Transformation of a Software Development Organization Using Software Acquisition Principles: A Case Study

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Agenda

• Background
• Outline of SEI Study Results
• The Transformation
• Results
Background

• Late 2001: Air Force leadership requested that the SEI conduct a brief probe to investigate software quality problems with the newly released Military Personnel Data System (MilPDS).
  - many airmen experienced pay problems
  - personnelists complained of poorly functioning software with a constant flow of patches/fixes

• Development, fielding, and sustainment of MilPDS was owned by an office within the Air Force Personnel Center (AFPC).
  - no acquisition/programmatic oversight or true Program Management
  - development budget/resources “taken out of hide”
  - indistinct line between “customer” and “developer”

• Late 2002: the SEI conducted a six-week, intensive study

• 2004: the SEI returned to conduct a follow-on study
SEI Study Results

• Requirements
  - requirement to “make it look like legacy”
  - no clear requirements management process
  - no distinction/differentiation between defects and new requirements/enhancements
  - advantages of powerful ERP systems not recognized or used

• Data
  - data irregularities handled on case-by-case basis, with little effort to identify larger patterns or root causes
  - data migrated from legacy system was not clean, causing problems in implementation of MilPDS

• Engineering Processes
  - no one owned software development process
  - multiple teams used multiple processes; in some cases, competing processes existed
  - gaps in process, no process documentation
SEI Study Results

• Deployment/Support Processes
  - limited/incomplete testing, focused largely on “happy path”
  - typical testers not qualified/experienced
  - little to no CM – code deployed without controls; constantly issuing emergency patches, which frustrated customers and introduced new defects

• Products
  - heavily customized COTS software implementation (modified source code)
  - 3M+ SLOC, with little/no documentation (user manuals, design, code standards, etc.)
  - database platform approaching obsolescence, hampering supportability/maintainability
  - relationship with COTS vendor not actively maintained
SEI Study Results

• Personnel & Management
  - not enough personnel with the appropriate skills/training in development, test, etc.
  - majority of personnel “blue-suiters” who would soon rotate out; combined with lack of documentation, led to supportability problems

• Acquisition
  - funding taken “out of hide”
  - programmed funding for future development/sustainment was not evident
Key SEI Recommendations: 2001

- Reinstate full program management a technical lead/system architect with authority

- Secure a long-term funding line for continued development for technology refresh for sustainment

- Consider the organizational implications
  
  Maintaining and evolving a COTS-based system is very different from the “old way.”
  
  Old concepts of “maintenance” must be replaced by a new mindset of operation and evolution.
  
  There will be major new releases for the life of the system.
## Status of Key SEI Recommendations: 2002

<table>
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<tr>
<th>Recommendation</th>
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*Excerpted from internal status briefing chart, October 2002.*
Transformation

• Reorganize

• Focus on repeatable development process with clear definition of stakeholder responsibilities

• Institute measurement program

• Implement requirements prioritization process

• Make changes for acquisition

• Create an acquisition strategy/dual responsibility strategy
Previous Organization

Pre-System Program Office (SPO):

• Air Force Personnel Center (AFPC), Directorate of Personnel Data Systems (DPD)
  - Responsible for development, maintenance, network operations, program management, security, system administration, architecture, engineering, database management, etc.

• AFPC, Directorate of Personnel Support (DPS)
  - matrixed to AFPC/DPD
  - Responsible for providing the functional requirement, operational test and evaluation, acceptance testing, documentation (Help screens)

• Activity Development Teams consisting of
  - functional
  - developer
  - tester
Reorganization

SPO

- Performing true Acquisition Program Management
- Contracting
- Financial Management
- Development/Programming
- Engineering
  - Database Administration/Management
  - Technical Requirement Analysis
  - System/Integration Testing
  - Configuration Management
  - Quality Assurance
Repeatable Development Processes

• Organizational goal ("CMMI Level 2 in 2")

• Re-chartered AFPC SEPG to SPO SEPG
  - Narrowed scope from improving AFPC business processes to defining MilPDS system maintenance processes

• Chartered Process Action Teams (PATs)
  - PAT performance was unsatisfactory
  - Placed functional managers as process owners—instant accountability

• Practitioners trained on new development processes

• Implemented QA audits on all MilPDS releases; identified non-compliance issues

• Performed series of SCAMPI appraisals to verify CMMI compliance
  - SCAMPI-C (Mar 05)
  - SCAMPI-B (July 05)
  - SCAMPI-A (Nov 05)

MilPDS Appraised at CMMI Level 2
Measurement Program

• Established strategic goals at Leadership Summit Fall 2002
  - stabilize MilPDS
  - develop a quality team
  - posture for the future
• Implemented SEI-supported Goal-Driven Software Measurement
  - process compliance
  - resources and cost
  - product quality
  - process performance
• Measurements used for stabilization and performance
  - prepare for CMMI Level 2 SCAMPI
• Measurements scope expanded to other projects
MilPDS Pay Defects & Dataloads per FY (2001-2006)

