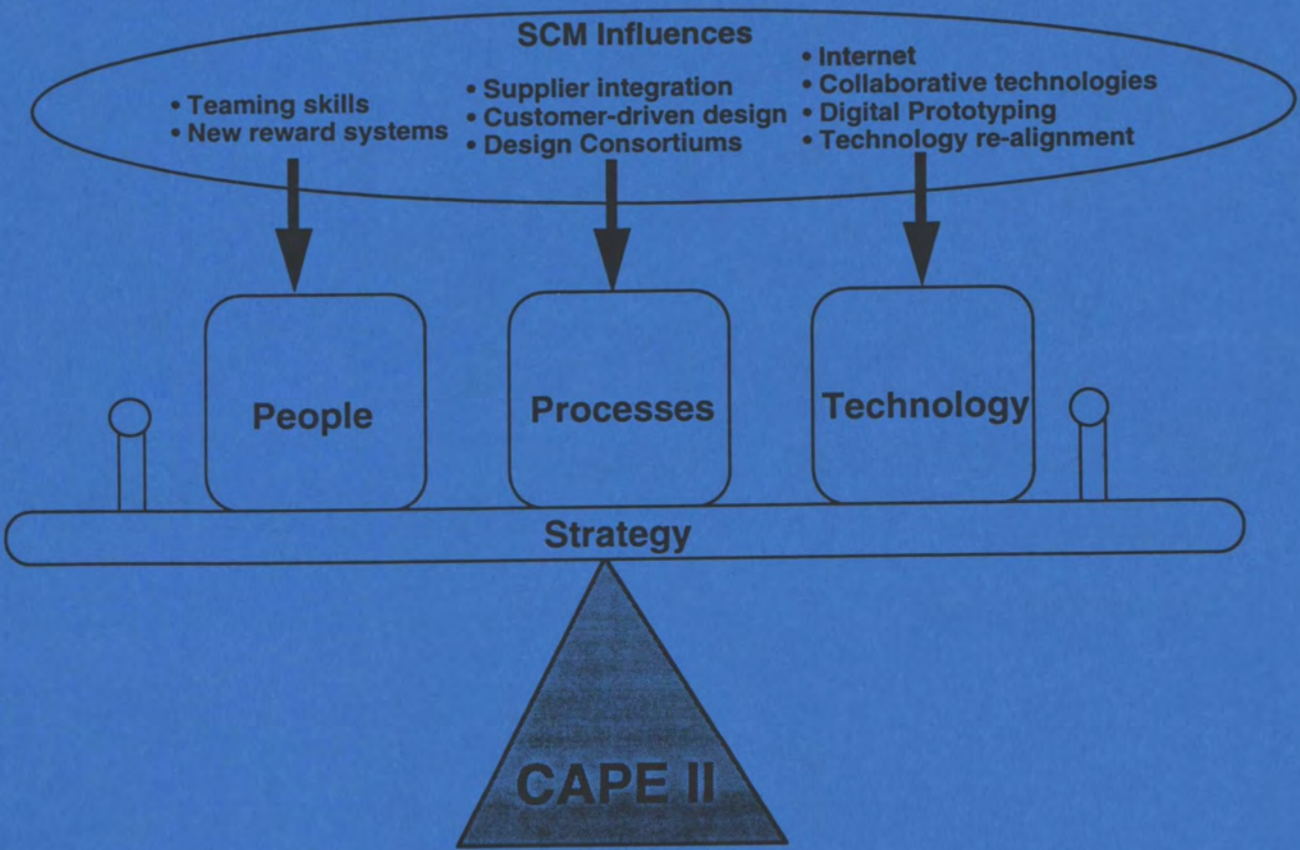
Bijlagen CV Userconference
d.d. 16 t/m 18 september 1996
te St Louis



Datum : oktober 1996
Rapportnr : BSW/96-39
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Frans van Dam, Jaap Brantenaar
Status : Concept versie 1

Bijlage 1

Sheets voordracht EPD (Electronic Product Definition)
door Computervision

Computervision's EPD Oriented Product Strategy

CUG/MSKEW.9/96p2

COMPUTERVISION

THE PARTNER OF CHOICE

↓

Electronic Product Definition (EPD)

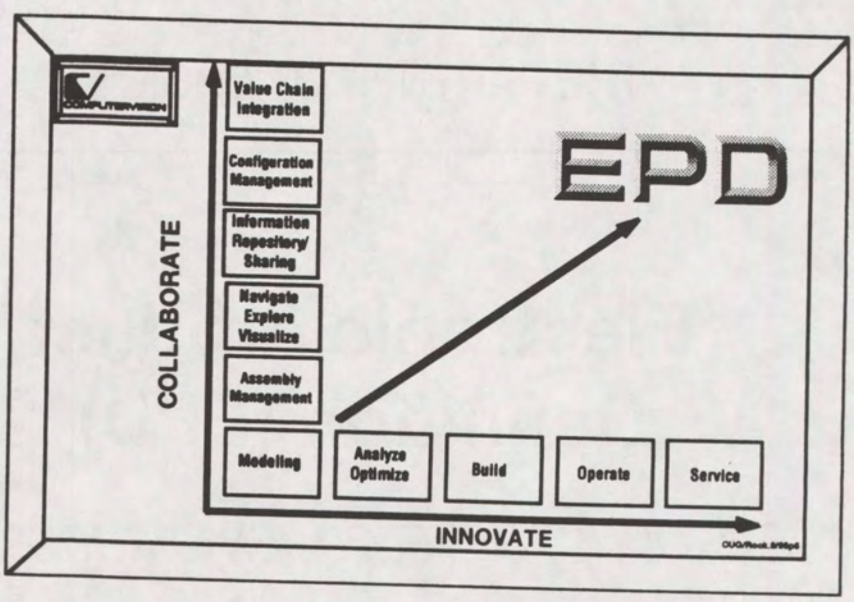
THE PRODUCT DEVELOPMENT PROCESS OF CHOICE

CUG/MSKEW.9/96p4

Summary

- EPD is a key Computervision difference
- Our product strategy is sharply focused on EPD implementation
- Today's products provide compelling support for EPD
- CV will remain at the forefront of next generation EPD oriented product development

CUG/MSKEW.9/96p21



EPD driven Dimension III

- Continue supporting customers
- Demonstrate Open EPD desktop access via Explorer interface
- Manage with Optegra

EPD Driven DesignPost Development

- Enable support for Open EPD Desktop
- Implement next generation EPD drafting, diagramming
- Provide Windows , NT upgrade path to Personal Designer users
- Ultimately a new generation of EPD life-cycle applications
  - object oriented
  - assembly centric
  - behavioral

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EPD driven CADDS 5 development

- Improve Integration with Optegra
  - CAMU/ Navigator/ CM integration
- Support within Open EPD Desktop
- Continue with Revisions 6.0, 7.0, 8.0....functionality enhancements
- Leverage CAMU based assembly centricity in more applications
  - NC, drafting, kinematics, routed systems
- Make CADDS 5 more widely accessible
  - NT platform
- Additional industry specific content

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EPD driven Medusa development

- Integrate with Optegra
- Medusa- CADDS interface
- Support implementation within Open EPD Desktop
- Enhance in line with customer demands and priorities
- Broaden applications making use of new GUI
- Windows NT

Today's products and their sweet spots - Managing

- Optegra CM : Configuration Management- the Backbone for EPD
- Optegra Vault : Secure information hub for EPD

EPD driven Optegra development

- Focus on four key application areas under common look and feel
  - Configuration Management
  - Parts and Product Classification
  - Document Management
  - Workflow
- Architecture
  - Object Oriented Data Model - based on CORBA II
  - Message passing framework to support legacy apps
  - Internet and JAVA support
- Become framework for supporting Open EPD Desktop

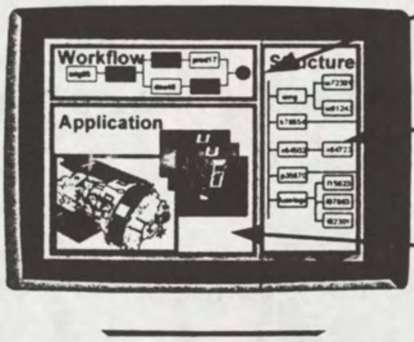
Today's products and their sweet spots - Authoring

