CALS & Document Imaging

Concurrent Engineering : Implementing Document Distribution

Conference Paper

MICAD ‘92

Jean-Michel Marcastel
Consultant, Litton MC2

Abstract

CALS is the program established by the U.S. DoD to coordinate and accelerate participation by the government and defense industry in a global trend towards more effective use of computer technology in product design, manufacture, and life cycle support. CALS calls for Concurrent Engineering as a means of achieving that goal.

Concurrent Engineering has been defined as "a systematic approach to the integration of design, production and related processes which considers all aspects of a product life-cycle". Concurrent Engineering essentially relies on the sharing of engineering databases and documents.

Documents - whether mechanical or electronic, are still massively produced and manipulated : the publications and documents required for Configuration Management in the aircraft industry are a critical example.

This presentation will discuss the importance of document distribution and management within a concurrent environment : How can Concurrent Engineering be applied to EDP systems ? What is the need and the reality for such an integration ? What is the most realistic approach for implementing an EDP system ? …

About the author

Jean-Michel Marcastel
Consultant, Technical Marketing Manager
Litton MC2, Grenoble, France

Jean-Michel Marcastel has been involved for several years in the design of medium and large electronic document and image management systems. He supports organizations whose core business relies on document processing, helping those professionals to plan and integrate imaging technologies in their existing document processing environment.

Introduction

Today's business problem

February 11, 1992. That is just ten months shy of 1993. Ten prelude months that will usher us into the new European marketplace : the European Economic Community, or ECC. By 1993 all remaining barriers to free trade among the 12 members of the ECC will be removed, making Europe the world's largest single marketplace. The creation of a unified market of 320 million consumers will create significant opportunities for suppliers and consumers alike.

For companies to reach the highest level of competitiveness in this new market, they need to put under detailed scrutiny such requirements as the critical *time to market* and production costs

Figure 1 shows a typical product's life cycle costs from *Market Research* to *Field Service.* This indicates that the major *cost commitment* occurs in the design stage. Improvements in production methods can only marginally alter costs. Thus a critical design decision is the selection of a technology which not only meets the performance and operational criteria but also keeps manufacturing cost commitment within target limits.

The low operating and support costs of the Airbus product has been one of the major marketing assets of the European consortium ever since the early days of the programme.

Figure 1 also illustrates that the critical *time to market* is the sum of the individual function times, if these activities are carried out sequentially. In this conventional sequential approach, the bulk of design mistakes and improvements are detected in production or, worse, in field service ; several change procedure iterations are required before the product reaches a mature steady state. This incures a *cost of quality* (repairs, fixes, replacements, etc.) which cannot be understated.

Concurrent Engineering has been successfully used in aerospace, automotive and computer manufacturing and is now generally accepted as the only way to meet both the commercial and *time to market* criteria.

What is Concurrent Engineering

A generally accepted definition of Concurrent Engineering is : "*a systematic approach to the integration of design, production and related processes which considers all aspects of a product life cycle*".

More colourfully, some describe it as "*the last frontier of competitive advantage in manufacturing*", meaning that the resulting benefit of reduced *time to market* is a critical attribute. However, the effects can be more than that and the Concurrent Engineering process can be summarised as follows :

◊ Effects :

» shorter time to market,
» improved *makability*,
» fewer modifications,
» higher quality,
» less maintenance costs ;

◊ Payoff :

» revenues come in earlier,
» less *cost of quality*,
» more profilt ;

◊ Implementation steps :

» better planning,
» combined use of Information Technologies,
» involvement of people.

The objectives of Concurrent Engineering are :

◊ to ensure that design decisions take account of production methods and quality issues,

◊ to shorten the product introduction lead time by overlapping the design and production engineering functions.

