The Look and Feel of a Successful CMMI Implementation

CMMI Conference
Denver, Colorado
2004
Welcome
SM CMM Integration SCAMPI are service marks of Carnegie Mellon University

® Capability Maturity Model, Capability Maturity Modeling, CMM, and CMMI are registered in the U.S. Patent & Trademark Office
Agenda

- Engineering Systems Think
- Business Results
- Roles and Responsibilities
- Project Management
- Risk Management
- Quality Management
- Supplier Management
- Recursive Nature of Requirements Engineering
- Alternative Solutions
- Components to Products
Agenda - 2

- Improving Processes At The Organizational Level
- The Knowledge and Skills Base
- Integrated Teams
- Reducing Variation
- Establishing a Measurement Program
- Improving Beyond Stability
- Repeatable, Effective, and Long Lasting
- Process Improvement Means Change
- Constagedeous Approach to Process Improvement
- Summary
Engineering
Systems Think
Systems Thinking is a discipline for seeing the whole.

In all of the project’s phases/stages, and along the system’s life, the systems engineer has to take into account:
- The customer’s organization vision, goals, and tasks
- The customer’s requirements and preferences
- The problem to be solved by the system and the customer’s needs

The whole has to be seen as well as the interaction between the system’s elements.
- Iterative or recursive thinking must replace the traditional linear thinking.
The solution is not always an engineering one – remember to always take into account:

- Business and economic costs
- Reuse or utilization of products and infrastructure already developed
- Organizational, managerial, political, and personal considerations

The end user must be considered as a major part of the system:

- At each stage the human element must be considered
Business Results
Support for the Organization’s Business Objectives
For a focus on Process Improvement to be successful, it must be tied to the organization’s business objectives for example:

- Improve predictability of development cycle length, delivery time and costs
- Find and fix each problem once
- Reduce system errors that are discovered by customers
- Increased control of suppliers
- Increase quality of products
- Always work with the correct version of a module or life-cycle work product
Support for Senior Management’s Vision
Vision

- Where does senior management think the organization will be in the next year, and in the next two to five years?
- What products will be in the mainstream?
- Who will the competitors be?
- Will there be collaborators or strategic alliance partners?
- What technology changes are expected and/or will be required to support the vision?
Vision - 2

What does the organizational structure have to be to support this vision?

Who will the organization’s suppliers be?

What must the organizational culture be to support this vision?

How will a Process Improvement Initiative support this vision?
Support for Project Leaders to Manage and Control Better
Process Improvement: What Value to Project Leaders?

What measurable value will the quality management initiative bring to the project leaders who bear the line responsibility for product delivery?

- More accurate schedules?
- Higher productivity of developers?
- Better quality products?
- Traceable requirements?
- Controlled configuration items?
- Reviews focused on critical components?
- Better control of suppliers?
- Reduction in potential risks?
Process in Perspective

PEOPLE

PROCESS

TECHNOLOGY
Roles and Responsibilities
Senior Management Must Lead the Charge

- Since there are inherent costs to implementing process, Senior Management must demonstrate their belief in it through their communications, daily decision making, and financial commitment.

- Senior Management’s resolve must not waiver when deadlines beg for shortcuts to get the product out the door.
Senior Management

- Establish Policies – behavior expectation setting documents
- Allocate or reallocate resources
- Establish Authority and Responsibility
- Authorize Training
- Approve Organizational Commitments
- Have Senior Management Oversight into the processes used on projects and resulting product quality
- Provide Visible Management Support
Middle Managers

- Provide the corporate bridge between the programs and projects and the senior management team
- Exercise risk management decision making based on data
- Guide the process improvement steering committee
- Serve as a “process owner”
  - The Middle Manager as “Process Owner” must participate in the periodic Senior Management Oversight Meeting and report the progress on his process focus area.
Today’s Project Manager is expected to be:

