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Capability Maturity Model Integration (CMMI®) Tailoring for an IT/MS Services Environment

Approach and Lessons Learned by BAE Systems Information Technology (BAE-IT)

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Executive Summary

- BAE-IT is a provider of Information Technology/Mission Support (IT/MS) Services
- CMMI® provides a narrow, undefined view of IT/MS Services as a product
- BAE-IT cleared new ground by developing and implementing a methodology to interpret CMMI for IT/MS Services
- Presentation will share approach, critical success factors and lessons learned

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Briefing Roadmap

- Overview of BAE-IT Operational Environment and Challenges
- Comparison to Alternative Models
- BAE-IT's Methodology for tailoring CMMI® for IT/MS Services through defining:
  - Process Improvement (PI) Participants
  - Process Architecture
  - Transitioning Activities
  - Tailoring Guidelines
  - Tools and Measurements
  - Success Factors/Lessons Learned

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Operational Environment – BAE-IT

- BAE-IT's primary "product" is IT/MS Services (Information Technology (IT) and Mission Support (MS) Services)
- Specific BAE-IT IT/MS Services include:

Operations and Services (O/S)

- Service Support
- Delivery of an Information Technology infrastructure
- Systems Engineering

Operations and Maintenance (O/M)

- Application/Software "Maintenance"
- Support of deployed products

Software Engineering & Development (SWD)

- Rapid Response Development
- Independent verification, validation & automated testing
- "Full-scope" SW Development

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Comparison to Other Models

- CMMI® Selected as best fit for the blended BAE-IT activities (IT/MS Services)
- International Organization for Standardization (ISO) 9000 series focuses primarily on quality management
- Information Technology Infrastructure Library (ITIL) focuses on IT service management
- Within BAE-IT, CMMI® was implemented in such a way as to ensure it can accommodate ISO and ITIL requirements

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Model Challenges

- Services not commonly viewed as a “product”
- Examples and suggested artifacts geared to Software/Systems Engineering
- Minimal documentation of “value-added” processes that pertain to multiple business types

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Operational Challenges – BAE-IT

- Nature of BAE-IT business and customer requirements dictate limited exposure and transfer of project artifacts

- BAE-IT is a customer-facing organization fostering projects with disparate, mature and ingrained legacy processes and procedures and a foundation in Integrated Project Teaming

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BAE-IT Approach to CMMI®

- Overall approach is similar to any organization implementing process improvement
- Significant tailoring occurs during implementation

