 Reconcile the project plan to reflect available and estimated resources.
SP 3.3 Obtain Plan Commitment Obtain commitment from relevant stakeholders responsible for performing and supporting plan execution.

Keys to Success



- **Ask suppliers to show how they extend the CMMI practices to proposal activities**
- **Request planning documents with the proposal**
- **During re-planning, ask suppliers to show how they performed the CMMI practices**

Back-Sliding:
A Failure of Institutionalization

Institutionalization: *The ingrained way of doing business that an organization follows routinely as part of its corporate culture.*
- CMMI-DEV v1.2

When mentioned in the generic goal and generic practice descriptions, institutionalization implies that the process is ingrained in the way the work is performed and there is commitment and consistency to performing the process.

An institutionalized process is more likely to be retained during times of stress.

GG 2 Institutionalize a Managed Process

GP 2.1 Establish an Organizational Policy

GP 2.2 Plan the Process

GP 2.3 Provide Resources

GP 2.4 Assign Responsibility

GP 2.5 Train People

GP 2.6 Manage Configurations

GP 2.7 Identify and Involve Relevant Stakeholders

GP 2.8 Monitor and Control the Process

GP 2.9 Objectively Evaluate Adherence

GP 2.10 Review Status with Higher Level Management

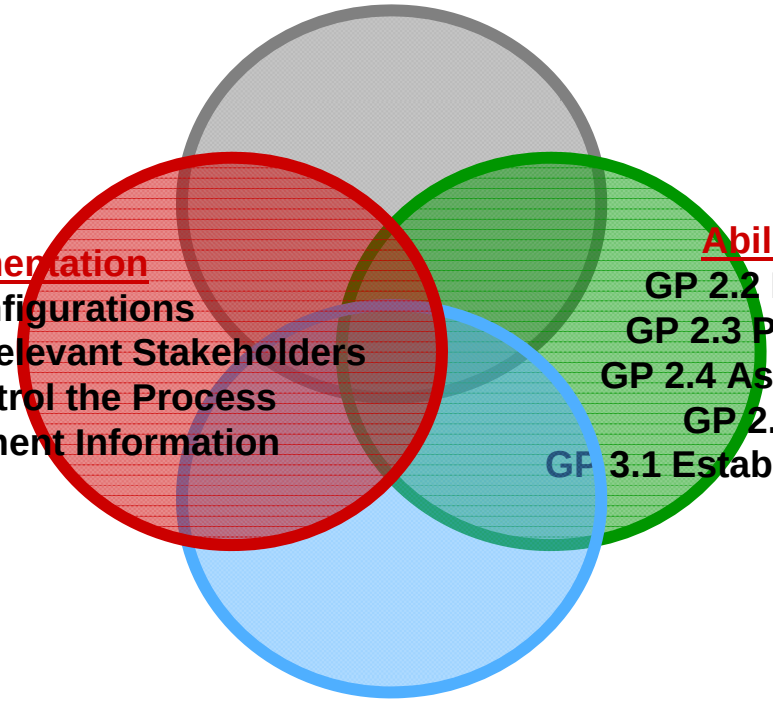
GG 3 Institutionalize a Defined Process

GP 3.1 Establish a Defined Process

GP 3.2 Collect Improvement Information

Common Features –
A Lost Perspective in CMMI® v1.2!

Commitment to Perform
GP 2.1 Establish an Organizational Policy



Directing Implementation
GP 2.6 Manage Configurations
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Ability to Perform
GP 2.2 Plan the Process
GP 2.3 Provide Resources
GP 2.4 Assign Responsibility
GP 2.5 Train People
GP 3.1 Establish a Defined Process

Verifying Implementation
GP 2.9 Objectively Evaluate Adherence
GP 2.10 Review Status with Higher Level Management

Organizational Support

Contenders

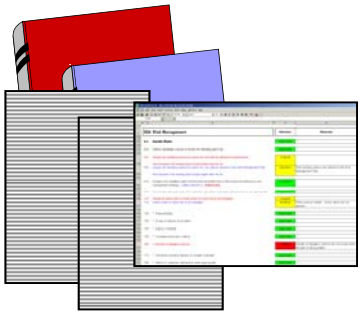
- **Fully support the CMMI ® -based improvement program by providing training, templates, tools, process assets libraries, measurement repositories and other work aids focused on improving the ability of practitioners to competently adopt the model**

Pretenders

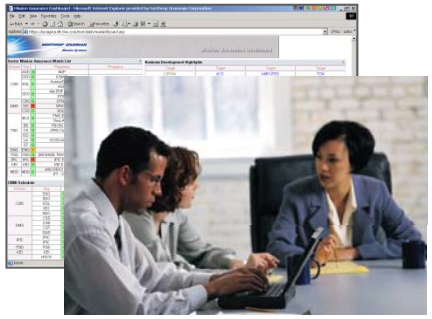
- **Largely ignore organizational support, often to save money**
- **Where required by the model, they establish process asset libraries and measurement repositories, but they are largely shelfware**

