

Systems Engineering Revitalization using CMMI®

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NDIA CMMI Technology Conference, November 15, 2006



Presentation Outline

- **Introduction**
- **Revitalization Effort using CMMI®**
- **Training**
- **Summary**



Systems Center
Charleston

Introduction to SSC-Charleston

➤ **Where we fit**

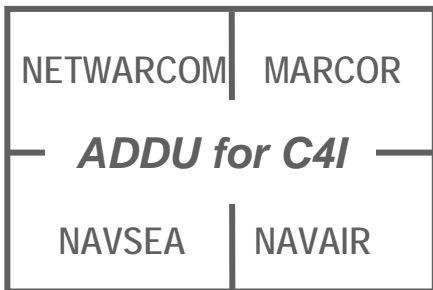
➤ **What we do**

➤ **Who we are**



Where We Fit

SPAWAR
Space and Naval Warfare
Systems Command



SPAWAR
San Diego, CA



NAVSEA
Washington, DC

NAVAIR
Patuxent River, MD

NAVSUP
Washington, DC

NAVFAC
Washington, DC

SYSCEN
San Diego, CA



SYSCEN
New Orleans, LA



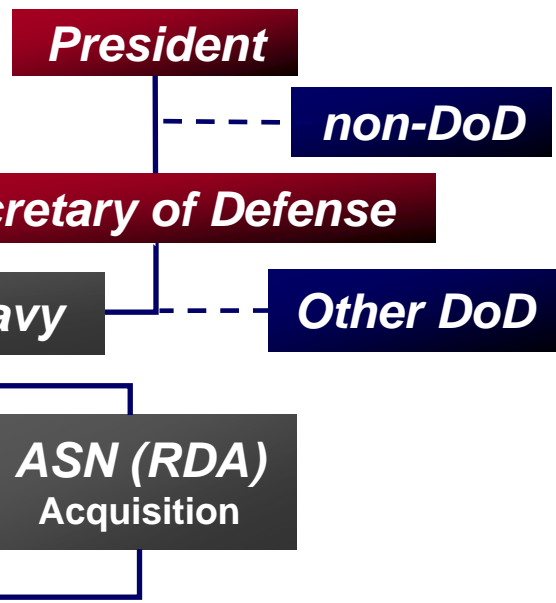
SYSCEN
Norfolk, VA



SFA
Chantilly, VA



SYSCEN
Charleston, SC



Connecting the Warfighter

Mission- We enable knowledge superiority to Naval and Joint Warfighters through the development, acquisition, and life-cycle support of effective, integrated C4ISR Information Technology, and Space capabilities.

Vision-
Fully Netted
in Three

We are the
Principal C4I
Acquisition
Engineering &
Integration
Center on the
East Coast
& Principal
C4ISR ISEA for
the Navy



MWR- MobileNet

Leveraging Technology

Body Worn Variant

NETCOP-Network Common Operating Picture

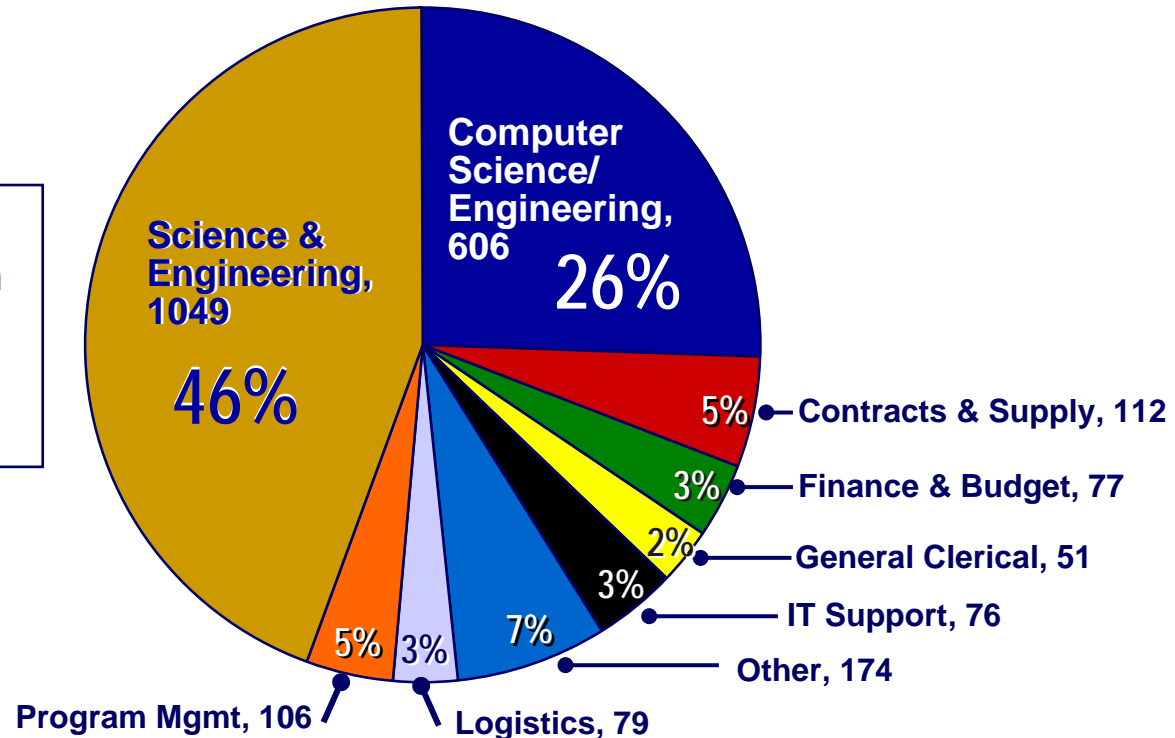
Rapid Prototyping

Speed to Capability

Connecting the Warfighter to the resources needed to win GWOT

A Large Systems & Software Engineering Organization

Over 70% of workforce is in an engineering or computer-related discipline



- The solutions to the global war on terror developed by SPAWAR result from good systems and software engineering.
- Systems engineering is our core competency.
- Total workforce of ~ 2,300 employees.



