



Adventures in Systems Engineering for a Product Data Management System: A Destination or a Journey?

November 11, 2009

**Ann Hodges, CSEP
Defense Systems and Assessments Strategic
Management Unit SE Lead
Sandia National Laboratories**



Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,
for the United States Department of Energy's National Nuclear Security Administration
under contract DE-AC04-94AL85000.





Outline

- **Context**
- **Product Data Management System Development**
 - **Key activities**
 - **Lessons learned**
 - **Soft skills**



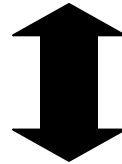
Context



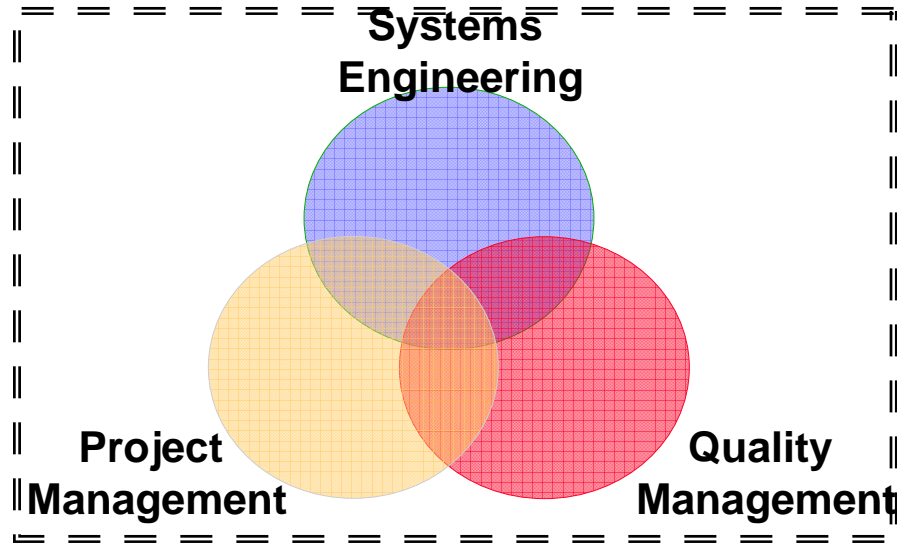


Mission Assurance

Corporate Mission Execution



DS&A SMU Mission Assurance



DS&A SMU Program





Historical Problem Statement

- The “work for others” (WFO) community is heavily reliant on corporate tools, policies, and processes but, WFO Customer constraints make full utilization of the corporate system an impossibility (tuned for supporting weapons work)
- The WFO community has created several stand-alone systems to meet specific program business needs
- WFO programs continue to re-create systems to meet specific Customer requirements
- WFO programs act as both the Design Agency (DA) and the Production Agency (PA) without an essential infrastructure or policy platform
- Frequently WFO Programs deliver the R&D Proto Unit as the first/only Production Unit
- WFO programs have reduced their Product Configuration data set to an insufficient level for Customer acceptance

Customers expect corporate-supported CM throughout the product lifecycle



Product Lifecycle Management (PLM) CM Activities

- **FY08**
 - Piloted product data management (PDM) system with 2 different programs
 - Determined PDM system will provide one organized location for project data, and manage all product-related data associations
- **FY09**
 - Focus on one of our largest programs as a use case for process prove-in
 - If it works for that program, will generalize well for others
 - Developing CM elements to support integration and assembly milestone
 - Implementing processes, procedures in PDM tool
 - Training for subject matter experts (SMEs)

