NAVAIR
Process Resource Team
Evolving Postmortems as Teams
Evolve Through TxP
November 2014
Agenda

• NAVAIR

• Team Process Integration (TPI)

• Team “X” Process (TxP)

• Time-Based Postmortem

• Size-Based Postmortem

• Quality-Based Postmortem
NAVAIR
What is NAVAIR?

- NAVAIR is the Naval Air Systems Command

- Develop, acquire, and support the aircraft and related weapons systems used by U.S. Navy and Marine Corps

- Our goal is to provide the fleet with quality products that are both affordable and available when most needed

- Our support extends across the entire life span of a product, including all upgrades and modifications to that product
Where is NAVAIR?

NAVAIR Headquarters
Acquisition/Test/Development Centers
Naval Aviation Depots

China Lake
WEAPONS DIVISION

Pt Mugu
WEAPONS DIVISION
NADEP DEPOT

North Island
NATEC DEPOT

Lakehurst
ALRE - SUPPORT EQ
AIRCRAFT DIVISION

Patuxent River
NAVAIRHQ, PEOs
AIRCRAFT DIVISION

Cherry Point
NADEP DEPOT

Jacksonville
NADEP DEPOT

Orlando
TRAINING SYSTEMS DIVISION

Approved for Public Release
Team Process Integration (TPI)
**Models and Processes**

**Capability Maturity Models:**
Reference for organizations building process capability

**Team Processes:**
Processes for teams building quality products on cost and schedule

**Personal Processes:**
Processes used to train individual skill and discipline
Key Team Process Framework

1. Define assignment
   - Track and report progress periodically
   - Update historical data used for future planning

2. Produce conceptual design
   - Team members develop products/provide services
     - Individuals collect measures daily
     - Team tracks progress weekly

3. Estimate size
   - Process Phases
     - Resources available
   - Size database
     - Process analysis
       - Repeat as necessary

4. Estimate effort
   - Customer Need
     - Customer
   - Develop products & services
     - Deliver products & services
   - Goals, products & services, top-down & bottom-up planning with load balancing, risk assessment

1. Plan
2. Work
3. Analyze
Each team member gathers four basic measures:
- Times
- Sizes
- Mistakes
- Task completion dates

Charts and tables of project metrics are available (updated in real time)

Direct Hours
Earned Value
Tasks in Progress
many more...
NAVAIR TPI

• Success of software teams using TSP led their organizations to ask for same performance on other teams
  – Worked with the SEI to develop approach
  – Based on same TSP fundamental principles

• NAVAIR approach has become TPI for all teams
  – Teams plan all work from first launch forward
  – Work is based on all products and services defined in process modeling
  – PSP for Engineers training planned as part of project if appropriate
Just-in-Time TPI Training

**Learning**

- Personal Process (half-day)
- Personal Planning
  Personal Quality
  Plan Overview (half-day)
- Operational Overview
  TPI Tool Overview (half-day)
- PSP Fundamentals (one week)

**Doing**

- Process Modeling (one to four half-day sessions)
- Plan the work (four days)
- Work the plan (cycle 1) (three to nine months)
Team [topic-name] Process (TxP)
TPI Pluses & Minuses

+ A detailed plan!
+ Ability to track progress (weekly)
+ Improved estimating (over cycles)

− No mature processes
  − “Where do we put mistake-fixing phases?”

− No defect type standards
  − “What kinds of mistakes do I make?”

− No quality planning
  − “Will our plan produce a good product?”

− No quality indicators (e.g., A/FR)
CMMI, TSP & PSP Relationship

CMMI

PSP - Builds individual skill and discipline

TSP - Builds quality products on cost and schedule

CMMI, TSP & PSP Relationship

TRP (Rqmts)

T (S/W)

TTP (Sys Test)

TXP

PRP

P

PTP

PXp

Rqmts

S/W

Sys Test

PROCESS VISION, 2018
TPI is Only a Waypoint

• TPI teams will hit a glass ceiling

• TPI teams need to evolve to achieve TSP-like performance (become a TxP team)

• What else does a TPI team have to do in order to become a TxP team?

