

# **Introduction to The Capability Maturity Model Integration®**

**SES CMMI® Training Series**

**Feb 3, 2009**



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® CMM and CMMI are registered in the U.S. Patent and Trademark Office.

# Agenda

- What is CMM<sup>®</sup>/CMMI<sup>®</sup>?
- Process Maturity
- CMM<sup>®</sup> vs. CMMI<sup>®</sup>
- CMMI<sup>®</sup> Basics
- Process Maturity and SES Personnel
- Implementing Process Improvement

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# Birth of the Capability Maturity Models (CMM<sup>®</sup>)

- Capability Maturity Models (CMM<sup>®</sup>)
  - Software/system process framework
  - common-sense proven software/system practices
- CMM<sup>®</sup> based on:
  - Process management concepts of well-known software engineering & management guru's like Crosby, Deming, Juran,...
  - over 30 years of similar/commonly known software problems
  - improvements to CMM<sup>®</sup> have been made continually via:
    - knowledge acquired from software process assessments
    - extensive feedback from industry and government
- CMM<sup>®</sup> Main Objective:



– help organizations achieve sufficient maturity to manage technology introduction



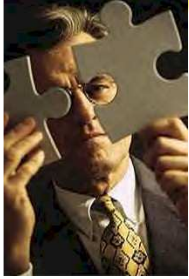
# Software Engineering Institute (SEI™) Establishment

- Software Engineering Institute (SEI™) established in 1984
  - by federal government at Carnegie Mellon University in Pittsburgh, PA
  - to address software engineering unpredictability and high failure rate
- SEI Mission
  - To provide leadership in advancing the state of the practice of software engineering to improve the quality of systems that depend on software
  - Reason for establishment
    - Software engineering community lacked a shared view of the state of practice or agreement about what constitutes good practice
    - Development activity and resulting products were unpredictable
    - Success or failure was totally dependent on the staff assigned

*“One way to measure the capability of a software organization is to observe what it does in a crisis. That is when good practices are important...” Watts Humphrey*

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# Process Maturity

- What is Process?
  - Various Familiar Definitions
    - Webster's definition (as related to software): "1. A systematic series of actions directed to some end."
    - IEEE definition: "a sequence of steps performed for a given purpose."
    - SEI definition (93-TR-24), p. 3: "...set of activities, methods, practices, and transformations that people use to develop and maintain software and the associated products."
  - Processes:
    - enable engineers to do their job much more effectively.
    - allow engineers to concentrate on resolving the technical issues.
    - gives engineers the tools they need to benefit from the lessons learned by others.



# Process Maturity

- What is Process Maturity?
  - puts the focus on process as well as product
  - consistent method for getting work done
  - give managers & engineers defined, documented, continuously improving processes:
    - well understood
    - well used
    - living
  - visibly supported by management and all staff
  - well-controlled with audits to ensure proper use and enforcement
  - measurements manage products & processes





# Process Maturity

- Why is Process Maturity Important?
  - Immature organizations rely on their current practitioners
  - About 85% of the problems are caused by the system, not the people
  - Most organizations are constantly fighting fires
    - project staff are constantly reacting with no time for improvements
    - firefighters eventually get burned out
    - even though the ember may get rekindled later, they are working in a reactive mode as opposed to the more successful proactive mode



# Process Maturity & CMM®

- Why use the CMM®?
  - “Just a good way to do business”
  - Common-sense practices proven successful
  - Good foundation for improvements
  - Great tool for maturing organizations & projects
  - Allows freedom to develop & improve over time
  - Unique processes to meet organizations unique needs
  - Builds culture based on proven common practices



# Process Maturity

- Benefits of Process Maturity
  - People develop more fully to their potential and are more effective within the organization
  - There is a much greater likelihood of developing successful products on time and budget
  - There is an increased likelihood of successful introduction of new technology, techniques, & tools
  - Due to defining, measuring, and controlling of processes, improvements are more successful and more likely to be sustained over time



# Process Maturity

- Barriers to Process Maturity
  - Organizational politics
  - Overly ambitious
  - Major reorganizations
  - Previous failures
  - Hinders ‘real work’ attitude
  - Executive turnover
  - Paperwork approvals
  - Declined market
  - Turf guarding

*at*



# Process Maturity

- Enhancers for Process Maturity
  - Executive emphasis and monitoring
  - Assigned responsibility
  - Respected Process Group
  - Involvement of technical staff in process improvement
  - Adequate resources
  - Clear goals established

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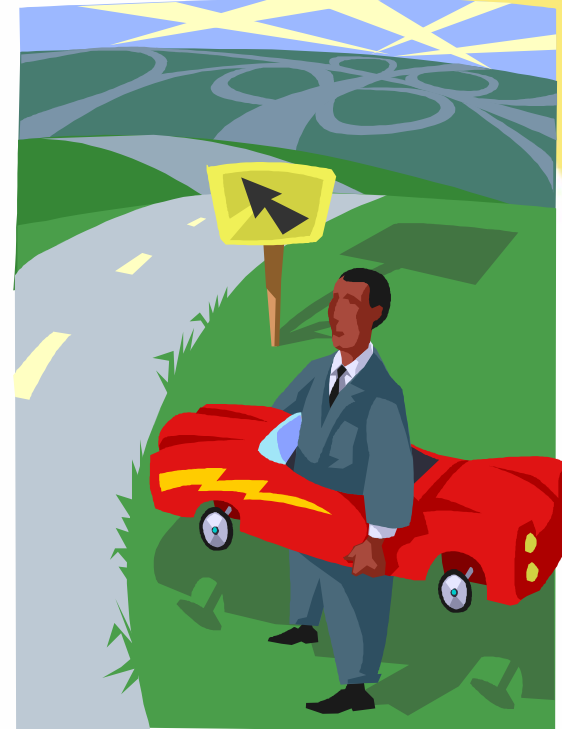
# CMMI<sup>®</sup> vs. CMM<sup>®</sup>

