Automated Monitoring of Process Compliance

Gary Natwick
Harris Corporation
Government Communications Systems Division

- $1.5B in Sales
- > 6,500 Employees
- ISO 9001:2000
- SEI CMM Level 4

DoD Programs

Civil Programs

National Programs

Strategic Management and Business Development

Homeland Security Programs

Harris Technical Services Corporation

Harris Communications

ISO 9001:2000

SEI CMM Level 4

$1.5B in Sales

> 6,500 Employees

ISO 9001:2000

SEI CMM Level 4

Automated Monitoring of Process Compliance
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Integrated Compliance Approach
### CMMI®-SE/SW Staged Representation

<table>
<thead>
<tr>
<th>Maturity Level</th>
<th>Focus</th>
<th>Process Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Optimizing</td>
<td><strong>Continuous Process Improvement</strong></td>
<td>Organizational Innovation and Deployment, Causal Analysis and Resolution</td>
</tr>
<tr>
<td>4 Quantitatively Managed</td>
<td><strong>Quantitative Management</strong></td>
<td>Organizational Process Performance, Quantitative Project Management</td>
</tr>
<tr>
<td>2 Managed</td>
<td><strong>Basic Project Management</strong></td>
<td>Requirements Management, Project Planning, Project Monitoring and Control, Supplier Agreement Management, Measurement and Analysis, Process and Product Quality Assurance, Configuration Management</td>
</tr>
<tr>
<td>1 Initial</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CMMI® Process Area Categories

- **Project Management**
  - Project Planning
  - Project Monitoring and Control
  - Supplier Agreement Management
  - Integrated Project Management
  - Risk Management
  - Quantitative Project Management

- **Engineering**
  - Requirements Management
  - Requirements Development
  - Technical Solution
  - Product Integration
  - Verification
  - Validation

- **Support**
  - Configuration Management
  - Process and Product Quality Assurance
  - Measurement and Analysis
  - Decision Analysis and Resolution
  - Causal Analysis and Resolution

- **Process Management**
  - Organizational Process Focus
  - Organizational Process Definition
  - Organizational Training
  - Organizational Process Performance
  - Organizational Innovation and Deployment

- **Maturity Levels**
  - Maturity Level 2
  - Maturity Level 3
  - Maturity Level 4
  - Maturity Level 5
Integrated Process Manual

IPM

Program Management Processes
- Program Planning
- Estimation
- Program Monitoring and Control
- Supplier Acquisition & Management
- Change Management

Program Life-Cycle Processes
- Proposal Development
- Requirements Analysis
- System Architecting/Design
- Design
- Code and Unit Test
- Fabrication and Assembly
- Product Integration
- Verification
- Validation
- Production
- Field Support

Program Support Processes
- Requirements Management
- Risk Management
- Configuration and Data Management
- Program Metrics
- Decision Analysis and Resolution
- Peer Review
- Design Review
- Quality Assurance
- Integrated Logistics Support

Organizational Processes
- Process Improvement
- Training
- Division Metrics
### Integrated Process Format

<table>
<thead>
<tr>
<th><strong>Overview</strong></th>
<th>A brief description of the process intent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entry Criteria</strong></td>
<td>State, Prerequisites, Criteria</td>
</tr>
<tr>
<td><strong>Exit Criteria</strong></td>
<td>State, Criteria</td>
</tr>
<tr>
<td><strong>Inputs</strong></td>
<td>Needed work products, resources</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td>Resulting work products</td>
</tr>
<tr>
<td><strong>Required Activities</strong></td>
<td>Mandatory tasks to implement the process</td>
</tr>
<tr>
<td><strong>Measures</strong></td>
<td>Process performance against plans</td>
</tr>
<tr>
<td><strong>Organizational Improvement Information</strong></td>
<td>Metrics, reusable work products</td>
</tr>
<tr>
<td><strong>Verification</strong></td>
<td>Process compliance oversight</td>
</tr>
<tr>
<td><strong>Tailoring</strong></td>
<td>Approved tailoring, process specific</td>
</tr>
<tr>
<td><strong>Implementation Guidance</strong></td>
<td>Common implementation descriptions</td>
</tr>
<tr>
<td><strong>Supporting Documentation and Assets</strong></td>
<td>Applicable organizational references</td>
</tr>
</tbody>
</table>
Process Compliance Evidence

- **Direct Artifacts**
  - Tangible outputs resulting directly from implementation of a practice
    - e.g., plans, documents, products
  - Required for:
    - every applicable IPM practice
    - every applicable program

- **Indirect Artifacts**
  - Artifacts that are a side-effect or indicative of performing a practice
    - e.g., meeting minutes, reviews, logs, reports, metrics
  - Optional for IPM compliance (expected, but not required).
  - In formal CMMI® appraisals (e.g., SCAMPISM), these are required to corroborate direct artifacts.