- CADDS 5 : An EPD "Modeler of Choice"
- MEDUSA : Production Drafting for EPD
- DesignPost Drafting, P&ID: Next Generation EPD life-cycle applications
- Dimension III: Electronic Process Plant Definition
- Personal Designer: MS-DOS based low end modeling, drafting, NC

Today's products and their sweet spots - Sharing

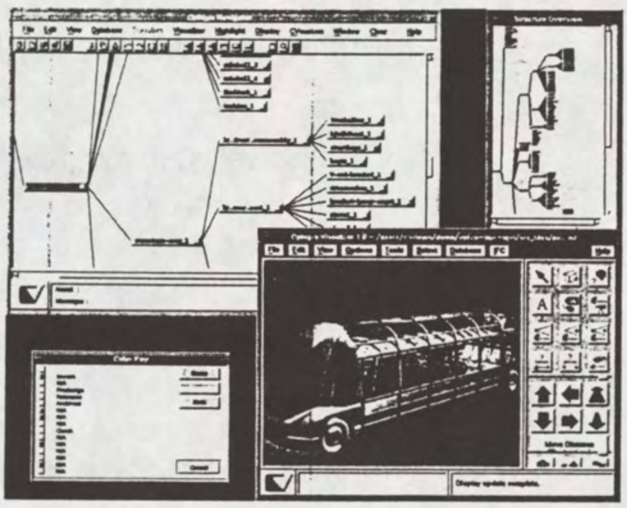
- Optegra Workflow : Process Structure for EPD
- Optegra Navigator : Product Structure for EPD
- Optegra Explorer : An Intelligent "Electronic Microfiche" for EPD

Open EPD: A Vision for the Desktop



- ***Process Strutcture***
- ***Product Structure(s)***
- ***Multi-vendor Life Cycle Application(s)***
  - *Document Authoring*
  - *Modeling*
  - *Visualization*
  - *Analysis*
  - *BOM*
  - *NC...*

Examples today



- **Explorer - Visualization + product structure**
- **CAMU - Product modeling + product structure**

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Fundamental Principles

- Products should evolve as a consequence of EPD
- Openness to other vendors' products
- Partnership: A key to achieving the complete solution
  - With customers
  - With "Best-in-Class" vendors
- Reduce cost of ownership
  - Windows NT

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EPD on NT

- Currently Available

  EDM Vault

  Locator

  Navigator

  Workflow Client

  DesignPost Drafting

  Scan/Full Text Retrieval

- Planned for Year-End

  Distributed Vault

  Explorer

  Medusa NG (2D)

- Planned for Release H197

  Optegra

  - Client /Server - CM, Workflow, Vault

- Planned for Release H297

  CADDS 5 Parametric Modeling and Detailing

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How Does EPD Impact Companies?

- Enables product developers to optimize creation of product data for their own needs
- Enables other company functions to obtain better, complete and up to date product information in usable formats
- Enables product buyers and operators to access product information to support ongoing operation of products

All the above provide key competitive advantages to our customers

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CV: Delivering Open EPD

EPD

Tools to *Author* Information
- Conceptual Designs
- Simulations
- Models
- Drawings
- Documents
- Plans
- BOMs

Tools to *Share* Information
- Navigate, Explore, Query
- Interoperable
- Open
- Assembly-Centric
- Workflow
- Legacy Data

Tools to *Manage* Information
- Information Hub
- Secure
- Access
- Leverage Product Information Throughout Its Life Cycle

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What is EPD?

Computervision's product and process response to the customer need to concurrently create, manage, share, and reuse electronic product information in a collaborative environment:

- Throughout a Product's Life Cycle
- Across a Distributed Value Chain

EPD Turns Product Information and Life-cycle Processes into Leveragable Business Assets

CUG/MSKEW.9/96p5

Bijlage 2

Sheets voordracht toekomstvisie Gartner

How can enterprises design a strategy that continuously maximizes product development competitiveness?

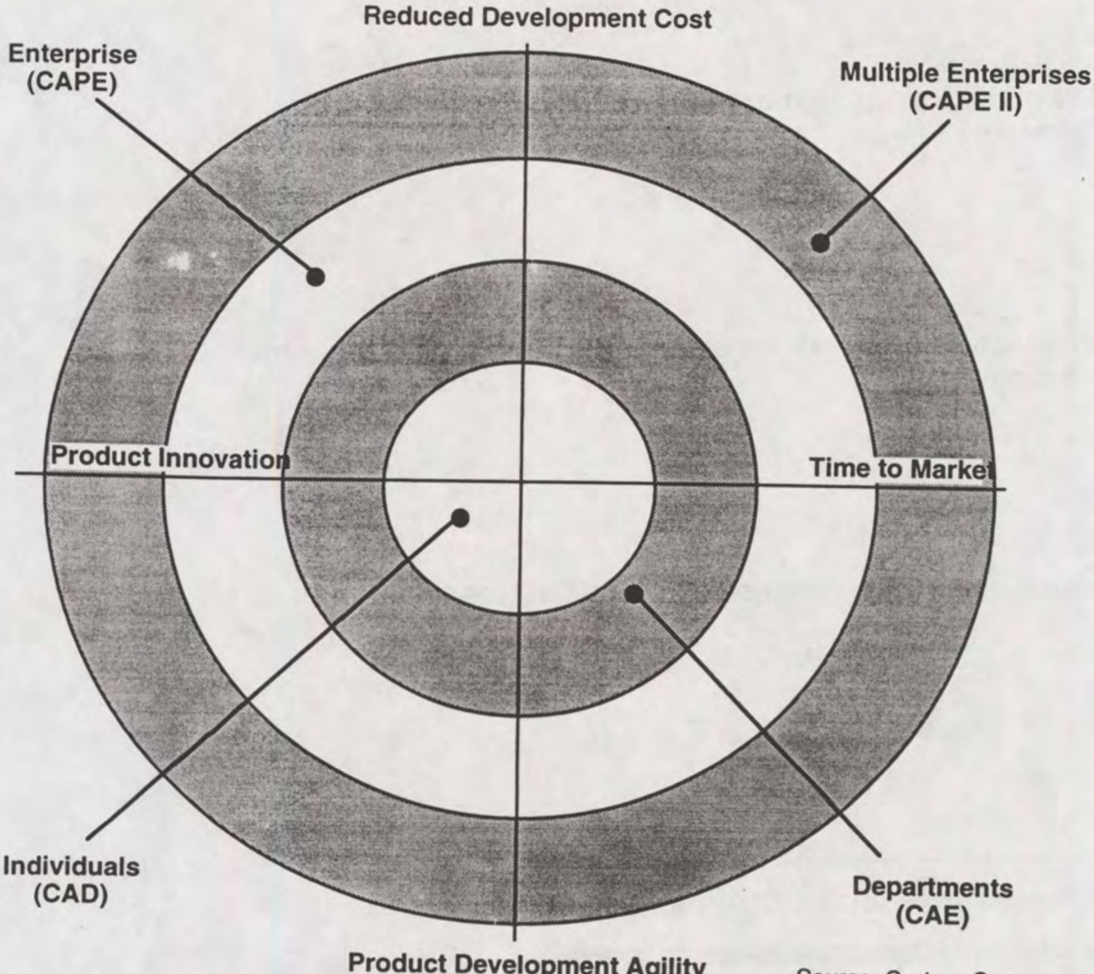
What new CAD/CAM/PDM technologies will emerge during the next three years that will impact CAPE strategies?

What are the key opportunities and challenges in forging the transition to CAPE systems?

CAPE: Concurrent Art-to-Product Environment

How can enterprises design a strategy that continuously maximizes product development competitiveness?