- SEI<sup>SM</sup> established in 1984
- CMM<sup>®</sup> published in 1991
- CMMI<sup>®</sup> published in 2000
  - merged several models into a coherent model
  - collaborative effort between the SEI, government representatives, and industry representatives
  - main objective: develop an integrated model that is consistent with as many other well-known models as possible



# CMMI® vs. CMM®

- Why CMMI®?
  - Explosion of CMMs® and CMM®-like models
  - Multiple models within an organization
  - Multiple assessments
  - Multiple training
  - Multiple expenses
  - Multiple concepts
  - Differing terminology

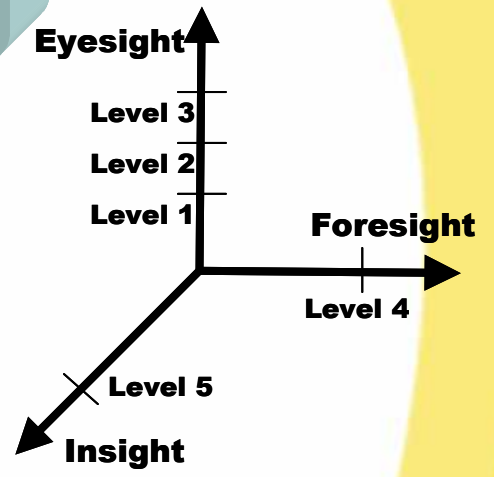
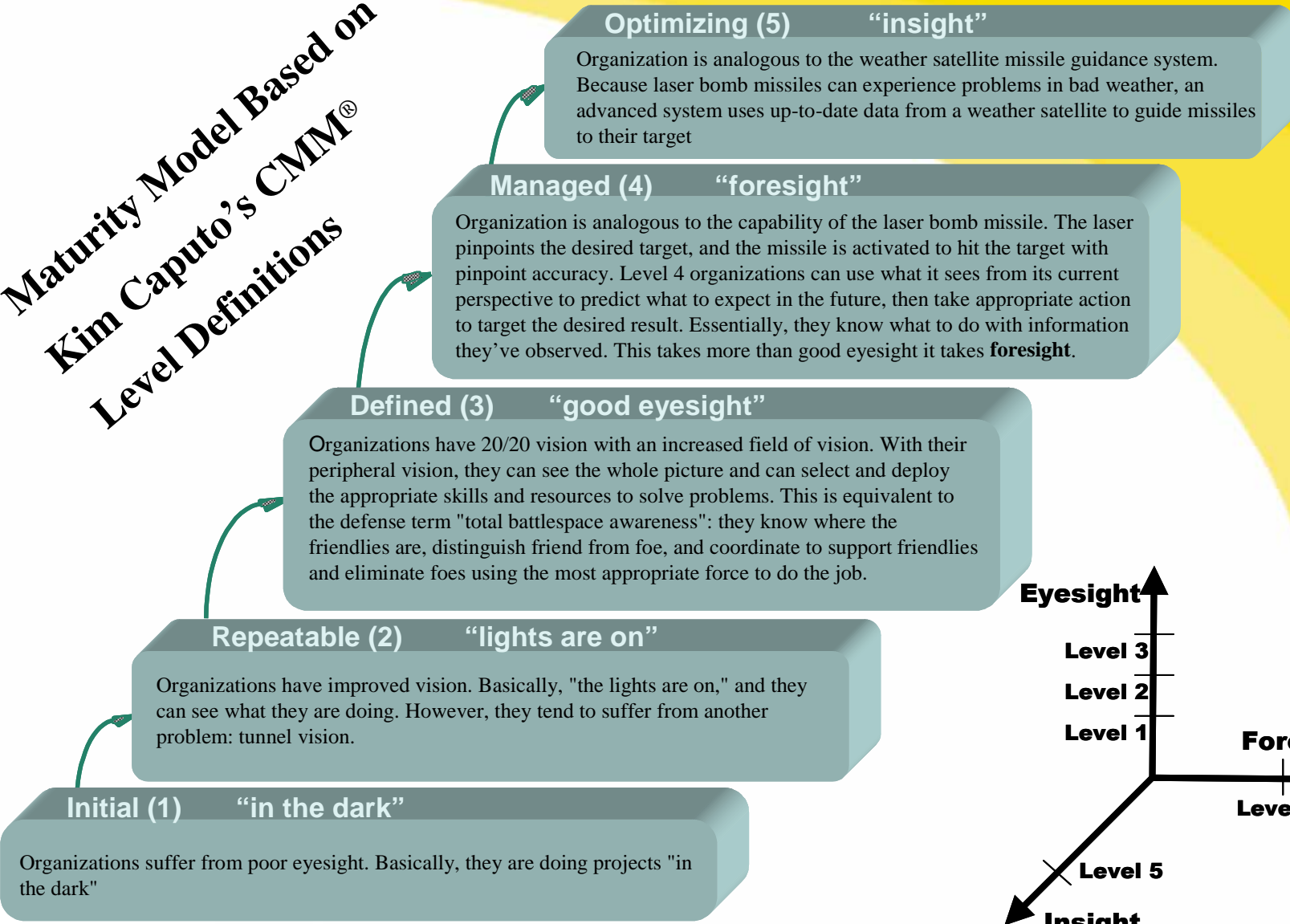