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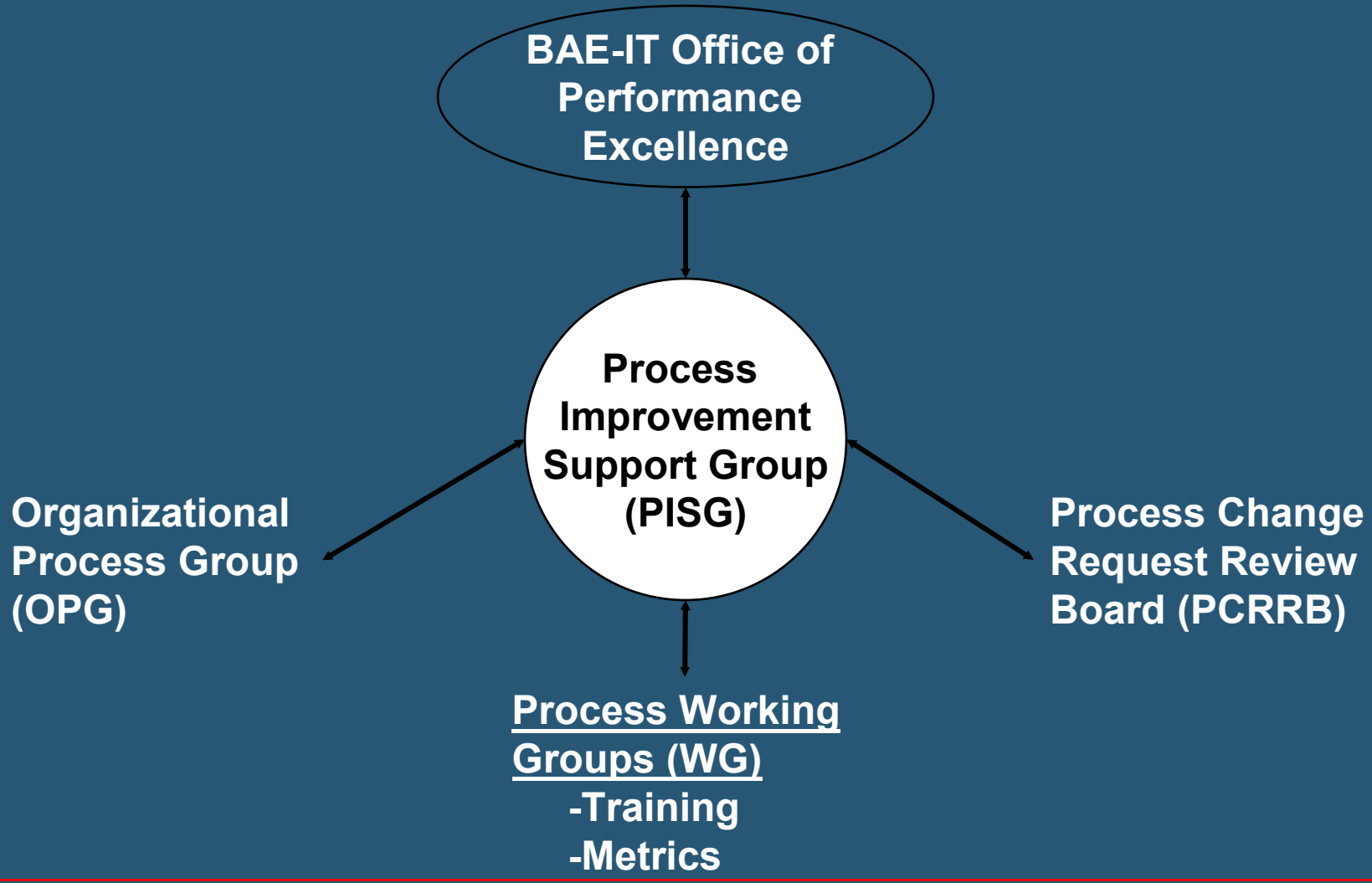
Process Improvement Participants



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Process Architecture – What is it?

- Similar to any other system architecture
  - Consists of core and sub components
  - Defines interaction between components
  - Hierarchy of processes
- Foundation for process improvement
- Provides guidance and structure to organizational entities
- Must cover all organizational business types and be flexible enough to incorporate future business
- Streamlines redundant legacy processes

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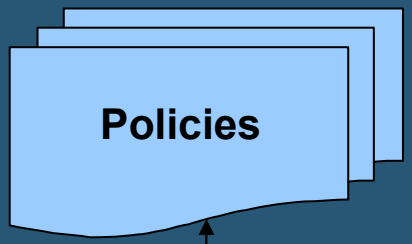
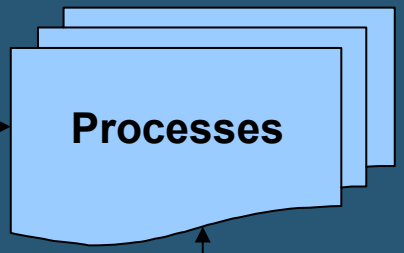
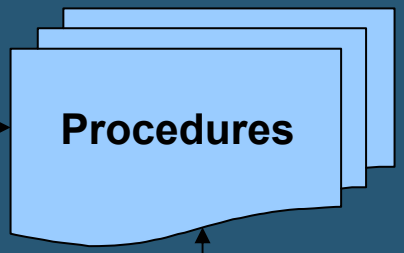
BAE-IT's Process Hierarchy



Each **policy** is mapped to a **CMMI process area**



Each **process** is mapped to CMMI **specific/generic practices** and an organizational **policy**



Each **procedure** is mapped to one or more **processes** and a **process flow diagram**

Each **process aid** is mapped to one or more **procedures**

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Process Mapping Matrix

Policy	Process Input	Process Number	Process	CMMI Requirement	Process Output
Policy name mapped to the process	*Inputs are outputs identified in another process*	*Unique process naming convention with the following equivalencies: PCS- Process VER- Verification 002- Verification Process number 2 vvv- process version*	*Process Name*	*CMMI specific practices that map to a specific process are identified. A single requirement can be mapped to more than one process.*	*Outputs are inputs identified in another process*
Verification	**PCS-VER-001** **SP1.1** Verification work product list Verification methods Verification environment **SP1.2** Verifications procedures **SP1.3** Verification criteria	**PCS-VER-002-vvv**	Perform Peer Reviews	**SG2- Perform Peer Reviews** **SP2.1** Prepare for peer reviews **SP2.2** Conduct peer reviews **SP2.3** Analyze peer reviews	**SP2.1** Peer review schedule; Peer review checklist; Work product entry and exit criteria; Peer review criteria **SP2.2** Peer review results; Peer review data **SP2.3** Peer review action items