Reader Notes

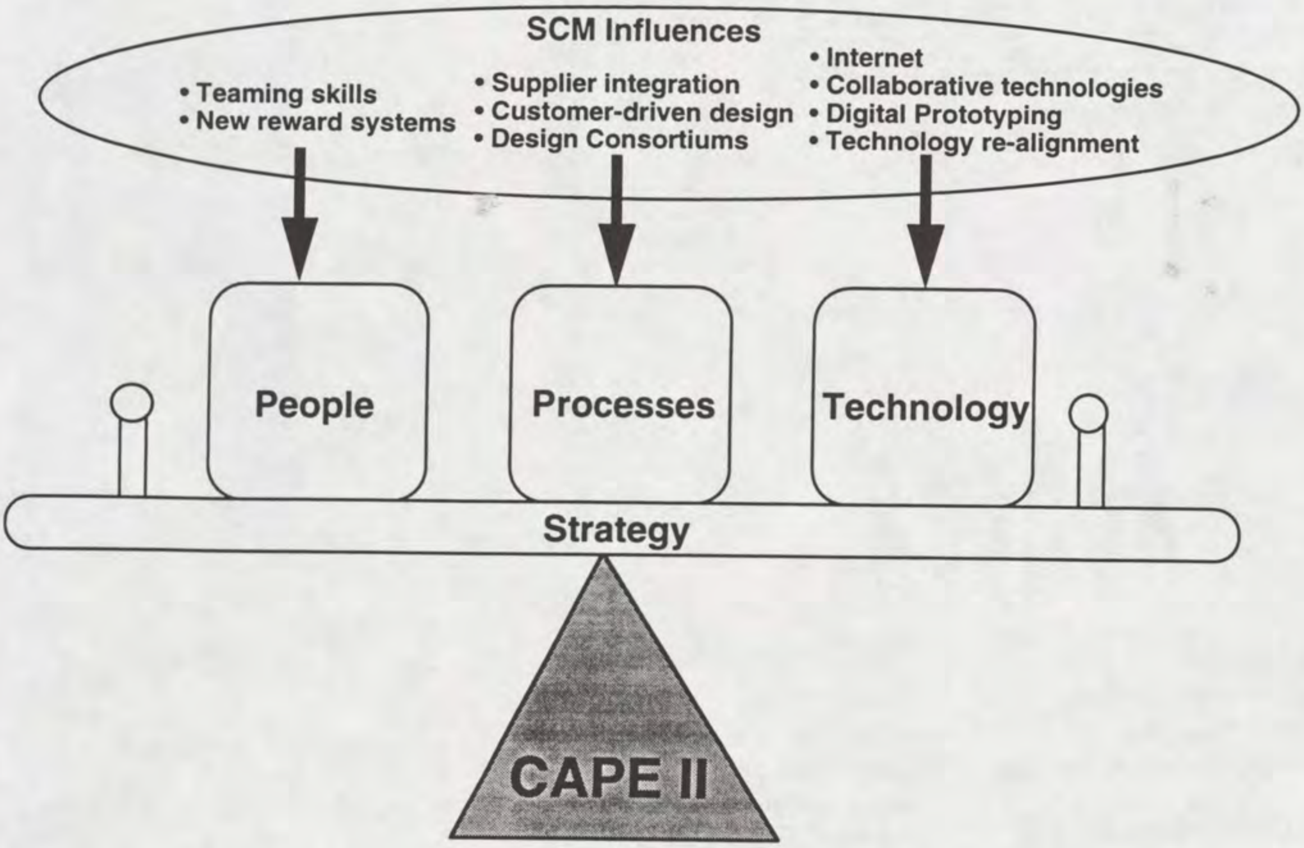


Source: Gartner Group

<u>Imperative:</u> The fourth wave of product development competitiveness (CAPE II) requires widening and integrating the collaborative design process beyond the bounds of the corporation.

To implement and effective CAPE strategy, people, processes and technologies must be brought into balance and alignment.

Reader Notes



Source: Gartner Group

Key Issue: How can enterprises design a strategy that continuously maximizes product development competitiveness?

Expanding the process of engineering across the supply chain will alter the strategic framework of product development by influencing the three fundamental aspects of people, processes and technologies. While the underlying issues with each of these fundamental aspects require specific actions, it is important to address these changes collectively. In other words, to construct a flexible and responsive enterprisewide design system, people, processes and technologies have to be brought into alignment and balance. In the past, for example, many users have been frustrated with the limited returns of CAD technology because the technology was installed and implemented on top of an older, suboptimal design processes. Thus, the process was out of balance with the technology, causing the system to fail in realizing its potential. Conversely, in other cases, users have embarked upon ambitious process re-engineering efforts but failed to gain substantial benefits because the technology was ill-suited to meet the demands of a streamlined, collaborative design process. In order to achieve CAPE II, all three aspects must be fully addressed with a cohesive, strategic plan that extends beyond a technology and includes a supply chain-centric view of the overall process.

Reader Notes

To properly align the people element of a CAPE product development strategy an individual's team skills and technology competency must be valued and rewarded as highly as engineering know-how and creativity.

Product Development Creator Evolution

	< 1960s	1970s	1980s	1990s
Period Name	**Drafting**	**CAD**	**CAE**	**CAPE**
Design information creators	Dedicated draftsmen	Dedicated CAD operators	Engineering departments	Multi-Enterprise • Suppliers • Engineering • Manufacturing • Purchasing • Sales & marketing • Customers

Old Reward Metrics

- **Years of design experience**
- **Number of new designs**
- **Number of engineering drawings**
- **Number of ECO's processed**
- **Design know-how**
- **Internal collaboration**

New Reward Metrics

- **Technology competency**
- **Amount of design re-use**
- **Speed of creating complete engineering models**
- **Fewest ECO's required**
- **Process know-how**
- **External collaboration**

Source: Gartner Group

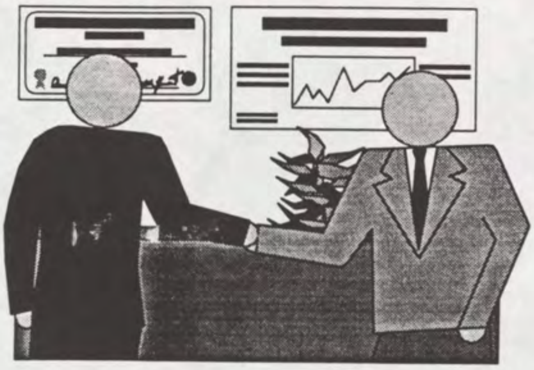
Key Issue: How can enterprises design a strategy that continuously maximizes product development competitiveness?

CAPE involves a fundamental shift in the usage character and underlying design process. In the 1970s and 1980s, CAD was deployed as a tool for dedicated draftsmen and engineering professionals. In the 1990s, CAPE systems will be used by *all* individuals involved with the creation and communication of design intent, including engineering, manufacturing, quality, purchasing, sales, marketing, suppliers and even customers. The focus will broaden from the historically narrow premise that product design starts and ends with the engineering department, to the more modern, realistic viewpoint that engineering is a multi-enterprise activity involving the contribution of many people with diverse skill sets. This requires the adoption of a new set of incentives, rewards and technology literacy programs aimed at continuously modernizing and upgrading the technology and interpersonal skills of the entire team.

Action Item: Recast reward systems to encourage team members to aggressively exploit technology, encourage teamwork and leverage existing design know-how.

Reader Notes

The movement from passive to active design relationships during the next five years will become a primary consideration for two-thirds of all companies when selecting which brands of CAD technology to adopt or avoid (0.8 probability).