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**Maturity Model Based on  
Kim Caputo's CMM®  
Level Definitions**



Maturity Level	Focus	Process Areas
5 Optimizing	Continuous Improvement	Organizational Innovation and Deployment Causal Analysis and Resolution
4 Quantitatively Managed	Process Performance and Quality	Organizational Process Performance Quantitative Project Management
3 Defined	Organizational and Engineering Processes	Requirements Development Technical Solution Product Integration Verification Validation Organizational Process Focus Organizational Process Definition Organizational Training Integrated Project Management Risk Management Decision Analysis and Resolution
2 Managed	Project Management	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Process and Product Quality Assurance Configuration Management
1 Initial	Ad hoc and chaotic	



# CMMI<sup>®</sup> Basics

- Some important clarifications:
  - Practices describe **what** is to be done, but should NEVER be interpreted as mandating **how**
  - Subpractices, typical products, practice notes, references, elaborations, amplifications are for informative purposes only

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# Process Maturity and SES Personnel

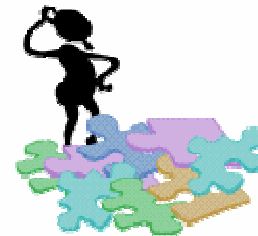
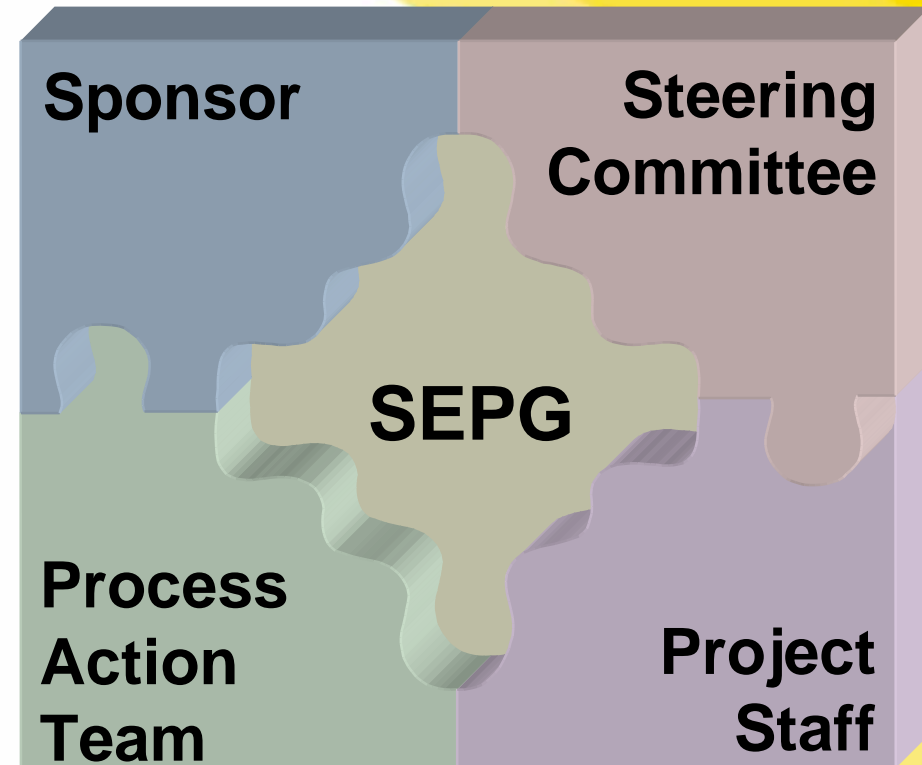
**SEPG:** Focal point for process improvement efforts.

**Sponsor:** Executive/senior managers that set the direction for continuing process improvement.

**Steering Committee:** Small management group that establishes and monitors the SEPG and their activities.

**Process Action Team:** Groups or teams of appropriately skilled staff to tackle specific issues/process improvement tasks.

**Project Staff:** Staff making teams that implement projects.





# Process Maturity and SES Personnel

SES uses a Process Management Group (PMG) as their SEPG. This name was adopted to emphasize that software is not our only focus.

The PMG is chartered to maintain processes for each process area of the CMMI®, to train CMMI® subjects, and to assist project personnel in adopting and tailoring processes for use on their projects.

The PMG is SES's focal point for process improvement.

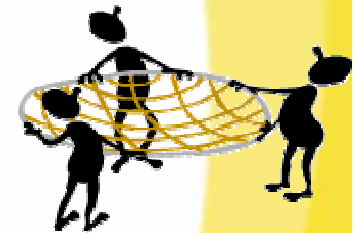


*"If we don't change our direction we will end up where we're headed"*



# Process Maturity and SES Personnel

- PMG Role and Responsibilities
  - Establish process standards
  - Develop improvement plans
  - Form Process Action Teams
  - Launch improvement activities
  - Manage all the improvement projects
  - Work with projects on project processes and tailoring activities
  - Report progress and issues to steering group
  - Maintain process databases
  - Serve as the focal point for technology transition
  - Provide project consultation
  - Make periodic assessments and status reports for senior management
  - Provide process training organization and projects







