CPET 575 Management Of Technology
Concurrent Engineering and Integrated Product Development

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Topics of Discussion

- The Pentagon Reconstruction Project
- The Need for Effective Management Processes
- A Spectrum of Contemporary Management Systems
- Concurrent Engineering – A Unique Project Management Concept
- Criteria for Success
- Defining the Process to the Team
- Understanding the Challenges
- Understanding the Organizational Components
- Recommendation for Effective Management
- Conclusion

The Pentagon Reconstruction Project

- Hijacked American Airline 77 slammed into the west face of the Pentagon on September 11, 2001
- Phoenix project was formed on the same day without any preplanning, budgets, or contract approval
- The primary constraint – one year deadline to complete the reconstruction
- Pentagon Renovation Program, PenRen resource reallocation to form the Phoenix Integrated Project Team (IPT)
- Overnight the budget was estimated, based on historic cost data from the ongoing PenRen Project
- U.S. Congree authorized $700 million in emergency funds

The Pentagon Reconstruction Project (cont.)

- Traditional Approach: Design-Bid-Build
  - Start-up delay, conflict between contractors and owners
- The Design-Build Approach:
  - Allowed design and construction to operate as a single entity under one contract
- Tight schedule
  - Concurrent scope and plan development in parallel to project execution
  - Ultra-fast track schedule was developed
  - The construction was divided into three horizontal stages
The Pentagon Reconstruction Project (cont.)

- New Procurement plan
  - The Government Program Office was exempt from system integration responsibilities
  - Contractors were fully responsible for:
    - The system integration, Subsystems, Equipment, Support Equipment, Validate full system performance after integration

- Advantages
  - Decrease implementation time
  - Increase product quality
  - Reduced engineering changes, program office staff, and over all project cost

What is the bottom line?
- 3,000-member project team, 28 days ahead of schedule and $194 million under budget
- Success factors: people and procedure

Additional References
The Need for Effective Management Process

- Many Enterprise Mission
  - Accelerating development projects
  - Effectively utilizing resources
  - Minimizing implementation risk

- Modern business/technology leaders must deal effectively with
  - Time-to-market pressure
  - Innovation
  - Cost
  - Risks

The Need for Effective Management Process – From Idea to Market

- Reducing project cycle time => cost saving, risk reduction, market advantages, and strategic benefits

- Project Management
  - Tools and techniques has been around since the Industrial Revolution of the 18th century focused on mass production, agriculture, construction, and military operation
  - Officially recognized as a business discipline and profession – 1950s
  - Balance Efficiency, Speed, and Quality
The Need for Effective Management Process – From Idea to Market

- New Project Management Tools and Delivery Systems
  - Under-Integrated product development (IDP) applications
  - Found in wide spectrum of modern projects: Construction, Research, Foreign Assistance Program, Election Campaigns, IT systems installation
  - Focus on
    - The effective, integrated, and often concurrent multidisciplinary project team efforts toward specific deliverables
    - The concurrent engineering processes

A Spectrum of Contemporary Management Systems

- Project Environment
  - Manufacturing
  - Marketing
  - Software Development
  - Field Services

- Mission Specific Project Management Platforms
  - Design for Manufacture (DMF)
  - Just-in-Time (JIT)
  - Continuous Process Improvement (CPI)
  - Integrated Product and Process Development (IPPD)
  - Structured Systems Design (SSD)
A Spectrum of Contemporary Management Systems (cont.)

- Mission Specific Project Management Platforms
  - Rolling Wave Concept (RW), [http://www.project-management-knowledge.com/definitions/r/rolling-wave-planning/](http://www.project-management-knowledge.com/definitions/r/rolling-wave-planning/)
  - Phased-Development (PD)
  - Stage-Gate Processes
  - Integrated Phase-Review (IPR)

Concurrent Engineering – A Unique Project Management Concept

- An extension of multiphased approach to project management
- Overlapped task segments increase the need for strong cross-functional integration and team involvement
- Figure 4.1 Graphical Representation of Concurrent Execution of Project Phases (R&D, Engr, Mfg, Fin, ..., Mktg)
  - Phase 1 – Concept
  - Phase 2 – Development
  - Phase 3 – Production
  - Phase 4 – Rollout
  - Phase 5 – Field Support
Concurrent Engineering – A Unique Project Management Concept

- Table 4.1 Potential Benefits of Concurrent Engineering
  - Better cross-functional communication and integration
  - Decrease time to market
  - Early detection of design problems, fewer design errors
  - Emphasizes human side of multidisciplinary teamwork
  - Encourage power sharing, cooperation, trust, respect, and consensus building
  - Engages all stakeholders in information sharing and decision making

Concurrent Engineering – A Unique Project Management Concept (cont.)

