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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

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SEI Study Results[1]

- 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[2]

- 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[3]

- 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

Recommendation	Oct 02 Status*
System/Process Cease proliferation of releases	
System/Process Define and use software processes	
Mgt/Training/Documentation Conduct personnel skills assessment	
System/SW/Test Base tests on requirements, mature processes, aggressively look for failures	
Documentation Develop technical/functional documentation	
Data Cleansing Validate data fields in MilPDS	

**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

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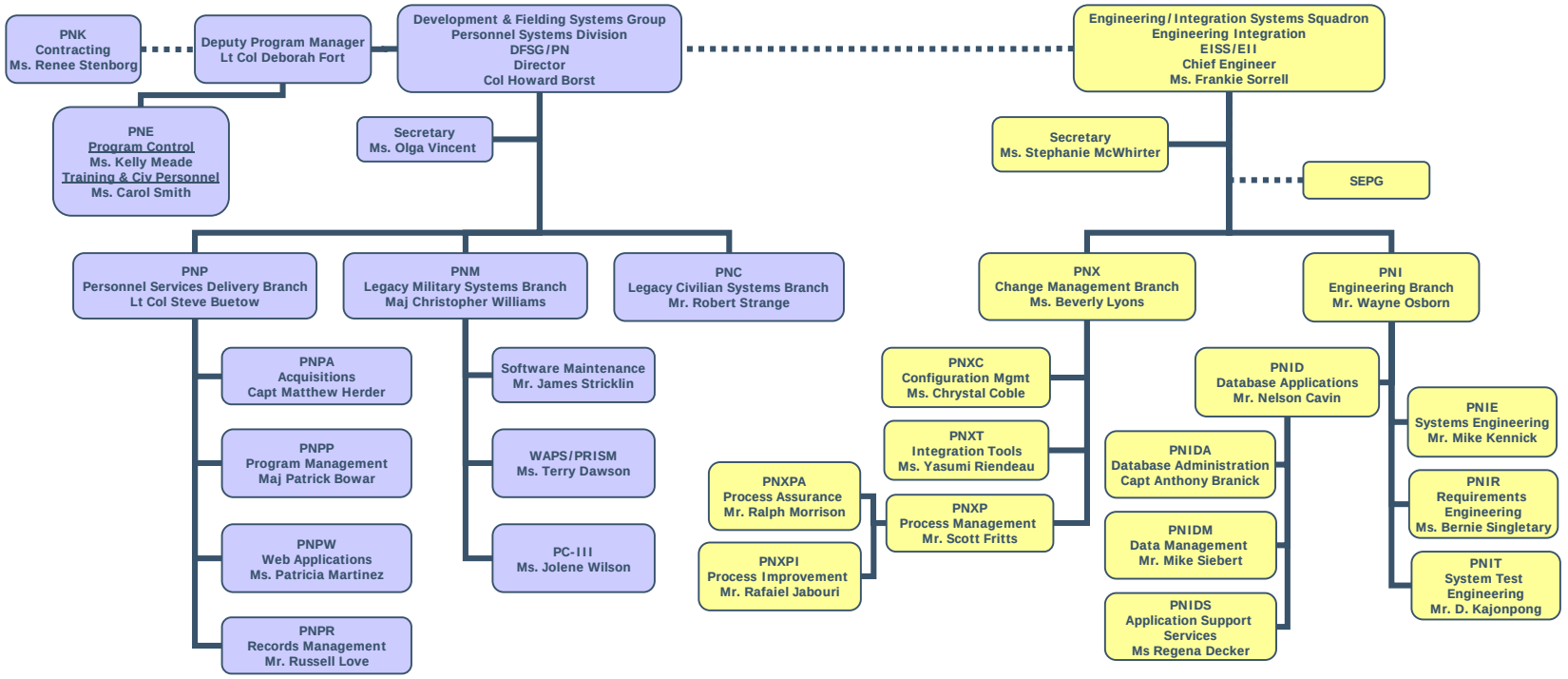
DRAFT
DFSG/PN and EISS/EII
as of 1 Jan 06