Active Relationship ↑ … ↓ **Passive Relationship**

High Technology Alignment ↑ … ↓ **Low Technology Alignment**

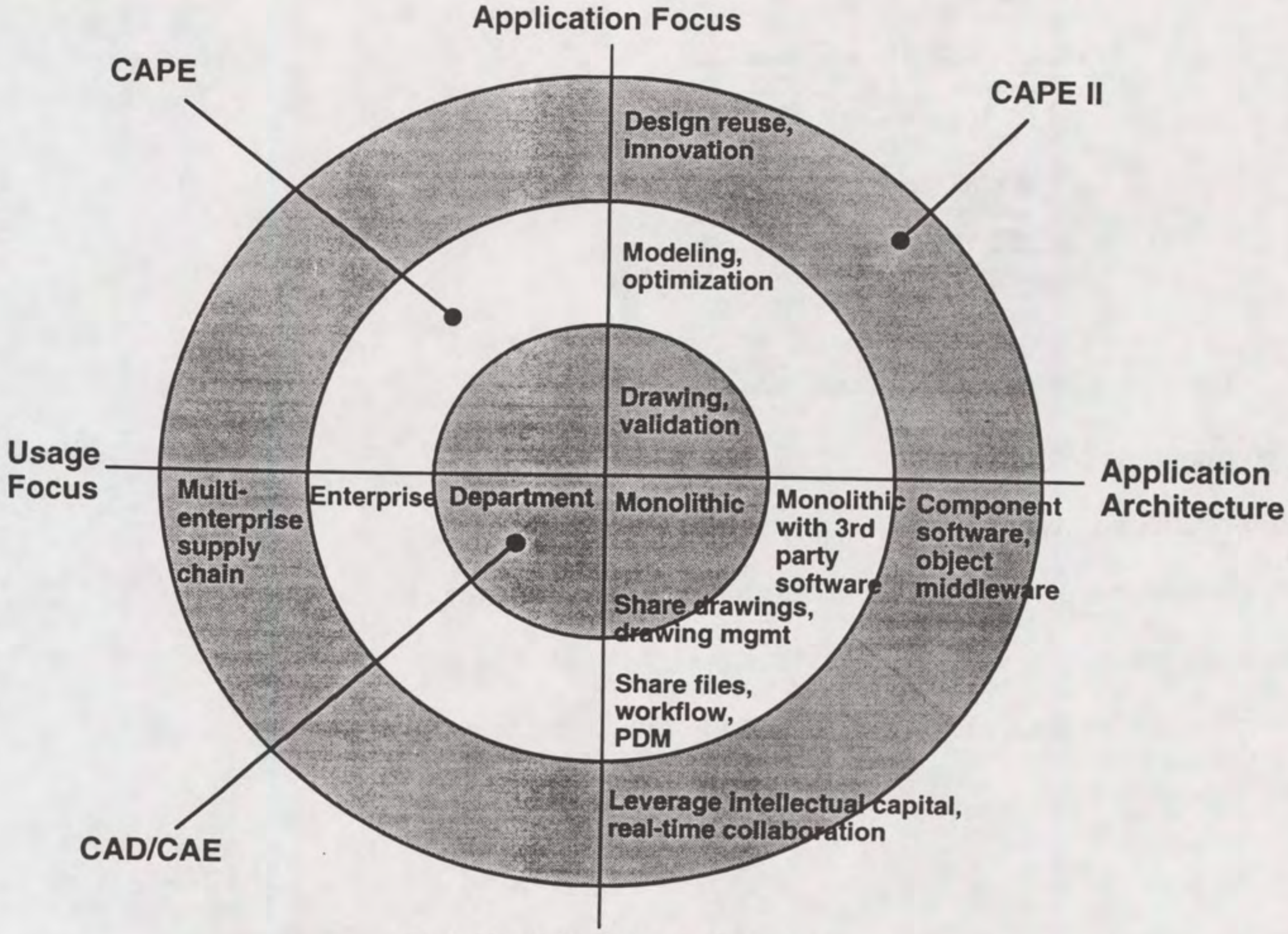
Design business relationship	Example
Share product equity	Airbus
Share product development risk	Fabless semiconductor companies
Process collaboration	Concurrent engineering
Preferred supplier status	Automotive tiered supplier programs
Share design files	EDIF, IGES, STEP

Key Issue: How can enterprises design a strategy that continuously maximizes product development competitiveness?

Supply chain centric product development will reshape the fundamental business relationships established between contractor and supplier. Increasingly, channel masters (e.g. contractors) are encouraging suppliers and sub-contractors to work in a more proactive fashion during design. This will extend beyond current preferred supplier programs and include a tighter process coupling along with risk sharing. Examples include concurrent engineering programs, manufacturing consortiums and design consortiums. The move to proactive business relationships will put increasing pressure on suppliers to more fully align technologies and business practices with those of the channel masters they serve.

What new CAD/CAM/PDM technologies will emerge during the next three years that will impact CAPE strategies?

Reader Notes

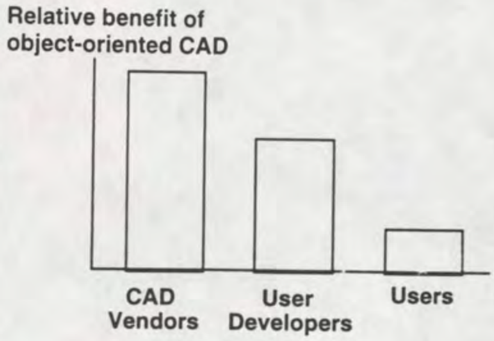


Source: Gartner Group

Significant *user* benefits of object-oriented CAD won't be widely realized until 1998 (0.7 probability).

Question: What *is* object oriented CAD?

- **a) Applications written using classes, inheritance and polymorphism**
- **b) C++ development environment**
- **c) OLE or CORBA middleware**
- **d) Dynamic link libraries**
- **e) Graphical user interface widgets**
- **f) Any new CAD software program**



Question: What *is the object* of object-oriented CAD?

Will it make applications:	Today	Future (2 to 5 years)
More powerful?	No	Yes (0.7 probability)
Faster	No	No (0.8 probability)
More interoperable?	No	No (0.6 probability)
Less expensive?	Yes	No (0.8 probability)
More user customizable?	No	Yes (0.8 probability)
Easier to embed proprietary know-how?	No	Yes (0.7 probability)

Source: Gartner Group

Key Issue: What new CAD/CAM/PDM technologies will emerge during the next three years that will impact CAPE strategies?

The key strategic user benefit of OO CAD is derived from the ability to more effectively tailor and extend generic CAD technology to achieve competitive advantage. However, because of functional limitations, lack of OO standards and system immaturity, users will be hard pressed to reap the benefits of object oriented CAD before 1998 (0.7 probability). Users should be following and experimenting with OO CAD technologies but not consider pure OO approaches as a viable mainstream, CAPE solution framework for several years. User developers and third party software vendors should be preparing for the OO CAD evolution (not revolution) by adding domain expertise in OO technology development and actively engaging in technical discussions and exchanges with the CAD vendors to understand the technical direction and timing of the OO transition.

The move to object oriented CAD will bring major benefits in providing a richer user development environment but will not be fully exploited without significant re-training.

Reader Notes

More user customizable?

	Legacy CAD	Object CAD
Customization environment	CAD Macros, 3GL API	Object API, Class Libraries
Degree of application access/ exposure	Limited	High
Dynamic link libraries	No	Yes
Ability to extend CAD data structure	None	Partial
PC application interoperability	Limited	Moderate

Source: Gartner Group

Key Issue: What new CAD/CAM/PDM technologies will emerge during the next three years that will impact CAPE strategies?

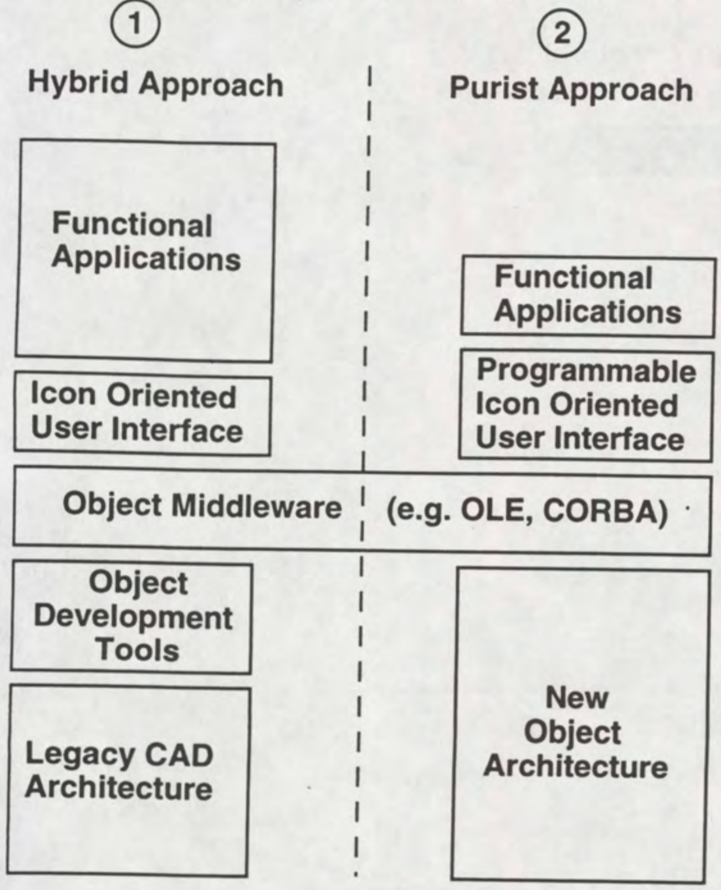
Strategic Planning Assumption ,

CV User Group

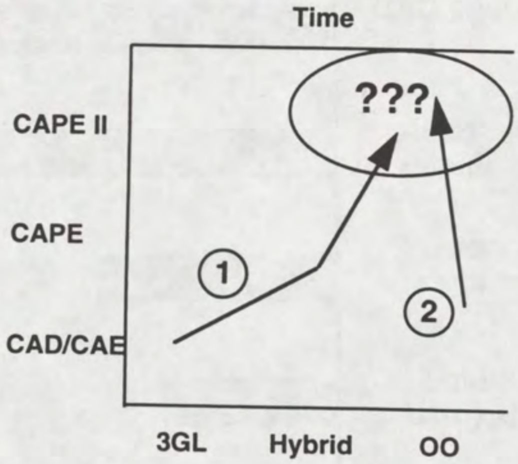
The tradeoff of greater CAD functionality found in hybrid OO architectures versus the flexibility and extensibility of pure object architectures will continue to hamper application selection until 1998 (0.7 probability).

