Extending the Team Software Process for Systems Engineering

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Topics

Need

NAVAIR/SEI Collaboration

Approach

Team

Research Challenges

Conduct of Pilot Project

What’s Next?
Need

TSP is being used with great results on software teams.


There is growing interest in applying TSP to other domains.
NAVAIR/SEI Collaboration

NAVAIR already has a great track record with TSP:
• ROI demonstrated on software projects
• other teams (SE) requested training and launch support

SEI is also receiving additional requests to apply TSP to non-software settings.

Solving software problems becomes increasingly difficult without addressing systems engineering and acquisition issues.
AV-8B TSP/CMMI Experience

AV-8B is a NAVAIR System Support Activity (SSA).

They integrate new features into the Marine Harrier aircraft.

They used TSP to reduce the time to go from CMMI Level 1 to CMMI Level 4.

<table>
<thead>
<tr>
<th>SEI Average</th>
<th>6 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV-8B</td>
<td>2.5 Years</td>
</tr>
</tbody>
</table>
## TSP Results at NAVAIR

<table>
<thead>
<tr>
<th>Program</th>
<th>Size of Program</th>
<th>Defect Density (Defects/KSLOC))</th>
<th>Cost Savings from Reduced Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV JMPS</td>
<td>443 KSLOC</td>
<td>0.59</td>
<td>$2,177,169</td>
</tr>
<tr>
<td>P-3C</td>
<td>383 KSLOC</td>
<td>0.6</td>
<td>$1,478,243</td>
</tr>
</tbody>
</table>
Approach

Conduct a series of pilot projects to determine if extending TSP practices to Systems Engineering and Acquisition Management results in measurable improvement.

Use the results of this work to establish a common process for both systems and software engineering across the NAVAIR Mission Area Teams (MATS).
What is TPi?

Team Process Integrated
• a multi-year experiment
• adapt and extend the training, methods, and tools associated with TSP
• targets selected systems engineering and acquisition teams within NAVAIR (i.e. already using TSP successfully for software development)
CMMI, TSP & PSP Relationship

CMMI - Builds organizational capability

TSP - Builds quality products on cost and schedule

PSP - Builds individual skill and discipline
TSP Builds Effective Project Teams

- **PSP** (Skill-building)
  - Personal measures
  - Process discipline
  - Estimating & planning
  - Quality management

- **TSP** (Team-building)
  - Project goals
  - Team roles
  - Team process
  - Project plan
  - Balanced plan

- **TSP** (Team-working)
  - Risk analysis
  - Team communication
  - Team coordination
  - Status tracking
  - Project reporting

- **Team Members**
- **Team Disciplines**
- **Team Management**

**Integrated Product Teams**

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The TSP Launch Process

Launch Meetings 1 & 2
- Management: Defines project goals
- Answers team questions
- Team: Establishes team roles
- Defines team goals

Launch Meetings 3 & 4
- Team: Defines the project strategy and process
- Produces process and support plans
- Makes an overall development plan

Launch Meetings 5 & 6
- Team: Produces quality plan
- Allocates next phase work to individuals
- Engineers produce detailed personal plans
- Consolidates individual plans into a team plan

Launch Meeting 7
- Team: Conducts a project risk assessment
- Assigns risks to engineers to track

Launch Meetings 8
- Team: Reviews launch work completed
- Prepares management presentation
- Conducts a launch postmortem

Launch Meeting 9
- Team: Presents the plan to management
- Defends the plan to management

Management: Reacts to the team’s plan
- Resolves plan issues with the team

One Week
The TSP Launch Products

Business needs
Management goals
Product requirements

What?何
How?如何
When?何时
Who?谁
How well?如何
What if?如果

• Team goals
• Conceptual design
• Planned products
• Size estimates
• Team strategy
• Team defined process
• Task plan
• Schedule Plan
• Earned-value Plan
• Team roles
• Task plans
• Earned-value Plan
• Quality plan
• Risk evaluation
• Alternate plans

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NAVAIR/SEI Team

NAVAIR
• Tim Chick
• Dennis Linck
• Linda Roush
• Jeff Schwalb
• Paula Strawser

SEI
• Anita Carleton
• Noopur Davis
• Watts Humphrey
• Jim Over

NAVAIR Systems Engineering Pilots
• AV-8B Harrier Aircraft
• E2-C Hawkeye
Research Challenges

As we kicked-off this effort, we realized that there were five areas of TSP that specifically had to be addressed for SE:

- Processes
- Measurement
- Role Definition
- Training
- Tool Support
Research Challenges - Processes

Develop prototype processes/scripts for SE

Develop prototype processes/scripts for ACQ based on:
  • the DoD 5000 series regulations
  • CMMI Acquisition Module

Used “traditional” TSP launch process
Schedule and effort measures are essentially unchanged.

Lines of Code/Function Points would not serve as relevant size measures for SE/ACQ. Formulate size measures for SE and ACQ. Examples:

- DOORS objects
- Requirements
- Verifies
Quality measures in SE
  • Define what “quality” means in SE
  • Where in the process do you collect data?
  • What are the derived quality measures (e.g., defects/DOORS object?)
  • Establish an initial quality baseline during Build 1
What are the quality goals? Examples:

• Goal: Accuracy in the work
  Measure: # of problem reports against requirements and test documents

• Goal: Conformance to standards
  Measure: # of defects in peer reviews; # of defects in requirements and test documents, etc…
Research Challenges – Role Definition

Apply four primary roles—planning, process, quality, support

Assess applicability of remaining roles and define additional roles needed for SE and ACQ.
- Added Requirements Manager
- Design and Implementation roles were combined into one role
- Test Manager role expanded to Flight Test Manager and Lab Test Manager
Currently, our training is geared to software teams.

Our challenges:
• building conviction and discipline in teams that don’t write software programs
• providing just the right amount of training to get a team started
• supplementing with additional training modules as needed
Research Challenges – Training - 2

Develop “JIT” training to support SE teams

Develop Leadership Seminar and Team Member Training to focus on:
• providing the fundamentals of TSP
• launching a team
• maintaining a plan

Follow-up with additional, “JIT” training, e.g.,
• Inspections
• Measurement, data analysis, and reporting
• Checkpoints and Postmortem Analysis
• Tool
Research Challenges – Support Tool

Develop an extensible tool that allows for:
• Defining any process
• Collecting data unobtrusively
• Defining a measurement framework
Progress

SE Pilot Projects Selected (AV-8B and E-2C)

SE/ACQ Prototype Processes/Scripts Developed

Training Developed

Prototype Support Tool Developed

AV-8B Team Trained and Launched
Some Early Data

Launch Sept. 2006 … Ran like a “normal” launch
- Two year overall plan
- Near-term plan is 4 months
- 475 tasks
- 12 team members
- 22,000 task hours
- Gantt Chart didn’t provide visibility into all of the tasks that had to be completed
- Team members engaged in discussions of what the work would entail, dependencies, and what “task complete” meant

Issues:
- Level of granularity of the plan
- Defining appropriate roles for SE Projects
- Defining the SE process
- Developing a quality plan
What’s Next?

Complete NAVAIR pilots

Expand NAVAIR use as warranted

Incorporate lessons learned in TSP Program Plans

Evaluate prototype tools and courses for broader use