**Baseline for a corporate-level product data management
CM system**

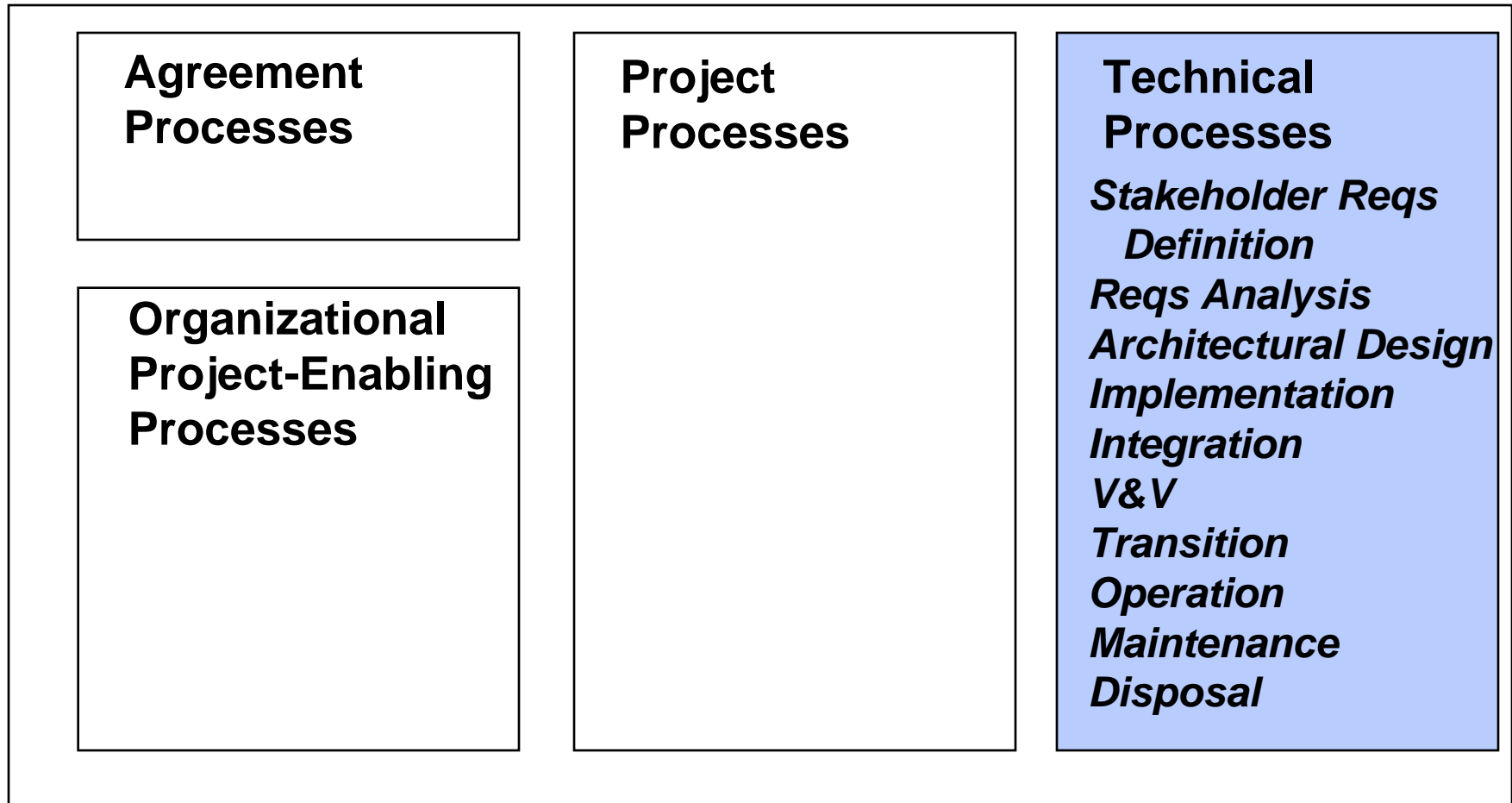


PDM System Development





Systems Engineering Activities* ~Spiral Life Cycle



*Based on ISO 15288-2008 *Systems and Software Engineering – System Life Cycle Processes*