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Steps for Transitioning

- Select Pilot Project/Process Improvement (PI) Personnel
- CMMI® Training
- Tailoring
- Project Level Implementation
- Tools and Metrics
- Internal Evaluations (Internal Readiness Review)
- External Evaluations (Class C and B assessments and SCAMPI^{SM} Class A Appraisal)

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Pilot Project/PI Personnel Selection

- Pilot Project Selection
  - Selected to ensure full representation of BAE-IT business activities and adequate lifecycle coverage
  - Project activities well suited for process improvement
  - Organizational PI activities organized as a “project”
- Process Improvement Personnel Selection
  - Selected for knowledge of project types and process improvement activities
  - Incorporated project points of contact and process improvement support group (PISG) “project liaisons”

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Training

Two type of training established:

- Awareness
  - Tailored to address specific levels of PI staff
  - Set expectations for participation
  - Communicated strategy to entire organization

- Role Based
  - Common set of organizational roles established to cover all project types
  - Process and Domain training developed
    - Process – BAE-IT specific processes
    - Domain – Subject Matter training
  - Required training dictated by role

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Tailoring

- Tailoring Guidelines established specifically for IT/MS Service project types
- Process level questionnaire, designed for IT/MS, used to assist in process selection
- Fostered collaborative development of project tailoring plans

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Process Tailoring Interview Questions

CMMI Sub practice Examples	O/S Project (Tier 1 Help Desk Support) Questions	O/S Project Answers
Identify work products for verification (SP1.1-1)	What types of services do you provide that need to be analyzed against a set of established requirements?	Requirements include customer Service Level Agreements which are aligned with the Help Desk Institute Industry Standard for Operations. The following operations are provided: -Tier 1 Help Desk Support which includes: 1. Verify that calls are answered and closed within required threshold and to customer satisfaction 2. Verify that tickets have been properly routed
Identify verification environment requirements (SP1.2-2)	What are the logistics necessary to prepare for verification of a service product?	On a daily basis, Tier 1 project manager performs random ticket analysis –based on ticket classifications. The manager uses Excel metric spreadsheet (with macros), Help Desk Query Spreadsheet, procedures database, SRS ticket audit trail report, and resolution follow-up worksheet

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Tailoring Plans

- Tailoring occurs at process and procedure levels
- Tailoring Plans developed for each project type – include:
  - Mandatory processes
  - Process waivers
  - Tailored processes / procedures
  - Lifecycle Models (LCM) – waivers and tailoring
- Tailoring Plans reviewed at organizational level but owned and updated at project level