Repeatable Development Processes

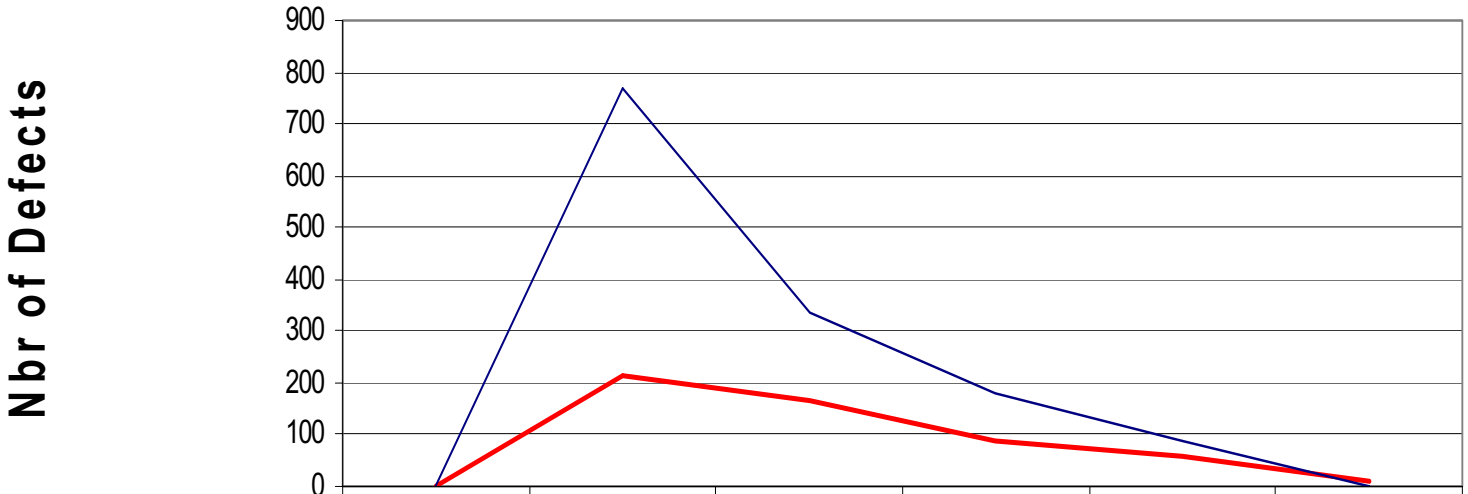
- Organizational goal ("CMMI Level 2 in 2")
- Re-chartered AFPC SEPG to SPO SEPG
  - Narrowed scope from improving AFPC business processes to defining MilPDS system maintenance processes
- Chartered Process Action Teams (PATs)
  - PAT performance was unsatisfactory
  - Placed functional managers as process 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)



	FY01	FY02	FY03	FY04	FY05	FY06
Total Pay Defects	0	213	166	89	59	12
Total Pay Dataloads	0	771	334	178	87	0

FY

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Requirements Prioritization[1]

- 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 Prioritization²

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

Recommendation	Oct 02 Status	Apr 05 Status*	Apr 05 Comments*
System/Process Cease proliferation of releases			Release frequency changed; allows for more comprehensive testing
System/Process Define and use software processes			Change Management Process documented, SEPG leading CMMI Level 2 efforts
Mgt/Training/Documentation Conduct personnel skills assessment			Positional skill assessment complete; training program in development
System/SW/Test Base tests on requirements, mature processes, aggressively look for failures			Test process being scrubbed,56% complete; updating/reviewing test processes; Rqmts, test cases, code will be linked with new tool (Oct-Nov 04)
Documentation Develop technical/functional documentation			Documentation of system requirements, code and test cases ongoing; sys rqmts 40%, code documentation started
Data Cleansing Validate data fields in MilPDS			System supports data validation; DPS is POC for actual data cleansing

**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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