• What does a TSP team do?
What Does a TSP Team Do?

Typical TSP Cycle

<table>
<thead>
<tr>
<th>Time</th>
<th>(Plan the Work)</th>
<th>(Work the Plan)</th>
<th>(Analyze the Data)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Launch</td>
<td>Weekly Meetings and Day-to-Day Actions</td>
<td>Postmortem</td>
</tr>
</tbody>
</table>

TSP Activities

- Planning Activities
- Working Activities
- Analyzing Activities

And they develop software too!
TxP Planning Activities

- Project and Management Objectives
- Team Goals and Roles
- Project Strategy and Support
- Overall Plan
- Planned sizes and rates used to compute times
- Quality Preparation
- Planned Defects Injected/Removed
- Planned quality indicator values are acceptable
- Balanced Plan
- Project Risk Analysis
- Launch Report Preparation
- Management Review
- Launch Postmortem

From The Start | Some Time Later | Get To Last
TxP Working Activities

Logging time
Logging defects
Tracking EV
Using PROBE in Planning phase
Entering actual sizes in Postmortem phase
Defining Defect Types
Using Review checklists
Holding periodic team meetings
Following an agenda during team meetings
Performing/reporting on assigned roles
Reviewing action items
Reviewing assigned goals and risks
Maintaining project plan and workbook

From The Start
Some Time Later
Get To Last
TxP Analyzing Activities

- Evaluate plan vs. actual schedule hours
- Evaluate plan vs. actual component hours
- Evaluate plan vs. actual component sizes
- Evaluate team performance vs. goals and quality plan
- Evaluate plan vs. actual quality of components
- Update planning data for schedule hours
- Update planning data for lifecycle time-in-phase %s
- Update planning data for productivity rates
- Update planning data for defect densities
- Update planning data for defect rates and yields
- Update planning data for quality indicator thresholds
**TIME-Based Planning Activities**
- Define size measures
- Add Planning and Postmortem phases
- Begin use of PROBE

**SIZE-Based Transitions**
- Define Defect Types
- Refine Processes with Defect Removal Phases

**QUALITY-Based Stages**
- Define Product Quality Indicators
- Define Process Quality Indicators

**Training & First Launch**
- 3-part TPI Training
- Process Modeling
- First Launch

**Product Size Definition**

**Defect Removal**

**Quality Indicators**

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**Planning Activities**

**Working Activities**

**Analyzing Activities**
Time-Based Postmortem

- The team’s most consistent data at first is time
  - Time on Task by Team Member
  - Planned vs. Actual Time by Component
  - Planned vs. Actual Time by Product/Service Type
  - Planned vs. Actual Time by Workflow

Sample Time Log

<table>
<thead>
<tr>
<th>Logged To</th>
<th>Start Time</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/AV-8B SW/Do</td>
<td>Tue Oct 08 08:00:52 PDT 2013</td>
<td>0:10</td>
</tr>
<tr>
<td>/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up</td>
<td>Tue Oct 08 08:20:49 PDT 2013</td>
<td>0:17</td>
</tr>
<tr>
<td>/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up</td>
<td>Tue Oct 08 08:45:47 PDT 2013</td>
<td>0:05</td>
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<td>/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up</td>
<td>Tue Oct 08 09:08:18 PDT 2013</td>
<td>0:21</td>
</tr>
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<td>/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up</td>
<td>Tue Oct 08 10:00:13 PDT 2013</td>
<td>0:05</td>
</tr>
<tr>
<td>/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/Informal/Do</td>
<td>Tue Oct 08 10:17:40 PDT 2013</td>
<td>0:10</td>
</tr>
<tr>
<td>/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up</td>
<td>Tue Oct 08 10:29:44 PDT 2013</td>
<td>0:10</td>
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<td>/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up</td>
<td>Tue Oct 08 10:54:50 PDT 2013</td>
<td>0:07</td>
</tr>
<tr>
<td>/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up</td>
<td>Tue Oct 08 11:23:09 PDT 2013</td>
<td>0:12</td>
</tr>
<tr>
<td>/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/CEI SSAT/Do</td>
<td>Tue Oct 08 14:01:02 PDT 2013</td>
<td>2:16</td>
</tr>
<tr>
<td>/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/CEI SSAT/Do</td>
<td>Tue Oct 08 17:44:18 PDT 2013</td>
<td>0:42</td>
</tr>
<tr>
<td>/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/H-1 SIT/Do</td>
<td>Wed Oct 09 06:35:14 PDT 2013</td>
<td>0:11</td>
</tr>
<tr>
<td>/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/CCS/Do</td>
<td>Wed Oct 09 08:00:06 PDT 2013</td>
<td>0:48</td>
</tr>
</tbody>
</table>
Time on Task by Team Member