# Process Maturity and SES Personnel

- SES Process Group Meetings
  - Meetings are held monthly, for about 1 hour
  - Everyone participates - interactive, not presentation
    - Some initial training
  - Process Action Teams will be established as needed
  - Actions will be assigned and tracked
  - Typical agendas
    - Scheduling, planning, & statusing
    - Training
    - Measurement reporting
    - Special topics
    - Action item review

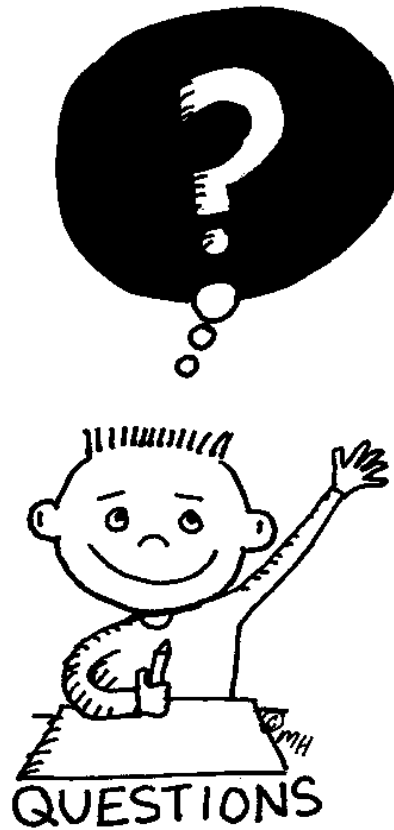
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# Implementing Process Improvement

- Software Process Improvement is a Project!
  - organized and managed
  - managed schedule with clear milestones and deliverables
  - resources must be allocated (people, computers, etc.)
  - ongoing reviews, planning, etc
  - clear expectations from management
  - publicly supported and recognized by executive management
  - supported and recognized by staff

# Summary and Q&A





# CMMI vs. CMM

- The following models used as a basis:
  - Software Engineering Institute's (SEI) Capability Maturity Model for Software Version 2.0 Draft C (SW-CMM);
  - Electronic Industries Association's Interim Standard 731 (EIA/IS 731), Systems Engineering Capability Model (SECM);
  - Integrated Product Development Capability Maturity Model, draft V 0.98 (IPD-CMM)
  - Consistency and compatibility with ISO/IEC 15504 considered



# CMMI vs. CMM

- SEI Defined Design Goals:
  - Eliminate inconsistencies,
  - Reduce duplication,
  - Reduce the cost of implementing model-based
  - process improvement,
  - Increase clarity and understanding, by using:
    - Common terminology
    - Consistent style
    - Uniform construction rules
    - Common components..., with
    - Minimal impact on legacy efforts
  - Design Goals



# CMMI vs. CMM

- SEI Defined Benefits from CMMI:
  - Efficient, effective assessment and improvement across multiple process disciplines in an organization
  - Reduced training and assessment costs
  - A common, integrated vision of improvement for all elements of an organization
  - A means of representing new discipline-specific information in a standard, proven process improvement context
- Other Benefits
  - Some companies experiences, up to Level 4, were rolled into CMMI which was not available for SW-CMM
  - Inputs from the reader and user community were incorporated