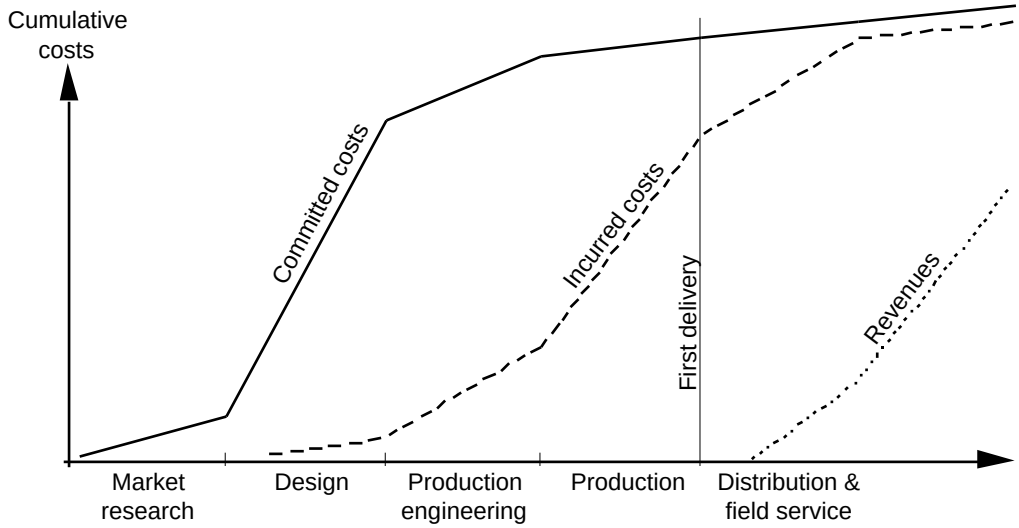


Figure 1. Product life cycle costs

The general principles of Concurrent Engineering are shown in Figures 2 and 3. The main features are the overlapping of activities and the sharing of data which is essentially held in electronic form. Previously these functions were performed serially with many records (eg. *Bill of Materials*) being reconstructed on handover to reflect assembly sequences. Design changes were also requested at a late stage to suit manufacturing processes.

Concurrent Engineering coordinates design and production technical ressources by

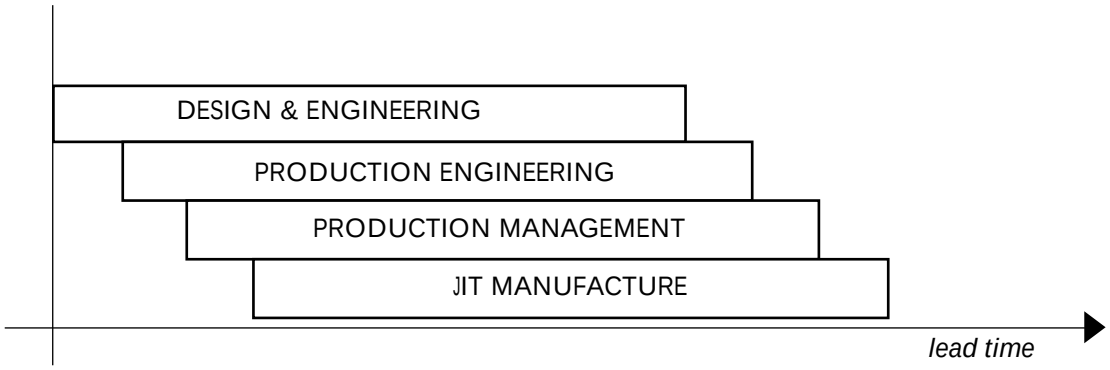


Figure 2. Concurrent Engineering.

designing the production processes at the same time as designing the product itself. Thus everyone's input is considered before the design is finalised and, where possible, the product is designed for manufacture. This concept is not of course new and it has been a desirable objective for many decades. However, what is new, is that modern Information Technology developments have smoothed the way towards a higher degree of integration.

Historically, designers and production engineers spoke subtly different languages which required a *translation* at the design/production interface. However the move towards *paperless* systems means that all information can be carried electronically via interconnected workstations. In such systems, both the design and production engineering functions send and receive data in a common form which, today, is prescribed by international standards.

This basic fact, together with the sheer speed and ease of change provided by electronic transfer makes, for the first time, Concurrent Engineering a practical workable proposition. Additionally, the availability of a common set of electronically held data and documents enables other management functions to be performed with increased efficiency, for instance :

◊ simulation of production processes,
◊ planning of plant layout,
◊ ressource planning,
◊ financial optimisation, and,
◊ progress control of new product introduction.

Concurrent Engineering is thus about technology and people. Systems only work as well as the people who both drive the system and act upon information provided by the system.

During today's presentation, I will desribe an Information Technology in which we, Litton MC2, have specialized for the past 10 years : Imaging Systems allowing for the aquisition, manipulation and distribution of documents and document contents. I will then discuss the implementation of such a technology in a Concurrent Environment. The implementation approach which we will discuss is based on our extensive experience of, and cooperation with, major aerospace companies such as Aerospatial, British Aerospace, Boeing or Deutsche Aerospace.