Stakeholder Requirements Definition

- **Performed stakeholder analysis**
- **Included technical/process leaders**
- **Initial interviews conducted**
 - **“CORE” questions (climate/context, opportunities, ramifications, end result/vision)**
- **Champions**
- **“Catch the wave”**
 - **effort addressing recent pain (build book exercise)**





Requirements Analysis

- **Documented and approved set of stakeholder *needs***
 - Rational Unified Process “Vision” document
 - ReqPro
- **Didn’t do a good job of updating needs with more detailed requirements as they became known**
 - “Groundhog’s Day”



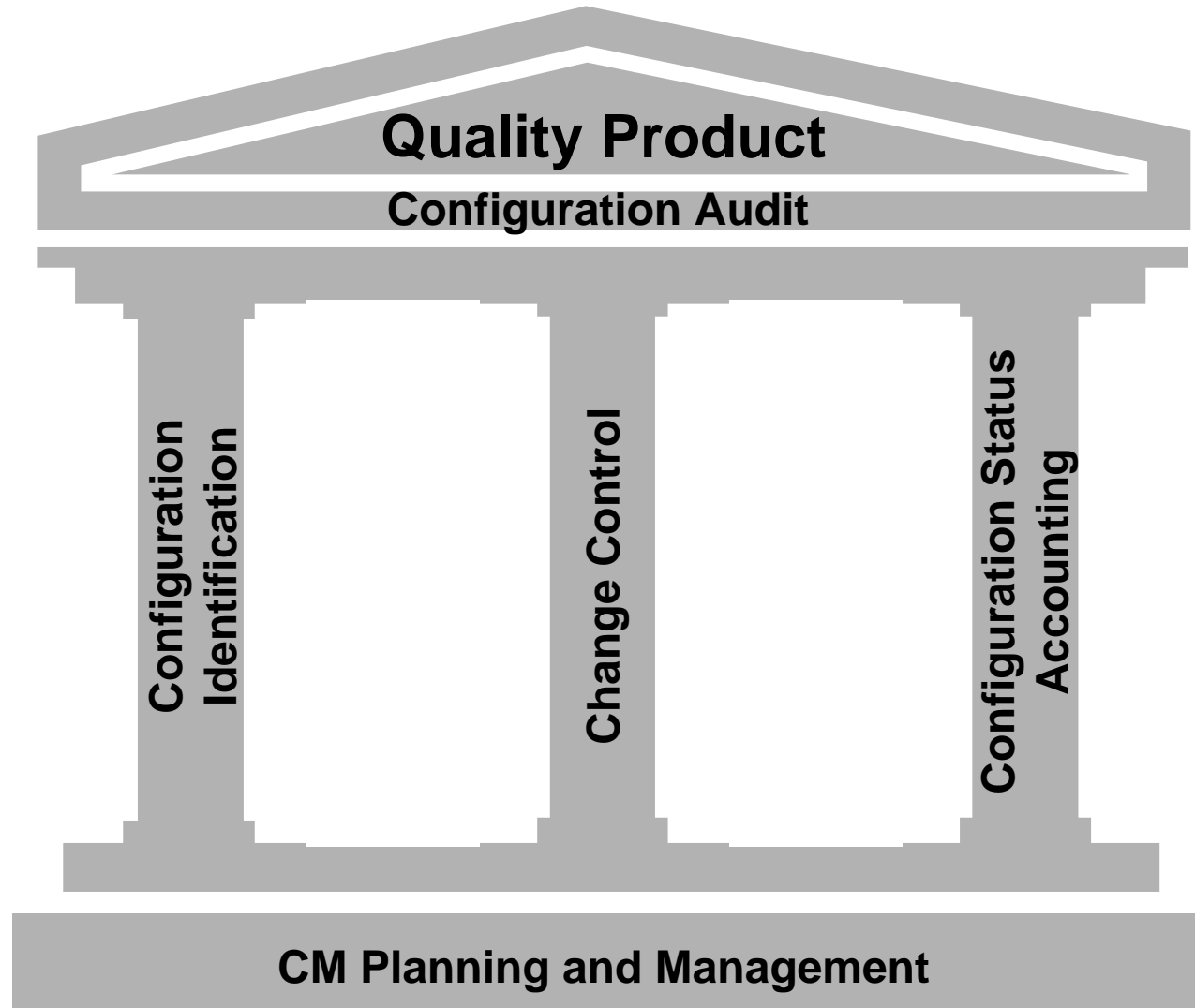
Architectural Design

- **Multidisciplinary team of subject matter experts (SMEs)**
 - Hand-picked SMEs representing various functional areas across the WFO business
 - Designed the CM system for product data management
- **CM system design is based on industry standards**
 - ISO10007, CMII, EIA649
 - Consistent with the DS&A Quality Manual (AS9100B), and CM procedures
 - If there was a gap, industry standards WON
 - Maximizing out of the box functionality (COTS), minimizing customization
 - Aerospace, common industry manufacturers utilize these best practices
 - Lockheed Martin, NASA, Boeing, Toyota, ...
- **Participative approach**
 - SME “deep dives”
 - Facilitator, PDM consultant, SMEs
 - Participative approach
 - Technical/process leaders
 - Light on Mission Assurance staff (users, not MA, have to *walk the path*)

Of the people, by the people, for the people



Industry Standard CM Activities





Architectural Design, continued

- **Configuration identification**
 - Items to be CM'd
 - What is product definition?
 - Product structure
 - Naming conventions
- **Configuration status accounting and configuration audit**
 - Metadata to support
- **Change control**
 - Non-CAD
 - Drawings
 - Problem Report
 - Change Request/Change Notice
 - Release

Consolidation and Standardization
Adhered to industry standards as much as possible



Implementation

- **Path finding effort**
 - Pushing the knowledge envelop of PDM service providers and consultant
- **Design participants had limited knowledge of the PDM tool**
 - Crucial understanding of linking “pedigree” documents came very late