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SE Revitalization Effort using CMMI®

➤ **Vision**

➤ **Organization**

➤ **Plan**

➤ **Process**

➤ **Tools**

- **Vision**

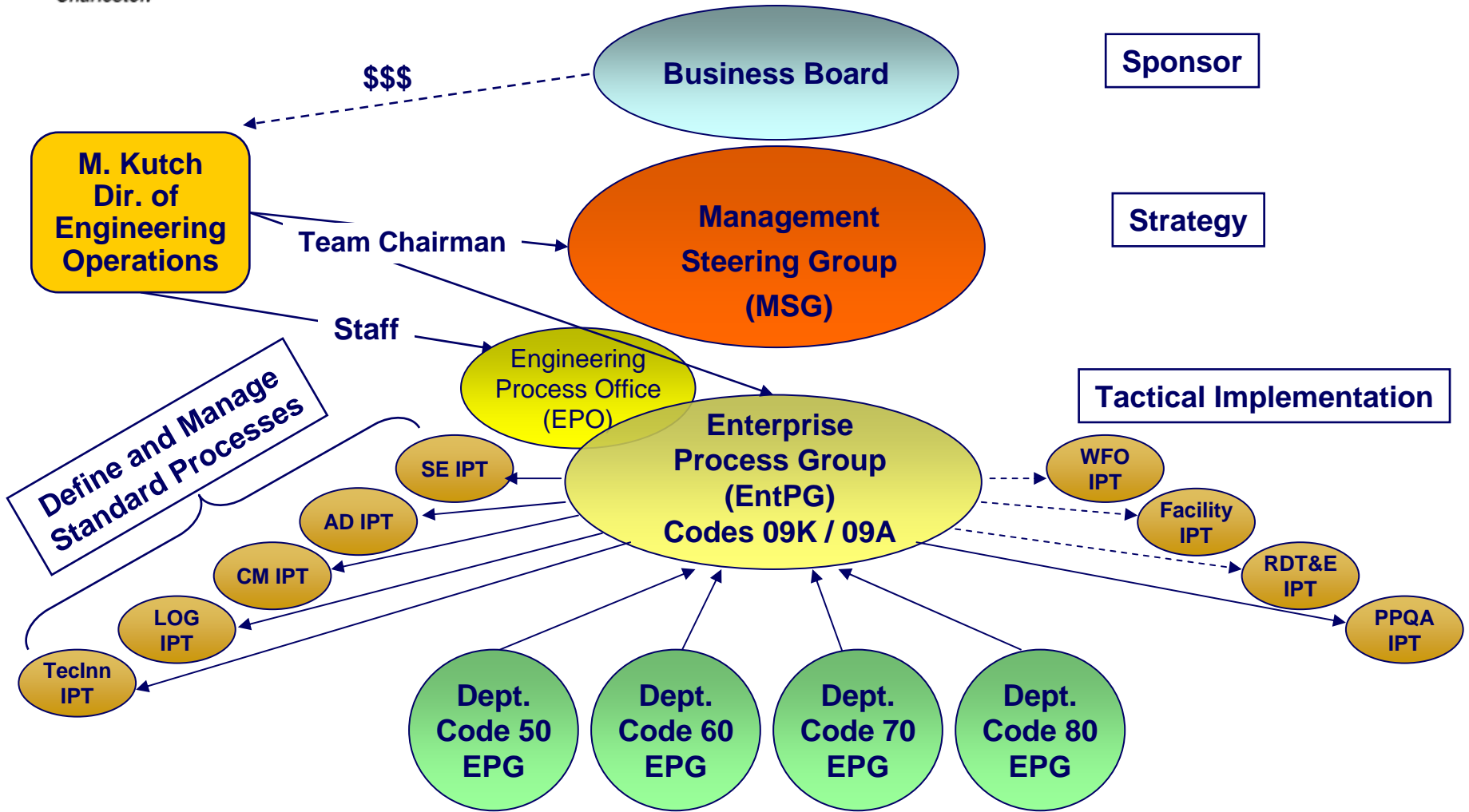
- Develop and maintain a World Class Systems Engineering Organization

- **Approach**

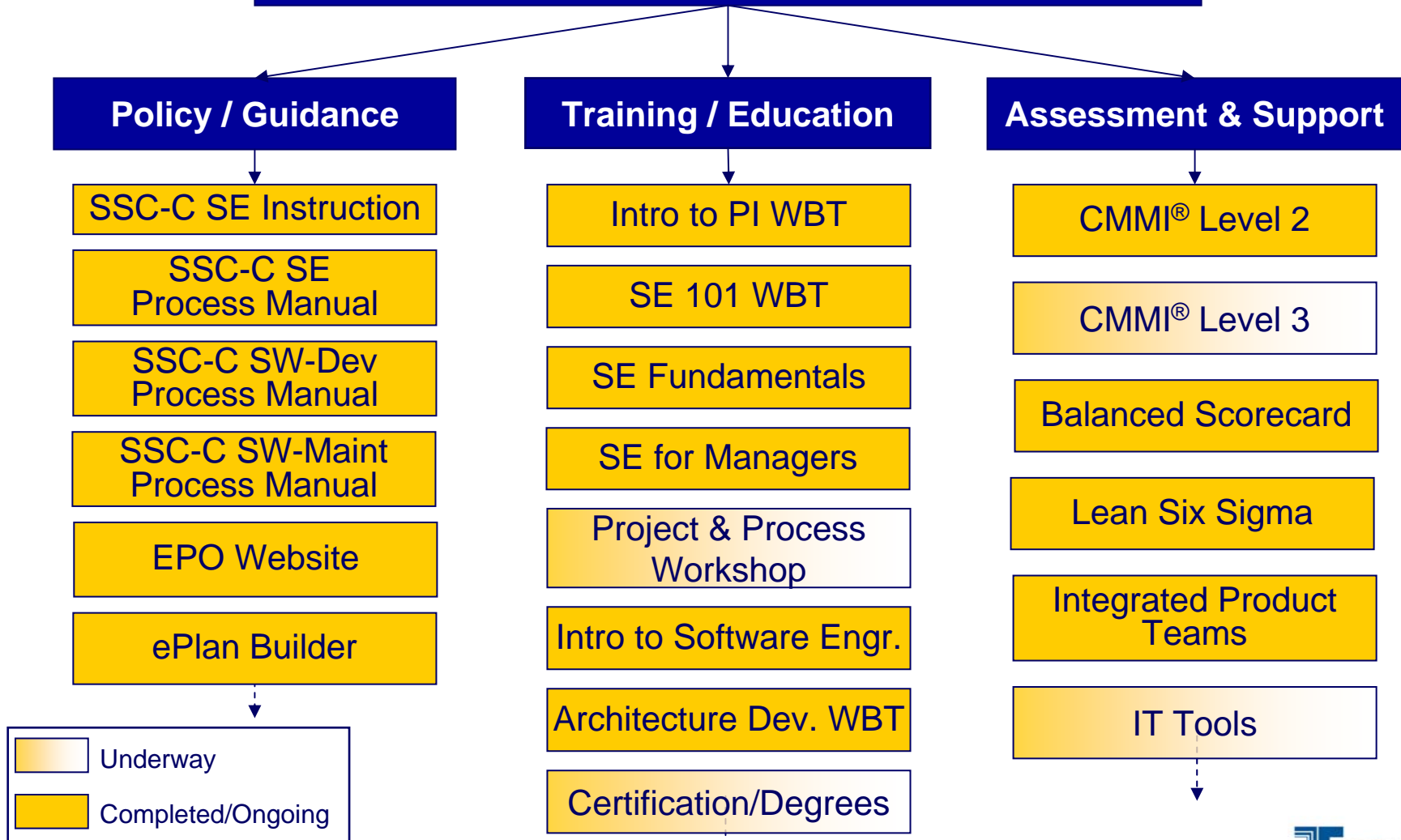
- Achieve Command-wide operational consistency
- Based on ISO/IEC 15288 – systems engineering
- Based on ISO/IEC 12207 – software engineering
- Based on implementing CMMI® “Staged Representation”
- Measure using best practices of CMMI® “Continuous Representation”