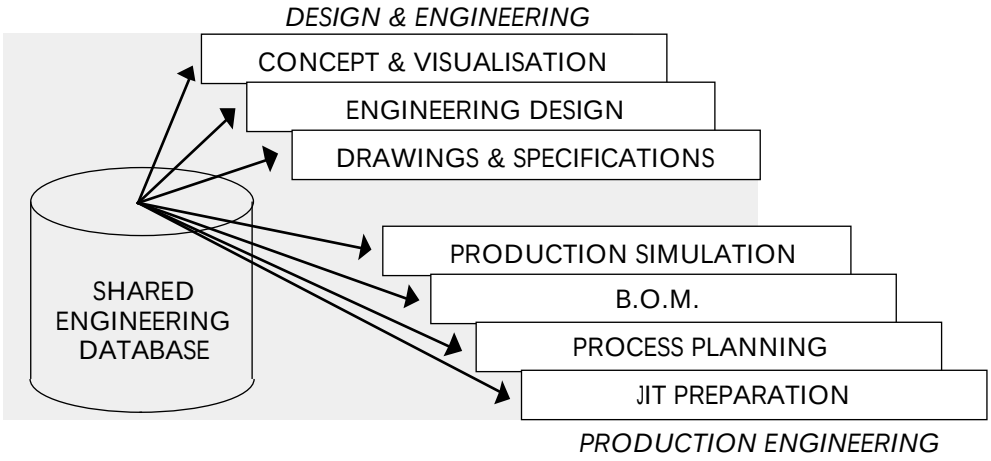


Figure 3. Concurrent Engineering, shared engineering database.

Bibliography

Prelimanary CALS Phase II Architecture, D-779-89-01.2 DACOM
(July 3, 1989)

CALS Phase II CITIS Prelimanary Architecture, D-779-89-01.1, DACOM
(January 31, 1989)

EDI's Role in a Strategy for Digital Data Exchange, EDI subcommittee and MAP/TOP Architecture Committee (March 12, 1990)

Program Implementation Guide, MIL-HDBK-59 (December 20, 1988)

Program Implementation Guide (draft), MIL-HDBK-59A (October 13, 1989)

Automated Interchange of Technical Data, MIL-STD-1840A
(December 22, 1987) [with change notice 1 dated December 20, 1988]

Logistic Support Analysis, MIL-STD-1388-1A (April 11, 1983) [with change notice 1 dated February 9, 1988]

Logistic Support Analysis Record, MIL-STD-1388-2A (July 20, 1984)

Logistic Support Analysis Record (draft), MIL-STD-1388-2B (March 31, 1989)

Digital Representation for Communication of Product Model Data : IGES Application Subsets, MIL-D-28000
(December 22, 1987) [incorporating amendment 1 dated December 20, 1988]

Markup Requirements and Generic Style Specification for Electronic Printed Output and Exchange of Text, MIL-D-28001
(February 26, 1988)

Markup Requirements and Generic Style Specification for Electronic Printed Output and Exchange of Text (draft), MIL-D-28001A
(July 17, 1989)

Requirements for Raster Graphics Representation in Binary Format, MIL-R-28002 (December 20, 1988)

Digital Representation for Communication of Illustration Data : CGM Application Profile, MIL-D-28003 (December 20, 1988)

