Systems Center Charleston

...ng a Successful CMMI® Maturity Level 3 SCAMPI℠ for SPAWAR Systems Center Charleston (SSC-C)

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National Competency Lead for I/A 5.8

Deputy National Competency Lead for ISR/IO 5.6

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SEI Authorized Lead Appraiser

SEI Authorized Instructor

SSC-C EPO Representative

7th Annual NDIA CMMI Conference
November 14, 2007

Improving operational effectiveness through C4ISR common integrated solutions

N65236-ENGOPS-BRIEF-0047-1.1

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➢ **Background**

➢ **Road to Maturity Level 3**

➢ **Appraisal Planning/Execution**

➢ **Lessons Learned**

➢ **Beyond Maturity Level 3**

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Background

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Where We Fit

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SPAWAR
Space and Naval Warfare Systems Command

President

non-DoD

Secretary of Defense

Other DoD

Secretary of the Navy

CNO
Fleet Support

ASN (RDA)
Acquisition

NETWARCOM	MARCOR
ADDU for C4I	
NAVSEA	NAVAIR
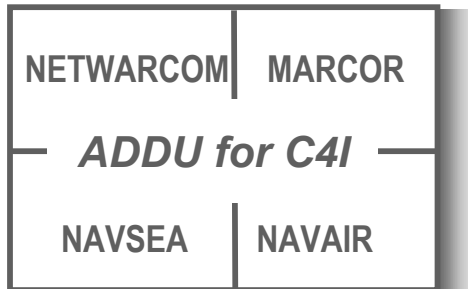
SPAWAR
San Diego, CA

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

Network Centric Enterprise

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What We Do

Systems Center Charleston

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

IR Pocketscope
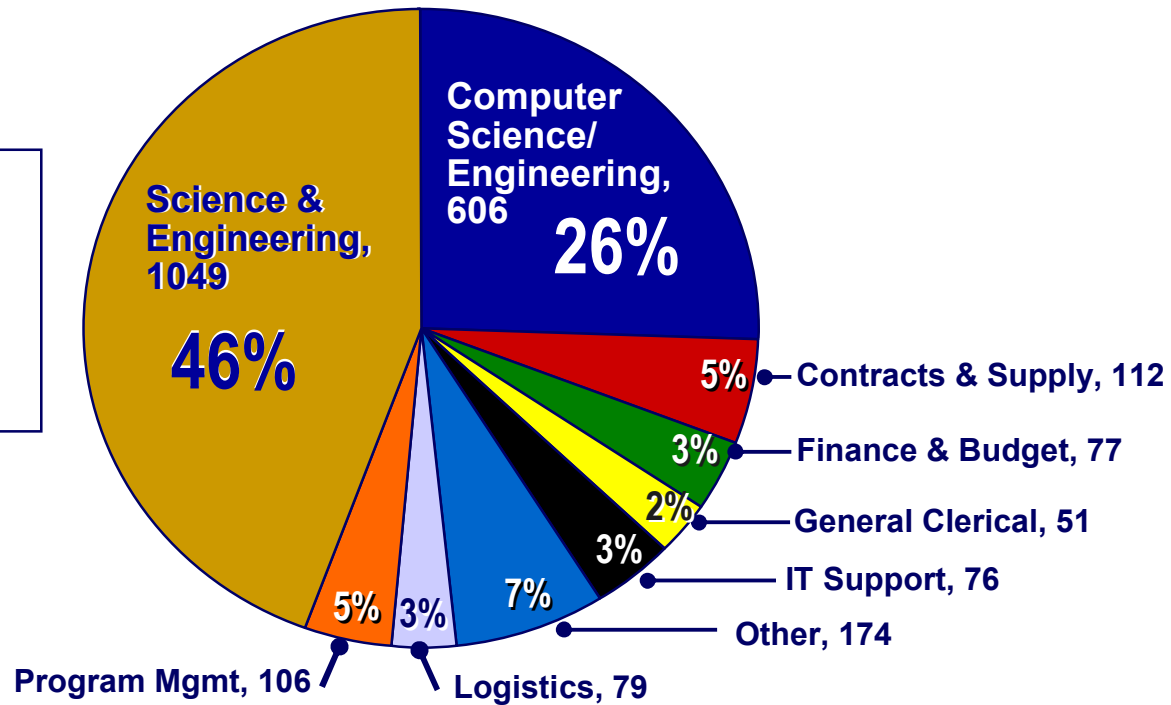
Rapid Prototyping

Speed to Capability

LIGHTSPEED

Connecting the Warfighter to the resources needed to win GWOT

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A Large Systems & Software Engineering Organization