<table>
<thead>
<tr>
<th>FY</th>
<th>Nbr of Defects</th>
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<tbody>
<tr>
<td>FY01</td>
<td>0</td>
</tr>
<tr>
<td>FY02</td>
<td>213</td>
</tr>
<tr>
<td>FY03</td>
<td>166</td>
</tr>
<tr>
<td>FY04</td>
<td>89</td>
</tr>
<tr>
<td>FY05</td>
<td>59</td>
</tr>
<tr>
<td>FY06</td>
<td>12</td>
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Legend:
- Red: Total Pay Defects
- Blue: Total Pay Dataloads

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Requirements Prioritization

• Customer has a responsibility to know their business, to communicate their needs, and to make tradeoffs
  - requirements liaison in place to “translate” customer needs
  - constant negotiation

• Facilitates expectation management and setting with customer/user community
  - Requirements Management Board briefed quarterly
  - SPO provides customer with status refresh daily

• Customer is responsible for ensuring that the need is reflected in priority order
  - fixed number of resources
  - continual policy changes in AF
  - continual technological advances to take advantage of
Requirements Prioritization

Not everything can be Priority 1

• Customer participation
  - Requirements Management Board (RMB) process
  - “rack & stack”
  - continual *negotiation*

• SPO process
  - continual “churn” of analysis/programming
  - static and aggressive testing windows
  - configuration CONTROL
  - process assurance “cops”

• System Configuration Control Board
  - chartered to make decisions
  - approves baseline to all releases
  - uses risk management process to approve out-of-cycle requests
Changes for Acquisition

SPO Stand-up
Focus: Fix MilPDS

• Absorbed analysis/programming staff

• Hired experienced/qualified Acquisition Program Managers
  - Absorbed program management staff

• Hired experienced/qualified Engineering Staff
  - Built a testing staff and implemented aggressive test program

• Hired experienced/qualified contracting officers

• Hired experienced/qualified financial managers

• Provided needed training (CMMI/SEI)
Acquisition Strategy

• Consolidation of contracts

• Aggressive contracting practices
  - correcting contracts awarded prior to SPO stand-up
  - following contracting processes for all future acquisitions
Results
SCAMPI appraisal in Nov 05
Program Director Goal of CMMI Level 2 in 2 years

2005 Shiely Award Winner – Best Program Office @ ESC

• “Personnel systems problems evaporated, exceeded expectations...off CSAF Top 6”

• “Standardized requirements process, implemented integrated requirements toolset, ensured user priorities met”

• “222% reduction in new defects–69% reduction in total defects–achieved during 33% turnover in workforce”

• “Consistently used a Systems Configuration Control Board–a proven technical advisory for all system changes”

• “Improved functional office review process and configuration control process–Impact: higher quality analysis”

• “Transformed strategy; awarded 1st unit performance-based contract–now at 80%, exceeding 40% OMB goal”

• “ID’d technology ‘quick-wins’ to reduce customer workload–80% implemented immediately–now a ‘big win’”
### Key SEI Recommendations

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<th>Apr 05 Comments*</th>
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<tr>
<td>Cease proliferation of releases</td>
<td></td>
<td>✧</td>
<td>Release frequency changed; allows for more comprehensive testing</td>
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<td>Define and use software processes</td>
<td>✧</td>
<td>✧</td>
<td>Change Management Process documented, SEPG leading CMMI Level 2 efforts</td>
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<td>Conduct personnel skills assessment</td>
<td>✧</td>
<td>✧</td>
<td>Positional skill assessment complete; training program in development</td>
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<td>✧</td>
<td>✧</td>
<td>Test process being scrubbed, 56% complete; updating/reviewing test processes; Rqmts, test cases, code will be linked with new tool (Oct-Nov 04)</td>
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<td><strong>Documentation</strong></td>
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<td>Develop technical/functional documentation</td>
<td>✧</td>
<td>✧</td>
<td>Documentation of system requirements, code and test cases ongoing; sys rqmts 40%, code documentation started</td>
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<td>✧</td>
<td>System supports data validation; DPS is POC for actual data cleansing</td>
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*Excerpted from internal status briefing chart, April 05.*
Closing Comments

• It’s critical to have a few “champions” who “understand and get the job done” – they’ll show up in surprising positions and guises

• Senior leadership, top-down commitment, boss has to say AND do; emphasize accountability

• This isn’t an overnight change – it didn’t get bad overnight and you’re not going to change it all in a day

• Hire qualified personnel and train the ones who aren’t - supplement institutional knowledge with fresh new eyes
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