- **SSC-C commitment reaffirmed and formalized in Process Improvement Policy, 11 December 2003**

Organization for Implementation



Elements of SSC-C SE Revitalization



SSC-C Engineering Process Guidance

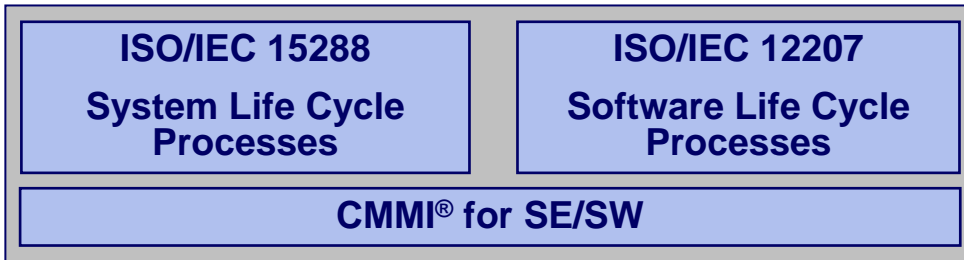
**SPAWAR Instruction 54xx.1 (draft)
SYSTEMS ENGINEERING POLICY**

SPAWAR Policy

**SSC-Charleston Engineering Processes
Improvement Policy (Dec. 2003)**

To be replaced with
SSC-C SE/SW Instruction

*Policies mandate the use of ISO/IEC life cycle processes
and CMMI® best practices*