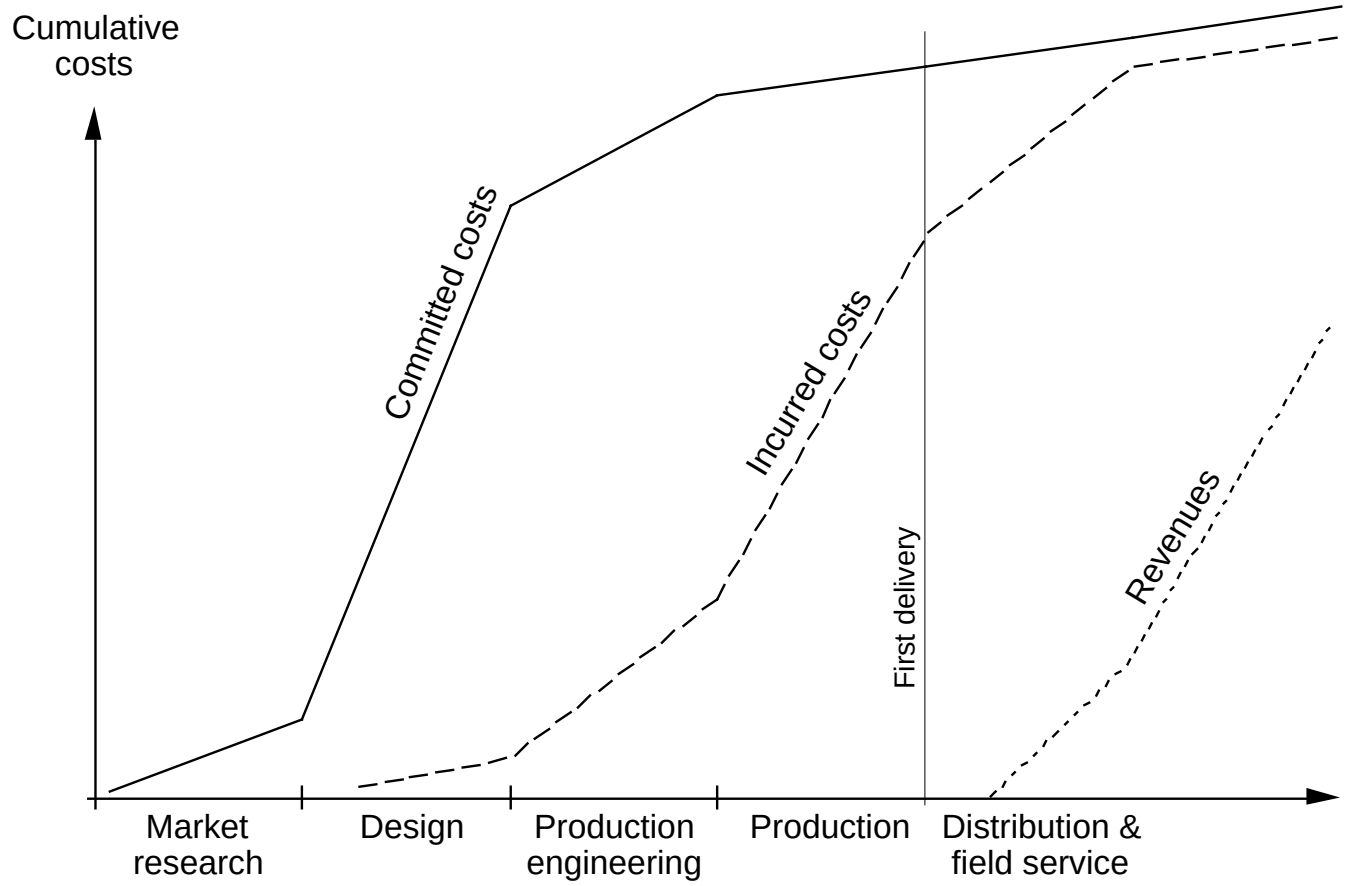
International Specification for Technical Publications, utilising a Common Source Data Base, AECMA 1000D (1989)

International Specification for Materiel Management, Integrated Data Processing for Military Equipment, AECMA 2000M (June 1, 1989)