Organizational Infrastructure Required for CMMI® Level 3

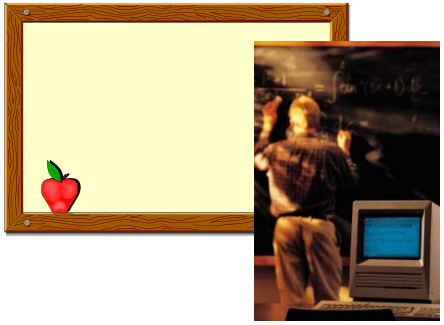
Policies, Processes, Templates & Tools



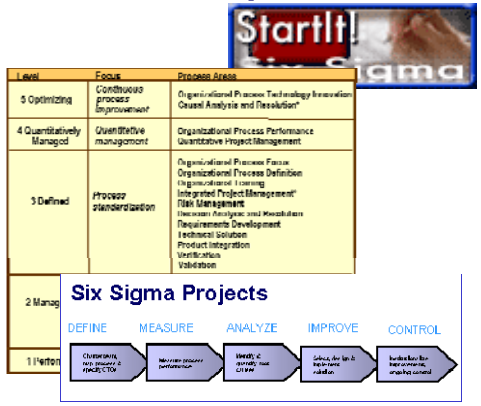
Process Group



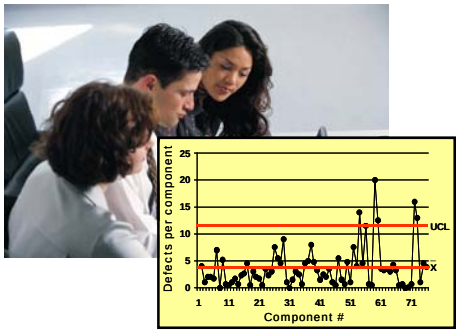
Training Program



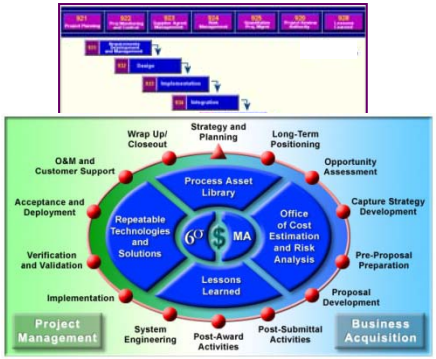
Process Improvement



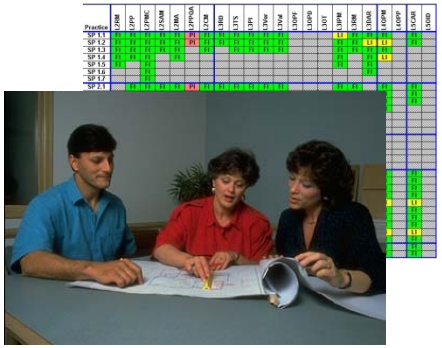
Measurement Repositories Predictive Modeling



Best-Practice Libraries



Audits & Appraisals



Communications

Developing and maintaining mature processes requires significant time and investment in infrastructure

Organizational Culture

A pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way you perceive, think, and feel in relation to those problems.

- **Artifacts**
  - The practices that can be observed in such areas as dress code, leadership style, communication processes
- **Espoused values**
  - The elements the organization says it believes in, the factors that it says influence the practices in which it engages
- **Basic underlying assumptions**
  - Unstated beliefs the organization has come to accept and abide by

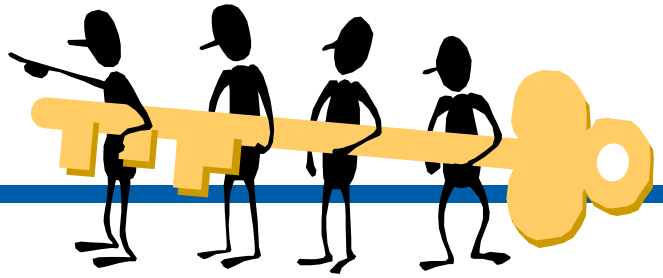
***Organizational Culture & Leadership*, Edgar H Schein, used with permission**

Management Commitment and Support

- **Understands the key messages**
- **Is willing to take actions to reinforce them**
- **Provides resources to support/sustain process improvement efforts**
- **Sets expectations that essential project functions will be funded and processes will be followed**
  - Project planning, estimation, tailoring, CM, QA, etc.
- **Supports process improvement and sustainment, rather than passing appraisals**
- **Rewards mature processes development and sustainment rather than individual heroics**

Rick Hefner, "Sustaining CMMI Compliance," 2006 CMMI Technology Conference and User Group

Keys to Success



- **Ask suppliers to show how they perform the CMMI generic practices**
- **When problems occur, ask why the CMMI practices were not effective in sustaining the desired behavior, and what will be done to prevent future problems**

Summary

- **There is a marked difference between organizations that truly want to implement CMMI®, and those who are simply try to get a “certificate”**
- **By discussing the differences, we hope to help the CMMI® community the true value of CMMI®**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