Industry Standards
Good Engineering
Top Level SSC-C Processes

**SSC-C Systems
Engineering Process**

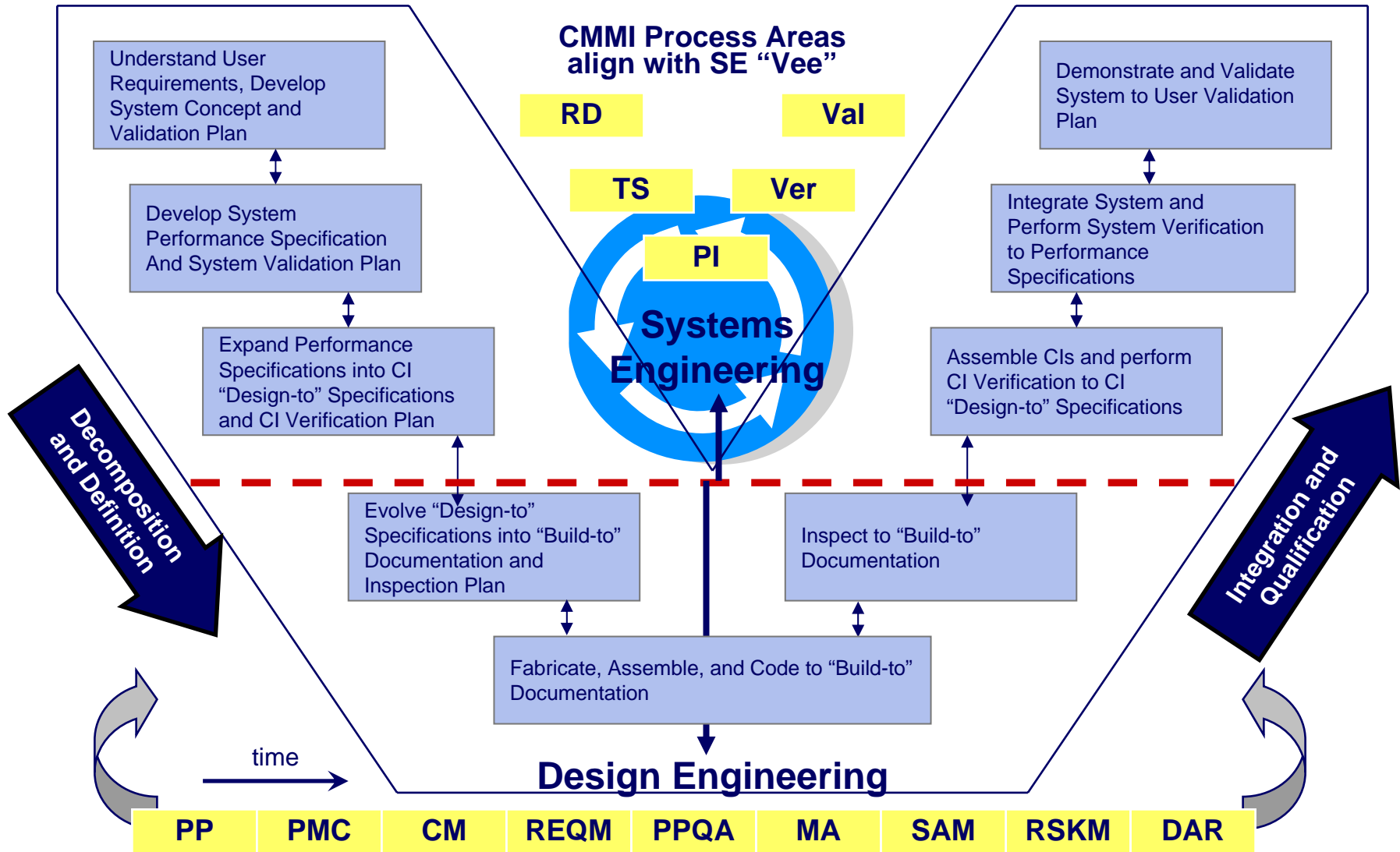
**SSC-C Software
Engineering Process**



CMMI® Supporting Process Areas to SE/SW Processes							
ML2	PP	PMC	CM	REQM	PPQA	MA	SAM
		OPF	OPD	OT	IPM		
ML3	RD	TS	PI	Ver	Val	RSKM	DAR


**Use CMMI® to
Measure & Assess
Processes**

Classic System Engineering "Vee" Diagram Aligning SE with CMMI and Process Improvement

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Address  <https://corpweb2.spawar.navy.mil/cmml/standardprocesses/standardprocesses.aspx> Go 



SSC-Charleston Engineering Process Office

[EPO Home](#) | [ePlan Builder](#) | [WBT Courses](#) | [eWBS](#) | [Contact EPO](#) | [CorpWeb](#)

Navigation

Calendar

SSC-C Standard Processes

- Systems Engineering Process
- Software Engineering Process
- Life Cycles
- Tailoring Criteria

Process Areas

Projects

Process Improvement Teams

Organizational Measurement Repository

Training

Innovation Program

SSC-C Standard Processes

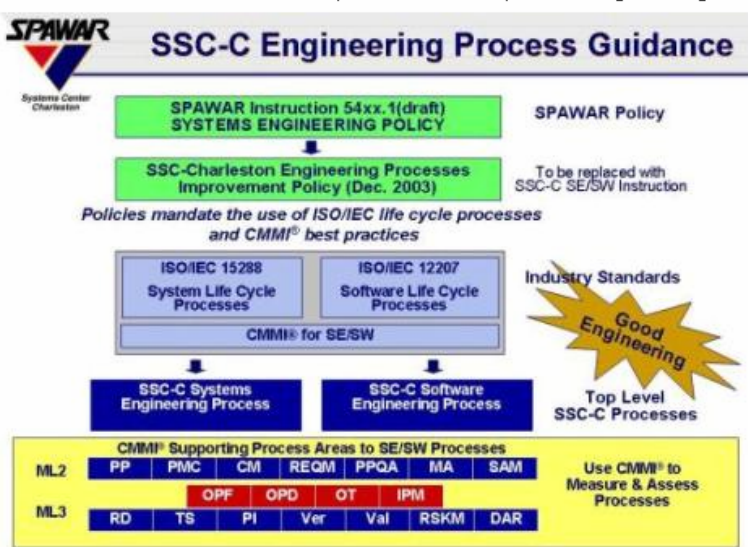
Currently, the SSC-C Standard Processes contain policies, process manuals for CMMI®-SE/SW Level 2 and Level 3 process areas, and select SOPs. The standard processes for Systems Engineering and Software Engineering provide detailed procedures for accomplishing tasks within these respective disciplines. The 3 top-level standard engineering processes are:

- Systems Engineering
- Software Development
- Software Maintenance

These processes were derived from the ISO/IEC industry standards to address the typical engineering work performed by SSC-C. Additional SSC-C standard processes have been developed to further refine these top level engineering processes and to support the process areas of CMMI®. The graphic depicts the derivation of the SSC-C standard processes.

Related Links

- [Process Improvement Communication Plan](#)
- [SSC-C Artifact Submittal Form](#)



SSC-C Engineering Process Guidance

The diagram illustrates the derivation of SSC-C processes. At the top, SPAWAR Instruction 54xx.1(draft) SYSTEMS ENGINEERING POLICY and SPAWAR Policy are shown. Below them is the SSC-Charleston Engineering Processes Improvement Policy (Dec. 2003), which is noted to be replaced by SSC-C SE/SW Instruction. A note states: 'Policies mandate the use of ISO/IEC life cycle processes and CMMI® best practices'. This leads to ISO/IEC 15288 System Life Cycle Processes and ISO/IEC 12207 Software Life Cycle Processes, which are categorized as Industry Standards and Good Engineering. These feed into CMMI® for SE/SW, which then leads to the SSC-C Systems Engineering Process and the SSC-C Software Engineering Process, collectively forming the Top Level SSC-C Processes. At the bottom, a table shows CMMI® Supporting Process Areas to SE/SW Processes:

