CONCURRENT ENGINEERING

Goal: Decrease time to market by shortening life cycle

via

Introduction of customer evaluation and engineering design feedback during product development

A greatly increased rate of focused, detailed technical interchange among organizational elements

Development of the product and creation of an appropriate production process in parallel rather than in sequence

[see Patterson, Systems Engineering Life Cycles, p 100, Sage and Rouse]

CONCURRENT ENGINEERING

INCOSE Conceptualization

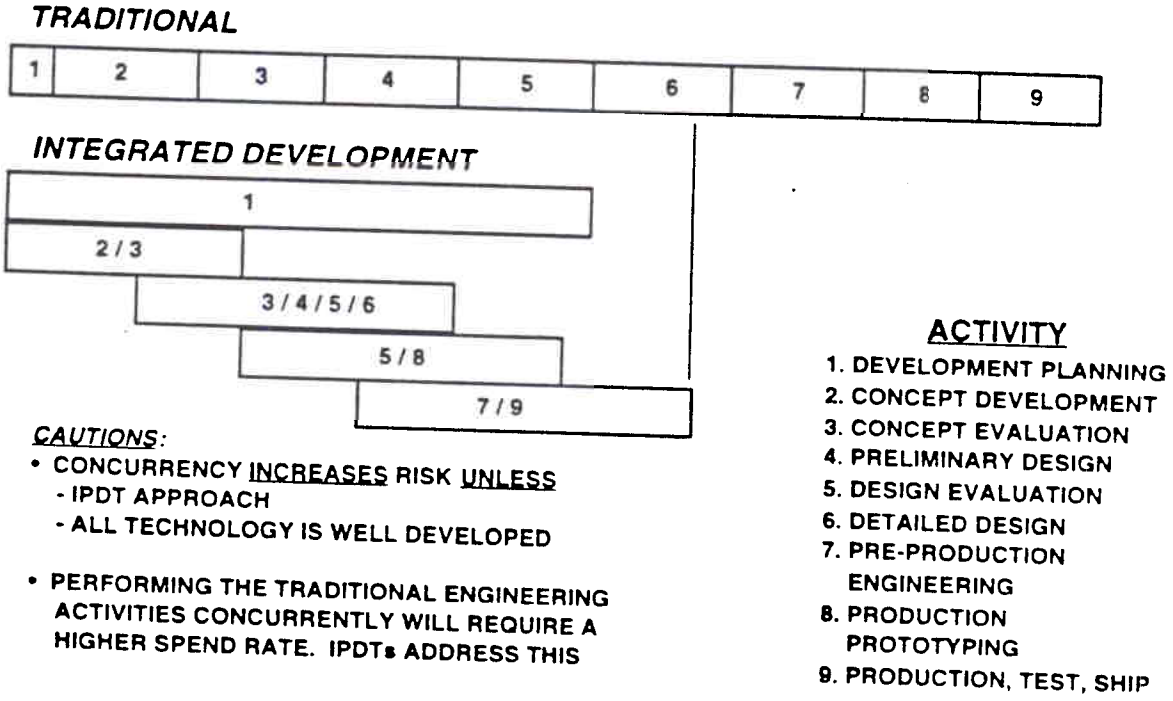

Figure 6-1A Concurrent Development vs. Traditional

[INCOSE, Systems Engineering Handbook, p 6-2]

Concurrent Engineering is:

✔ the practice of considering the entire functionality of the product, as well as its assembly and manufacture, in an integrated design process

[Kusiak and Larson, p 328, Sage and Rouse]

✔ the practice of considering the entire product life cycle, from design to disposal, in an integrated design process

[Kusiak and Larson, p 328, Sage and Rouse]

✔ a systematic approach to the integrated, concurrent design of products and their related processes, including manufacturing and support

[Institute of Defense Analysis, Report R-338]

✔ the simultaneous consideration of product and process downstream requirements by multidisciplinary teams

[NASA Systems Engineering Handbook, p 22]

Concurrent Engineering Benefits:

TABLE 9.1 Benefits of Concurrent Engineering

Performance Measure	Benefit
Development time	30–50% less
Engineering changes	60–95% less
Scrap and rework	75% reduction
Defects	30–85% fewer
Time to market	20–90% less
Field failure rate	60% less
Service life	100% increase
Overall quality	100–600% higher
White-collar productivity	20–110% higher
Return on assets	20–120% higher

Source: Lawson and Karandikar, 1994.

[see Kusiak and Larson, p 329, Sage and Rouse]

Building a CE Environment

Requires integration of:

- **People**
- **Processes**
- **Problem-Solving Mechanisms**
  (i.e., "approaches for solving specific design problems")
- **Information**

[presentation structure used by Kusiak and Larson in Sage and Rouse]

Concurrent Engineering Roadblocks:

1. The currently available tools are not adequate for the new CE environment

2. There are a plethora of noninteroperable computers, networks, interfaces, operating systems, and software in the organization

3. There is a need for appropriate data and information management across the organization

4. Needed information is not communicated across horizontal levels in the organization

5. Correct decisions, when they are made, are not made in a timely manner

[Sage, Systems Reengineering, p 901, Sage and Rouse]

Integrating People

Building CE Teams

(consider conceptual approach in 9.3.1.1)

Negotiation in Engineering Design

Integrating Processes

Process Modeling

Process Reengineering

Integrating Problem-Solving Mechanisms

Requirements Decomposition

Constraint-Parameter Decomposition

(consider conceptual approach in Example 9.6)

Decomposition-Based Design Optimization

Integrating Information

Database Management Systems

Information and Data Modeling

[presentation structure used by Kusiak and Larson in Sage and Rouse]

CE Risk Assessment:

- **What can go wrong?**
- **What is the likelihood that it will go wrong?**
- **What are the consequences?**

TABLE 9.10 Consequences of Concurrent Engineering Risk Factors

Risk Factor	Consequences	Measures of Consequence
Requirements risk	Loss of customer base	Number of customer complaints
	Due date violation	Days past deadline
Technical risk	Poor quality	Number of rejects
		Rework cost
Schedule risk	Additional resource requirement	Days past deadline
	Due date violation	Personnel cost
		Overhead cost
Cost risk	Higher product cost	Sale price of product
		Loss of market share
Network risk	Due date violation	Capital cost
	Information loss	Days past deadline
Redesign risk	Additional design iterations	Personnel cost
	Due date violation	Overhead cost
	Additional resource requirement	Days past deadline
Resource risk	Due date violation	Capital cost
	Additional resource requirement	Personnel cost
		Overhead cost
		Days past deadline
Environmental risk	Pollution	Cleanup expenses
	Negative public perception	Product disposal costs

[see Kusiak and Larson, p 362 and p 364, Sage and Rouse]

Kusiak and Larson CE Implementation:

1. Develop "As-Is" Model
2. Develop "To-Be" Model
3. Identify Performance Measures
4. Monitor CE System

? Sufficiency ?