Team-of-Four

Powerful Mechanism for Deployment

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- SW CMMI Level 5 and SE CMMI Level 3 + in December 2003
- Second SW-CMM Level 5 in September 2002
- SW-CMM Level 5 in October 1998
- First SW-CMM Level 3 in world in 1990
Many pieces to puzzle for organization and project success

- Organization Processes
- Best Practices
- Program Requirements
- Lessons Learned
- Quantitative Methods
Process Improvement Requires Synergy between Organization and Programs

- To achieve high levels of process maturity, the organization and programs must work closely together
  - New process at the organization level need to be deployed to programs
  - Best practices and lessons learned from the program levels must be flowed to the organization and shared across programs
  - Quantitative management activities need infrastructure to facilitate metrics collection and analysis
Team of Four (ToF) Concept

- Team of Four Concept successful at other Raytheon sites
- Adopted the concept in Fullerton in 2001
- Consistent with integrated product team approach
- Very effective mechanism for process improvement

Team of Four promotes synergy between organization and programs
What is a Team-of-Four (ToF)?

- A teamed approach to project leadership and support
  - Team goal is to help ensure project success while helping the organization improve over time
  - The team members bring a broad perspective, can better facilitate sharing across projects and help the organization improve as a whole
- Also the primary mechanism for process deployment activities on projects
  - Supports the organization’s process improvement efforts
Who is on a SW Team-of-Four (ToF)?

- Software Program Manager
- Engineering Management Rep
- Quality Assurance Rep
- Engineering Process Group Rep
Morphing of SW ToF to ToX

SW ToF

SE ToF

ToF with multiple engineering disciplines
Expanded Team of X

<table>
<thead>
<tr>
<th>Functional Managers</th>
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</thead>
<tbody>
<tr>
<td>Software Engineering Manager</td>
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</tbody>
</table>

Team of Four concept expanded beyond software to include other engineering disciplines
ToF adds Value

- Better visibility of key drivers (e.g., Productivity and other measures)
- Collaborative risk mitigation
- Timely resolution of issues (more proactive, less reactive)
- Eliminates wasted activities (no “reinventing the wheel”)

- Institutionalized processes
- In-Phase containment of defects
- Shared Lessons Learned and Best Practices

- Improved Program Performance
- Improved Process/Product Quality

Stronger Tie between Programs and Functional Organizations
More Successful IPTs
More Predictable Programs
Team of Four supports Level 1 through Level 5 programs

- Less mature programs focus on improving measurements, configuration management, etc.
- More mature programs focus on quantitative management, process improvement.
ToF Supports Program through Life Cycle

Team of Four supports programs during
- Start up
- Development
- Wrap up
- Maintenance
The Team-of-Four Process - Project Start-up

- Team sets up plans, process and metrics
  - Uses engineering startup checklist to plan for startup events
  - Develops plans for programs plans and procedures
  - Tailors program process to organization processes
  - Reviews plans including Software Development Plan/ Systems Engineering Management Plan, Metrics Plan, etc.
  - Develops and reviews the Process Improvement Plan (PIP)
Process Deployment at Start up

Establish “Team of Four” → Tailor Organization Engineering Directives → Obtain Approval of Tailoring from Policy Board

Develop Project Plans

- IMP/IMS
- SEMP/SDP
- Metrics Collection Plan
- Risk Mgt Plan
- Facilities Plan
- Process Improvement Plan

Update Project Plans

- Update, Baseline & Release Project Plans
- Conduct Project Startup Review
- Update Tailoring as needed
The Team-of-Four Process-Development Phases

- During program development ToF focus is on:
  - Quantitative Management
  - Process Improvement
ToF Quantitative Management

- Determine what metrics to collect
- Determine best method for collection
- Establish goals and thresholds for key metrics
- Analyze metrics
- Look for trends, compare to organization norms
- Identify areas of concern
- Do causal analysis
- Prepare for reviews with senior management
Sample Requirements Volatility Report

Requirements Volatility % Change (example)

- % Requirement Volatility
- Org Volatility Baseline
- Upper Tolerance (+10%)
- Lower Tolerance (-10%)

Customer requested deletion of these requirements. ECP-029 cost/schedule in negotiation.

New functionality added. ECP-030 being generated, schedule relief of 2 weeks needed.

