Model-Based Software Process Improvement

Brenda T. Zettervall
Naval Surface Warfare Center (NSWC)
Port Hueneme Division (PHD)
East Coast Operation (ECO)
Dam Neck
Virginia Beach VA

This presentation demonstrates our organization's approach to model-based Software Process Improvement (SPI). Our organization, a Process Transfer Technology Affiliate of the STARS program, was selected in April 1993 to participate as a field test site for the Software Engineering Institute (SEI) Software Process Definition (SPD) project. The products tested included the improvement model itself, descriptive modeling techniques, the CMM level 2 framework document, and the use of process definition guidelines and templates.

The SPI model developed by the SPD project at the SEI represents a five stage cyclic approach for organizational process improvement. The cycle consists of the initiating, diagnosing, establishing, acting, and leveraging phases. Our organization's three year Total Quality Initiative facilitated the adoption of this model for our software improvement teams.

The process improvement infrastructure includes the steering committee, SEPG team leader, the SEPG core advisors, Quality Management Boards (QMB), and designated working groups chartered by the SEPG. The QMB's directly support the strategic goals of the organization. Monthly briefings from the SEPG team leader to the steering committee and the QMB's facilitate the integration of the SPI initiative with the strategic business goals.

The SPD project at SEI field-tested the Process Framework Document for CMM level 2 at our organization. The document provides checklists to determine CMM compliance for each Key Process Area (KPA). In addition, we gained insight into the necessary organizational components to support well-defined processes.

Process Definition (PD) training was provided for our SEPG, Technology QMB, and the Project Planning Working Group. Our SEPG recognized the need to establish a documented standard approach for PD that all software improvement teams can use (i.e. a well-defined process!). Our Process Breakdown Structure establishes planning, definition, and enactment as the top-level phases of the Process Engineering life-cycle.
The process planning phase is necessary to baseline and document the current process by establishing the purpose and the high-level process flow. In addition, it is important to set the policy that will over-arch the process and help set the context for the follow-on process definition engineering. The process definition phase is decomposed into three activities: layout, design, and enactment information. The layout activity establishes the process relationships by organizing the high-level entry/tasks/validation/exit (ETVX) information and defining the work flow and work products associated with the process. In addition, a mid-level process flow is established during this step which will facilitate using the information organizers in the design activity. The agents that will perform each task are also identified during this activity.

The design activity of the definition phase is characterized by the use of multiple information organizers (i.e. templates) which provide the necessary data to develop the enactment information. Measurement criteria and the validation method are further defined in this stage of process definition.

The development of the enactment information is the last activity to be performed in the definition phase of process engineering. The procedures must be developed during this activity in order to trial test the process during a pilot project. The training requirements for the process must also be established at this time.

The enactment and process support is the final phase of process engineering and constitutes the institutionalization of the process. This phase must establish process control and process assurance procedures to ensure that the process has the ability to improve. A training plan is important to support the on-going use of the process.

The outer ring represents all of the work products developed during the process engineering life-cycle. In an attempt to avoid shelfware, the SEPG is targeting a Process User’s Manual for each KPA that will contain only the essential information required for the user of the process.
MODEL - BASED SOFTWARE

PROCESS IMPROVEMENT

Ms. BRENDA T. ZETTERVALL
QUALITY IMPROVEMENT ADMINISTRATOR

1920 REGULUS AVE
DAM NECK
VIRGINIA BEACH VA
23461-2097

BZETTERVALL@HERCULES.NSWSES.NAVY.MIL
AGENDA

SPI MODEL
IMPROVEMENT INFRASTRUCTURE
ESSENCE OF LEVEL 2
PROCESS DEFINITION FRAMEWORK
  - PLANNING
  - LAYOUT
  - DESIGN
  - ENACTMENT
PROCESS MANUAL
SOFTWARE PROCESS IMPROVEMENT MODEL

Initiating

- Stimulus for Improvement
- Set Context and Establish Sponsorship
- Establish Improvement Infrastructure

Leveraging

- Document and Analyze Lessons
- Revise Organizational Approach
- Appraise and Characterize Current Processes

Diagnosing

- Develop Recommendations & Document Phase Results

Acting

- Implementation plan
- Define processes
- Define measures
- Plan and execute pilot(s)
- Plan, execute, and track installation
- Establish Process Action Teams
- Action Planning
- Set Strategy and Priorities

Establishing

- PAT Charters & Plans
NSWC - PHD - ECO
PROCESS IMPROVEMENT INFRASTRUCTURE

STRATEGIC PLAN

QUALITY IMPROVEMENT DEPARTMENT

SEPG CORE ADVISORS

SEPG LEADER

OIC

DIRECTOR

DEPT A

DEPT B

DEPT X

SEPG -- SOFTWARE ENG. PROCESS GROUP
TQMB -- TECHNOLOGY
MQMB -- MARKETING
IQMB -- ISEA
WEQMB -- WORKFORCE ENHANCEMENT
RDQMB -- RESOURCE / DEMOGRAPHICS
QA -- QUALITY ASSURANCE
WG -- WORKING GROUP

MQMB

IQMB

TQMB

WEQMB

WG

WG

WG

RDQMB
THE ESSENCE OF LEVEL 2
"TAKES COMMITMENT
AND TIME!"