- **Affirmations**
  - Oral or written statements confirming or supporting implementation of the practice
    - e.g., interviews, questionnaires
Process Compliance

Integrated Process Manual

Tailoring

1. Program Plans
2. Program process baseline
3. Program execution
4. Compliance evidence
5. QA verification
6. Non-compliance mitigation
PCM Integrates IPM & CMMI

CMMI

- CMMI Process Areas
- CMMI Specific/Generic Practices
- CMMI Typical Work Products

SCAMPI

- SCAMPI Artifacts (Direct/Indirect)

IPM

- IPM Processes
- IPM Process Statements
- IPM Expected Artifacts (Direct/Indirect)

Process Compliance Monitor (PCM)

- Functional command media
- GCSD best practices

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PCM Functionality

**Process Compliance Monitor**

**System Management**
- Manage IPM content, traceability, versions (Process, section, statement, artifact, lifecycles, media x-ref)
- Manage CMMI content, traceability, versions (PA, Goal, Practice)
- Manage appraisal types, versions (QA Audits, SCAMPI*)
- Manage web page access
- Manage user roles
- Create/delete projects
- Monitor tool usage and performance

**Project Management**
- Open/close project
- Manage user access
- Create/tailor project process baseline
- Add/modify evidence and location for process compliance
- Monitor project process compliance (IPM, CMMI*)

**Appraisal Management**
- Manage appraisal access (leaders, members)
- Create/close appraisals
- Score process compliance

**Organizational Oversight**
- Approve/reject project process baseline
- Monitor project process compliance (IPM, CMMI)
- Monitor organizational process compliance (IPM, CMMI)
**PCM Project Workflow**

**Project request to DPG**

- **Create Project**
- **Close/Open Project**
- **Add/Modify Project Users**

**Process Baseline**

- **Create New Process Baseline**
- **Tailor New Process Baseline**
- **Submit New Process Baseline**
- **Approve/Reject New Process Baseline**

**Startup & Planning**

**Execution**

- **Process Evidence**
  - **Add/Modify Process Evidence**

- **Process Appraisal**
  - **Create Process Appraisal**
  - **Release New Process Baseline**
  - **Score Process Appraisal**
  - **Close Process Appraisal**

- **Process Monitoring**
  - **Monitor Process Compliance**
## PCM Roles

<table>
<thead>
<tr>
<th>Users</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Administrator</td>
<td>Administer all functionality of tool, access to all features of the system, create new projects, monitor tool usage/performance</td>
</tr>
<tr>
<td>General User</td>
<td>Read-only access to example projects</td>
</tr>
<tr>
<td>Project Administrator</td>
<td>Project-specific: close/open project, add/modify users, create/tailor/submit new process baseline, add/modify evidence, monitor process compliance</td>
</tr>
<tr>
<td>Project Member</td>
<td>Project-specific: tailor new process baseline, add/modify evidence, view appraisal scores, monitor process compliance</td>
</tr>
<tr>
<td>Division Approver</td>
<td>Project-specific: approve/reject new process baseline</td>
</tr>
<tr>
<td>Appraisal Administrator</td>
<td>Add/remove appraisal leaders, release process baseline, create/close appraisal, add/remove appraisal member, monitor process compliance</td>
</tr>
<tr>
<td>Appraisal Leader</td>
<td>Release new process baseline, create/close appraisal, add/remove appraisal member, score appraisal, add/modify evidence, monitor process compliance</td>
</tr>
<tr>
<td>Appraisal Member</td>
<td>Score appraisal, add/modify evidence, monitor process compliance</td>
</tr>
<tr>
<td>Global Reader</td>
<td>Monitor all projects &amp; organization process compliance</td>
</tr>
</tbody>
</table>
**Project Administration**

- **Roles:**
  - System Administrator: add/remove projects, project administrators, division approvers, appraisal administrators
  - Project Administrator: add/remove project administrators, project members
Project Administration

Project Information

- Edit Project Information
- Show Modification Details

Project Access

- Edit Project Access

Edit project information; close/open project

Edit project user access
• **Roles:**
  – Project Administrator: create/tailor/submit new process baseline
  – Project Member: tailor new process baseline
  – Division Approver: approve/reject new process baseline
  – Appraisal Administrator: view new process baseline
  – Appraisal Leader: view new process baseline
  – Appraisal Member: view new process baseline
  – Global Reader: view new process baseline