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

Computer Science/ Engineering, 606 — 26%

Science & Engineering, 1049 — 46%

Contracts & Supply, 112 — 5%

Finance & Budget, 77 — 3%

General Clerical, 51 — 2%

IT Support, 76 — 3%

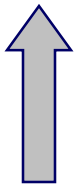Other, 174 — 7%

Logistics, 79 — 3%

Program Mgmt, 106 — 5%

˝**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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Road to Maturity Level 3

Implementation of Best Practices

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A Vision of World Class

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When you want it done right, Who do you want working on it?

Cutting corners, undisciplined, untrained

Rigorous processes, Skilled resources

Permission to use Redneck Mechanic photo received from Dave Lilligren, 3/9/2007
Permission to use NASCAR Technical Institute photo received from Popular Mechanics, 3/16/2007

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˝ Vision
- . Develop and maintain a World Class Systems Engineering Organization

˝ Approach
- . Achieve Command-wide operational consistency
- . Based on ISO 15288 . systems engineering
- . Based on ISO 12207 . software engineering
- . Measure using best practices of CMMI®

˝ Goals
- . CMMI Maturity Level 2 by April, 2005
- . CMMI Maturity Level 3 by April, 2007

WORLD CLASS SYSTEMS ENGINEERING
SPAWAR
MATURITY LEVEL **3**
April 27, 2007
Capability Maturity Model Integration (CMMI®)
SYSTEMS CENTER CHARLESTON

Both Goals attained on schedule

1st SPAWAR Systems Center to Achieve ML2 and ML3

New Goal: Maturity Level 4 by 2010

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Critical Success Factors

CRITICAL SUCCESS FACTORS FOR CMMI® IMPLEMENTATION	
Command-wide Policy (Create vision that is urgent)	**Assign Responsibilities (Strong Change Agents are essential)**
Strategy and Plan (Include knowledge of why change is necessary and benefits)	**Provide Training**
Senior Management Support	**Build a Central Repository**
Provide Resources and Funding (New Organizational Structure Usually Needed)	**Measure and Communicate Progress**

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SSC-C SE Revitalization Plan Aligned with DoD SE Revitalization

Elements of SSC-C SE Revitalization

Policy / Guidance

- SSC-C SE Instruction
- SSC-C SE Process Manual
- SSC-C SW-Dev Process Manual
- SSC-C SW-Maint Process Manual
- EPO Website
- ePlan Builder

Training / Education

- Intro to PI WBT
- SE 101 WBT
- SE Fundamentals
- SE for Managers
- Project & Process Workshop
- Intro to Software Engr.
- Architecture Dev. WBT
- Certification/Degrees