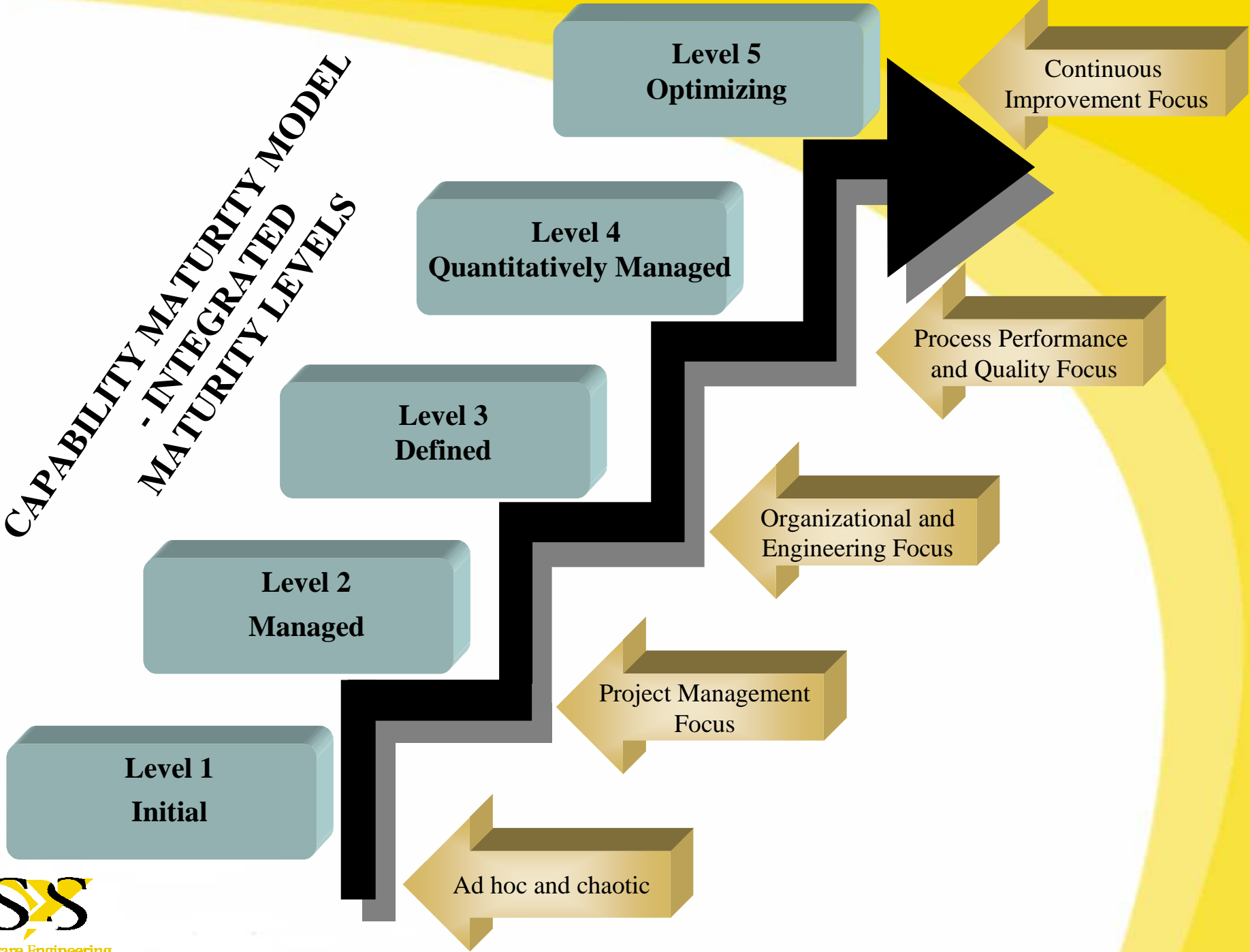


# CMMI Basics

- What the CMMI does NOT cover
  - All software/system process and quality improvement issues
  - Some issues are addressed only indirectly or by implication, including:
    - specific tools, methods, and techniques
    - concurrent engineering and teamwork
    - system engineering, marketing, etc.
    - human resources
    - organizational behavior



**CAPABILITY MATURITY MODEL  
- INTEGRATED  
MATURITY LEVELS**





# CMMI Basics

- Maturity Levels
  - Well-defined evolutionary plateaus on the path toward becoming a mature software organization.
    - Each level is a layer in the foundation
    - 5 maturity levels:
      - Initial, Managed, Defined, Quantitatively Managed, Optimizing
    - Maturity levels are composed of Process Areas (PAs)



# CMMI Basics

- Level 1 Initial Features
  - Processes ad hoc and chaotic
  - Unstable organizational environment
  - Project success is based on hero and competence of staff
  - Even though products work most of the time, projects exceed budget and schedule
  - Processes abandoned during crisis
  - Over commitment of resources





# CMMI Basics

- Level 2 Managed Features
  - Requirements are managed
  - Processes planned, performed, measured, and controlled
  - Processes implemented even during times of crisis
  - Projects managed according to documented plans
  - Products and services are visible to management via statusing
  - Work products reviewed with stakeholders and they satisfy established requirements, standards and objectives





# CMMI Basics

- Level 3 Defined Features
  - Processes well-characterized and understood
  - Processes established and improved over time
  - Processes consistent throughout the organization
  - Organizational processes tailored by projects based on established organizational tailoring criteria
    - Important distinction between Level 2 and 3
  - Processes more detailed and followed rigorously
  - Processes proactively managed by organization





# CMMI Basics

- Level 4 Quantitatively Managed Features
  - Statistical and quantitative processes used to control selected subprocesses
  - Quality and process performance criteria established and used to manage processes
  - Process variations identified and sources corrected
  - Quality and performance measures incorporated into organizational measurement repository
  - Key is predictability





# CMMI Basics

- Level 5 Optimizing Features
  - Processes continually improved based on quantitative measures and understanding of causes of variation
  - Focus on incremental and innovative technological improvements
  - Process improvement objectives established for organization
  - Business objectives continuously revised to reflect changes
  - Common causes of variations is key as opposed to concentration on special causes





# The People Side of CMM

## SEI Definition of the SEPG:

“The software engineering process group is the focal point for process improvement. Composed of line practitioners who have varied skills, the group is at the center of the collaborative effort of everyone in the organization who is involved with software engineering process improvement. Group size is usually equal to 1-3% of the development staff. Because the process group is small, it relies upon outside support, in particular, the support of a steering committee and technical working group.”





# The People Side of CMM

- Common Problems Establishing Process Groups
  - Too large teams
    - Too many cooks spoil the meal
    - Team must be small enough to make decisions and act upon them
  - Lack of some Full-Time Process Professionals
    - Need dedicated team focused on accomplishing the process improvement goals
    - Team of part-time workers can become large and unwieldy hence lacking focus on what needs to be accomplished
    - Some part-time members balanced against at least one full-time member of the Process Group
    - Sends a very loud signal to the organization, the improvement project is not “real work”



# The People Side of CMM

- Process Groups Common Problems
  - Anyone who wants to be on the team can
    - Select the right people for the Process Team
    - Just because process improvement means that everyone is involved it does **not** mean that everyone should be part of the improvement team
    - Team should not be run as a democracy
  - Lack of empowerment
    - Must be empowered with the authority to make the appropriate changes
  - Entire process team must be synergistic
  - PMG must work closely with programs rather than “throwing things over the fence”
  - PMG **MUST** be proactive



# The People Side of CMM

Mark Paulk, SEI, *Software Process Proverbs*

“Competence: The competence of the people who do the work is crucial to project performance and organizational success.”





