Integrated Processes for CMMI® 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
Division Process Integration

• **Division Level Integration**
  – Processes where integration and collaboration are required across functional organizations
  – Minimum division requirements to ensure process integration (and CMMI compliance)

• **Mandatory Compliance**
  – All Qualifying Programs
  – All Functional Organizations Supporting Qualifying Programs
**Improvement Organization**

**Division Process Council**
- President, GCSD Staff
- Steering Committee for integrated, division-wide process improvement
- Representatives from each functional organization

**Division Process Group**
- Working Arm of the DPC
- Empowered representatives from each functional organization
- Owns and maintains (CCB) division-level process command media (Integrated Process Manual)
- Monitors and enforces process compliance

**Division Process Council**
- Program Mgmt Exec Council
- Eng Proc Council
- Bus Ops Council
- Sub contracts Council
- Contracts Council
- Material Mgmt Council
- Mfg/I&T Council
- BD Council
- Security Council
- Quality Council
- Human Resources
Integrated Compliance Approach

**Division**

- Command Media
  - IPM

**Programs**

- Compliance Evidence
- Program’s Compliance Metric

**Organizational Learning**

- Improve
- Reuse
- Submit

- Historical Data
- Best Practices
- Example Assets
- Improvement Requests

**Integrated Processes for CMMI® Compliance**

CMMI® Technology Conference & User Group 2004
<table>
<thead>
<tr>
<th>Maturity Level</th>
<th>Focus</th>
<th>Process Areas</th>
</tr>
</thead>
</table>
| 5 Optimizing   | **Continuous Process Improvement** | Organizational Innovation and Deployment  
Causal Analysis and Resolution                                           |
| 4 Quantitatively Managed | **Quantitative Management**   | Organizational Process Performance  
Quantitative Project Management                                           |
| 3 Defined      | **Process Standardization**                  | 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      | **Basic 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      | **Management**                  |                                                                                  |
The quality of a product is largely determined by the quality of the processes used to develop and maintain it.

- Disciplined repeatable processes with objective criteria
  - Inputs, outputs, entry/exit criteria, verification, measures
- Planning each process, and tracking against plan
  - Budgets, schedules, resources
- Managing changes to established baselines
- Stakeholder involvement (integrated management)
- Standardized processes and assets, tailored onto programs
- Measurable progress and improvement
- Institutionalization
What is a Process?

- Tasks, Activities, Procedures
  - Plan
    - Budget
    - Schedule
    - Resources
    - Roles
  - Corrective Action
    - Measures
    - CM
  - Monitor
  - Outputs
  - Exit Criteria
  - Training
  - Verification / Reviews / QA
  - Inputs
  - Entry Criteria

- Standard process
- Templates, assets
- Historical data
- Examples
- Metrics
- Reporting
- Measures
- CM

- Standard process
- Templates, assets
- Historical data
- Examples
- Metrics
- Reporting
- Measures
- CM
## Integrated Process Format

<table>
<thead>
<tr>
<th>Overview</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, Prerequisites, Criteria</td>
</tr>
<tr>
<td><strong>Inputs</strong></td>
<td>Required work products</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 GCSD references.</td>
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CMMI® Process Area Categories

CMMI®

- 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 Level 2
- Maturity Level 3
- Maturity Level 4
- Maturity Level 5

Integrated Processes for CMMI® Compliance
CMMI® Technology Conference & User Group 2004

assuredcommunications™

Gary Natwick - 10
15-18 November 2004
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
Process Interrelationships

**Color Key:**
- Program Management Processes
- Program Support Processes
- Program Life-Cycle Processes
- Organizational Processes


**Program Planning, Estimation, Program Monitoring & Control, Supplier Acquisition & Management, Change Management**

**Time**


Verification, Validation

**Process Improvement, Training, Division Metrics**
Integrated Process Manual

Tailoring

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

Process Compliance Monitor (PCM)
PCM Project Workflow

Project request to DPG

Create Project ➔ Close/Open Project ➔ Add/Modify Project Users

Process Baseline


Startup & Planning

Process Evidence

Add/Modify Process Evidence

Execution

Process Appraisal


Process Monitoring

Monitor Process Compliance
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>
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<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
Approving Tailored Processes

- IPM tailoring approved by Program Director (Division Approver)
- IPM deviations beyond acceptable tailoring guidelines requires approval of an Integrated Process Waiver
- Functional plans (SEMP, SDP, etc.) are reviewed and approved by cognizant functional manager. Integrated plans including functional content are encouraged.
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., SCAMPI\textsuperscript{SM}), these are required to corroborate direct artifacts.

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

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Program evidence needed to demonstrate IPM process compliance
### Evidence Collection across the Program Life Cycle