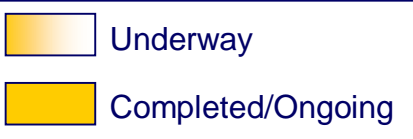### Assessment & Support

- CMMI® Level 2
- CMMI® Level 3
- CMMI® Level 4/5
- Project Reviews
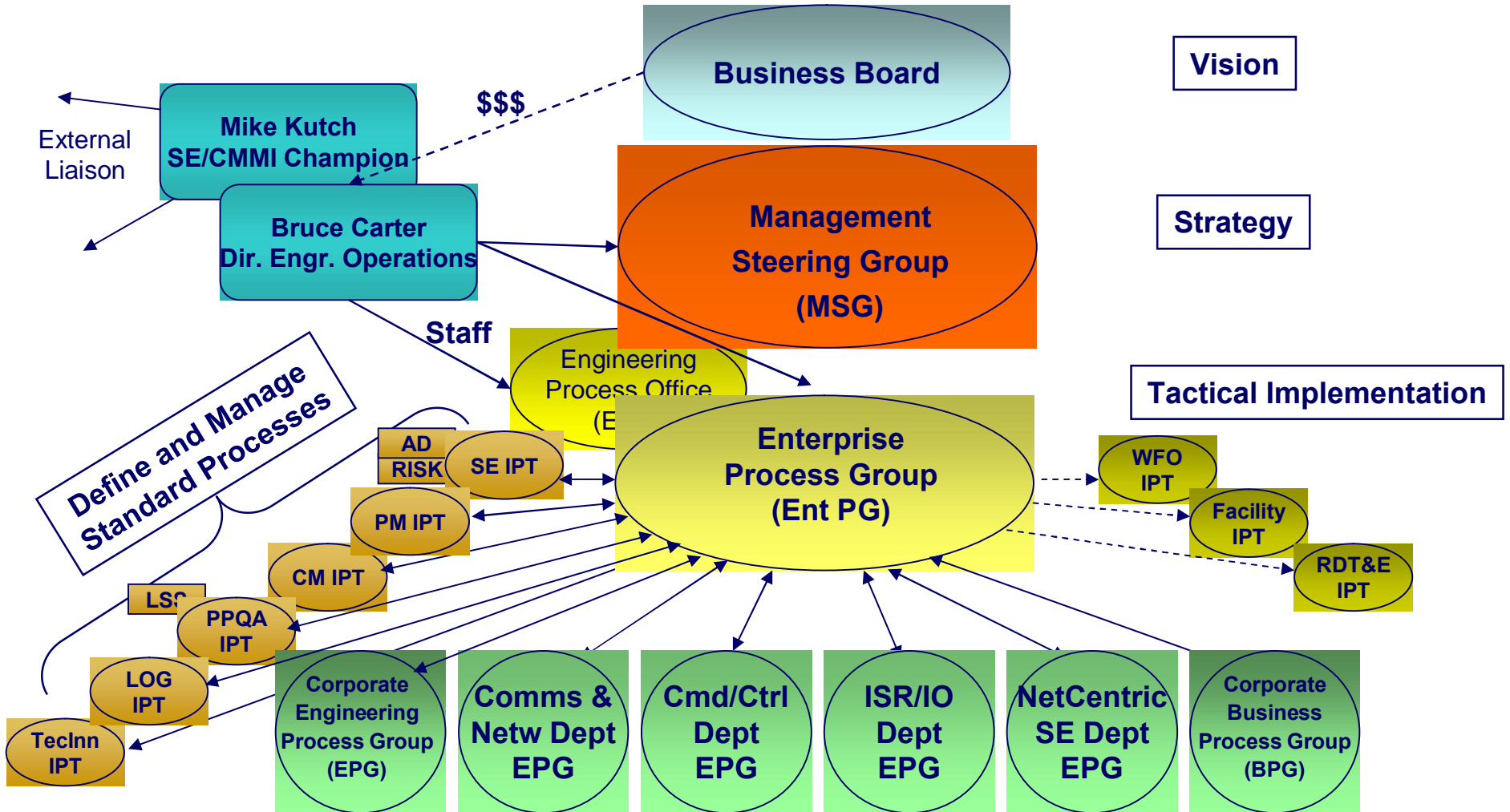- Balanced Scorecard
- Lean Six Sigma
- Integrated Product Teams
- IT Tools

Legend:
- Underway
- Completed/Ongoing

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Vision

Business Board

Mike Kutch **SE/CMMI Champion**

$$$

External Liaison

Bruce Carter **Dir. Engr. Operations**

Management Steering Group (MSG)

Strategy

Staff

Engineering Process Office (E...)