# The People Side of CMM

- Process Action Teams
  - Groups or teams of appropriately skilled staff to tackle specific issues/process improvement tasks
    - determine cause of cross-organizational problems
    - report status and any issues to PMG
    - analyze the nature of the problem
    - propose a solution to the problem
    - pilot test the solution
    - roll out the solution to the rest of the organization
    - follow the plan to accomplish tasking as developed by and approved by the PMG
    - leverage work previously accomplished and method currently used, as applicable, before creating new methods



# The People Side of CMM

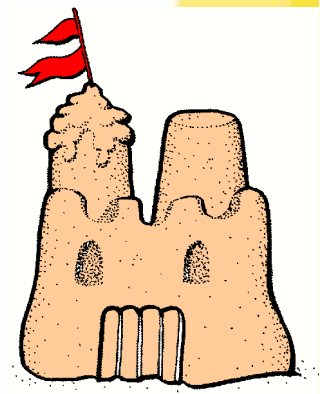
- Selecting the right people
  - The skill of the members of the various infrastructure roles is critical
    - One bad apple can spoil the batch
    - People are key the success of the improvement effort
    - The Process Group team members often makes the difference between whether the improvements are actually undertaken with the benefits realized or the effort is wasted.

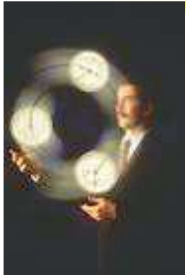
## Makeup of a Successful Process Group Member

- **Software/Systems Engineering Background**
- **Confident without huge ego**
- **Proactive and willing to take reasonable chances when necessary**
- **Organized/Ability to organize without over-organizing (avoid bureaucracy)**
- **Visible, respected member of the organization**
- **Easy-going but not too easy-going that things don't get done**
- **Ability to communicate at all levels from managers to practitioners**
- **Ability to interpret explanations made by both management and practitioners**
- **Non-argumentative**
- **Detail oriented**
- **Good listener, open to others opinion**
- **Strong without being overbearing**
- **Willing to bend when necessary and knowing when it's necessary**
- **Totally committed to process improvement and the organization**
- **Immense drive/motivation and ability to drive others**
- **Ability to work in stressful situations**
- **Able to withstand criticism from all levels (both internal and external to the organization)**
- **Ability to keep a proper perspective (don't get angry)**
- **Focused**
- **Adaptable - "roll with the punches"**
- **Never lose sight of goals**
- **Creditability with senior management and even more important practitioners**
- **Ability to maintain confidentiality**
- **Ability to lead as well as follow (recognize when each is appropriate)**
- **Ability to become an "expert" in many different areas not normally field of expertise - may have to be self-taught**

*“I want to build sand castles and leave.  
I don’t want to be there when it needs  
to be painted. I want to hand it over  
and go on to the next one.”*

*Sherry Higgins ,  
Top Gun at Lucent Technologies*





# Implementing Process Improvement

- Plan-Do-Study-Act (PDSA) Cycle
  - W. Edwards Deming introduced the concept in Japan subsequently it was called the Deming cycle.
    - Mechanism for perpetual change
    - Also called Shewhart Cycle for Learning and Improvement
  - Four-step quality improvement process
    - **Plan** - a plan to effect improvement is developed.
    - **Do** - the plan is carried out, preferably on a small scale.
    - **Check** - the effects of the plan are observed.
    - **Act** - results are studied to determine what was learned and what can be predicted.





# Deming Cycle

## Act

- three options:
  - adopt the change
  - abandon the change
  - modify your prediction or rerun the cycle with different variables (environment, materials, people, rules)

## Plan

- study the process
- recognize the opportunity
- define the opportunity
- gap between the customer needs and the process performance
- define the theory on how to realize the opportunity
- statement of theory, an idea
- plan for a test, comparison, or experiment
- choice between several suggestions
- predict the outcome -- form an hypothesis

## Check [Study]

- observe the test results
- use statistical methods where possible
- do they correspond with the hopes and expectations
- how does it affect your ability to predict tomorrow's results?

## Do

- test the theory to achieve the opportunity (carry out the test, comparison, or experiment)
  - preferably on a small scale
  - according to the plan
- test on customers to
  - increase satisfaction by educating them
  - improve your understanding of customer expectations