- Table 4.1 Potential Benefits of Concurrent Engineering (cont.)
  - Enhances ability to support multisite manufacturing
  - Enhances ability to cope with changing requirements, technology, and markets
  - Enhances ability to execute complex projects and long-range undertakings
  - Enhances supplier communication
  - Fewer engineering changes
  - High-level of organizational transparency, R&D-to-marketing
Concurrent Engineering – A Unique Project Management Concept (cont.)

Table 4.1 Potential Benefits of Concurrent Engineering

- Higher resource efficiency and personnel productivity; more resource-effective project implementation
- Minimizes “downstream” uncertainty, risks and complications; makes the project outcome more predictable
- Minimize design-build-rollout reworks
- Ongoing recognition and visibility of team accomplishments
- Promote total project life cycle thinking

Society for Concurrent Project Development, www.scpdnet.org
Criteria For Success

- Tables 4.2 Criteria for Successful Management of Concurrent Engineering Projects
  - Up-front planning – allocate sufficient time and resources
  - Identify major task teams, mission, interface at the beginning of project cycle
  - Logics and protocol for concurrent phase implementation
  - Master project plan (top level) covering the whole project life cycle
  - Etc (see page 67)


Defining the Process to the Team

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Defining the Process to the Team

- Each Project Phases or Stages
  - Scope, Objectives, Activities, Deliverables
  - Functional Responsibilities
- Quality Function Deployment (QFD) Matrix
  - The specific cross-functional requirements
  - The methods of work transfer (technology transfer)
  - The stakeholder interactions (capturing and dealing with changes that ripple through the product design process)

Defining the Process to the Team

- Figure 4.2 Quality Function Deployment (QFD) Matrix for defining interfaces
  - 5 x 5 matrix
  - 25 interfaces
    - Arrows – Input/output requirements
    - Personnel Contacts
    - Types and timing of deliverables
  - Upstream phases (design process)
  - Downstream
Strong autonomy of task teams makes system integration a shared responsibility of all team leaders.

Power and resource sharing => sophisticated management style, conflicts and politics.

The focus on process templates (i.e. CE) tends to make project execution rigid.

CE process templates tend to isolate task teams within their program activities.

Objectives focused on phase outputs, such as deliverables, rather than on overall project and mission objectives.

The need for self-directed teamwork limits top-down and central control.

The need to work with incremental, partial inputs and outputs at the task level, makes project planning, measurements, and progress reporting more difficult.

Intricate work processes such as concurrent engineering require additional administrative support, management, and resources.

Implementing and sustaining concurrent engineering requires senior management involvement and support, and long-term organizational commitment.
Understanding the Organizational Components

- Additional Insight
  - Uniform Process Model
    - Primary Benefit
    - Secondary Benefits
  - Integrated Product Development (IPD)
  - Gate Functions
  - Standard Project Management Process
  - QFD Approach
  - Early Testing
  - Total Organizational Involvement and Transparency
Recommendations for Effective Management

**Phase I: Organizational System Design**
- Take a System Approach
- Build on Existing Management Systems
- Custom Design

**Phase II: System Implementation**
- Define Implementation Plan
- Pretest the New Technique
- Ensure Good Management Direction and Leadership
- Involve People Affected by the New System
- Anticipate Anxieties and Conflicts
- Detect Problem Early and Resolve
- Encourage Project Teams to Fine-Tune the Process
- Invest Time and Resources
Recommendations for Effective Management

- Phase III: Managing in Concurrent Engineering
  - Plan the Project Effectively
  - Define Work Process and Team Structure
  - Develop Organizational Interface
  - Staff and Organize the Project Team
  - Communicate Organizational Goals and Objectives
  - Define Work Interface and Effective Communication Channels
  - Ensure Senior Management Support and Leadership
  - Manage Conflicts and Problems
  - Encourage Continuous Fine-Tuning and Improvement

Questions & Summary

- Critical Thinking: Questions for Discussion