Culture transition to CMM-$I_{\text{ntegrated}}$: The gold is at the end of the rainbow

Bryan Pflug
The Boeing Company
We will continuously develop, advance and protect the technical excellence that allows us to integrate effectively the systems we design and produce.

Core competencies
- Detailed customer knowledge and focus
- Large-scale systems integration
- Lean Enterprise

Values
- Leadership
- Integrity
- Quality
- Customer satisfaction
- People working together
- A diverse and involved team
- Good corporate citizenship
- Enhancing shareholder value

WATCH THE VIDEO
PRINTER FRIENDLY VERSION (311K PDF)
ORDER A POSTER
REPLAY
Product diversity: Integrated Defense Systems

Homeland Security and Services

Missile Defense Systems

Naval Systems

Space & Intel Sys

NASA Systems

Air Force Systems

Aerospace Support

Army Systems

Launch and Satellite Systems
What is integration?

“to form, coordinate, or blend into a functioning or unified whole”

(Source: Merriam-Websters Collegiate Dictionary)
Examples of interfaces to be integrated

Enterprise Integrated Processes

Enterprise Business Integration Processes

Integrated Creation and Support Processes

Program Management Processes

Network-centric Architecture Development Processes

Life-cycle management processes

Systems and Platform Engineering Processes

Engineering Management Processes

Structures & Mechanical Processes

Electronic Hardware Processes

Software Engineering Process

Software Engineering Management Processes

Design
and verify
software item

Develop
Software Component

Integrate
and test software item

Integrate and Validate

Tooling Processes

Manufacturing Processes

Delivery Processes

Services & Support Processes

Business and Product Line Strategic Processes

Manufacturing Processes

Delivery Processes

Services & Support Processes
What does the CMMI say about integration?

- **Organizational Process Definition**
  - Subpractice 6 of SP 1.1-1: "Ensure that there is appropriate integration among the processes that are included in the organization's set of standard processes."
  - Subpractice 3 addresses identification of process elements and their interfaces "among the process elements" and "with external processes."

- **Organizational Process Focus**
  - the SG1 elaboration for IPPD says "Integrated processes that emphasize parallel rather than serial development are a cornerstone of IPPD Implementation".
Uses of process information

• Identify rules of conduct for the enterprise
• Facilitate understanding and communications of business and technical approaches
• Support program and process management
• Support process improvement
• Provision for automated guidance in performing, assuring, or assessing a process
• Provision for automated execution support
• Provide a basis for demonstrating compliance with, or benchmarking against, external frameworks
Opportunities for unintended variation

• Across discrete business element boundaries
• Across planning & execution
• In establishing & tracking schedules
• Across processes, methods, and tools
• Across product teams
• Across design disciplines
• Across stakeholders

Such variation can significantly increase cost, introduce delay, and reduce a group’s ability to learn and apply knowledge.
Integrating business elements

- Each separate organization has its own priorities and plans
- This is good except where plans overlap or conflict
Integrating planning

RFP Received

- Draft IMP/IMS
- Summary WBS, SOW, Tech Rqmts, CDRL Rqmts, T&Cs, etc. Provided
- Define/Extend WBS and Identify Team Structure
- Define Program Baseline

- Start Final PEP Preparation
- Automated PEP

Functional Mgmt Plans

- Develop Responsibility Assignment Matrix (RAM)
- Establish Program/Metrics
- Develop Program Schedules
- Identify Schedule/Cost/Technical Risks
- Tailor/Document Program Processes

- Process Capability Database

Automated ‘Go’ Plan

- Final PEP Complete and Approved
- Update PEP as Required

Proposal Submitted

- Training
- Program Implementation Review (PIR)

Contract Award

Proposal Planning Review (PPR)

- Program Planning Review
- Team Charters Developed and Approved

Team Charters Developed and Approved

- Functional Commitment Reviews

Process Asset Library:
- PEP/TEP
- IMP/IMS
- Go-Plan
- Functional Mgmt Plan

Automated TEP

Develop TEPs

- Dedicated Process SMEs
Technical and business decision-making must be integrated
Integrating processes and tools

Virtual Product Environment

- Process Architecture
  - Mission Analysis
  - Define Mission Requirements
  - Concept Definition
  - Concept Development
  - Preliminary Definition
  - Detailed Definition
  - First Article
  - Production
  - Ops/Support