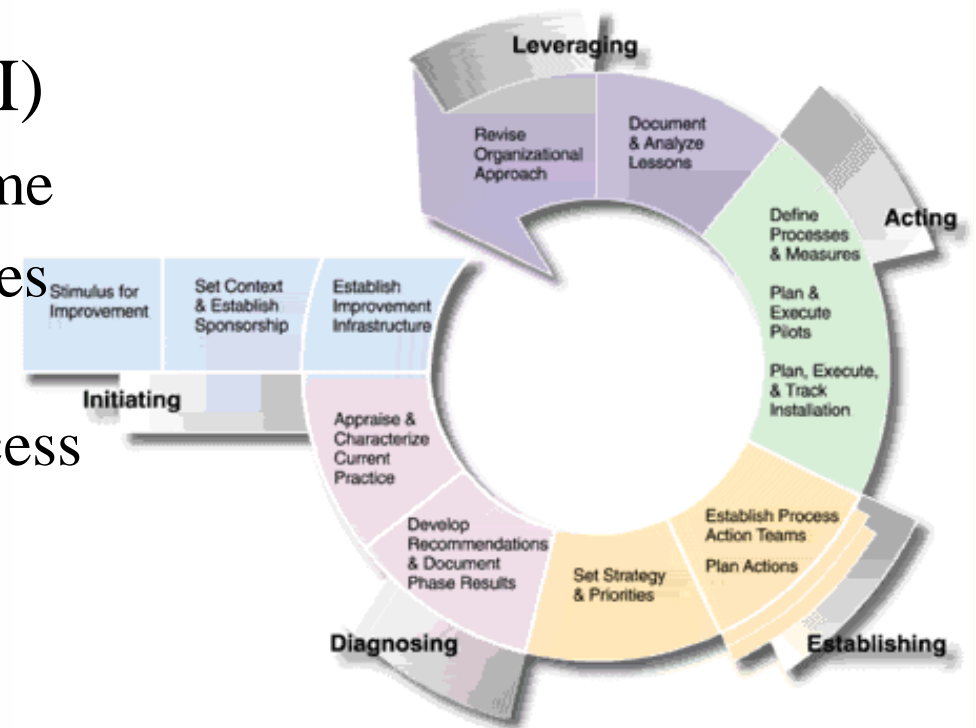


# Implementing Process Improvement

IDEAL<sup>(SM)</sup> Model is an adaptation of the Deming Cycle

Created by Software Engineering Institute (SEI)

- Model has evolved over time
- Outlines five different stages in the iterative improvement process
- Provides roadmap for Process Improvement



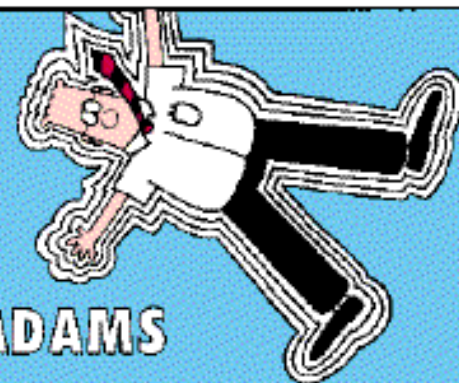


# Implementing Process Improvement

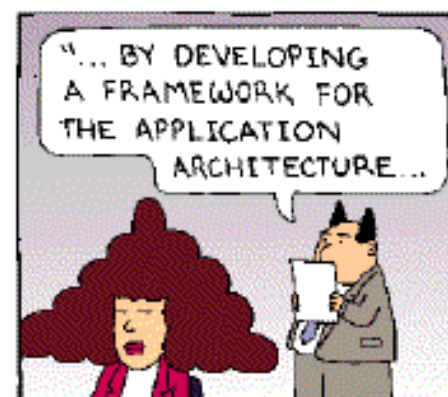
- Enhancers to Process Improvement
  - Strong Leadership and Sponsorship
  - Enthusiastic Engineers and Support Personnel
  - Strong, Enthusiastic Process Improvement Team
  - Adoption of the processes by majority of personnel
    - Roger's adoption curve (a marketing notion assuming a normal population distribution):
      - 2.5 percent are the innovators: they will be the first to listen to a new idea
      - 13.5 percent are the early adopters: they are next and are great for communication
      - 34 percent are the early majority
      - 34 percent are the late majority
      - 16 percent are the laggards: they will be the last to consider something new
    - » Rogers, Everett M., Diffusion of Innovation, Free Press, New York, NY, 1962.



# DILBERT<sup>®</sup>



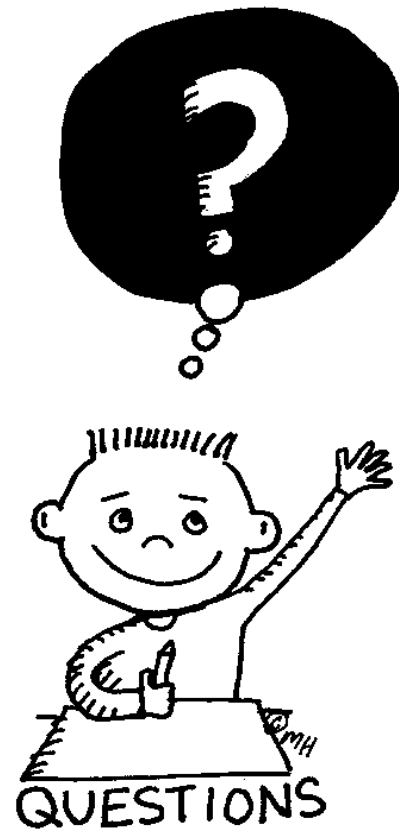
BY  
**SCOTT ADAMS**



# Capability Im-Maturity Model (CIMM)

Level	Description
<b>Characteristic</b>	
<b>0. Negligent</b> Indifference	Failure to allow successful development process to succeed. All problems are perceived to be technical problems. Managerial and quality assurance activities are deemed to be overhead and superfluous to the task of software development process. Reliance on silver pellets.
<b>-1. Obstructive</b> Counter Productive	Counterproductive processes are imposed. Processes are rigidly defined and adherence to the form is stressed. Ritualistic ceremonies abound. Collective management precludes assigning responsibility. Status quo
<b>-2. Contemptuous</b> Arrogance	Disregard for good software engineering institutionalized. Complete schism between software development activities and software process improvement activities. Complete lack of a training program.
<b>-3. Undermining</b> Sabotage	Total neglect of own charter, conscious discrediting of peer organizations software process improvement efforts. Rewarding failure and poor performance.

# Q& A?



# Remember Quiz

- Reminder that you have to take the quiz within two weeks after you attend the training
- To access the quiz, follow the steps on next few slides

# Log in to team member website

The screenshot shows a Mozilla Firefox browser window displaying the SES Team Member Site. The address bar shows the URL <https://teammember.sesolutions.com/>. The page features a navigation menu with 'Most Visited', 'Getting Started', 'Latest Headlines', and 'Customize Links'. Below the navigation is a banner with the SES logo and the tagline 'Team Performance & Accountability. Improving Processes for Success'. The main content area is titled 'Our Vision' and includes the SES logo and a paragraph of text. A login form is centered on the page, containing fields for 'User ID:' and 'Password:', and a 'Sign In' button. The browser's status bar at the bottom shows the address 'teammember.sesolutions.com' and the Windows taskbar with various open applications.