- Better educated
- Open, friendly, and people-oriented
- A better listener
- Quality conscious
- Receptive to new ideas
- More participative
- A Facilitator
- Skilled at group process and group dynamics
- Encouraging to others to participate in plans and decisions
- Skilled on how to coach, inspire, and motivate the project team
- Able to span boundaries
- Able to provide and apply integrative management techniques to unique, complex organizational ventures characterized by interdependent efforts, a variety of specialists, over multiple sites, multiple languages and multiple cultures
Process Group: Sample Improvement Infrastructure

Process Improvement Infrastructure

Senior Management Advisory Board
Steering Committee
SEPG
Work Group 1
Work Group n

Development Organization

Senior Management
Middle Management
Project Management
Process Liaisons
Project Members
Non-Project Staff

© 2004 Kasse Initiatives, LLC

Version NDIA CMMI Conf-2004 v2.4
LNF Successful CMMI Imp-24
SQA - Agent for Process Improvement

Provides visibility into the effectiveness and efficiency of the processes being used and the resulting product quality

Management

Developers

SEPG

SQA

Provides feedback to the individual projects on the efficiency and effectiveness of the processes that they are following so they can be improved at the project level

Provides feedback to the SEPG on the organizational processes they have facilitated in developing so they can be improved at the organizational level
CM Roles and Responsibilities

- Configuration Management Group
  - Configuration Management Manager
  - Configuration Management Engineer
  - Configuration Management System Manager
  - Test Library Manager
  - Release Library Manager

- Project Manager

- Project Team

- Project CM Specialist

- Configuration Control Board
  - Organizational Level
  - Project Level
Integration & Systems Testing

- Integration ensures the product components match the interface descriptions and “fit together”
  - Interfaces are tested to ensure that Systems Testing can be conducted against a complete system or subsystem
- Systems Testing is the first time at which the entire system can be tested against the Systems Specification
- Systems Testing measures and determines what the systems capabilities are
- Systems test plan covers types of testing to be performed, test strategies, test coverage approaches, methods and approach for tracing requirements to test cases, and reliability metrics
Most organizations have at least one person who has an interest in and an ability to understand metrics and measurements.

Few organizations have a designated Measurement Group.

While it may not seem worthwhile for an organization to form a separate Measurement Group, having a measurement expert or two supporting the organization’s metrics needs is quite valuable.
Systems Engineering

- Systems Engineering provides a “cradle to grave” view of the evolving system
- Systems engineers help to define the total technical and managerial effort required to transform the set of customer needs, expectations, and constraints into a life-cycle balanced solution.
Project Management
Project Management

- Project Management is a set of tools, techniques and knowledge that, when applied, helps produce better results for a project.

- Project Management provides a process that can help answer basic questions:
  - What are you going to produce?
  - What is it the customer wants and needs?
  - Who is going to do the work?
  - How long will it take?
  - How much will it cost?
  - What might go wrong?
  - How can you avoid potential problems?
Project Management functions include:

- Define scope of project
- Work Breakdown Structure
- Estimation
- Risk Management
- Stakeholder Involvement
- Commitment Process
- Planning including integrating all support plans that affect the project
- Supplier Management
- Monitoring and Control
Relationships among the Planning Processes

Core Processes

- **SCOPE**
  - Initiation Planning
  - Scope Definition

- **TIME**
  - Activity Definition
  - Activity Sequencing
  - Schedule Development

- **COST**
  - Resource Planning
  - Activity Duration Estimating
  - Cost Estimating
  - Cost Budgeting

- **RISK**
  - Planning
  - Risk Identification
  - Qualitative Risk Analysis

Facilitating Processes

- **Quality**
  - Quality Planning

- **Human Resources**
  - Organizational Planning
  - Staff Acquisition

- **Procurement**
  - Procurement Planning
  - Solicitation Planning

- **Risk**
  - Risk Identification
  - Qualitative Risk Analysis
  - Quantitative Risk Analysis
  - Risk Response Planning

© 2004 Kasse Initiatives, LLC
Risk Management
Risk Management Cycle

- Risk Identification
- Risk Monitoring
- Risk Assessment and Prioritization
- Risk Reduction and Contingency Planning
Elements of Risk Management