OPERATIONAL FRAMEWORK

- POLICY
- STANDARDS
- PROCESS
- PROCEDURES
- TOOLS
- TRAINING

SEPG Process Improvement
Senior Management
Product Engineering
Software Configuration Management (Product Integrity)
Software Quality Assurance (Process Assurance)

Informed Decisions
Oversight & enforcement
Plan the Work
Work the Plan

Conformance/Non Conformance

Constraints
Implemented By...
"How To"

Supported By...
### PROCESS DEFINITION FRAMEWORK

<table>
<thead>
<tr>
<th>PLANNING</th>
<th>DEFINITION</th>
<th>ENACTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PROCESS PLANNING</strong></td>
<td><strong>LAYOUT</strong></td>
<td><strong>DESIGN</strong></td>
</tr>
<tr>
<td><strong>ENACTMENT INFORMATION</strong></td>
<td><strong>ENACTMENT &amp; PROCESS SUPPORT</strong></td>
<td></td>
</tr>
</tbody>
</table>

- **BASELINE**
  - DATA GATHERING
    - AUDIENCE
    - ROLES
    - USAGE
    - KNOWLEDGE
    - MOTIVATION
    - INTERVIEW

- **HIGH LEVEL PROCESS FLOW**

- **POLICY STATEMENT**
PROJECT PLANNING COMMITMENT PROCESS

NEW BUSINESS FORM

PREPARE PROJECT PLANNING REQUIREMENTS FORM

STAGE 1

GENERATE PROJECT ESTIMATES

STAGE 2

CONSOLIDATION AND CONCURRENCE

STAGE 3

RESOURCE ALLOCATION GROUP
PROCESS DEFINITION FRAMEWORK

<table>
<thead>
<tr>
<th>PLANNING</th>
<th>DEFINITION</th>
<th>ENACTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROCESS PLANNING</td>
<td>LAYOUT</td>
<td>ENACTMENT &amp; PROCESS SUPPORT</td>
</tr>
<tr>
<td></td>
<td>DESIGN</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ENACTMENT INFORMATION</td>
<td></td>
</tr>
</tbody>
</table>

- PROCESS RELATIONSHIPS
  - INITIAL MODEL
    -ETVX
  - MID-LEVEL PROCESS FLOW
  - WORK PRODUCTS DEFINED
THE ETVX PROCESS
(ENTRY, TASK, VALIDATION, EXIT)

PURPOSE: Ensure all Departments and Divisions are involved in Project planning process

TASK: Project Planning (Bids, RFP, Potential)

INPUT
1. Task Letter
2. Estimate Request
3. New Business Opportunity form

ENTRY CRITERIA
- New Business Form
- Formal Project Officer identified

TASK
Agent: Project Coordinator
1. Determine Scope of SOW
2. Establish Key Codes
3. Requirements Brief
4. Complete Checklists
5. Prepare Schedule, WBS, Funding
6. Resolve Comments
7. QA Checkpoints Complete

VALIDATION
- Approval to Proceed

EXIT CRITERIA
- Checklist, WBS
- Resolution Meeting

OUTPUT
1. To Sponsor:
   - Estimate
   - Schedule
   - Risk Analysis
2. Commitment to Task
3. To Resource Allocation Committee
   - Schedule
   - WBS
   - Funding

PARENT: Project Officer's Handbook

ACTION CODE: Project Coordinator
Project Planning Process
(Bid, Proposal, Potential)

Legend:
- Input
- Activities
- Output
- QA Review
PROCESS DEFINITION FRAMEWORK

<table>
<thead>
<tr>
<th>PLANNING</th>
<th>DEFINITION</th>
<th>ENACTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROCESS PLANNING</td>
<td>LAYOUT</td>
<td>DESIGN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- INFORMATION ORGANIZERS
  - INPUTS
  - OUTPUTS
  - TASKS
  - AGENTS
  - MEASUREMENTS
  - VALIDATION
PROCESS DEFINITION
FRAMEWORK

<table>
<thead>
<tr>
<th>PLANNING</th>
<th>DEFINITION</th>
<th>ENACTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROCESS PLANNING</td>
<td>LAYOUT</td>
<td>ENACTMENT</td>
</tr>
<tr>
<td></td>
<td>DESIGN</td>
<td>&amp; PROCESS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SUPPORT</td>
</tr>
</tbody>
</table>

- PROCEDURES
- PILOT PROJECT
- PROCESS MANUAL
- TRAINING REQUIREMENTS
**PROCESS DEFINITION FRAMEWORK**

<table>
<thead>
<tr>
<th>PLANNING</th>
<th>DEFINITION</th>
<th>ENACTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROCESS PLANNING</td>
<td>LAYOUT</td>
<td>ENACTMENT INFORMATION</td>
</tr>
<tr>
<td></td>
<td>DESIGN</td>
<td>ENACTMENT &amp; PROCESS SUPPORT</td>
</tr>
</tbody>
</table>

- INSTITUTIONALIZATION
- PROCESS CONTROL
  - MONITOR
  - MEASUREMENT
  - ANALYSIS
  - IMPROVEMENT
- PROCESS ASSURANCE
  - TAILORING / GUIDANCE
  - ENFORCEMENT
- TRAINING PLAN