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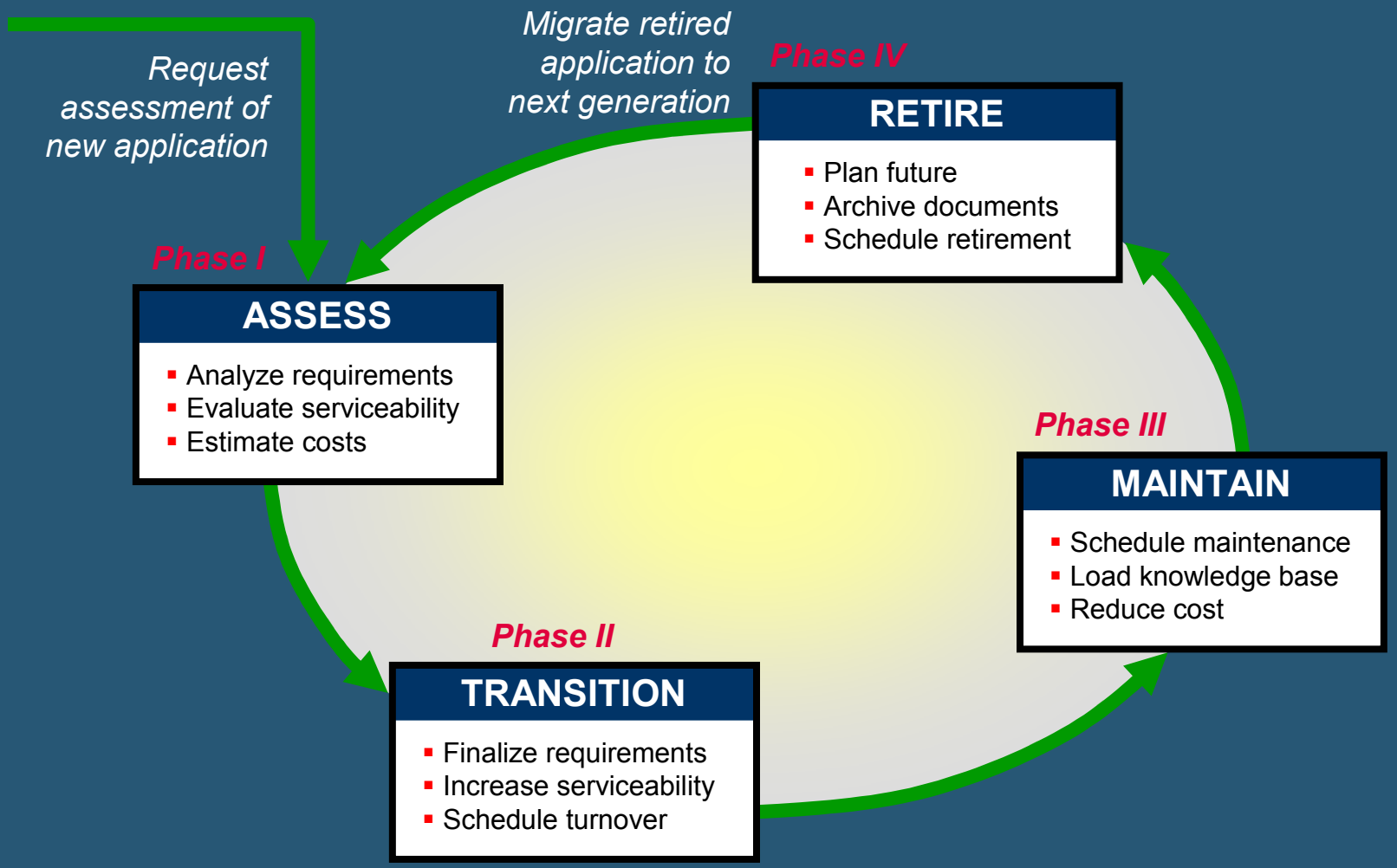
Sample O/M Lifecycle Model



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Project Level Implementation

- Staff, both at organizational and project level, trained for two-way communication
- Process Selection as a collaborative tailoring activity
- Large-scale procedure tailoring for IT/MS services. Process areas receiving the most tailoring included:
  - VER, REQM, PPQA, CM, PP, and PMC

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Process Selection Sample

Verification (VER)	
SG 1 Prepare for Verification **SP 1.1-1** Select Work Products for Verification **SP 1.2-2** Establish the Verification Environment **SP 1.3-3** Establish Verification Procedures and Criteria SG 2 Perform Peer Reviews **SP 2.1-1** Prepare for Peer Reviews **SP 2.2-1** Conduct Peer Reviews **SP 2.3-2** Analyze Peer Review Data SG 3 Verify Selected Work Products **SP 3.1-1** Perform Verification **SP 3.2-2** Analyze Verification Results and Identify Corrective Action	In an IT services environment, the most common work product is the service itself which does not naturally lend itself to verification. However, verification, the act of testing the product against specification, is necessary in an IT managed support model. **O/M**: For verification in the O/M environment on requirement of transition into the program was the provision, by the functional staff, of a testing environment. In many support programs problem resolution is typically provided in the production environment. The BAE-IT O/M model requires that a test environment be established so that verification can be performed. Additionally, any change in the support item, whether it be code or structure, must go through the verification process – to include a peer review using specially modified peer review forms. **O/S:** Daily reviews of a random selection of tickets for ticket routing and proper ticket closure techniques serve as the basis for verification in the O/S environment.