Risk Management
- Risk Identification
- Risk Assessment
- Risk Analysis
- Risk Prioritization
- Risk Management Planning
- Risk Control
- Risk Mitigation
- Risk Monitoring
Establishing Risk Thresholds

Risk Management Strategy
- Mitigation Techniques
- People Assigned
- Contingency Planning

Project Start

Risk Monitoring

Risk Exposure Threshold

Mitigation

Contingency Plan

Current State

Tracking

Problem

Risk Exposure Threshold
Quality Management
Quality Management consists of:

- Setting **Quality Goals** that support business objectives
- Establishing and enforcing a **Quality Policy**
- **Planning** for quality
- Developing **Processes**
- Establishing the use of **Standards and Procedures**
- Conducting Objective Evaluations Audits with respect to **product** quality
- Conducting Objective Evaluations Audits with respect to **process** quality
Quality Management - 2

- Performing multiple levels of **Testing**
- Conducting **Peer Reviews** throughout the product lifecycle
- Designing in **Quality Factors** (e.g., maintainability, reliability)
- Providing visibility into the process and product quality for management (**Reporting**)
- Getting **non-compliance issues** resolved before the product is delivered to the customer
- **Configuration Management**
- **Measurement**
These quality functions may be performed by:
- Project Leaders and project staff
- Quality Manager or Quality Representative
- Organizational level QA Group
- Systems Engineering
- Independent Test
- Documentation
- Customer

and others………..
Quality Management Components

- Planning for Quality
- Auditing for Compliance
- Setting Quality Goals
- Designing in Quality Factors
- Auditing for Compliance
- Testing
- Reviews
- Standards, Policies, and Procedures
- Configuration Management
- Quality Policy
- Quality Reporting
- Quality Assurance

PRODUCT DEVELOPMENT
The CM Functions

- Identification
- Baselining
- Change Control
  - Organizational Change Control Board
  - Developmental Change Control Board
- Status Accounting
- Configuration Auditing
- Configuration Management System
- Interface Control
- Supplier Control
Supplier Management
Supplier Management Overview

- Sister Divisions
- Other Projects in Business Unit
- Project
- Off-the-Shelf Products
- Subcontractors
- Outsourcing
- Contractors (Resource Hiring)
- Reuse Components
Treating the Supplier As A Project Member
Requirements Engineering
Requirements Development
Customer, Product, and Product Component Requirements

Customer Requirements

- Quality Assurance
- Marketing
- Regulatory Agencies
- Independent Test
- End User
- Co-workers & Management
- Customer

Product and Product Component Requirements

- Operational Concept & Scenarios
- Derived Requirements
- Definition of Functionality

Stakeholders

- End User
- Co-workers & Management
- Customer
- Marketing
- Regulatory Agencies
- Independent Test
- Quality Assurance
- Customer, Product, and Product Component Requirements

© 2004 Kasse Initiatives, LLC

Version NDIA CMMI Conf-2004 v2.4
LNF Successful CMMI Imp- 49
Customer, Product, and Product Component Requirements - 2

Stakeholders
- Customer
- End User
- Co-workers & Management
- Independent Test
- Marketing
- Regulatory Agencies
- Quality Assurance
- Services
- People
- Processes
- H/W, S/W, Mechanical, Electrical, Engineering
- Customer, Product, and Product Component Requirements
- Allocated to Functions

© 2004 Kasse Initiatives, LLC
Operational Concepts and Scenarios

Scenarios and Operational Concepts are developed, analyzed, and reviewed to refine existing requirements and discover new requirements, needs, and constraints.

- **Scenarios** are normally sequences of events that might occur in the use of the product.