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Program Lifecycle Phase

- CDR
- System Integration

Team of Four
November 2004

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**Project Monitoring and Control**

**Raytheon Management Chain**
- Process & quality goals & objectives
- Review status towards goals and objectives

**Engineering Management**
- Engineering Director
  - Sets engineering goals
  - Reviews project status bi-monthly
- Engineering Manager regularly monitors project activities as member of ToF

**Engineering Metrics Coordinator**
- Supports Engineering Director in establishing engineering goals
- Collects and analyzes metrics across the organization
- Maintains and reports status of progress against engineering goals
- Monitors project-level metrics collection
- Provides metrics training and consultation

**Project Team of Four**
- Meets at least monthly to:
  - Analyze metrics and identify corrective and preventive actions
  - Sponsor and monitor project process improvement activities
  - Ensure program records are maintained
  - Review org-level process improvements for incorporation into project processes

**EPG**
- Provides process support to project a member of ToF
- Flows organization level process improvements to project via ToF
- Shares project best practices with organization via EPG

**Product Assurance**
- Member of ToF
- Monitors process compliance and product quality

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ToF Process Improvement

- Address activities identified in the program’s process improvement plan
- Seek process improvements for areas identified in quantitative management
- Sponsor Six Sigma activities on the program
- Identify lessons learned and best practices to share with rest of organization
- Review other programs lessons learned and best practices and determine if they should be applied to this program
- Prepare for appraisals and audits
Process Improvement Cycle

**Project Level Process Improvement Activities**

**Org / Eng Level Process Improvement Activities**

**Eng / Business Unit Level Activities**

1. **Identify & prioritize improvements**
2. **Plan improvements, piloting, deployment**
3. **Improve & pilot org. process improvements**
4. **Evaluate effectiveness of improvements**
5. **Candidate improvement opportunities**
6. **Collect & analyze pj data, requests, recommendations**
7. **Process Improvement Requests & Recommendations to Org-level Processes**
8. **Identify org & business unit goals and needs**
9. **Process Improvement Requests & Recommendations to Org-level Processes**
10. **Significant improvements Process innovations**
11. **Pilot improvements, as necessary**
12. **Plan & deploy process improvements**
13. **Improve & pilot project process improvements within projects**
14. **Evaluate effectiveness of improvements**
15. **Collect data, requests, recommendations**
16. **Analyze data, identify improvements**
17. **Perform Process Collect Data**
18. **Updated engineering directives, training, tools & enablers**
19. **Incorporate process improvements**

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The Team-of-Four Process - Wrap-up Activities

- At end of development:
  - Collect and review lessons learned for the entire project
  - Complete the end-of-project report and submit to the organization metrics team
  - Present a project shutdown/summary report at the Engineering Project Reviews
  - Determine if project is transitioning to maintenance and categorize the type of maintenance activity
The Team-of-Four Process - Transition to Maintenance:

- Develop a Maintenance Plan
- Review and revise the Software Development Plan and Systems Engineering Development Plan.
- Update tailoring report as needed
- Review and revise other plans and process documents as applicable
## ToF Members Roles

<table>
<thead>
<tr>
<th>Functional Managers</th>
<th>Software Engineering Manager</th>
<th>Systems Engineering Manager</th>
<th>Hardware Engineering Manager</th>
</tr>
</thead>
</table>

- **Program Engineer**
- **Engineering Process Group Rep**
- **Quality Rep**
Program Engineer’s Role

- Program Engineer responsible for all engineering activities on the program
- Chair of ToF
- Responsible for program reviews with senior management
- Looking out for overall project success
- Communicates to program members and to PMO
Functional Manager’s Role

- Functional Manager includes SW, SE and/or HW program level manager
- Responsible for their discipline’s activities
  - Processes
  - Monitoring progress
  - Training of their team members
- Provide inputs for tailoring, planning, risk identification, causal analysis, etc.
Quality Engineer’s Role

- Audit ToF Activities
- Participate
  - Identify process problems
  - Monitor deployment of new processes
  - Participate in solving problems
Engineering Process Group (EPG) Member’s Role

- Flow information between program and organization
  - Engineering goals
  - Lesson’s learned
  - Best practices
  - Measurement data

- Facilitate
  - Set up meetings
  - Take minutes/track actions
Deploying Team of Four Concepts

- **Team of Four procedure**
  - Identifies responsibilities, roles, typical activities
- **Team of Four Training conducted during meetings**
  - Hour ToF training course
  - Training on metrics analysis, new processes, etc.
- **EPG Liaison support team**
  - To provide training for new EPG members
  - To ensure consistency in approach across teams
Benefits of Effective Teams-of-Four

- Improved engineering processes
- Improved communication/collaboration
- More consistency across projects
- Shared lessons learned for use on other programs
- Better product quality
- Improved competitiveness
- Promotes higher maturity processes

“Working as a Team Fosters Program Success”
Q & A
## Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>CMMI</td>
<td>Capability Maturity Model Integration</td>
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<tr>
<td>EPG</td>
<td>Engineering Process Group</td>
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<tr>
<td>HW</td>
<td>Hardware</td>
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<td>IMP</td>
<td>Integrated Master Plan</td>
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<td>IMS</td>
<td>Integrated Master Schedule</td>
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<td>Integrated Product Team</td>
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<td>Management</td>
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<td>PIP</td>
<td>Process Improvement Plan</td>
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<td>Rep</td>
<td>Representative</td>
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<td>Raytheon Fullerton Operations</td>
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<td>Software Development Plan</td>
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<td>ToF</td>
<td>Team of Four</td>
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<tr>
<td>ToX</td>
<td>Team of Many</td>
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