Define and Manage Standard Processes

Tactical Implementation

Enterprise Process Group (Ent PG)

AD RISK

SE IPT

PM IPT

CM IPT

LSC

PPQA IPT

LOG IPT

TecInn IPT

WFO IPT

Facility IPT

RDT&E IPT

Corporate Engineering Process Group (EPG)

Comms & Netw Dept EPG

Cmd/Ctrl Dept EPG

ISR/IO Dept EPG

NetCentric SE Dept EPG

Corporate Business Process Group (BPG)

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Timeline 2001-2002

˝ Prior to 2001

- Code 70 had experience with SW-CMM®

˝ 2001

- SSC-C Process Improvement (PI) effort began
- Code 70 developed PI Policy for SE, SW, and Security Engineering using SEI CMM® and CMMI®
- Code 70 Engineering Process Group expanded to Command-wide
- Engineering Process Office (EPO) Website started
- Pilot Projects selected and evaluated
- Some templates published

˝ 2002

- Began developing and delivering training
- Began conducting Class C+ assessments as progress checks

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˝ **2003**

. **Established and Funded Dir. of Engineering Operations position**
- ˝ Staffed Engineering Process Office (EPO)

. **Developed Organizational Standard Policies**
- ˝ Policy for each CMMI® Level 2 and 3 Process Area

. **Developed Organizational Standard Process Manuals**
- ˝ Top Level
  - ˝ Systems Engineering
  - ˝ Software Development
  - ˝ Software Maintenance
- ˝ Supporting Processes
  - ˝ Process Manual for each CMMI® Level 2 and 3 Process Area

. **Developed plan templates**

. **Coached and mentored pilot projects**

. **Built tools**

. **Developed and delivered training**

. **Performed interim assessments**

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˝ 2004

- Conducted project-level Maturity Level (ML) 2 SCAMPI^SM Class ‰+appraisals
  - ˝ 6 Projects Appraised
  - ˝ 6 Achieved ML2

˝ April 2005

- Conducted Command-level ML2 SCAMPI^SM Class ‰+appraisal . First SPAWAR Systems Center to achieve Command-level ML2

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2

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World Class Systems Engineering

Capability Maturity Model Integration (CMMI®)

MATURITY LEVEL

April 28, 2005

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˝ **Addressed the three Organizational Process Areas early to provide a smoother transition to ML3**

. *Organizational Process Focus (OPF)* - Purpose: Plan, implement, and deploy organizational process improvements based on an understanding of the current strengths and weaknesses.

  ˝ Determined Process Improvement Opportunities

  . Management commitment . the PI strategy

  . Benchmarked current state, addressed identified needs/gaps

  ˝ Planned and Implemented Process Improvements

  . Determined Scope, Model (CMMI-SE/SW), Approach (Staged, but appraise using Continuous)

  . Created appropriate teams to champion PI efforts

  ˝ Deployed Organizational Process Assets and Incorporated Lessons Learned

  . Shared sample project plans, improvements, etc., across the organization

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The Second Wave – ML2 to ML3[2]

˝ **Addressed the three Organizational Process Areas early to provide a smoother transition to ML3 (con't)**

. *Organizational Process Definition (OPD)* . Purpose: Establish and maintain a usable set of organizational process assets and work environment standards.

˝ Developed EPO website, which is a repository for standard process manuals, SOPs, checklists, etc. The site also contains Tailoring criteria and other useful resources such as sample plans, etc., shared with the SSC-C organization by its projects

˝ Built SSC-C Organizational Measurement Repository (OMR) for projects to use for managing their projects and capturing standardized cost, schedule, and process performance measurement data

. Defined Balanced Scorecard measures directly related to CMMI® and Process Improvement

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The Second Wave – ML2 to ML3[3]

˝ **Addressed the three Organizational Process Areas early to provide a smoother transition to ML3 (con't)**

. *Organizational Training (OT)* - Purpose: Develop the skills and knowledge of people so they can perform their roles effectively and efficiently.