Reader Notes

CAD Object Architectures



CAD Object Architectures

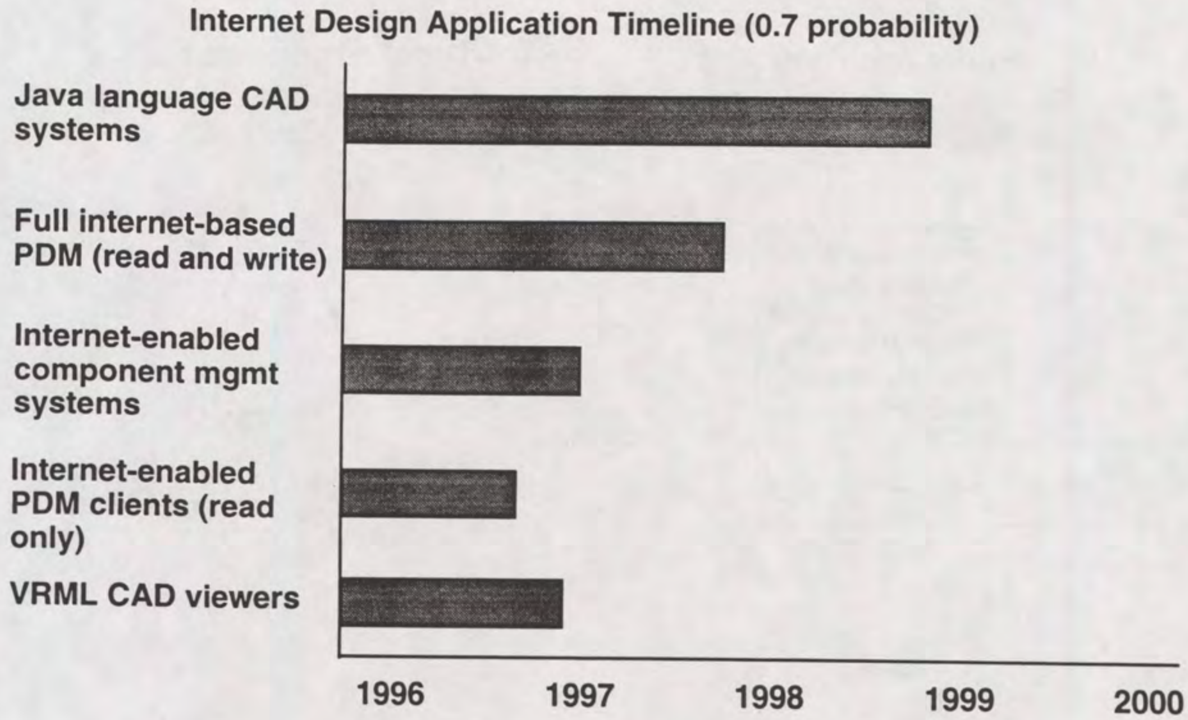


Source: Gartner Group

Key Issue: What new CAD/CAM/PDM technologies will emerge during the next three years that will impact CAPE strategies?

Internet compliant design technologies will become widely available during the next three years but will not create an architectural dislocation in today's current design systems (0.6 probability).

Reader Notes

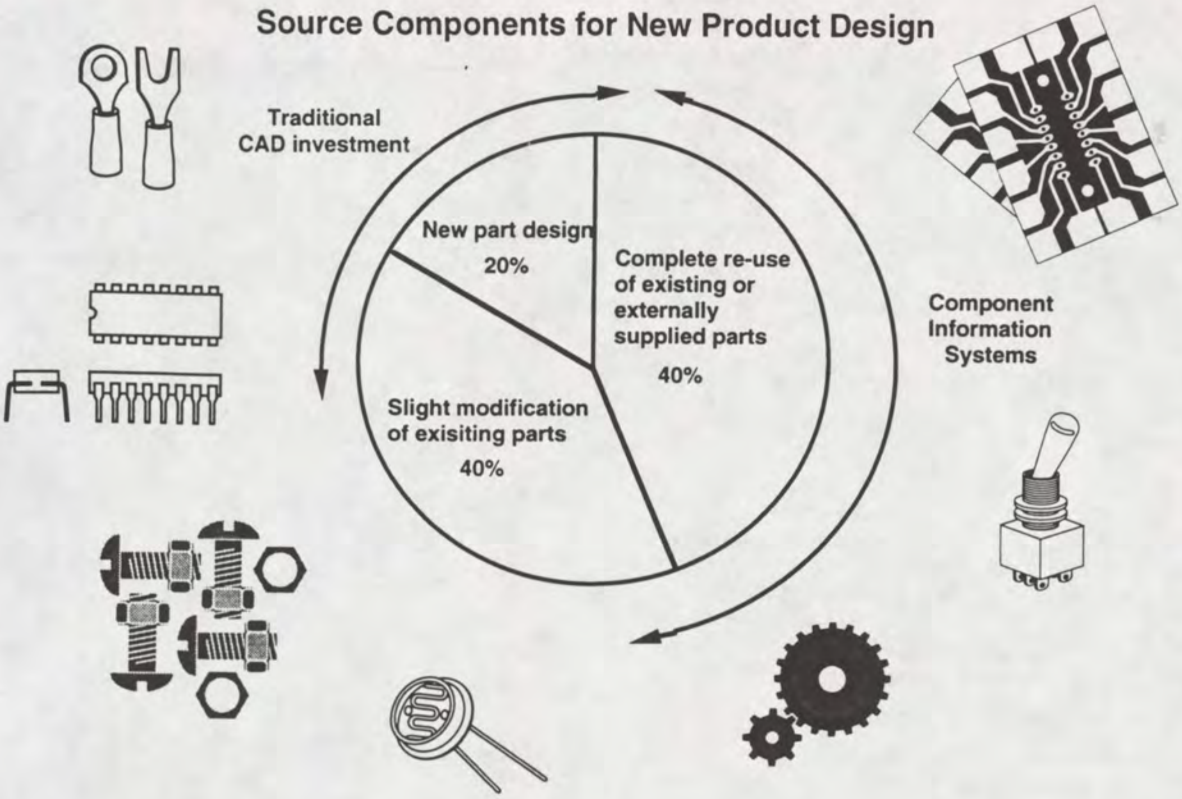


Source: Gartner Group

Key Issue: What new CAD/CAM/PDM technologies will emerge during the next three years that will impact CAPE strategies?

Internet-based technologies will have a profound effect on design applications during the next several years. A key positive aspect of the move towards internet-enabled technologies is that it will not require a fundamental rearchitecture of current CAD technologies (0.6 probability). Instead, the internet will serve as a companion architecture that will improve many of the collaborative aspects of CAD systems. Over the next two years, VRML (Virtual Reality Markup Language) CAD viewers, internet PDM clients and internet-enable component information systems will emerge (0.7 probability). Over the next three years and beyond, full PDM systems based solely on internet web servers and CAD systems built with Java language applets will be common. Users should be examining their design technology portfolio and structure a plan that allows for full internet-enabled design collaboration over the next three years.

Product development budgets will increase spending on design re-use technology investments from 10 percent to 40 percent during the next three years (0.7 probability).