- **Operational concepts** depend on both the design solution space and the scenarios:
  - define the interaction of the product, the end user and the environment.
  - define the operational, maintenance, support, and disposal needs.
Customer requirements are *analyzed* in conjunction with the development of the operational concept to derive a more detailed and precise set of requirements called “product and product component requirements.”
Spiral Model of the Product Requirements Engineering Process

- **Requirements elicitation**
- **Requirements validation**
- **Requirements analysis and negotiation**
- **Requirements documentation**

**Decision point:**
- Accept document
- Re-enter spiral

**Informal statement of requirements**

**Agreed requirements**

**START**

**Draft Requirements document**

Requirements Management
The Requirements Management and Requirements Development Partnership

Requirements Development

Requirements Management
Impact Analysis for Requirements Change Requests

- Impact Analysis is made based on the requirements change request:
  - Development Schedule
  - Release Schedule
  - Changes required to this system
  - Staffing
  - Components
  - Development and Target equipment
  - Risks
  - SCOPE
  - Costs
  - Changes required to other systems or interfaces within the project
  - Other existing products or product lines
Alternative Solutions
Problem: Alternative solutions need to be identified and analyzed to enable the selection of a life-cycle balanced solution in terms of the quadruple constraint of cost, schedule, technical performance and quality.
Solution: This may be accomplished through the allocation of the requirements to:
- Software
- Hardware
- Electronics
- Mechanics
- Hydraulics
- Manufacturing Processes
- Services
- People

It may be accomplished through:
- In house development
- Purchase of Commercial-Off-The-Shelf products
- Use of Suppliers
- Use of Re-use components
Develop the Product or Product Component Design

◆ Product or product component designs must provide the appropriate life-cycle content for:
  ◇ Implementation
  ◇ Modification
  ◇ Reprocurement
  ◇ Maintenance
  ◇ Sustainment
  ◇ Installation

◆ Design documentation provides a reference point to support the mutual understanding of the design by relevant stakeholders
Architecting
The Traditional Approach

© 2004 Kasse Initiatives, LLC
Evolutionary Approach

SOLUTIONS THAT LEAD TO DESIGNS

PROBLEM

SOLUTIONS

time
Quality Factors
Product Quality is described through a number of factors (reliability, maintainability).

Each factor has several attributes that describe it called criteria.

Each criterion has associated with it several metrics which taken together quantify the criterion.
## Quality Factors

- Correctness
- Efficiency
- Expandability
- Flexibility
- Integrity
- Interoperability
- Maintainability
- Manageability
- Portability
- Reliability
- Reusability
- Safety
- Survivability
- Usability
- Verifiability
From Components to Products
Integration Strategy

◆ The **basis for effective product integration** is an integration strategy.

◆ Establishing the product integration strategy includes the following:
  ◆ Integration sequence
  ◆ Work to be done
  ◆ Responsibilities for each activity
  ◆ Resources required
  ◆ Schedule to be met
  ◆ Procedures to be followed
  ◆ Tools required
  ◆ Product Integration Environment
  ◆ Personnel skills
Ensure Interface Compatibility

Product Component

Interface to Product Component

Product Component

Interface to Environment

Environment
Verification includes verification of the product and intermediate work products against all selected requirements, including customer, product, and product component requirements.
Validation

- Demonstrate that a product or product component fulfills its intended use when placed in its intended environment

- Validate Maintenance, Training, and Support Services
  - Demonstrate that the maintenance tools are operating in the actual product
  - Verify in the field that support of the product is effective as specified by the customer (e.g., Mean Time to Repair)
  - Demonstrate adequate training of the products and services
Improving Processes at the Organizational Level
Sample Improvement Infrastructure

Process Improvement Infrastructure

- Senior Management
  - Advisory Board

- Steering Committee

- SEPG
  - Work Group 1
  - Work Group n

Development Organization

- Senior Management
- Middle Management
- Project Management
- Process Liaisons
- Project Members
- Non-Project Staff

© 2004 Kasse Initiatives, LLC
Organization’s Process Assets

OPD-SG1 Establish Organizational Process Assets

- Measurement Repository
- Life-cycle Models
- Tailoring Guidelines
- Process Asset Library
- Support Environment
- Organization’s Standard Process Definition
  - Process Architecture
  - Process Elements

