High Maturity Practices in Quality Assurance

Mechanisms for Quantitative Management (QM) and Continuous Process Improvement (CPI)
Presentation Outline

- Mission Solutions’ Maturity Profile
- Quality Assurance (QA) Influence Model
- Quality Assurance Sub-processes
- Quantitative Management
- Continuous Process Improvement
- Results and Lessons
### PROCESS IMPROVEMENT PROGRAM

**CMMI Capability Profiles for SE/SW/IPPD/SS**

<table>
<thead>
<tr>
<th>CMMI Capability Levels</th>
<th>Process Management</th>
<th>Project Management</th>
<th>Engineering</th>
<th>Support</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OPF</td>
<td>OPD</td>
<td>OT</td>
<td>OPP</td>
</tr>
<tr>
<td>5</td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td></td>
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<tr>
<td>3</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Legend:
- **Current Capability Profile as of Dec '03 Class A SCAMPI (SE/SW)**
- **Target Capability Profile for 2004-2006 (SE/SW)**
- **Target Capability Profile for 2004-2006 (IPPD)**
- **Target Capability Profile for 2004-2006 (SS)**

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Quality Assurance Influence Model

- Quality Assurance
  - Process Audits and Product Reviews
    - Management Audits: Direct Influence on Management Processes, Improving Cost and Schedule Performance Indices
    - Development Audits: Influence Development Processes, Improving Productivity, Defect Leakage
    - Product Reviews: Directly Influence Product Quality, Improving Post-Delivery Defect Density
Primary Quality Assurance Sub-processes

Plan QA

Review Products

Audit Processes

Ensure Corrective Actions

Record and Retain Quality Records

QA DB
Quantitative Management: Creating the Basis

Select Events

Collect/Analyze Event Data & Derive Control Limits

Establish/Update QM Thresholds

Statistically Set Thresholds

EVENTS:
- Audits
- Document Reviews
- Change Control Board Support
- Metrics Validations

MEASURES:
- Size (#),
- Effort ($),
- Quality/Yield (Q)

THRESHOLDS:
- Set near Mean +/- ‘3 Sigma’
  - Productivity (#/$)
  - Yield Rate (Q/$)
  - Batch Yield (Q/#)
Quantitative Management: Event Level Checking and Intervention

- Event Data (And Revised Event Data) → Event-Level Metrics Tab
- QA DB → Violation Indicator
- Statistically Set Thresholds → Violation Responses – 1) Rework, 2) Added actions, 3) Explanations/Clarifications

Quality Engineer → Event-Level Metrics Tab → Quality Engineer
# Metrics Tab

The Metrics Tab provides various metrics for the document being reviewed. Here are the key metrics:

- **Event Type:** PRODUCT EVALUATION
- **Event Subtype:** DOCUMENT REVIEW
- **Plant:** RANCHO BERNARDO
- **DB:** IQS1
- **SQER Status:** C - Closed
- **Record:** 4425 of 4478
- **Close Date:** 02/25/2004
- **Number of Defects:** 33

### Metrics

<table>
<thead>
<tr>
<th>Metric</th>
<th>Low</th>
<th>Current</th>
<th>High</th>
<th>Analysis</th>
<th>Commentary &amp; Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size/Hour</td>
<td>2.1</td>
<td>34.</td>
<td>75.</td>
<td>The calculation for Size/Hour falls within the control limits of 2.1 and 75.</td>
<td></td>
</tr>
<tr>
<td>Defects/Hour</td>
<td>2.0</td>
<td>22.</td>
<td>15.0</td>
<td>The calculation for Defects/Hour falls above the upper control limit of 15.9. Please explain.</td>
<td>Spreadsheet document - quick identification of some repeat errors.</td>
</tr>
<tr>
<td>Defects/Size</td>
<td>.05</td>
<td>.65</td>
<td>1.6</td>
<td>The calculation for Defects/Size falls within the control limits of .05 and 1.6.</td>
<td></td>
</tr>
</tbody>
</table>

**THOMPSON_SE**  **QUERY**  **SQER is Closed -- No Updates Allowed**  **15-MAR-2004**

Enter value for the number of units reviewed based upon the unit type.

Record: 1/1...<OSC>
Continuous Process Improvement: Transforming Data into Action

QA DB (& other DBs)
Lessons Learned
Process Change Requests

Data Extraction and Charting
Trending and Analysis
Action Planning and Implementation
Institutionalization (Documentation, Tooling, Training, Management)

Data Mining and Response Reports
Data Mining for Improvement

**Metrics Cycle:**
- Identify Quantitative Goals and Indicators
- Develop and Implement Plans to Accomplish Goals
- Identify Measures, Charting, and Analysis

- Collect Data
- Create Charts

- Identify Trends/Anomalies
- Perform Causal (“Contributing Factors”) Analysis
- Identify and Trigger Actions
- Track and Report Status

- Document all together (“Data Mining Report”)
Realized Improvements

- **Quantitative Results:**
  - Provided event-level data for estimating QA
    - Project CMMI Audits take 11.74 hours on average, etc.
  - Improved detection of problems
    - Discrepancy Report review findings/hour increased 108%
  - Improved Corrective Actions
    - Proportion with Preventive actions increased from 15.7% to 26.5%
  - Reduced audit cycle time
    - 48.1% reduction in cycle time (days to complete audits)
Realized Improvements (continued)

- Qualitative Results:
  - Improved discipline of Quality Engineers (QE)
  - Provided example of QM/CPI for organization
  - Improved QE ability to support project QM/CPI
  - Improved perception of QA organization
Lessons Learned (QM & CPI)

- Improvement of Data Collection dominated early QM/CPI activity
- Link to organization level goals was allegorical rather than provable
- Few (~10%) data mining charts provide insights
  - Combinations of charts provide better picture
- QM/CPI Plans and Reports provide critical artifacts for focusing and proving QM/CPI
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