CMMI® Supporting Process Areas to SE/SW Processes									
ML2	PP	PMC	CM	REQM	PPQA	MA	SAM	Use CMMI® to Measure & Assess Processes	
	OPF				OPD	OT	IPM		
ML3	RD	TS	PI	Ver	Val	RSKM	DAR		



ePlan Builder

Electronic CMMI® Compliant Documentation Application

Save Quit Help

Sponsored by the Director of Engineering Operations (O9K) - Michael Kutch

ePlan Builder tool

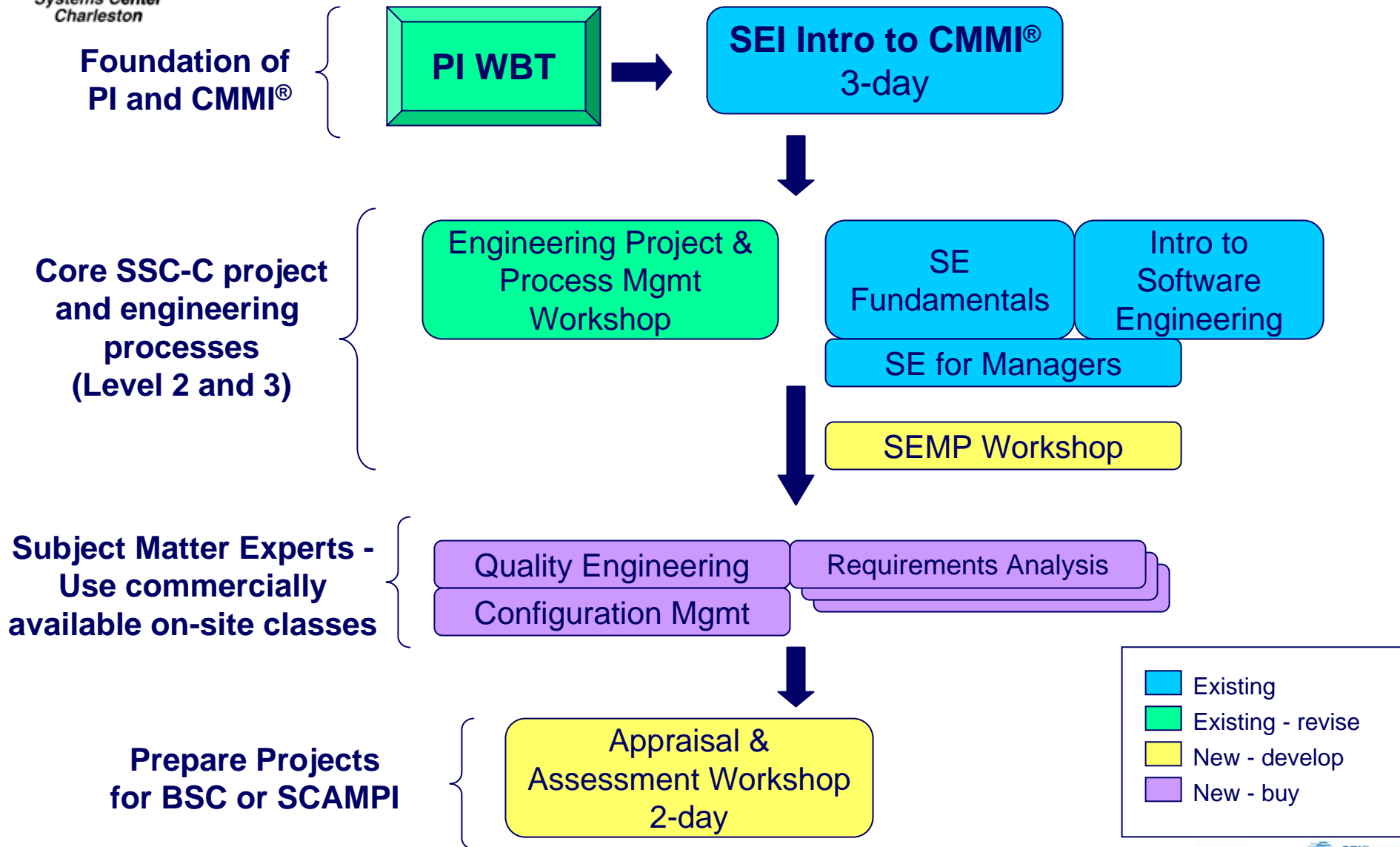
- An interactive, web-based application that leads the user through a structured interview process (like TurboTax®) to generate a CMMI®-compliant plan
- Includes standard, consistent text
- Generates an initial project-specific document
 - Project Management Plan (with Work Breakdown Structure)
 - Configuration Management Plan
 - Process and Product Quality Assurance Plan
 - Requirements Management Plan
 - Measurement and Analysis Plan
 - Systems Engineering Plan (DoD SEP Format)