˝ Identified the training needed by the organization

˝ Obtained and provided training to address those needs

˝ Established and maintained training capability

˝ Established and maintained training records

˝ Assessed training effectiveness

. Objective evaluation of OT process performed by the Process and Product Quality Integrated Product Team (PPQA IPT)

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The Second Wave – ML2 to ML3[4]

- ˝ SSC-C organization developed Tailoring Guidelines
- ˝ SSC-C Projects developed ML2-to-ML3 Action Plans
- ˝ Developed internal "self-assessment" process for measuring ongoing implementation of ML2 processes
- ˝ Continued enhancing ePlan Builder tool to create new plans (e.g., SEP/SEMP) that are ML3 compliant
- ˝ Updated/Improved existing plans
- ˝ Provided additional CMMI® Training
- ˝ Added Work Breakdown Structure Tool and Architecture Development Web-Based Training Course
- ˝ Continued to Measure and Communicate Progress
- ˝ Maintained Momentum and Commitment to Goals

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˝ May – Dec 2005

- Updated Organizational processes with ML3 language
- Built Organizational Measurement Repository (OMR) to track cost, schedule, and process performance measurement data
- Developed Sample ML3 plans
- Projects: Built ML2 to ML3 transition plans
    - ˝ Coaching and mentoring continued

˝ 2006

- Conducted project-level Maturity Level 3 SCAMPI^{SM} Class A+ appraisals
    - ˝ 6 Projects Appraised between June and December
    - ˝ 5 Achieved ML3
- Projects worked to correct consistent weaknesses in Peer Reviews, Decision Analysis and Resolution (DAR), PPQA

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˝ **January 2007**

. 1 additional project achieved ML3

. Collected data from 30+ % ˝non-focused˝ projects

  ˝ Tailoring Guidelines

  ˝ Project Management Plans

  ˝ SEMP/SDPs

  ˝ PPQA Plans

  ˝ CM Plans

  ˝ M&A Plans

˝ **February 2007**

. Conducted 5-day Readiness Review

. Collected additional artifacts needed

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˝ April 2007

- . Conducted Command-level ML3 SCAMPI^{SM} Class %A+appraisal .
  First SPAWAR Systems Center to achieve Command-level ML3

- . 9 Projects in appraisal scope . 7 Focused, 2 Non-Focused

  ˝ >8000 artifacts submitted, 164 interviewees

- . SEI Senior Member was Lead Appraiser (Team Leader)

- . 2 other SEI Authorized Leads on the Team

- . 1 Government person from NSA

- . 1 Government person from SSC-C

- . 3 Appraisal experienced team members

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MATURITY LEVEL
3
Capability Maturity Model Integration (CMMI®)
April 27, 2007
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ccess Factors of Implementation[1]

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˝ **Carefully select Initial Projects**

. Start with interested projects

˝ High Sponsor interest

˝ Strong need/desire to improve

˝ **Set Guidelines (criteria) that yield benefits, for example, SSC-C's CMMI® Projects meet the following:**

. Systems or software engineering effort

. Funding directly with SSC-C

. SSC-C performs the Project Management function

. SSC-C PM is directly responsible for product delivery

. Multi-year effort

. Over $2M per year

. Not limited to level of effort for services

. Not merely a pass-through contract

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cess Factors of Implementation²

˝ Assign a CMMI® resource to each project

- Strong facilitator with strong CMMI® knowledge
- Conduct regular (at least monthly) process-focused meetings to ensure steady progress
  - ˝ Include all key process area members (including contractors)
- Review projects plans, SOPs, work products
- Explain process area practices to the teams subject matter experts
  - ˝ Relates model to project
  - ˝ Helps team define typical work products
  - ˝ Helps team identify and collect direct and indirect evidence
- Conduct mini assessments to benchmark progress
- Share/provide organizational tools, templates

ccess Factors of Implementation[3]

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˝ Project Team

- Project Manager - involved and committed to success
- Document specialist/Technical Writer role for coordinating documentation, revisions
- Active, skilled PPQA manager is a great benefit
    - ˝ Also can serve as the Measurement Analyst
- Useful plans are built by the key players; shelfware is built by the novice or new contractor
- Dont let one person wear too many hats
    - ˝ Resource the team properly
- New technology and complex systems are NOT necessary for success

˝ A Customer that supports the initiative is a plus

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ccess Factors of Implementation[4]

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˝ Recognize and Publicize Early Successes

- ± Project-level qSCAMPIs provided early successes due to conducting the appraisal using the ‰continuous representation+ of the model

  - ˝ Scope of appraisal looked at all 7 ML2 PAs, then 11 ML3 PAs

  - ˝ If all the PAs were satisfied, then the project achieved ML2 and/or ML3 through equivalent staging