- Tool Architecture
  - Mission Analysis
  - Define Mission Requirements
  - Concept Definition
  - Concept Development
  - Preliminary Definition
  - Detailed Definition
  - First Article
  - Production
  - Ops/Support

- Data Architecture
  - Data Access
  - Electronic Workflow

- Architectural Principles
  - Interoperability / Plug & Play
  - Electronic Delivery to the Floor
  - Engineering Design Tied to Line Flows
  - Mono-Detail (Part Number Control)
  - Maximize Visualization in Work Instructions
  - Single Source of Product Data
  - Solid Model Master Authority
  - Single Bill of Material
  - Concurrent Release

- Dimensional Management
- Simplified Drawings
- Build-To-Package Portability
- Critical Feature Inspection
Integrating Product Teams

**Program Life Cycle**

Mission Analysis Definition
- **MCR** Mission Concept Review
- **RA** Product Requirements Established
- **FA** Product Concepts Traded and Selected
- **SYN** Product Configuration Developed
- **STD** Product Configuration Testing Defined
- **F&A** Product Fabricated & Assembled
- **SI** Product Integrated
- **VVT** Product Verified, Validated & Tested
- **PRD/DPLY** Product Produced & Deployed
- **SPT** Product Operated & Supported
- **Risk Reduction Activities (if required)**

**Product Development Script**
- **RA** Product Requirements Established
- **FA** Product Concepts Traded and Selected
- **SYN** Product Configuration Developed
- **STD** Product Configuration Testing Defined
- **SA** Product Lifecycle Analyzed
- **F&A** Product Fabricated & Assembled
- **SI** Product Integrated
- **VVT** Product Verified, Validated & Tested
- **PRD/DPLY** Product Produced & Deployed
- **SPT** Product Operated & Supported
- **Risk Reduction Activities (if required)**

**Program Events / Milestones**
- **ACR** Alternative Concept Review
- **SRR** System Requirements Review
- **SDR** System Design Review
- **PDR** Preliminary Design Review
- **CDR** Critical Design Review
- **FRR** Flight Readiness Review
- **PRR** Production Readiness Review
- **ORR** Operational Readiness Review
- **DR** Decommissioning Review

**Iterative Product Development Process**
Integrating Design Disciplines

**PROCESS MANAGEMENT**

| SYSTEMS ENGINEERING & INTEGRATION | • Mission Analysis  
| • Req Analysis  
| • System Architect  
| • Test |

| FLIGHT SYSTEMS DESIGN & ANALYSIS | • Detailed Design  
| • Test |

| SOFTWARE & SIMULATION | • Detailed Design  
| • Coding  
| • Test |

| STRUCTURAL DESIGN & ANALYSIS | • Analysis  
| • Design  
| • Test |

| PROP/FLUID/MECH DESIGN & ANALYSIS | • Analysis  
| • Design  
| • Test |

| AVIONICS DESIGN & ANALYSIS | • Analysis  
| • Design  
| • Test |

| TEST & EVALUATION | • Analysis  
| • Test |

---

**Program Life Cycle**

(ACQUISITION + PROJECT MANAGEMENT + IPPD PROCESSES)

1. **1 SYSTEM**
   - Product Development Process
   - (includes ENGINEERING PROCESSES)

2. **2 SEGMENT or PRODUCT**
   - Product Development Process
   - Integrated

3. **3 SUBSYSTEM or CHUNK**
   - Product Development Process
   - Teams

4. **4 ELEMENT or ASSEMBLY**
   - Product Development Process

5. **5 COMPONENT**
   - Product Development Process

---

**Iterative Product Development Process**

**ORGANIZATIONAL SUPPORT & BUSINESS MANAGEMENT**

(SUPPORT PROCESSES)
Integrating decision-making across stakeholders

IPTs
- Business sys
- Design Authoring
- Process Authoring
- Simulations
- Collaboration
- Change Mgmt
- Config Mgmt
- Workflow

Tools

Single source of process data

On Demand Views

Baselines

Updates

View Generation
- Design detail
- Assembly
- Installation
- Allocation

Analyses & metrics

Integration/Build Plans

Status information

Inventory management

Data Set Exchange

Screen

Screen

Screen

Synthesis

Suppliers

Centers of Excellence

Assessment teams

Customers

Management
Summary

• The key to realizing business results with CMMI is in successfully accomplishing integration across many dimensions.

• Integration is a core competency of Boeing’s Integrated Defense Systems organization.

• Our CMMI investments provide a complement to existing integration activities which are being leveraged throughout our businesses.