- Time Log analysis
  - Accuracy & precision of estimates
  - Real-time logging vs. backfilling

Planned vs. Actual Time by Week

\[ y = 1.0731x \]
\[ R^2 = 0.4001 \]

### Planned vs. Actual Time Table

<table>
<thead>
<tr>
<th>Planned Time</th>
<th>Count</th>
<th>Avg Actual Time</th>
<th>% of PT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>6.9</td>
<td>173%</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>4.0</td>
<td>80%</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>5.9</td>
<td>98%</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>7.7</td>
<td>110%</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>4</td>
<td>10.8</td>
<td>120%</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>6.7</td>
<td>67%</td>
</tr>
<tr>
<td>11</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>21</td>
<td>13.5</td>
<td>113%</td>
</tr>
<tr>
<td>13</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>15.2</td>
<td>72%</td>
</tr>
<tr>
<td>22</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% of Time Entries Ending in

- % of entries across all numbers: 70%
- Extra on 5s and 0s: 30%
• Study any points in red regions
• Adjust team productivity rates for next cycle

By Component

y = 0.5018x
R² = 0.4022

By Component Type

+18%
-3%
+29%
### Time by Workflow

<table>
<thead>
<tr>
<th>Activity</th>
<th>Plan Time</th>
<th>Actual Time</th>
<th>Plan %</th>
<th>Actual %</th>
<th>Act - Plan</th>
<th>Next Plan</th>
<th>Normalized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>68:06</td>
<td>41:03</td>
<td>2.4%</td>
<td>1.4%</td>
<td>-1.1%</td>
<td>2.4%</td>
<td>2.3%</td>
</tr>
<tr>
<td>High-Level Design</td>
<td>248:01</td>
<td>251:46</td>
<td>8.8%</td>
<td>8.4%</td>
<td>-0.4%</td>
<td>8.8%</td>
<td>8.4%</td>
</tr>
<tr>
<td>HLD Inspection</td>
<td>103:07</td>
<td>65:44</td>
<td>3.7%</td>
<td>2.2%</td>
<td>-1.5%</td>
<td>3.7%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Detailed Design</td>
<td>356:52</td>
<td>339:32</td>
<td>12.7%</td>
<td>11.3%</td>
<td>-1.4%</td>
<td>12.7%</td>
<td>12.2%</td>
</tr>
<tr>
<td>Detailed Design Review</td>
<td>129:06</td>
<td>90:59</td>
<td>4.6%</td>
<td>3.0%</td>
<td>-1.6%</td>
<td>4.6%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Test Development</td>
<td>61:44</td>
<td>34:58</td>
<td>2.2%</td>
<td>1.2%</td>
<td>-1.0%</td>
<td>2.2%</td>
<td>2.1%</td>
</tr>
<tr>
<td>Detailed Design Inspection</td>
<td>294:44</td>
<td>220:51</td>
<td>10.5%</td>
<td>7.4%</td>
<td>-3.1%</td>
<td>7.4%</td>
<td>7.1%</td>
</tr>
<tr>
<td>Code</td>
<td>435:48</td>
<td>575:10</td>
<td>15.5%</td>
<td>19.2%</td>
<td>3.7%</td>
<td>19.2%</td>
<td>18.4%</td>
</tr>
<tr>
<td>Code Review</td>
<td>143:08</td>
<td>112:39</td>
<td>5.1%</td>
<td>3.8%</td>
<td>-1.3%</td>
<td>5.1%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Compile</td>
<td>21:04</td>
<td>16:06</td>
<td>0.7%</td>
<td>0.5%</td>
<td>-0.2%</td>
<td>0.7%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Unit Test</td>
<td>349:58</td>
<td>485:12</td>
<td>12.4%</td>
<td>16.2%</td>
<td>3.7%</td>
<td>16.2%</td>
<td>15.5%</td>
</tr>
<tr>
<td>Code Inspection</td>
<td>365:50</td>
<td>444:37</td>
<td>13.0%</td>
<td>14.8%</td>
<td>1.8%</td>
<td>13.0%</td>
<td>12.5%</td>
</tr>
<tr>
<td>Build and Integration Test</td>
<td>189:47</td>
<td>290:05</td>
<td>6.7%</td>
<td>9.7%</td>
<td>2.9%</td>
<td>6.7%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Postmortem</td>
<td>46:48</td>
<td>29:26</td>
<td>1.7%</td>
<td>1.0%</td>
<td>-0.7%</td>
<td>1.7%</td>
<td>1.6%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2814:03</strong></td>
<td><strong>2998:08</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>104.3%</strong></td>
<td><strong>100.0%</strong></td>
<td></td>
</tr>
</tbody>
</table>