• **New Baseline**

• **Filters** – process, phase, artifact, tailored statements
Recording Tailored Processes

- IPM tailoring is documented in the PCM tool during initial program planning
  - Specify the planned compliance and implementation of each IPM statement and expected artifacts (optionally)
  - Tailoring codes:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Accept IPM statement as written (no changes)</td>
</tr>
<tr>
<td>T</td>
<td>Tailored; description of tailoring must be specified (e.g., modifications meeting intent of IPM statement)</td>
</tr>
<tr>
<td>D</td>
<td>Deviation; program alternative to IPM statement(s), or not implemented</td>
</tr>
<tr>
<td>N</td>
<td>Not applicable; specify rationale</td>
</tr>
</tbody>
</table>

- The documented tailoring is called the program’s “defined process”, establishing the approved baseline against which process compliance audits are performed
Tailoring IPM Processes – 1

To tailor CDR, expand IPM statement and “Edit”

Tailoring Code (TC)
- Accept (default)
- Tailor (modified; no waiver)
- Deviation (waiver)
- Not applicable (outside scope)
Tailoring Code (TC)

- **Accept** (default)
- **Tailor** (modified; no waiver)
- **Deviation** (waiver)
- **Not applicable** (outside scope)

**IPM Tailoring**
- Enter statement of IPM tailoring, rationale, and approach to be followed
- Reference the waiver (H-2634), if outside IPM tailoring guidelines

**Artifact Tailoring** (Optional)
- Identify artifacts that will be used to demonstrate compliance with program processes (tailored or not)
PCM Filters – Baselines & Tailoring

Constrain or expand IPM content for context of tailoring

Tailored statements only

Limit display to those IPM statements fully completed prior to program transition (i.e., no evidence needed; consensus scoring)

Changes to the process baseline (deltas)

Limit PCM displays to selected IPM processes

Filter IPM statements by an artifact expected as evidence (e.g., WBS, PWA, ECMD)

Project Process Baseline

Used for tailoring the Process Section Statements and Expected Artifacts for a project.

This is the initial approved baseline and it may not be tailored.

Process: [All]
Phase: [All]
Artifact Keyword:

- Include Information-only Statements
- Display Only Statements That Have Been Tailored
- Display Only Statements Implemented Prior to IPM
- Display Only Statements That Have Changed From Prior Baseline
- Display Differences Between the Current Baseline and Prior Baseline

Apply Filters
Process Evidence

- **Stakeholders:**
  - Project Administrator – add/modify process evidence
  - Project Member – add/modify process evidence
  - Appraisal Administrator – view process evidence
  - Appraisal Leader – add/modify process evidence
  - Appraisal Member – add/modify process evidence
  - Global Reader – view process evidence

- **Current baseline**

- **Add/modify evidence and locations**

- **Filters** – process, phase, artifact, appraisal
Project Artifact Requirements

- The PCM identifies expected artifacts produced or available as a result of following IPM practices
  - Many expected artifacts are explicit in the IPM process statement (e.g., documentation, forms); IPM tailoring or waivers needed to deviate
  - Other artifacts are derived from division best practices or common usage
  - Project alternatives are acceptable, as long as IPM intent is satisfied
  - Tailored artifacts can optionally be identified during program planning
- QA judges compliance with the approved project process baseline by inspecting the identified artifacts
  - Artifact exists and has appropriate content (e.g., required by IPM, compliant with templates or checklists)
  - Coverage of associated program process statement
- Compliance is scored at the process statement level
  - Individual artifacts are not scored
Entering Project Artifacts

Select “Add” to specify artifacts for a program process statement.
PCM Filters – Evidence

Filter by IPM processes applicable to current life cycle phase

Filter by expected or actual artifacts for copy/paste across applicable IPM processes (e.g., WBS, PWA, BOE, H-2517)

Constrain or expand IPM content for context of process/evidence entry

Process: [All]
Phase: [All]
Artifact Keyword: 
Artifact Location: 
Display Information Statements
Display Only Statements Needing Project Artifacts
Display All Statements
Display Only Not Yet Statements
Display Only Not Scored Statements
Display Only Fully Implemented Statements
Display Only Largely Implemented Statements
Display Only Partially Implemented Statements
Display Only Not Implemented Statements

Apply Filters

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**Process Appraisal**

- **Stakeholders:**
  - Appraisal Administrator – add/remove appraisal leaders, release process baseline, create/close appraisal, add/remove appraisal member
  - Appraisal Leader – release new process baseline, create/close appraisal, score appraisal, add/remove appraisal member
  - Appraisal Member – score appraisal