© 2004 Kasse Initiatives, LLC
The Knowledge and Skills Base
Core Competencies

- What business is the organization in?
- What are the core competencies required to perform the organization’s business and remain competitive?
- What is the organizational workforce knowledge and skills base?
- What training, mentoring, and coaching does each person need in order to develop the necessary skill set to do their everyday job and gain in the organization’s core competencies?
- What must recruiters do to find appropriate candidates with either the necessary knowledge and skills or the proven ability to learn
The organization’s strategic business objectives and improvement plans should be analyzed to plan for current, intermediate, and future training needs in order for the organization to remain competitive.
Determine which training needs will be focused on at the organizational level

Analyze the project and support groups’ needs to identify common training needs that can be most efficiently addressed organization-wide

Negotiate specific training needs with various projects and support groups

“Economy of Scale” must always be considered when planning for organizational vs. project-level training
Integrated Teams
Integrated Teaming

Successful Integrated Teaming depends on:

- Integrated Project Management which emphasizes **proactively integrate** the concepts in the Project Plan and all supporting plans
- Collaboration skills from Integrated Team members to satisfy customer and business needs that would not normally be achieved by normal project members
- Shared Vision
- Organizational Environment for Integration
- Team members who have strong interpersonal skills and ability to work in a team environment and the ability to complement the mix and knowledge and skills in the team
Shared Vision Context

- Individual
- Integrated Team
- Project
- Organization
Reducing Variation
# CMMI Overview

<table>
<thead>
<tr>
<th>Level</th>
<th>Process Characteristics</th>
<th>Process Areas</th>
</tr>
</thead>
</table>
| **5** Optimizing | Focus is on quantitative continuous process improvement | Causal Analysis and Resolution  
Organizational Innovation and Deployment |
| **4** Quantitatively Managed | Process is measured and controlled | Quantitative Project Management  
Organizational Process Performance |
| **3** Defined       | Process is characterized for the organization and is proactive | Requirements Development  
Technical Solution  
Product Integration  
Verification  
Validation  
Organizational Process Focus  
Organization Process Definition  
Organizational Training |
| **2** Managed      | Process is characterized for projects and is often reactive   | Requirements Management  
Project Planning  
Project Monitoring and Control  
Supplier Agreement Management  
Product and Process Quality Assurance |
| **1** Initial      | Process is unpredictable, poorly controlled, and reactive    | Configuration Management  
Measurement and Analysis |
Variation Among Individuals

One of the traits of CMMI Maturity Level 1 is that the process “belongs” to the people. If others follow a process, it is normally due to the strong personality of someone on the project who has experienced using processes in another environment.

From a variation point of view, a level one organization has great variation based on its individual employees following their own process paths. This is why maturity level one companies depend so heavily on the heroics of its people.
At CMMI Maturity Level 2, processes normally belong to the project and are enforced by the Project Manager.

The processes, standards, guidelines, checklists, and templates are enforced for all of the project members to achieve more uniformity in development and product quality.

Assuming that all projects follow some form of process, the amount of variation that was seen in organizations of maturity level 1 is reduced even if all of the projects followed a different process.
At The Organizational Level, an organization that wishes to achieve CMMI Maturity Level 3 needs to have its processes owned by the organization for economy of scale to be realized and process measurement to make practical sense.

These process definitions are tailored and incorporated into the project’s defined processes throughout the organization and thus variation in project development and product and service quality is again reduced.
Quantitative Project Management

- Quantitative Management is tied to the organization’s strategic goals for product quality, service quality, and process performance.
- When higher degrees of quality and performance are demanded, the organization and projects must determine if they have the ability to improve the necessary processes to satisfy the increased demands.
- Achieving the necessary quality and process performance objectives requires stabilizing the processes that contribute most to the achievement of the objectives and reducing process variation to support the quantitative management objectives.
Establishing a Measurement Program
A measurement initiative involves the following:

- Specifying the objectives of measurement and analysis such that they are aligned with established information needs and business objectives.
- Defining the measures to be used, the data collection process, the storage mechanisms, the analysis processes, the reporting processes, and the feedback processes.
- Implementing the collection, storage, analysis, and presentation of the data.
- Providing objective results that can be used in making business judgments and taking appropriate corrective actions.
Basic Measures