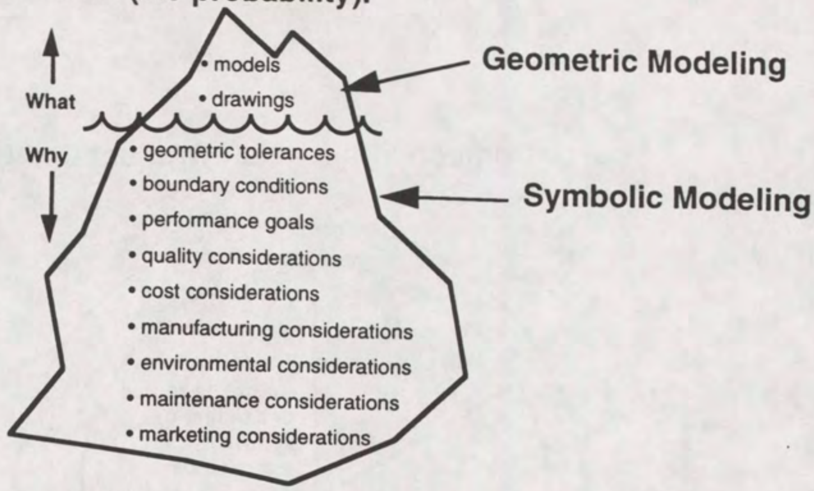
Source: American Machinist

Key Issue: What new CAD/CAM/PDM technologies will emerge during the next three years that will impact CAPE strategies?

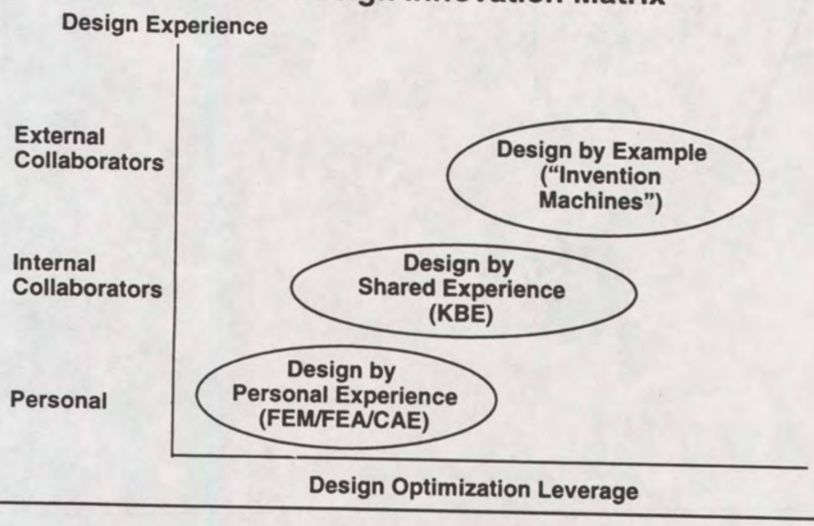
Design retrieval and re-use is an underdeveloped aspect of most engineering system strategies, but represents a key capability for achieving enterprise leverage by enabling greater reuse of existing design information to create new products. Currently, PDMs can accommodate the manual entry of generic attribute information to describe a component's form, fit and function. This form of design information capture is problematic because it is time consuming and error prone. Several niche specialty vendors such as Aspect and Cadis have developed component information systems that allow users to leverage external components and parts into product designs. These systems are also being integrated into common PDM technologies. A major area of opportunity lies in automatically creating part retrieval attributes by extracting design features directly from the CAD model. Users should be driving their vendors toward this capability by insisting on open access to model feature information. Also, users should consider the creation of a re-use administrator position and re-cast engineering merit systems to emphasize re-use opportunities.

Symbolic modeling and "design by example" tools will become available during the next two years allowing companies to build a framework for increasing design innovation (0.6 probability).

Reader Notes



Design Innovation Matrix

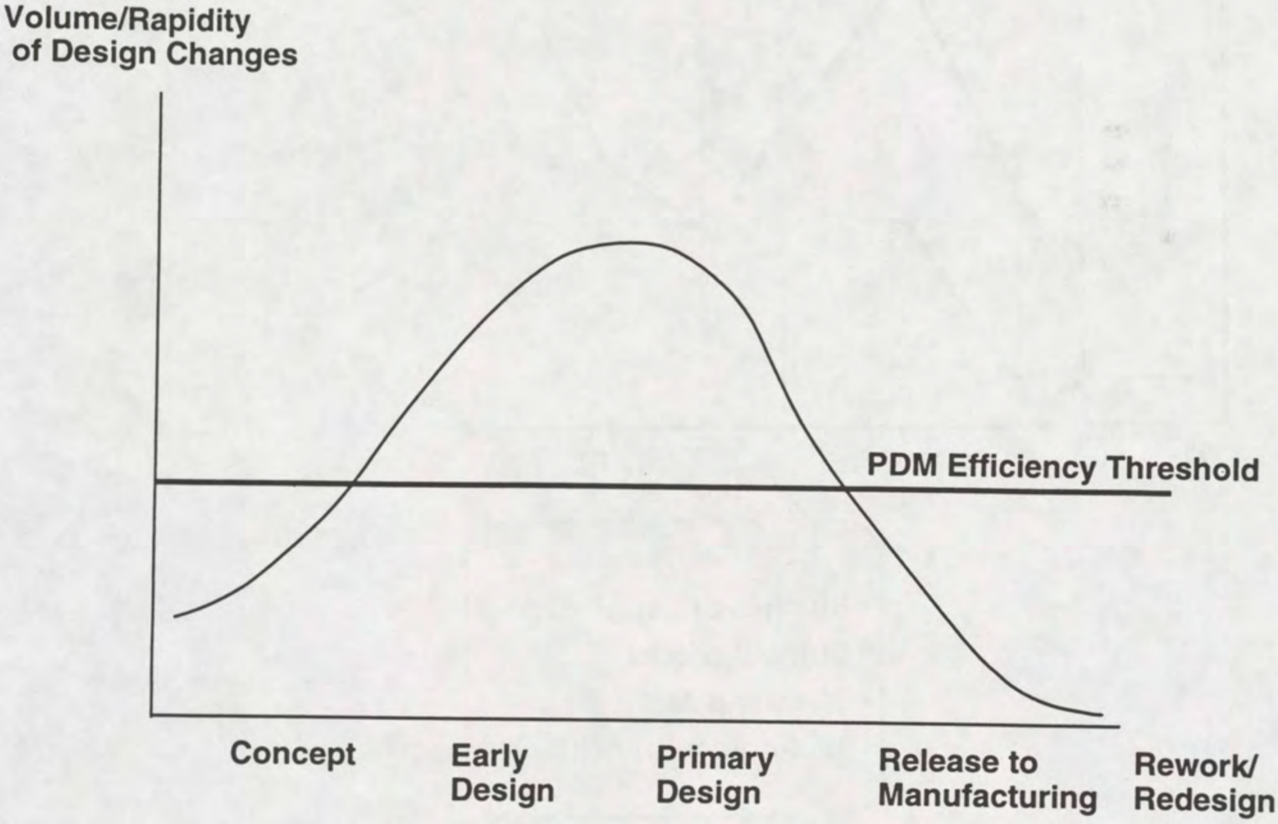


Source: Gartner Group

Key Issue: What new CAD/CAM/PDM technologies will emerge during the next three years that will impact CAPE strategies?

Current generation client-server PDM systems are well positioned to solve stable, well behaved, serial engineering and manufacturing process problems but are ill equipped to serve as the informational backbone for the increasingly chaotic, and hyper collaborative activities required for next generation product development (0.8 probability).