- **Current baseline**
- When a new process baseline is released, then evidence and scores roll forward
- **Score process statements**
- **Filters** – process, phase, artifact, statements to be re-scored, scored statements
Appraising Processes

- Process compliance and process strengths/weaknesses are assessed in many ways:
  - IPM QA process audits
  - Development Cycle Readiness Reviews (phase transitions)
  - CMMI mini-assessments
  - Formal CMMI SCAMPI assessments
  - ISO 9001 audits
  - Independent program management audits
  - Risk assessments
  - Metrics

- Process appraisal results are used to characterize, measure, and improve process effectiveness and compliance with standards
  - Action plans to address appraisal findings
## Process Compliance Scores

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NY</td>
<td>Not Yet • To be appraised at a later date (i.e., the process has not yet been executed by the process and cannot be appraised)</td>
</tr>
<tr>
<td>NA</td>
<td>Not Applicable • Not applicable to the project (e.g., Code and Unit Test Process is not applicable to a production-type program)</td>
</tr>
<tr>
<td>NS</td>
<td>Not Scored • Pending an appraisal</td>
</tr>
<tr>
<td>FI</td>
<td>Fully Implemented • Direct artifacts are present and appropriate • No substantial weaknesses</td>
</tr>
<tr>
<td>LI</td>
<td>Largely Implemented • Direct artifacts are present and appropriate • One or more substantial weaknesses</td>
</tr>
<tr>
<td>PI</td>
<td>Partially Implemented • Direct artifact is absent or inadequate • Substantiated by indirect artifact/affirmation • One or more substantial weaknesses</td>
</tr>
<tr>
<td>NI</td>
<td>Not Implemented • Any situation not covered by the above</td>
</tr>
</tbody>
</table>
Score process statement; optionally, enter date valid thru and/or update artifact. A comment MUST BE entered if not FI
Compliance Scoring Rollup

Process-level Compliance Scores

Process statement compliance score assigned by QA

Description of non-compliance

Not all applicable team members have completed the training
PCM Filters – Appraisals

- Filter by IPM processes applicable to current life cycle phase
- Filter by expected or actual artifacts for copy/paste across applicable IPM processes (e.g., WBS, PWA, BOE, H-2517)
- Constrain or expand IPM content for context of process/evidence entry
- Review improvement progress over time
- Filter by statements needing evidence or pending appraisal
- Filter by appraisal scores to help establish improvement actions
Process Monitoring

- Stakeholders:
  - Project Administrator – monitor process compliance
  - Project Member – monitor process compliance
  - Appraisal Administrator – monitor process compliance
  - Appraisal Leader – monitor process compliance
  - Appraisal Member – monitor process compliance
  - Global Reader – monitor process compliance
- Current or historical baselines
- Scoring aggregation, bands, and counts
- Filters – process, phase, artifact, appraisal, scored statements
Program Process Compliance

A

• Represents overall process compliance score for program
• Based on lowest color score – harsh, but in keeping with CMMI® standards

B

• Depicts scoring distribution over all process items
• More insight on the overall project score (A)

C

• Depicts score for each process executed or being executed by this program
• 3 columns identify types of processes
• In PCM, point+click on underlined acronym drills down to scoring details for the process

Project Evidence
This page allows users to edit project evidence.

<table>
<thead>
<tr>
<th>Project Management</th>
<th>Life Cycle</th>
<th>Supporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHG</td>
<td>CUT</td>
<td>GBN</td>
</tr>
<tr>
<td>AQE</td>
<td>DSN</td>
<td>GAB</td>
</tr>
<tr>
<td>PME</td>
<td>FAB</td>
<td>QE</td>
</tr>
<tr>
<td>PP</td>
<td>FIELD</td>
<td>ILS</td>
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<tr>
<td>SAM</td>
<td>PI</td>
<td>PEER</td>
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<td>VAL</td>
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<td>SER</td>
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</tbody>
</table>
Lessons Learned

- Establish an implementation guide for how the CMMI® is implemented in organizational/project processes
  - Internal users (projects, managers, DPG/EPG)
  - External users (customers, appraisal teams)
- Trade-off how much projects must understand CMMI® details
  - Organization/project process knowledge vs. model knowledge
- Facilitate efficient on-line access and review
  - Process baseline tailoring
  - Evidence entry and appraisal
  - Compliance monitoring
- References to evidence must be very specific
  - Expected evidence
  - Project evidence and location (hyperlinked files/directories)
Contact Information

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• SEI-Authorized SCAMPISM Lead Appraiser
• SEI-Authorized SCAMPISM B&C Team Leader

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