- Isolate times for one kind of activity
  - Analyze & discuss big differences
  - Proposed planned %s for next cycle
Size-Based Postmortem

- Once the team has consistent size data...
  - Productivity Rates by Team Member
  - Planned vs. Actual Size by Component

Example of Size Documentation

<table>
<thead>
<tr>
<th>BASE PROGRAM SIZE</th>
<th>Estimated Size</th>
<th>Actual Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASE SIZE (B)</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>DELETED SIZE (D)</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>MODIFIED SIZE (M)</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BASE ADDITIONS</th>
<th>Estimated Items</th>
<th>REL_SIZE</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report Altitude</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>add more rows for base additions...</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PARTS ADDITIONS</th>
<th>Estimated Items</th>
<th>REL_SIZE</th>
<th>SIZE</th>
<th>NR</th>
</tr>
</thead>
<tbody>
<tr>
<td>GUI</td>
<td>I/O</td>
<td>Medium</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Altimeter Referencing</td>
<td>Logic</td>
<td>Large</td>
<td>23</td>
<td>33</td>
</tr>
<tr>
<td>add more rows for parts additions...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total: 10
Actual: 13
Productivity Rates by Team Member

- All individuals have their own rates... per product type

**Beta1 (minutes/LOC) = 1.587**

**PSP Productivity Rate (LOCs/Hr) = 38**
Size by Component

Previous Cycle Components

Current Cycle Components
Quality-Based Postmortem

• Getting a handle on defects usually happens last
  - Defect Injection Rate by Phase
  - Defect Measures by Defect Type
  - Defects Injected by Phase
  - Defects Removed by Phase