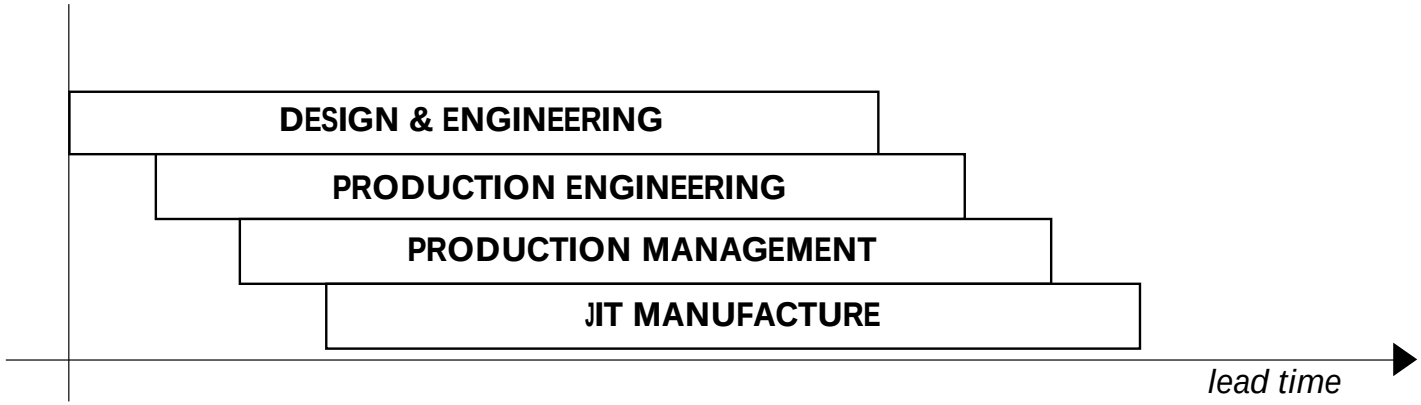
The Role of Concurrent Engineering in Weapon System Acquisition,
IDA report R-338 (December 1988)

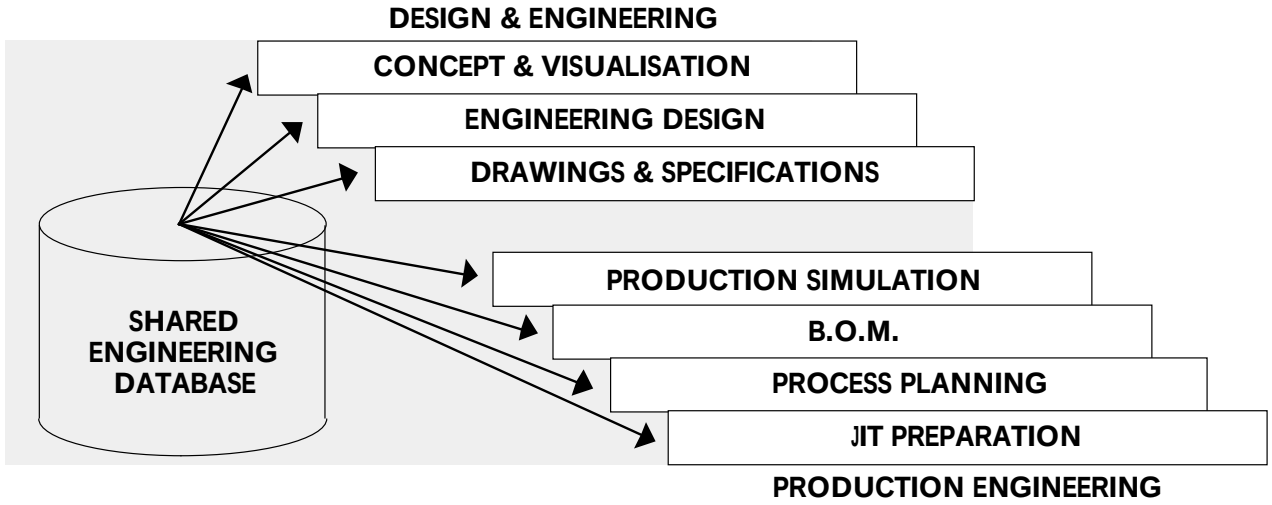
Cost Considerations of an Integrated Design-Manufacturing-Support System, IDA document D-619 (June 1989)