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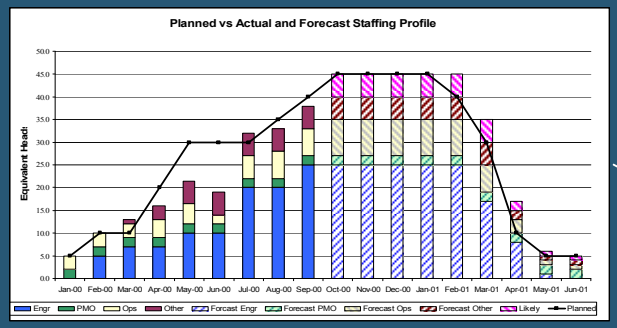
Process Area/Activity Based Tools

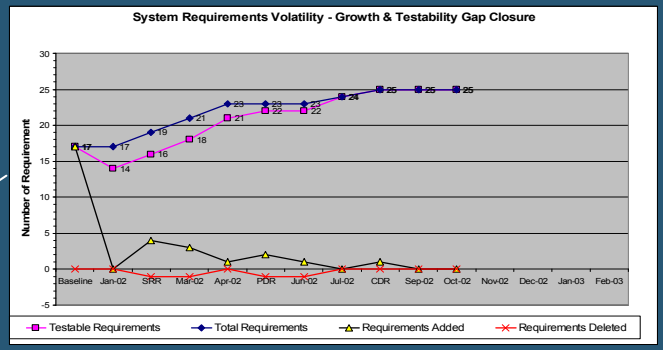
- Risk Register – standardized, automated risk tool for risk identification, quantification, mitigation and tracking
- Training Database – consolidated repository to track training
- Automated Configuration Management (CM) – Configuration Management controlled through automated tools

Process Area/Activity Based Tools

- Measurement Template/Repository – linked, dynamic workbook for tabular and graphical measurement representation

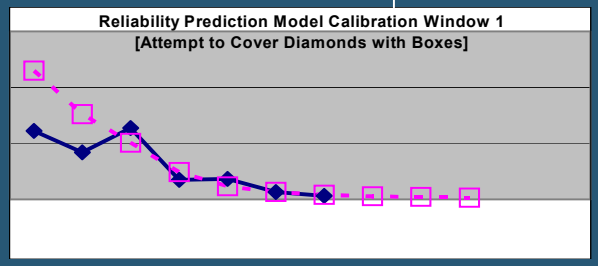


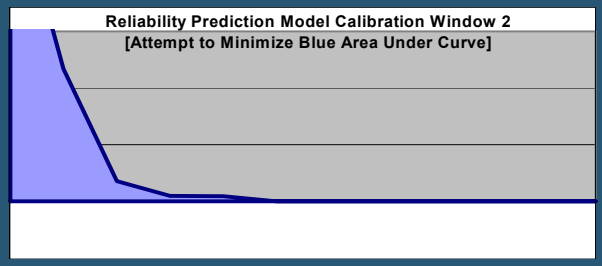
Measurement Repository



Reliability Prediction Model Parameters	
Weekly Reliability Threshold	0.0500
Calculated Lambda - Method 1	0.4635
Calculated Lambda - Method 2	0.9269
Calculated Lambda - Method 3	0.6879
Calibration Lambda	2.0000
Calibration Theta	0.0075

Sum of Squared Differences	0.4322





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Process Improvement Tools

- Tailoring Plan Template – template for development and implementation of project specific process selection tailoring

- Process Asset Templates – templates for each level of process architecture documentation

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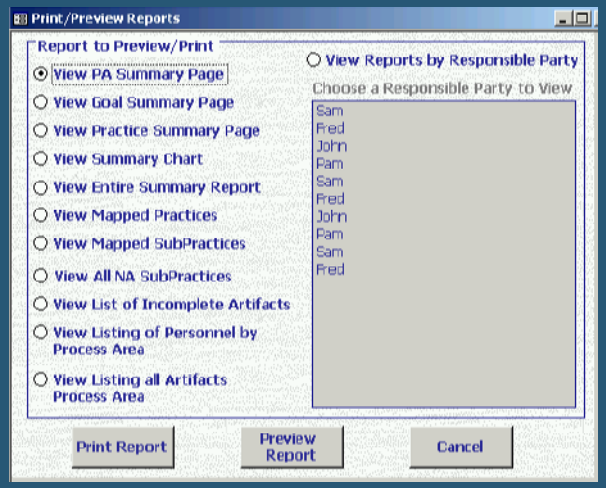
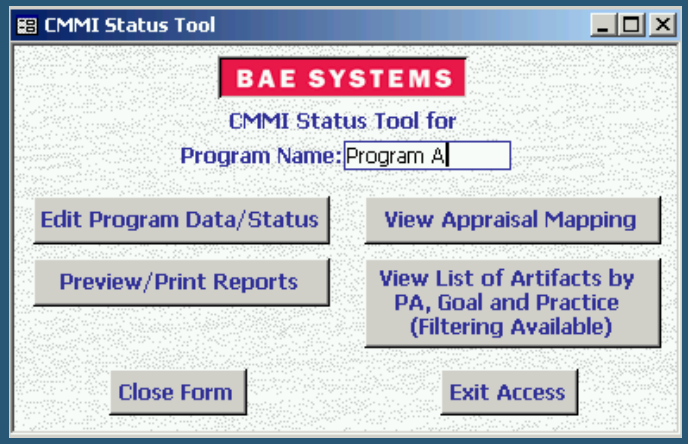
Process Improvement Tools