  - ˝ Or, Projects received Capability Level 2/3 for various PAs satisfied (e.g., CM, SAM, REQM, PP, PMC, TS, PI, DAR)

- Led to BIG success! - SSC-C became the first SPAWAR Systems Center to achieve CMMI® Maturity Level 2 (April 2005)

- Continued similar approach to Maturity Level 3

  - ˝ 1st Successful ML3 Program . July 2006

  - ˝ 4 more projects achieved ML3 in late 2006

- Command CMMI® Maturity Level 3 . April, 2007

  - ˝ 1st SPAWAR Systems Center to achieve ML3

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Appraisal Planning/Execution

Measuring Progress

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- ˝ 7 SEI staff members were involved in the SSC-C Class "A" SCAMPIs

- ˝ Required early planning to get each SEI staff member's commitment to appraisal dates

- ˝ Built detailed schedule for ML2 and ML3 project and organizational-level appraisals

- ˝ Obtained commitment from project team members concerning availability on appraisal dates

- ˝ Reserved conference and meeting rooms well in advance

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˝ **Pre-Readiness Reviews (PRRs) helped to ensure projects were ready and the Formal RR would lead to 90%-100% coverage**

- Used Appraisal tool to conduct PRRs
  - ˝ Provided <u>early</u> and easy access to the direct and indirect evidence for each process area's specific and generic practices
  - ˝ Provided means for communicating appraisal team comments
    - Used convention to denote status of each practice
      (e.g., PRR-SG: Direct OE satisfies practice OR
      PRR-SG: Direct and indirect OE is too old)
  - ˝ Provided early feedback to the projects
  - ˝ Provided easy upload of new artifacts supplied by projects

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˝ Formal RRs conducted on-site with Appraisal Team Members (ATMs)

. SEI Lead Appraiser and ATMs worked as a team

. Used Appraisal tool to conduct RR

˝ Provided easy access to the direct and indirect evidence for each process area's specific and generic practices

˝ Provided means for communicating appraisal team comments

. Used convention to denote status of each practice

(e.g. RR-CS: Direct OE indicates performance of practice OR RR-CS: Direct and indirect OE is too old)

˝ Provided good feedback to the projects on items still missing

˝ Provided easy upload of new artifacts supplied by projects

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˝ SCAMPI[SM] Class A appraisals conducted on-site

- Involved mostly the %Interview+process since RR ensured direct and indirect coverage was evident

- Used Appraisal tool to conduct SCAMPI[SM]

  - ˝ Affirmation section of tool allowed for easy update following each interview

  - ˝ Tool allowed primary team member to select practice compliance and secondary member to concur (or not)

  - ˝ Authorized lead appraiser (team lead) then verified each practice within the process area

  - ˝ Built-in color coding provided easy visibility to %weaknesses+

  - ˝ Facilitated voting process at Goal level and Process Area

- Each project-level ML3 SCAMPI[SM] conducted in 5 days and Command-level ML3 SCAMPI[SM] conducted in 10 days

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Lessons Learned

Implementation

Appraisals

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essons Learned - Implementation

- ˝ **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

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Lessons Learned – Appraisals[1]

″ **Provide CMMI® mentoring and coaching for projects selected for an appraisal**

″ **Build detailed schedules for appraisals early in planning phase to use as a roadmap**

″ **Plan early in order to obtain project team member and appraisal team member commitment to appraisal dates**

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˝ **Invest in an Appraisal Tool to facilitate easy collection and evaluation of appraisal data**

˝ **Perform a Pre-Readiness Review to ensure minimal coverage gaps are identified at the formal Readiness Review**

˝ **Conduct individual project appraisals to ensure successful organizational appraisals**

˝ **Document Lessons Learned from conducting appraisals to improve the appraisal process**

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What has success meant?