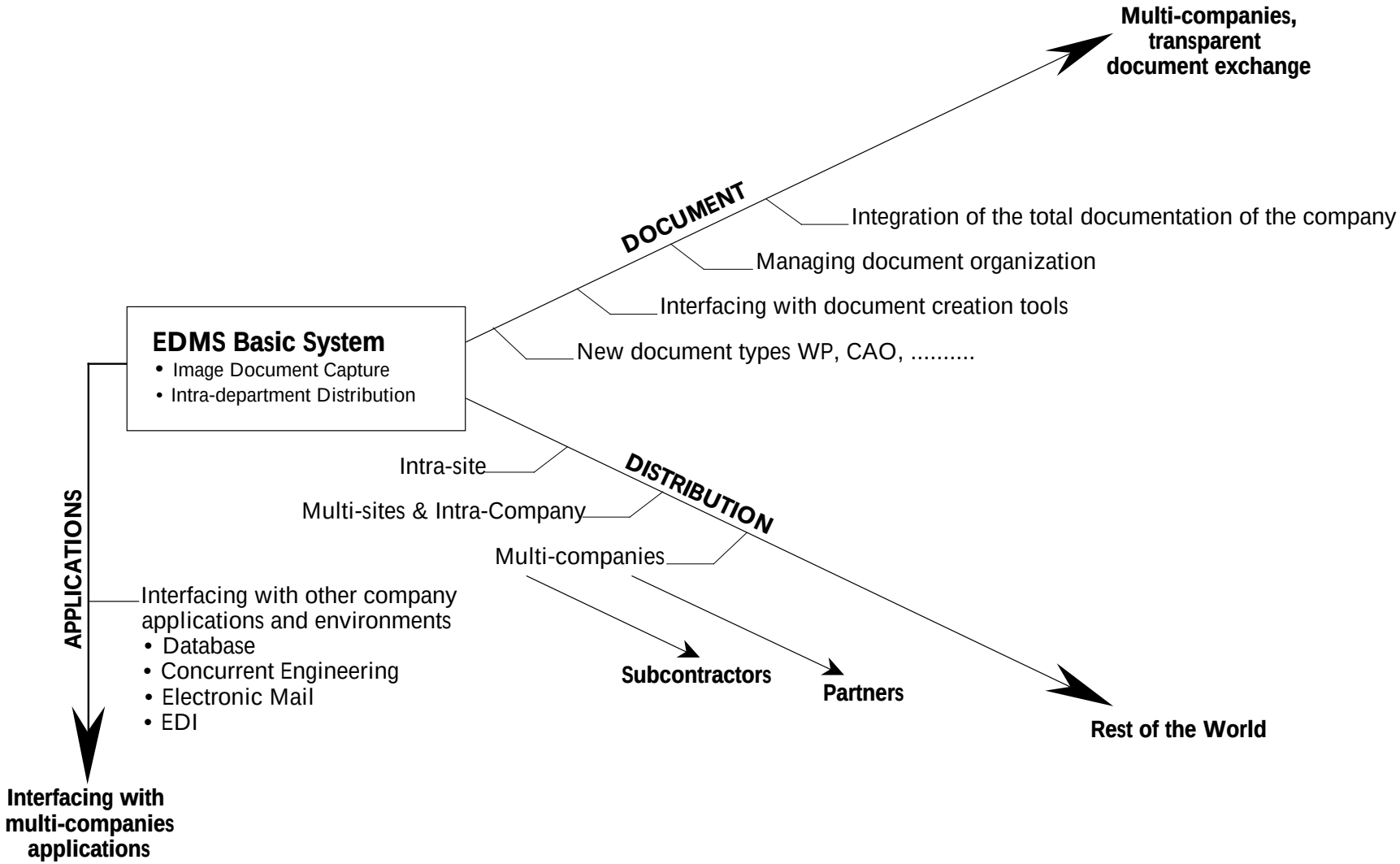
The Relationship between CALS and Concurrent Engineering,
IDA paper P-2306 (March 1, 1990)


Cumulative costs
Committed costs
Incurred costs
Revenues
First delivery
Market research
Design
Production engineering
Production
Distribution & field service

Concurrent Engineering is “a systematic approach to the integration of design, production and related processes which considers all aspects of a product life cycle“.


DESIGN & ENGINEERING
PRODUCTION ENGINEERING
PRODUCTION MANAGEMENT
JIT MANUFACTURE
lead time


DESIGN & ENGINEERING
CONCEPT & VISUALISATION
ENGINEERING DESIGN
DRAWINGS & SPECIFICATIONS
SHARED ENGINEERING DATABASE
PRODUCTION SIMULATION
B.O.M.
PROCESS PLANNING
JIT PREPARATION
PRODUCTION ENGINEERING


Multi-companies, transparent document exchange
DOCUMENT
Integration of the total documentation of the company
Managing document organization
Interfacing with document creation tools
New document types WP, CAO, ...
EDMS Basic System
• Image Document Capture
• Intra-department Distribution
DISTRIBUTION
Intra-site
Multi-sites & Intra-Company
Multi-companies
Subcontractors
Partners
Rest of the World
APPLICATIONS
Interfacing with other company applications and environments
• Database
• Concurrent Engineering
• Electronic Mail
• EDI
Interfacing with multi-companies applications