<table>
<thead>
<tr>
<th>Program Phases</th>
<th>IPM Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Business Acquisition</td>
</tr>
<tr>
<td>Program Planning</td>
<td>X</td>
</tr>
<tr>
<td>Estimation</td>
<td>X</td>
</tr>
<tr>
<td>Program Monitoring &amp; Control</td>
<td>X</td>
</tr>
<tr>
<td>Supplier Acquisition Mgmt</td>
<td>X</td>
</tr>
<tr>
<td>Change Management</td>
<td>X</td>
</tr>
<tr>
<td>Proposal Development</td>
<td>X</td>
</tr>
<tr>
<td>Requirements Analysis</td>
<td>X</td>
</tr>
<tr>
<td>System Architecting &amp; Design</td>
<td>X</td>
</tr>
<tr>
<td>Design</td>
<td>X</td>
</tr>
<tr>
<td>Code and Unit Test</td>
<td>X</td>
</tr>
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<td>Fabrication and Assembly</td>
<td>X</td>
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<td>Product Integration</td>
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<td>Verification</td>
<td>X</td>
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<td>Validation</td>
<td>X</td>
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<td>Production</td>
<td>X</td>
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<td>Field Support</td>
<td>X</td>
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<td>Requirements Management</td>
<td>X</td>
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<td>Risk Management</td>
<td>X</td>
</tr>
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<td>Configuration and Data Mgmt</td>
<td>X</td>
</tr>
<tr>
<td>Program Metrics</td>
<td>X</td>
</tr>
<tr>
<td>Decision &amp; Analysis Resolution</td>
<td>X</td>
</tr>
<tr>
<td>Peer Reviews</td>
<td>X</td>
</tr>
<tr>
<td>Design Reviews</td>
<td>X</td>
</tr>
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<td>Quality Assurance</td>
<td>X</td>
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<td>Integrated Logistics Support</td>
<td>X</td>
</tr>
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</table>
## Process Compliance Scores

<table>
<thead>
<tr>
<th>Status Code</th>
<th>Description</th>
</tr>
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<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>
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### Program Life-Cycle Processes - 1

<table>
<thead>
<tr>
<th>Life-Cycle Phase</th>
<th>Baseline</th>
<th>Milestones / Reviews</th>
<th>Key Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Acquisition</td>
<td>Proposal Baseline</td>
<td>TBR, PCR</td>
<td>Proposal, Prog Plans (P), Sys Arch (P)</td>
</tr>
<tr>
<td>System Requirements</td>
<td>Requirements Baseline</td>
<td>SRR</td>
<td>Prog Plans Requirements, CONOPS, Operational Threads / Use Cases</td>
</tr>
<tr>
<td>System Design</td>
<td>Functional Baseline</td>
<td>SDR</td>
<td>Sys Arch, Sys Design, Interface Defn, Technical Data Package, Traceability</td>
</tr>
<tr>
<td>Prelim Design, Detail Design</td>
<td>•Allocated •Design</td>
<td>PDR, CDR</td>
<td>Prelim Design, Detail Design, Design docs, Test cases / descriptions, Traceability</td>
</tr>
<tr>
<td>Fab, Code, Integration</td>
<td>Developmental Configuration</td>
<td>TRR</td>
<td>Assembled Components, Component test procs / results</td>
</tr>
<tr>
<td>Verification</td>
<td>Product Baseline</td>
<td>System Test PCA, FCA</td>
<td>Test procedures, Test results, Traceability, Delivered systems</td>
</tr>
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#### Integrated Processes for CMMI® Compliance
CMMI® Technology Conference & User Group 2004

**IPM Verification Process**

**IPM Validation Process**

**Program Startup Review**

**Development Cycle Readiness Reviews**
Program Life-Cycle Processes - 2

<table>
<thead>
<tr>
<th>IPM Production process</th>
<th>IPM Field Support process</th>
</tr>
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<tbody>
<tr>
<td><strong>IPM Verification process</strong></td>
<td></td>
</tr>
<tr>
<td><strong>IPM Validation process</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Other IPM Program Life-Cycle processes (as applicable)</strong></td>
<td></td>
</tr>
</tbody>
</table>

- **Life-Cycle Phase**
  - **Production**
  - **Milestones / Reviews**
  - **Field Support**
  - **Key Products**

- **Baseline**
  - **Product Baseline**
  - **Production Readiness Review**

- **Milestones/Reviews**
  - **Site Transition/Install Plan**
  - **Revisions to product baseline**
  - **Test results**

- **Key Products**
  - **Production plan**
  - **Delivered systems**
  - **As-built documents**
  - **Test results**

- **IPM Production and Field Support processes apply only to the extent required by contract**
  - May be not applicable
  - May implement revisions to the baseline products
  - May involve other life cycle processes
    - Requirements, design, implementation

- **IPM Production Process**
  - Produce and deliver multiple systems

- **IPM Field Support Process**
  - Site installation
  - Operations support
  - Engineering services
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Program Support Processes

IPM Program Management processes

Requirements Change Requests

IPM Requirements Management process

IPM Decision Analysis & Resolution process

IPM Peer Review process

IPM Design Review process

IPM Risk Management process

IPM Program Metrics process

IPM Configuration and Data Management process

IPM Integrated Logistics Support process

IPM Quality Assurance process

Requirements Impact Issues Structured Decisions Products Identified Defects Products Approved Baseline

Product Support Data

Product Baseline

Baselines

• Metrics • Analyses • Products • Changes

Info Needs

• Identify • Monitor

Status Actions

• Metrics • Analyses • Products • Changes

• Identify • Monitor

• Information Needs

• Identify • Monitor

Identify • Monitor

• Information Needs

• Identify • Monitor

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Organizational Processes

**Organizational Processes**

- **IPM Process Improvement process**
- **IPM Division Metrics process**
- **IPM Training process**

**Division Objectives**

- Standard process
- Historical metrics
- Process assets
- Trained staff

**Program Plan**

- Tailoring
- Program Defined Process

**IPM Program Management processes**
- Program metrics
- Program assets
- Lessons learned

**IPM Program Life-Cycle processes**

**IPM Program Support processes**
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 CMMI® Instructor
- SEI-Authorized SCAMPI™ Lead Appraiser
- SEI-Authorized SCAMPI™ B&C Team Leader

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