• Sample Defect Log

<table>
<thead>
<tr>
<th>Project</th>
<th>ID</th>
<th>Type</th>
<th>Environment</th>
<th>Injected</th>
<th>Removed</th>
<th>Time</th>
<th>Count</th>
<th>...</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>/Non Project/PSP for Engineers/Program 5</td>
<td>1</td>
<td>Interface</td>
<td>Design</td>
<td>Design</td>
<td>Design Review</td>
<td>5.3</td>
<td>1</td>
<td></td>
<td>09/03/2009</td>
<td></td>
</tr>
<tr>
<td>/Non Project/dev/FMPT/JDAM Cross Range</td>
<td>2</td>
<td>Assignment</td>
<td>Design</td>
<td>Design</td>
<td>Design Review</td>
<td>10.8</td>
<td>15</td>
<td>didn't initialize parameters</td>
<td>09/10/2010</td>
<td></td>
</tr>
<tr>
<td>/Non Project/dev/FMPT/JDAM Cross Range</td>
<td>3</td>
<td>Documentation</td>
<td>Design</td>
<td>Design Review</td>
<td>5</td>
<td>1</td>
<td>didn't draw data flow arrows in correct direction</td>
<td>10/13/2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>/Non Project/dev/FMPT/JDAM Cross Range</td>
<td>4</td>
<td>Interface</td>
<td>Design</td>
<td>Design Review</td>
<td>0.6</td>
<td>1</td>
<td>forgot to flesh out paras for func Compute Angle</td>
<td>11/17/2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>/Non Project/dev/FMPT/JDAM Cross Range</td>
<td>5</td>
<td>Interface</td>
<td>Design</td>
<td>Design Review</td>
<td>1.2</td>
<td>1</td>
<td>forgot to flesh out paras for func Compute Range</td>
<td>11/18/2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>/Non Project/sw history/Prod A Req 3</td>
<td>1</td>
<td>Function</td>
<td>Code</td>
<td>Test</td>
<td>inverted to variables</td>
<td>1.1</td>
<td>1</td>
<td>did not give vars initial values...</td>
<td>01/29/2009</td>
<td></td>
</tr>
<tr>
<td>/Non Project/sw history/Prod A Req 3</td>
<td>2</td>
<td>Unclear</td>
<td>Design</td>
<td>Design Review</td>
<td>0.9</td>
<td>3</td>
<td>did not initialize parameters</td>
<td>10/11/2011</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Defect Injection Rate by Phase

Classic Lifecycle Injection Rates

Defects/Hr

High-Level Design  HLD Inspection  Detailed Design (DLD)  Test Development  DLD Inspection  Code  Code Review  Compile  Code Inspection  Unit Test  Build and Integ Test

Product A (48%)  Product B (31%)  Product C (12%)  Product D (9%)  All
Defect Measures by Defect Type

- How many doesn’t always matter

- Sorted by Fix Time

Defect Fix Times

Defect Counts
Defects Injected/Removed by Phase

Height of Red above Green indicates how many mistakes were in the product at that phase of development.

<200 remaining

>600 remaining
TxP Postmortem

- Only after the team knows what level of process performance results in a quality product, then they can set goals and compare planned values to actual values.

<table>
<thead>
<tr>
<th>RATIOS</th>
<th>REVIEW RATES (LOCs/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan</td>
<td>Actual</td>
</tr>
<tr>
<td>0.36</td>
<td>0.27</td>
</tr>
<tr>
<td>0.82</td>
<td>0.59</td>
</tr>
<tr>
<td>0.33</td>
<td>0.20</td>
</tr>
<tr>
<td>0.00</td>
<td>3.15</td>
</tr>
<tr>
<td>8.86</td>
<td>7.81</td>
</tr>
</tbody>
</table>

Cost of Quality (COQ)

<table>
<thead>
<tr>
<th>Topic</th>
<th>Plan</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Appraisal COQ</td>
<td>36.8%</td>
<td>30.8%</td>
</tr>
<tr>
<td>% Failure COQ</td>
<td>19.9%</td>
<td>26.1%</td>
</tr>
<tr>
<td>Appraisal / Failure Ratio (AFR)</td>
<td>1.85</td>
<td>1.18</td>
</tr>
</tbody>
</table>
Things to Remember

• As a team’s process evolves from TPI to TnP, the analysis of their data needs to evolve too

• Focus on what is value-added to the team and they will strive to collect the data

• This analysis gives them insight into the quality of their processes used to produce their products and provide their services
Questions?

NAVAIR Process Resource Team
Brad Hodgins

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Acronym List

- A/FR – Appraisal Failure Ratio
- CMM – Capability Maturity Model
- CMMI – Capability Maturity Model Integration
- COQ – Cost of Quality
- DLD – Detailed-Level Design
- EV – Earned Value
- HLD – High-Level Design
- LOC – Line of Code
- NAVAIR – Naval Air Systems Command
- PI – Process Improvement
- PROBE – PROxy-Based Estimating
- PRT – Process Resource Team
- PSP – Personal Software Process
- SEI – Software Engineering Institute
- TSP – Team Software Process
- TPI – Team Process Integration
- TxP – Team [topic name] Process