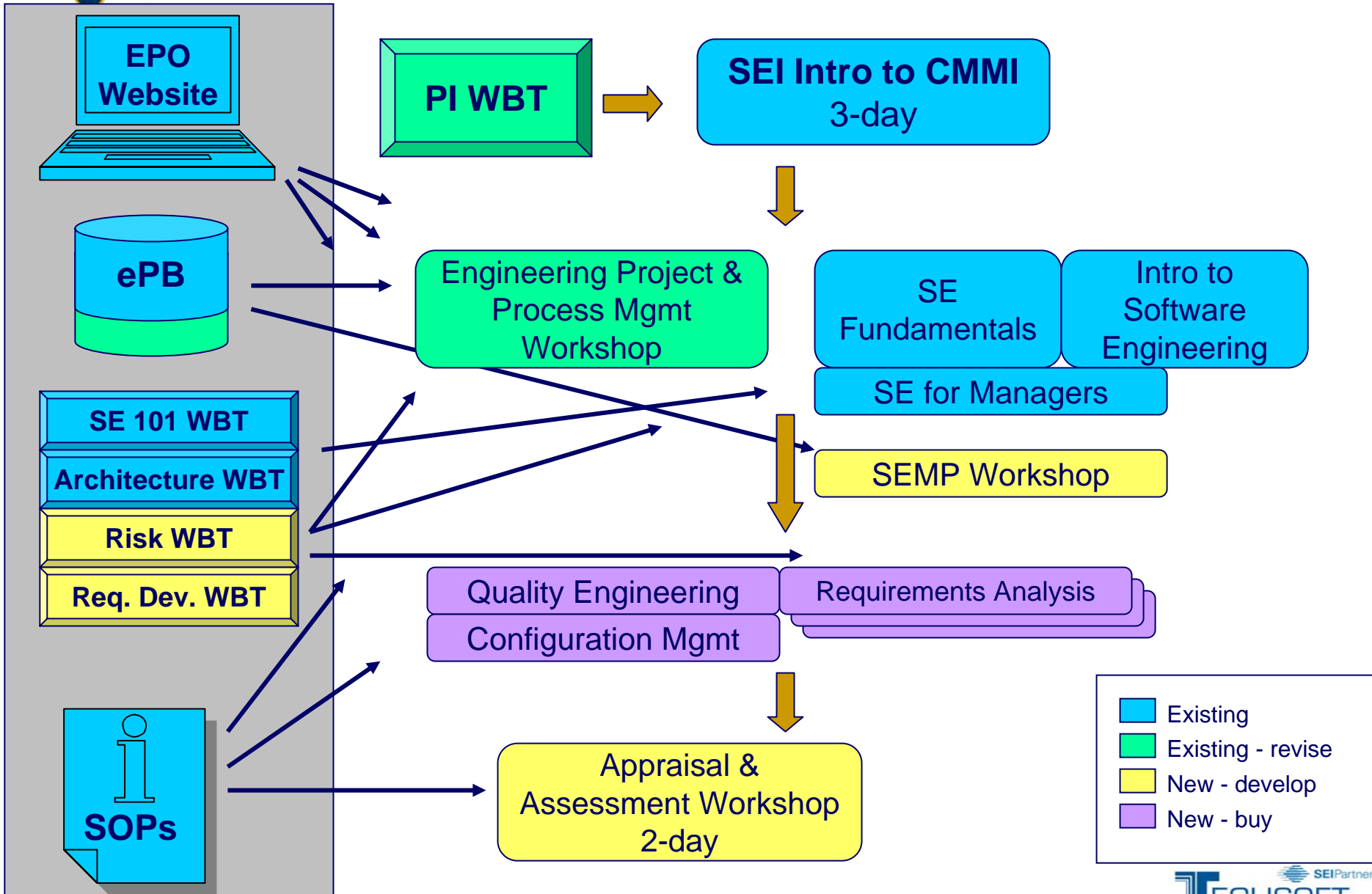
- **SE Training Architecture**
- **Process Improvement and CMMI®**
- **Systems/Software Engineering Classroom**
- **Web Based Training (WBTs)**

What do we need to be world class?

- All employees need a basic understanding of process improvement
- All project teams need to fully understand the CMMI® model (all processes, all levels)
 - To understand all of the best practices and maturity levels
 - To comply/prepare for DoD and NAVY policy
- All project team members and supporting personnel need to know how to perform the standard processes and best practices required
 - How to do good SE, CM, QA, Planning, Measurement, Risk, ...
- To properly prepare for and complete an assessment or appraisal, key project team members need to map the project work products to the practices assessed.

These needs can be depicted in a training architecture





Intro to Process Improvement

- Over 950 people trained
- Provided via WBT
- Now Required for all employees

CMMI®

- SEI Intro to CMMI®
 - Over 300 attendees to date
- SSC-C Level 2 Processes overview

Project Management/Project Monitoring & Control

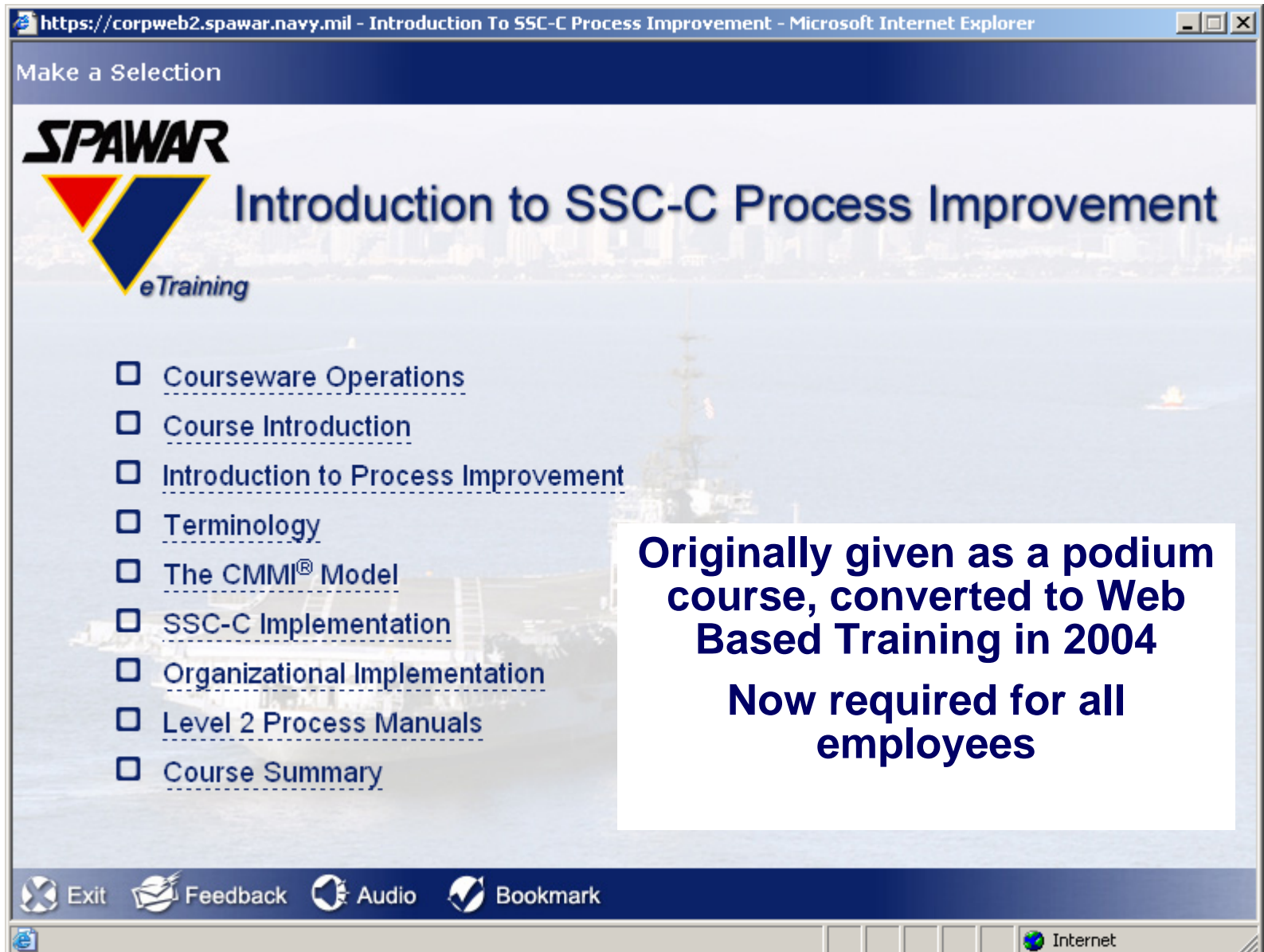
- 730 people trained

Process-specific Workshops (CM, QA, REQ, M&A)