- CMMI® Status Database – developed by Mandy Parmer and recognized as a best practice by assessment team.
- Database is used to:
  - Map process assets against the model
  - Provide status reports to organization
  - Serve as Process Implementation Indicator Database (PIID) for assessment team





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Process Improvement Metrics

- Process Improvement Support Group (PISG) treated as a project and reported a series of measures
  - Schedule – Performance against scheduled activities
  - Status – Milestone tracking
  - Cost – Budget tracking
  - Risk – “Risk Register” reporting monthly
  - Quality – Process and Product Quality Assurance (PPQA) and Process Change Request (PCR) tracking

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Internal/External Evaluations

- Internal Readiness Review (IRR)
  - Artifact Review and Mock Interviews
  - Progress reviewed against CMMI Status Database
  - Gauge readiness for external appraisals
  - All findings documented and tracked in Process Action Plan
- Class C and B assessments and SCAMPI^{SM} Class A Appraisal

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Critical Success Factors

- Participation by cross-representation of project types
- Consultant and lead appraiser support/guidance
- Development of IT/MS Service specific tailoring questionnaire to support process development
- Ongoing communication with lead appraiser to provide details on tailoring
- Conduct Internal Readiness Reviews (IRRs)
- Tie corporate goals to success
- Use of CMMI Status Database and Automated CM

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Lessons Learned

- Perform Formal Gap Analysis
- Develop Process Architecture early
- Risk Analysis of implementing Tailoring Guidelines
- Dedicated, funded personnel for documentation
- Outsource role based domain training
- Use of ETVX to write procedures
- Implement Project Level Configuration Control Board (CCB)
- Use ITIL framework to support Operations and Services (O/S) Lifecycle Model (LCM)

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Conclusions and Next Steps

- BAE-IT forged new ground in the tailoring of CMMI for use in an IT/MS Services environment
- BAE-IT is participating in the SEI Steering Committee working towards the inclusion of Services into the CMMI® framework
- BAE-IT is continuing its process improvement activities including goals to:
  - Reach Level 4
  - Include additional projects
  - Incorporate ITIL methodologies as part of the process improvement initiative

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Presenters

- Stacy Savage – Managed the organization process improvement activities during BAE-IT's successful transition to CMMI® Level 3

- Mandy Parmer – Managed the project level pursuit of CMMI Level 2 and participated as project level lead for BAE-IT's transition to CMMI® Level 3

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Back Up Slides

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History - CMMI®

- Public Release Start Ver 0.2 in Aug 1999
- CMMI® Ver 1.1 released in 2001 to combine a series of overlapping CMMs
- CMMI® focus remains Software/Systems engineering
- Current version of model provides little guidance or suggested work products for IT Services
- SEI currently looking to expand model disciplines to cover IT services

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Acronyms

BAE-IT	BAE Systems Information Technology
CCB	Configuration Control Board
CM	Configuration Management
CMMI ®	Capability Maturity Model Integration
ETVX	Entry Test Verification and eXit
IRR	Internal Readiness Review
IS/MS	Information Technology/Mission Support
ISO	International Organization for Standardization
ITIL	Information Technology Infrastructure Library

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Acronyms (Cont'd)

LCM	Lifecycle Model
MA	Measurement and Analysis
O/M	Operations and Maintenance
O/S	Operations and Services
PCR	Process Change Request
PCRRB	Process Change Request Review Board
PI	Process Improvement
PIID	Process Implementation Indicator Database
PISG	Process Improvement Support Group

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Acronyms (Cont'd)

PMC	Project Monitoring and Control
PP	Project Planning
PPQA	Process and Product Quality Assurance
REQM	Requirements Management
SCAMPI[SM]	Standard CMMI® Appraisal Method for Process Improvement
SWD	Software Engineering and Development
VER	Verification
WG	Working Group