◆ Project Management Measures
  ◇ Size and complexity
  ◇ Effort and Cost
  ◇ Schedule
  ◇ Computer Resources
  ◇ Data Management
  ◇ Knowledge and Skills
  ◇ Stakeholder Involvement
  ◇ Technical Performance
  ◇ Commitments
  ◇ Critical Dependencies
  ◇ Quality
Effectiveness of Processes

- We must not only define and follow processes but we must determine if the processes are working for us the way we expected them to.
  - How well are the processes working?

- Requirements Management Processes Effectiveness - Example
  - Number of change requests per month compared with the original number of requirements for the project
    - Critical change requests
    - Intermediate change requests
    - Nice to have change requests
More Advanced Measures

- Peer Review Effectiveness
- Testing Effectiveness
- Test Coverage
Quantitative Project Management
Quantitative Management Concepts

- Quantitative Management is tied to the organization’s strategic goals for product quality, service quality, and process performance.

- When higher degrees of quality and performance are demanded, the organization and projects must determine if they have the ability to improve the necessary processes to satisfy the increased demands.

- Achieving the necessary quality and process performance objectives requires stabilizing the processes or subprocesses that contribute most to the achievement of the objectives.

- Assuming the technical requirements can be met, the next decision is to determine if it is cost effective.
Define and document measurable quality and process performance objectives for the project.

**Examples of Quality Objectives**
- Mean time between failures
- Critical resource utilization

**Examples of Process Performance Objectives**
- Percentage of defects removed by type of verification activity
- Defect escape rates
- Number and density of defects (by severity) found during the first year following product delivery
- Rework time as a percentage of total project life-cycle time
Measures
and Analytic Techniques
A point above or below the control lines suggests that the measurement has a special preventable or removable cause.

The chart is used for continuous and time control of the process and prevention of causes.

Plotted points are either individual measurements or the means of small groups of measurements.

The chart is analyzed using standard Rules to define the control status of the process.

Data relating to the process.

Center Line (CL) (Mean of data used to set up the chart)

Upper and Lower Control Limits represent the natural variation in the process.

Upper Control Limit (UCL)

Lower Control Limit (LCL)

Numerical data taken in time sequence.

METRIC:

PROCESS CONTROL CHART TYPE:

Statistical Methods for Software Quality
Adrian Burr – Mal Owen, 1996
Improving Beyond Stability
Causal analysis and resolution is the process of improving quality and productivity by preventing the introduction of defects into a product.

Based on an understanding of the defined process in use and how it is implemented, the root causes of the defects and the future implications of the defects are determined.
Cause and Effect Diagrams (Fishbone)

- Vague Requirement
- Incorrect Requirement
- Missing Requirement
- Infeasible Requirement
- Customer Requirement Changed

Req’mts Defects
Pareto Charts

Percentage of Defects Detected During System Testing by Phase Where Defect Was Injected

- **Req'mts**: 50
- **Design**: 25
- **Code**: 20
- **Test**: 5
What are the issues relating to traffic jams?

A- Auto Accidents
In= 4 Out=1

B- Road Construction
In= 0 Out=2

C- Rush Hour Traffic
In= 6 Out=1

D- Weather Conditions
In=2 Out=3

E- Cultural Events
In=2 Out=2

F- Mechanical Breakdown
In=0 Out=2

Interrelationships Diagraph
Organizational Innovation and Deployment Overview

- The Organizational Innovation and Deployment process area selects and deploys improvements that can enhance the organization’s ability to meet its quality and process performance objectives.

- Quality and process performance objectives that this process area might address include:
  - Improved product quality
  - Increased productivity
  - Decreased cycle time
  - Greater customer and end user satisfaction
  - Shorter development or production time to change functionality, add features or adapt to new technologies
Process performance is a measure of the actual process results achieved and is characterized by both process measures and product measures.