- 450 people trained


** This accounts for many employees attending more than one course*





https://corpweb2.spawar.navy.mil - Introduction To SSC-C Process Improvement - Microsoft Internet Explorer

Make a Selection



Introduction to SSC-C Process Improvement

eTraining

- [Courseware Operations](#)
- [Course Introduction](#)
- [Introduction to Process Improvement](#)
- [Terminology](#)
- [The CMMI® Model](#)
- [SSC-C Implementation](#)
- [Organizational Implementation](#)
- [Level 2 Process Manuals](#)
- [Course Summary](#)

Originally given as a podium course, converted to Web Based Training in 2004

Now required for all employees

Exit Feedback Audio Bookmark

Internet

- **3-day *Introduction to CMMI[®]* course teaches the full CMMI[®] model**
 - Students learn how the best practices build and relate across process areas
 - Learn the terminology
- **SEI-Authorized instructors are well-versed in our implementation to augment material with SSC-C specific content**
 - Highlight SSC-C tools and resources
 - Actively involved in projects, teams, and infrastructure
- **Over 300 employees trained**
 - Want to build a cultural foundation within the engineering departments

- Teach the Systems Engineering process
- 3-day on-site, classroom course
 - Based on SMU SE Masters course
 - Customized to incorporate SSC-C SE process
 - Over 300 SSC-C engineers trained
- 1-day SE for Managers course added



“Thought provoking, motivating, and challenging. Learning basic SE caused me to brainstorm many different applications of organized system processes. It motivated me to want to begin organizing its application. It also challenged me to apply GOOD SE practices in order to successfully be more efficient in the process..”

“It was extremely beneficial to have a professor with extensive knowledge of the subject matter and one who could apply it to the SPAWAR methods.”

Student Feedback



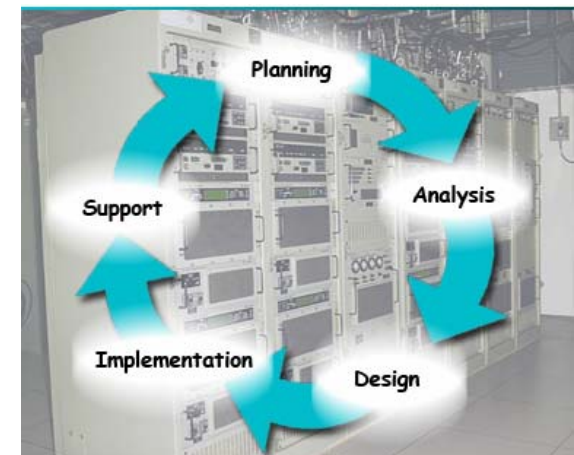
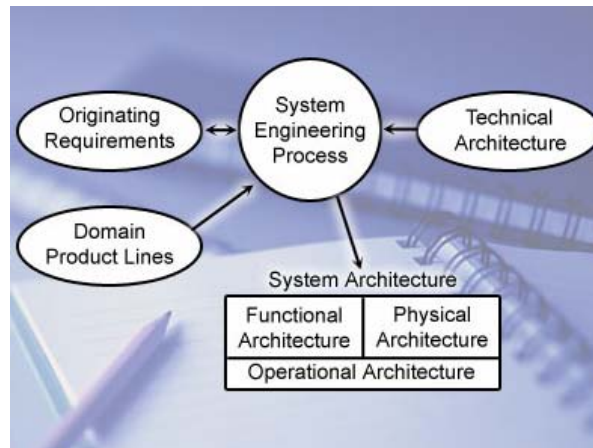
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Engineering Management Workshop

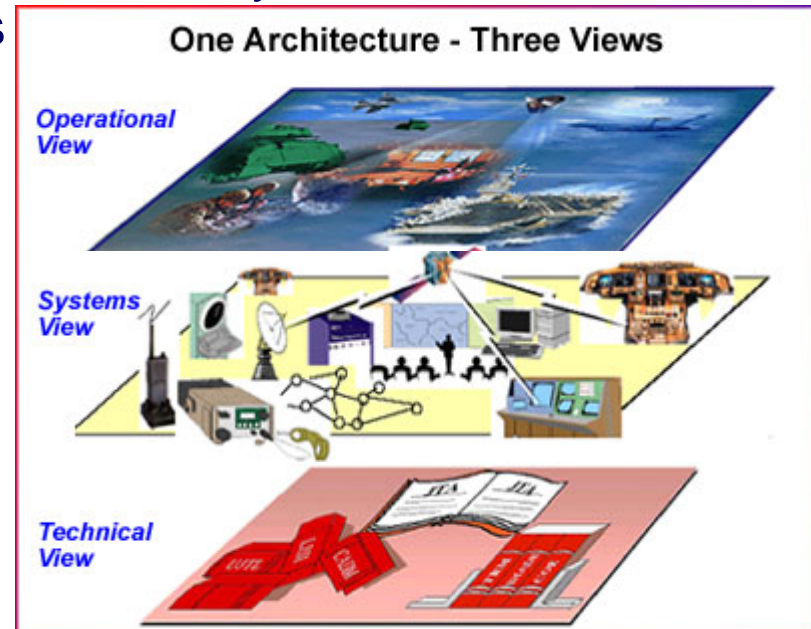
- **Multi-session workshop oriented “how to” class**
- **What is a good process? Is my process good?**
- **How to generate project plans**
 - What makes a good PMP, CM Plan, QA Plan...
 - How to use ePlan Builder
 - Hierarchy of plans (Based on level 2 or level 3 goals)
- **Configuration Mgmt**
 - Are my Configuration Items (CI's) and Change Control adequate?
- **PPQA**
 - How to execute a process review and work product review
- **Measurement and Analysis**
 - Are my measures measurable?
- **Requirements Management**
 - Traceability - simple to complex
- **Monitoring and Control using Reviews**