SES Team Member Site - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://teammember.sesolutions.com/

Most Visited Getting Started Latest Headlines Customize Links

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**SES**  
Software Engineering  
SERVICES  
Team Performance & Accountability. Improving Processes for Success

## Our Vision

**SES**  
Software Engineering  
SERVICES

Achieve greatness as a leading-edge industry problem solver. Maintain technical expertise providing state-of-the art solutions that consistently exceed customer expectations. Create and sustain a working environment that fosters free exchange of innovative ideas. Retain talented staff by exemplary treatment of our employees.

User ID:

Password:

Sign In

Done teammember.sesolutions.com

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# Click-> Document Management System-> TeamTrack /Process-Trak

SES Team Member Site - Mozilla Firefox

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Most Visited Getting Started Latest Headlines Customize Links

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**SES**  
Software Engineering  
SERVICES

Team Performance & Accountability. Improving Processes for Success

Timesheet Management System
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Employee Contact Info
Team Management Office (TMO)
Project Management Office (PMO)
Policies
Document Management System
Corporate Website
SES Outlook Web Mail
Security
CMMI Home Page
Corporate Communication
Logout

**Our Vision**

**SES**  
Software Engineering  
SERVICES

Achieve greatness as a leading-edge industry problem solver. Maintain technical expertise providing state-of-the art solutions that consistently exceed customer expectations. Create and sustain a working environment that fosters free exchange of innovative ideas. Retain talented staff by exemplary treatment of our employees.

**Quote of the Week:**

"We Will Do Much, Much Better This Year, I PROMISE!!!" - Jim Bridges, CEO

Done

teammember.sessolutions.com

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# Login to TeamTrack

Process-Trak by Software Engineering Services (www.process-trak.com) - Mozilla Firefox

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http://fw.sessolutions.com/tmtrack/tmtrack.dll?LoginPage&Template=loginform&Message=

Most Visited Getting Started Latest Headlines Customize Links

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## Login

### TEAMTRACK™

#### Login to TeamTrack

User ID:

Password:

Login

**LOGIN**

**USER GUIDE**

Done

start | Inbox - Micr... | Requirements | CMMI Training | SES Training... | 5 Firefox | CMMI Marke... | Microsoft Po... | 11:12 AM

# Logged in as Shonda Spears

Process-Trak by Software Engineering Services (www.process-trak.com) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://fw.sessolutions.com/tmtrack/tmtrack.dll?

Most Visited Getting Started Latest Headlines Customize Links

pdf Search PDF

TeamTrack™ Launch Page SERENA™

(as Shonda Spears) Manage Data | About TeamTrack | Help | Exit

Status Reports SES Training Global Search | Knowledge Base

Home Submit Search Reports Settings ID Search:

Active Items

Browse reports

Built-in reports

System reports

SES\_Trainings: All Active Items I Own 02/03/2009 11:13:39 AM

Now showing 0 - 0 of 0 Excel

Sorry, no data was found meeting conditions of this report.

Search reports

Show My Projects | Manage My Projects

Reload | Save | Help

Favorites

Public Folders

Knowledge Base

Done

start Inbox - Mic... Requirements CMMI Training SES Training... 5 Firefox CMMI Marke... Microsoft Po... 11:13 AM

# Answer Multiple Choice Questions

After you have answered all 25 questions, click submit to complete your quiz.

The screenshot shows a web browser window titled "Process-Trak by Software Engineering Services (www.process-trak.com) - Mozilla Firefox". The address bar shows the URL "http://fw.sesolutions.com/tmtrack/tmtrack.dll?". The page content includes a navigation menu with "Status Reports" and "SES Training" tabs. The "SES Training" tab is active, showing a "Submit" button and a "Search" field. The main content area displays the test title "SES CMMI Orientation Test" and five multiple-choice questions. The questions are:

- \* 1. What does CMMI stand for?:
  - A) Capability Maturity Model Instantly
  - B) Capability Maturity Model Integration
  - C) Capture Meaningless Metric Information
  - D) None of the above
- \* 2. Process Maturity means the following:
  - A) The ability of the organization to function more capably
  - B) The ability of individuals to do more work in less time
  - C) Adding greater discipline to organizational performance
  - D) Reducing stress in the organization
  - E) All of the above
  - F) A and C above
- \* 3. Which are not barriers to process improvement?:
  - A) Executive Turnover
  - B) Personal Agreements
  - C) Politics
  - D) Previous Failures
  - E) Turf Guarding
- \* 4. The CMMI come in how many representations?:
  - A) 5
  - B) 2
  - C) 4
  - D) 1
- \* 5. PA stands for:
  - A) Process Access

The bottom of the screenshot shows the Windows taskbar with the "start" button and several open applications including "Inbox - Mic...", "Requirements", "CMMI Training", "SES Training...", "5 Firefox", "CMMI Marke...", and "Microsoft Po...". The system clock shows "11:14 AM".

# Further Info

CMMI Homepage

<https://teammember.sessolutions.com/sescmmi.aspx>

Quiz Page

<http://fw.sessolutions.com/tmtrack/tmtrack.dll?>

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