Reader Notes



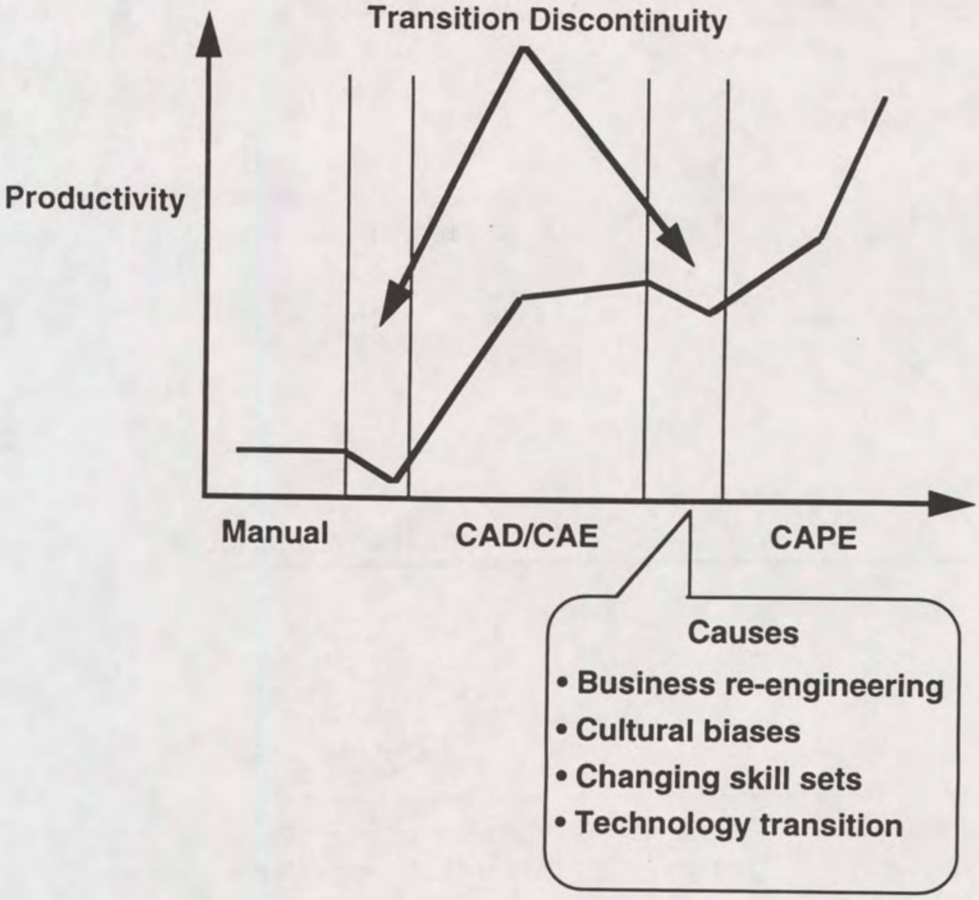
Key Issue: What new CAD/CAM/PDM technologies will emerge during the next three years that will impact CAPE strategies?

Strategic Planning Assumption:

By 1999, a new breed of agent-based PDM systems using a publish/subscribe architecture will emerge (0.7 probability).

What are the key opportunities and challenges in forging the transition to CAPE systems?

Reader Notes

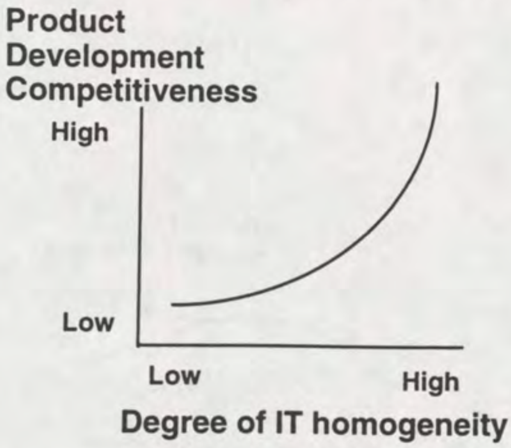


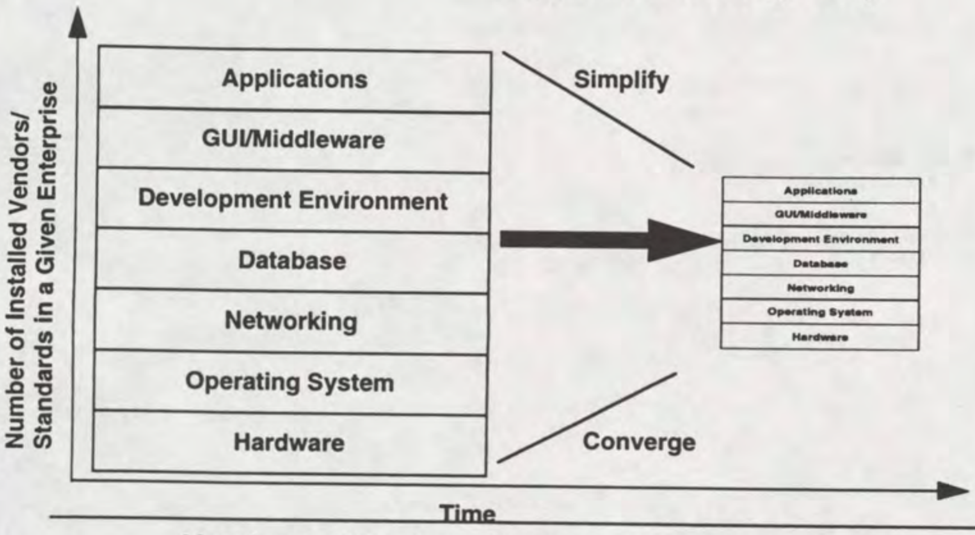
Source: Gartner Group

The move to CAPE poses major transition challenges that are similar in scope and difficulty to the past move from manual drafting to CAD. The need to re-engineer the underlying processes, dealing with cultural biases, new and changing skill sets and wrestling with new technology will all contribute to a short-term productivity decline when moving to CAPE. Users and upper management must recognize this and not become alarmed or overly preoccupied with this brief downturn. Instead, companies should focus on maximizing the large potential gains in meeting the strategic business imperatives by breaking with the past and creating a new, revitalized future. In breaking with the past and making the transition to CAPE, there are several areas that become key focal points. These include the matters of design representation, leveraging proprietary knowledge and dealing with legacy CAD data.

Despite the promise of middleware and data exchange technologies, organizations that can achieve a converged, homogeneous IT infrastructure across the product development chain will be 30 percent more competitive (0.7 probability).

Reader Notes





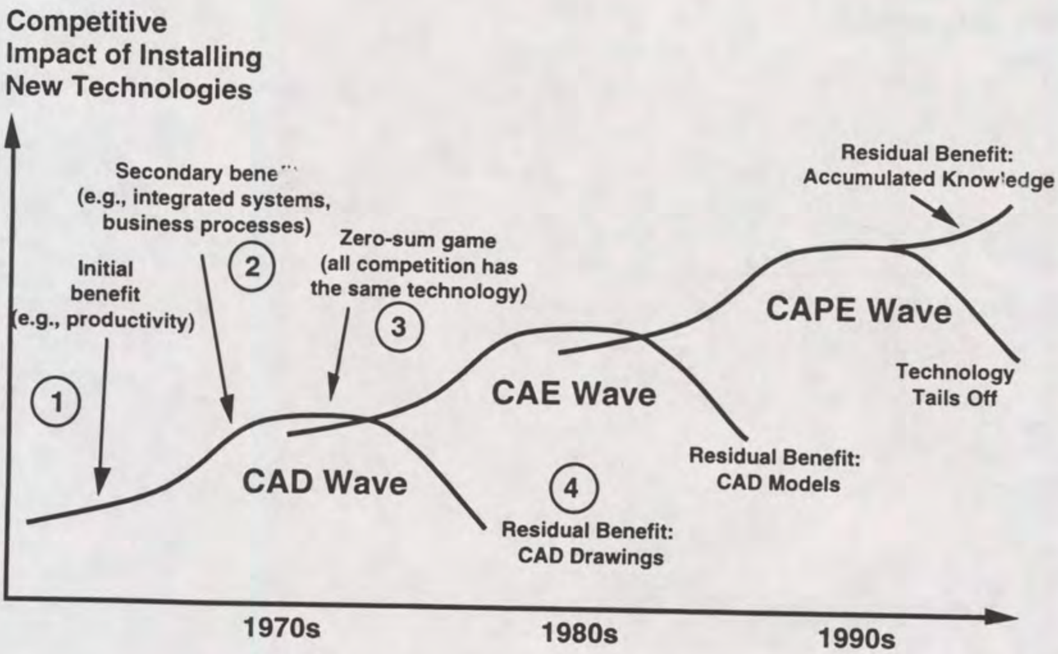
Source: Gartner Group

Key Issue: What are the key opportunities and challenges in forging the transition to CAPE systems?

For the past 30 years, manufacturing companies have been layering technology on top of business practices, piece by piece. The net result is a technological infrastructure that is overly complex and correspondingly difficult to manage, enhance and maintain. Much of this is because hardware and software had not previously evolved to a point beyond stand-alone implementation. This has resulted in as much as 80 percent of the cost of information technology going to infrastructure support. Fortunately, a set of technological enablers and standards are emerging that will, for the first time, permit architectural simplification across the entire applications portfolio. This will permit the scarce technological resources to focus on value-added work at the applications layer without compromising infrastructure support. Now the key will be tearing down the "old" and replacing it with a much simpler and less hierarchical model. For SCM to succeed, the organization must simplify and converge the IT infrastructure, and drive new applications toward a common IT vision.