Include SME with deep knowledge of PDM tool



Integration

- **Integration with respect to current processes**
 - Willingness to consolidate, standardize
 - Could see how their current process was being addressed in the PDM system
 - Champions (programmatic and technical managers)
- **Integration with respect to corporate-level needs**
 - Addressed project needs
 - Designed/implemented with the larger scope in mind



V&V

- **Be clear about roles**
 - Co-dependent
 - Doing more than user acceptance testing
- **User acceptance testing**
 - Assumed V&V had been done by PDM capability provider
 - Started more formally
 - Test coverage of work flows, roles
 - Regression testing
 - Training opportunity
 - Sensitivity to PDM system impressions
 - Wring out major errors (core test team) before allowing wider user group
 - Issue tracking is key
 - Common understanding of severity/priority
 - Communication tool
 - This is where the detailed requirements ended up (not ideal!)



Transition

- **Phased approach to adoption**
- **Role-based training and documentation**
 - **General**
 - **Business process**
- **Product Manager**
- **Library Manager**
- **Rein in enthusiastic leaders**
 - **“Success”**



Build it and they will come? *Not!*



Operation

- **Support**
 - Identify “super user” for each project
 - Support model, with escalation
 - POCs, both project and service provider
 - PDM tool and other consultants
 - Response time expectations
- **On-going training**
 - Basic tool training
 - Business process training (work instructions)
 - Easily available user material
 - Work instructions
 - Job aids

Still a work in progress



Disposal

- **Position SNL for the next PDM system migration**
 - Negotiated current data migration requirements
 - Definitive understanding of product data definition

Not *if* but *when* the next PDM system migration will occur



Summary

- **PDM system development has been both!**
 - **Destination**
 - Meeting project's milestones (both the system development and using project)
 - **Journey**
 - Road map for other system development efforts
 - Iterative
 - Better understanding of requirements as gained process and tool experience