˝ Business Results

- SCN: %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 ±wrapperq 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 successõ +

˝ Others Asking for Help

- PMS 408 . CREW program
- SESG / NAVAIR / NAVSEA
- Marine Corp . Quantico
- Air Armament Center, Eglin AFB

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Beyond Maturity Level 3

Plan of Action for ML4/5

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˝ No more "Ratings for Life"

. Ratings are now valid for only 3 years (April 2007- April 2010)

. SSC-C will lose its CMMI® ML3 rating on 27 April 2010 if another Command-level SCAMPI^{SM} Class A+appraisal is not successfully completed before then

   ˝ Sustain the current Command-sponsored projects (representative sample)

   ˝ Self-Assessments/Appraisals . mentoring and coaching of more projects

˝ Plan for and Implement

. CMMI® V1.2 (CMMI®. DEV) New Model

. Maturity Levels 4/5

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- **Take a fresh look at the entire measurement program with an eye towards managing the projects using quantitative data**

- **Collect and evaluate project historical data for measuring cost, schedule, and quality**

- **Establish a process for maintaining the appropriate data to begin managing quantitatively**

  - Select at least one "main contributor" sub process per project lifecycle phase, at least one project management sub process and at least one support sub process

- **Statistically manage the data**

  - Using statistical methods (e.g., Statistical Process Control charts, histograms, trend charts, etc.)

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˝ **Demonstrate stable historical data for measuring cost, schedule, and quality**

- Stable data will help you answer questions like:
  - ˝ Can you predict where your next data point will fall?
  - ˝ Do you know what your baseline is for cost/schedule performance?
  - ˝ Is your product quality what you expect it to be?
  - ˝ Are you finding %enough+defects before the customer gets the product?
- As a guideline, strive for at least 4 consecutive data points within your established control limits

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Plan of Action for ML4/5[3]

˝ **Formalize performance baselines for the project and provide baseline data to organization**

˝ **Re-establish quantitative objectives (for example):**

. Reduce cost variance to +/- 5%

. Reduce schedule variance to +/- 10%

. Reduce delivered defects by +/- 10%

. Improve major saves found in peer reviews by 20%

˝ **Use baselines and variance to predict future performance**

˝ *Keep up the ML2 and ML3 process performance!*

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˝ May – Dec 2007

- Developed Process Improvement Plan for ML4/5
- Developed Detailed Schedule for ML4/5
- Developed QPM Plan Template
- Held various ML4 Meetings with projects
- Held SCAMPI[SM] for one project using CMMI® v1.2
  - ˝ September: Project achieved ML3
- Increase usage of tools across departments/projects
- Add additional plans to ePlan Builder as needed
- Continue internal CMMI® Level 3 mini assessments

Begin Maturity Level 4/5 implementation

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˝ May – Dec 2007 con't

. Enhance/Expand OMR

˝ More Quality Data from Peer Reviews, Testing Phase and Defects from Production

˝ More Statistical Process Control (SPC) Charts

. Command and Department Project Reviews process

˝ Look at quality of plans and implementation of best practices

˝ Reviews of project status by management driven by project metrics

˝ More Peer Reviews to measure %saves+

. Better tailoring guidance for smaller projects

Begin Maturity Level 4/5 implementation

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˝ 2008

- Conduct ML3 SCAMPI^{SM} Class ‰A+appraisals for new projects
- Conduct ML4/5 SCAMPI^{SM} Class ‰A+appraisal for one program

˝ 2009

- Conduct ML3 SCAMPI^{SM} Class ‰A+appraisals on other Command projects
- Conduct ML4/5 SCAMPI^{SM} Class ‰A+appraisals on other Command projects

˝ 2010

- Conduct SSC-C Command-level ML4 SCAMPI^{SM} Class ‰A+ appraisal in April 2010

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˝ Decided on Approach . Use CMMI® for Process Improvement and Measuring Progress

˝ Using extensive research, determined the ±Critical Success Factorsqfor Implementing CMMI®

˝ Built Plan of Action/Detailed Schedule for Appraisals

˝ Provided Training . Systems Engineering, Processes, & CMMI®

˝ Advertised Early Successes

˝ Implemented Plan Successfully for Phase 1 . CMMI® Maturity Level 2 and Phase 2 . CMMI® Maturity Level 3

. On schedule, on budget

˝ Laying groundwork for higher maturity

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Any Questions?

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