Process measures include:
- Effort
- Cycle time
- Defect removal efficiency

Product measures include:
- Reliability
- Defect density
- Response time
Process and Quality performance objectives that will be deployed are selected from proposals based on the following criteria:

- A quantitative understanding of the organization’s current quality and process performance
- The organization’s quality and process-performance objectives
- The resources and funding available for that deployment
- Estimates of the improvement resulting from the deployment
- The expected benefits weighed against the cost and impact to the organization
Repeatable
Effective
and
Long Lasting
Institutionalization involves implementing practices that:

- Ensure the process areas are effective, repeatable and long lasting
- Provide needed infrastructure support
- Ensure processes are defined, documented, understood
- Enable organizational learning to improve the processes
CL-2 Generic Practices

◆ GP 2.1 Establish an Organizational Policy
  ◊ Establish and maintain an organizational policy for planning and performing the process
    • Policies exist for Project Planning
    • New Client Offers

◆ GP 2.2 Plan the Process
  ◊ Establish and maintain the requirements, objectives, procedures and plan for performing the process

◆ GP 2.3 Provide Resources
  ◊ Provide adequate resources for performing the planned 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 planned process as needed

◆ GP 2.6 Manage Configurations
   ◊ Place designated work products of the process under appropriate levels of configuration management

◆ GP 2.7 Identify and Involve Relevant Stakeholders
   ◊ Identify and involve the relevant stakeholders as planned
CL-2 Generic Practices - 3

◆ GP 2.8 Monitor and Control and Measure the Process
  ◇ Monitor and control the process against the plan and take appropriate corrective action

◆ GP 2.9 Objectively Evaluate Adherence
  ◇ Objectively evaluate adherence of the process, and the work products and services of the process to the applicable requirements, objectives, and standards, and address non-compliance

◆ 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
CL-3 Generic Practices

◆ GP 3.1 Establish Defined Process
   ◇ Establish and maintain the description of the defined process

◆ GP 3.2 Collect Improvement Information
   ◇ Collect work products, measures, measurement results, and improvement information derived from planning and performing the process to support the future use and improvement of the organization’s processes and process assets
Process Improvement Means Change!
Principles of Process Change

- Major changes must be sponsored by Senior Management
- Focus on fixing the process, not assigning the blame
- Understand current process first
- Change is continuous
- Improvement requires investment
- Retaining improvement requires periodic reinforcement
Building Support for Change

[courtesy JMaher]
Inputs:
- Human
- Financial
- Technological
- Material
- Resources

Outputs:
- Products
- Services

Input-output flow of materials, energy, information

[Source: Morgan, 1986]
Managing Complex Change Requirements

VISION → SKILLS → INCENTIVES → RESOURCES → ACTION PLAN → CHANGE
VISION → SKILLS → INCENTIVES → RESOURCES → ACTION PLAN → CONFUSION
VISION → INCENTIVES → RESOURCES → ACTION PLAN → ANXIETY
VISION → SKILLS → RESOURCES → ACTION PLAN → GRADUAL CHANGE
VISION → SKILLS → INCENTIVES → ACTION PLAN → FRUSTRATION
VISION → SKILLS → INCENTIVES → RESOURCES → FALSE STARTS

“Managing Technological Change”
Carnegie Mellon University
Software Engineering Institute
Process Improvement Model
Process Improvement Model (PIM)

1. Commitment to Process Improvement
2. Appraisal of the Engineering Process
3. Infrastructure and Plans for Process Improvement
4. Implementation of Process Improvements
Constagedeous
Approach to
Process
Improvement
Both the Staged Representation and the Continuous Representation not only can be but **must** be used together to provide proper guidance that results in effective process improvement that supports an organization’s business objectives.
Summary

- The CMMI has evolved from contributions of engineers, managers, and social psychologists over the past 100 years.
- The multiple views of the CMMI contribute to the picture that process improvement must concern itself with people, technology, measurement, risk, and customer satisfaction if an organization’s business objectives are to be supported with the CMMI-based process improvement initiative.