• Introduction to Systems Engineering WBT

- 10-module web based training
- Closely aligned to SSC-C SE Process, SE Fundamentals Course, and ISO/IEC 15288
- Includes hotlinks to referenced documentation
 - SSC-C Process manuals, policies, standards
- Extensive branching for more detail



- **Developing web-based training courses in specific topics**
- **Architecture Development WBT - completed**
 - Introduction to Architecture Development and DoDAF
 - Designed to educate and promote value of system architecture to non-architects and new engineers
 - Tests for understanding
- **Risk Management**
 - Risk identification
 - Analysis tools and techniques
 - Mitigation planning
 - Risk monitoring
- **Requirements Development**



- **Accomplishments**
- **Results and Measures**
- **Lessons Learned**
- **Going Forward**

- **Process Focus**

- Defined Policies and Processes
- Aligned with DoD and SPAWAR guidance
- Aligned with industry standards and CMMI® model
- Built organization structured around processes and process improvement

- **Training is Critical**

- Providing Fundamentals of Engineering for new and old professionals
- Developed web-based training for “self-paced” and refresher training
- Defining a structured technical career development path for engineers

- **Tools for the Engineers**

- Developed *ePlan Builder* application to generate planning documents
- Developed templates, checklists, and web-based document repositories to link standards and DoD guidance to day-to-day tasks and processes

Early and persistent Systems and Software Engineering applied to programs and projects

- **Selected pilot projects**
 - Training and Mentoring of project teams
- **Informal Appraisals, Process Reviews, and Document Reviews to measure progress and identify gaps**
 - Class B/C appraisals of selected projects
 - Define/review project-specific plans and procedures
- **Project-level Formal SCAMPISM Appraisals (Class A)**
 - Evaluated compliance with CMMI[®] Maturity Level 2 requirements
 - 8 projects appraised between June 2004 and February 2005
- **Command-wide ML2 appraisal in April, 2005**
- **Immediately began ML3 effort using similar approach**
- **4 Program/Project-level ML3 SCAMPISM Appraisals completed**
 - Mix of Maturity Level 3 and Capability Level 3 successes
 - Preparing for Command-wide ML3 appraisal in April, 2007
- **Continue to internally assess additional projects against Maturity Level 2 and 3 best practices for Balanced Scorecard**



- **Recognition of SE and CMMI effort**

- 1st Systems Center to achieve Maturity Level 2
- 1st Systems Center to have a program achieve Maturity Level 3 (AP)
- Multiple presenter at NDIA SE and CMMI conferences
 - High interest in Tools, Training, and Implementation

- **Business**

- LPD 17: “They see us as a model and want to increase our efforts.”
- Automation Program: “We had hundreds of sites and there was a need for a structured organization to put a ‘wrapper’ around that and control it. CMMI became the wrapper.”
- CICS: “CMMI was key to achieving the project goal.”
- VIDS: “The VIDS failure (2000) motivated implementing CMMI because the team needed to change course or the customer would have no confidence in system development. It was a tremendous success...”

- **Innovation - Code 71 is receiving USMC/ONR \$1M Intelligence Metadata Project due to “Quantum Leap” Innovation Initiative**

- “I don’t think we would have even been considered if we hadn’t told them about this Innovation Project”

- **Senior Management support is critical to success**
- **Training**
 - Everyone needs to be engaged – “train the masses”
 - Specific training for process owners/subject matter experts
- **Utilize Teams (IPTs) as champions of specific processes**
 - Multi-department representation
 - Change agent mentality
 - Process-focused charters
- **Resource Properly**
 - Implement with projects that want to improve, can benefit from efforts, and that recognize own weaknesses
 - EPO staff provided skilled coaching, resources, support, and tools
 - Project members learned by doing and maintaining
- **Goals and Publicity**
 - Keep goals to sizable bites (projects)
 - Publicize successes; Share best practices

• 2007

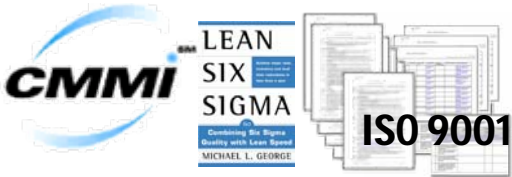
- Conduct interim Maturity Level 3 appraisals on projects
- Correct findings and strengthen institutionalization
- Conduct Command Maturity Level 3 appraisal in April, 2007
- Incorporate new version of CMMI model (V1.2)
- Incorporate IPPD (Integrated Product and Process Development)
- Push Level 2 projects to Level 3

• 2008 - 2009

- Begin Maturity Level 4/5 implementation
- Establish/Refine organizational and project measures
- Increase collection of project, process, and organizational measurement data
- Conduct interim Maturity Level 4 appraisals on projects

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- **Aggressive SE Program**
- **Industry Standards**
 - Systems Engineering
 - Software Engineering
- **Best Practices**



- **Successes**

- April 2005 Command Achieved CMMI[®] Maturity Level 2 as certified by Software Engineering Institute
- June 2006 Common Information Centric Security (CICS) project achieved CMMI Level 3 in 16 of 18 Process areas
- 1st SPAWAR Systems Center to achieve these levels

- **Goals**

- World-Class SE Program
- Support Command Balanced Scorecard
- April 2007, Command to achieve CMMI[®] Level 3

- **Automated Tools**

- ePlanBuilder
- eWBS



corpweb2.spawar.navy.mil/cmmi/

- **Training – 1,600+**

- SE Fundamentals - 305
- Web-Based Training courses
 - SSC-C PI; Intro to SE; Arch. Dev.



Thank you !

Any Questions ?

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