Reader Notes

CAPE technological competitive advantage =
0.1 * ability to implement new technologies +
0.3 * accumulated process knowledge +
0.6 * degree of residual benefit leverage



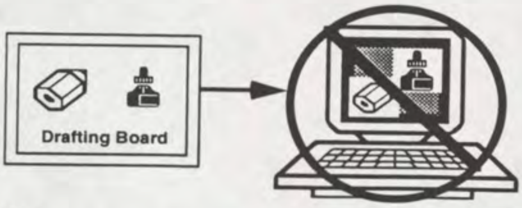
Source: Gartner Group

Key Issue: What are the key opportunities and challenges in forging the transition to CAPE systems?

There are three well-defined technology waves in the design arena. Each wave has a similar shape, beginning with the initial benefit stage where competitive advantage is achieved by applying technology for a specific purpose and doing it before your competitors. The secondary benefit is to more fully integrate the technology into the broader business process. Eventually, the wave flattens out, reaching a point where all competition has implemented the technology and has integrated it to the same degree. Finally, a new technology emerges and the old technology wave diminishes, yielding a residual benefit in the form of digital data. The residual benefit in the CAD and CAE waves is insignificant because the data has only limited reusable value. This is the area of greatest competitive opportunity when implementing CAPE because the residual data will be far more valuable provided that users not only capture the "what" of design, but also capture the "why." By capturing the "why" in the form of accumulated, proprietary design knowledge, the residual benefit curve will not diminish as in previous technology generations, but continue to increase long after the underlying CAPE technology becomes obsolete, giving users a new basis on which to compete more effectively.

To achieve the full benefits of CAPE, the underlying design representation must be extended beyond drawings and traditional geometric CAD technologies (0.8 probability).

Reader Notes



CAPE Design Representation Benefits

Design Representation Robustness

	Manual	CAD/CAE	CAPE	Benefits
Design Rules			✓	• Promotes design reuseability • Leverages accumulated design knowledge • Can dramatically reduce cycle times for critical path design problems
Associativity			✓	• Enables automatic downstream modifications to occur by changing the model
lodel Constraints			✓	• Enhances design reusability by allowing new designs to be created from existing designs
ometric Features			✓	• Simplifies design entry complexity • Provides downstream leverage for mfg applications
Geometry		✓	✓	
Drawings	✓	✓	✓	

Source: Gartner Group

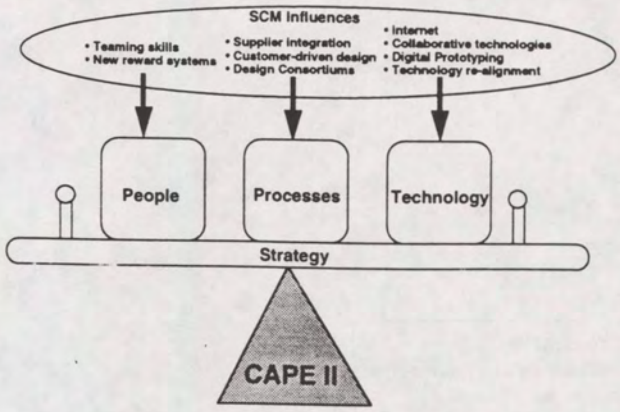
Key Issue: What are the key opportunities and challenges in forging the transition to CAPE systems?

Some key goals of CAPE are to help users deal more productively with increasing design complexity and derive greater enterprise leverage from the design data at the time of creation. To accomplish this, the fundamental design representation needs to be enhanced beyond drawings and traditional CAD geometries. Several technological attributes found in CAPE systems contribute to these goals. Geometric features and design rules assist the engineers in dealing with design complexity by raising the level of abstraction and enabling the reuse of historical design knowledge. Associativity provides a backbone allowing design changes to ripple through all downstream applications using the same model. Model constraints permit upstream modifications to be made so that new or revised versions of similar designs can be made quickly and easily. These benefits are impossible to achieve with older CAD/CAE technologies.

Action Item: Stop or limit investments into drafting-oriented CAD systems and begin targeting expenditures at CAPE technologies that can provide a richer and more robust design representation.

Reader Notes

How can enterprises design a strategy that continuously maximizes product development competitiveness?



What new CAD/CAM/PDM technologies will emerge during the next three years that will impact CAPE strategies?

Significant *user* benefits of object-oriented CAD won't be widely realized until 1998 (0.7 probability).

What are the key opportunities and challenges in forging the transition to CAPE systems?

CAPE technological competitive advantage =
0.1 * ability to implement new technologies +
0.3 * accumulated process knowledge +
0.6 * ability to embed and leverage design knowledge

Dimension III
Product Status

Key Strategic Direction: Dimension III

- **Productivity enhancements for existing users within the product's architecture**
- **Achieve EPD through integration with Optegra products**
- **Introduction of Pelorus DesignPosts for Dimension III Users**
  - intially P&ID, drafting
  - eventually; full object oriented, assembly centric Plant Design capability

DIMENSION III
Planned Projects

- On-going HP-UX and Digital Unix support
- Optegra Navigator/Explorer interface
- Increase Max. viewfile size (from Rev. 10)
- Increase DACDISK area (from Rev. 10)
- Reference Model
- Optional graphics screen size change
- Upper to lower case text conversion
- Filtering enhancement

DIMENSION III
Planned Projects

- **GUI enhancements:**
  - L&D
  - Ver/LST
  - PLDUP in GUI
  - Prompt in GUI
  - SWLIBRARY

DIMENSION III
On-going project planning

- **Under Consideration/Review**
  - ISOGEN upgrade
  - improved copying and mirroring of items
  - improved automated drawing functions
  - Allow Macro execution from within DAL
  - Allow more than 512 lines in a macro
  - Improve structural model checking
  - Correct steel cross sectional drawing representation
  - minimized variable headshape tesselation

DIMENSION III
On-going project planning

- **Under Consideration/Review**
  - STEP Ship AP's/AP 227 translator (DARPA project)
  - Pelorus translators or transition aids
  - Improvements to product structure representation in Explorer
  - Users should continue to submit productivity enhancement requests

Bijlage 4a

Sheets voordracht ontwerpsystemen door Integration partners

Integration Partners, Inc.

Integrating People, Process, & Technology

Presented By

Paul J. Lorson

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The Integration Partners Solution

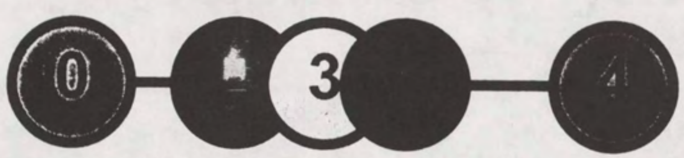
The key to maximizing the utilization of company knowledge and expertise lies in the degree of integration of People, Process, and Technology.

Productivity Improves Through People

- Computers do Routine or Repetitive Tasks Well - People do Difficult or Creative Tasks Well;
- Free Up People to Serve the Customer Instead of Serving Other Peripheral Activities or Tasks;
- High Productivity Tools Relieve Designers of Syntax and Let Them Focus on Design;
- Involve Management Through Sponsorship - Get Workers Involved in all Steps of the Process.

Early Design Drives Process Improvement.

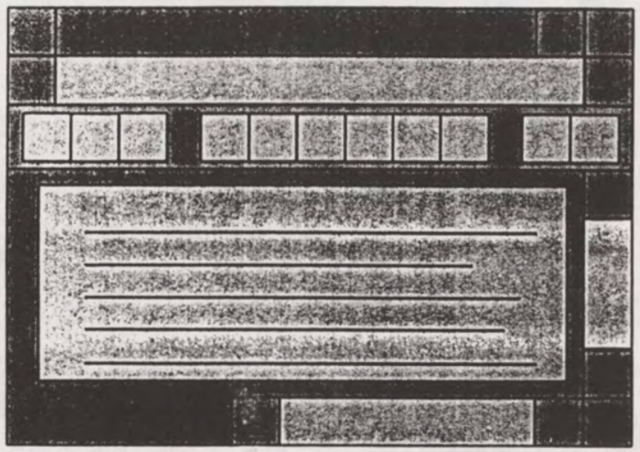
0 = Begin Proposal
1 = Purchase Order
2 = Early Design
3 = Detail Engineering
4 = Equipment Manufacturing

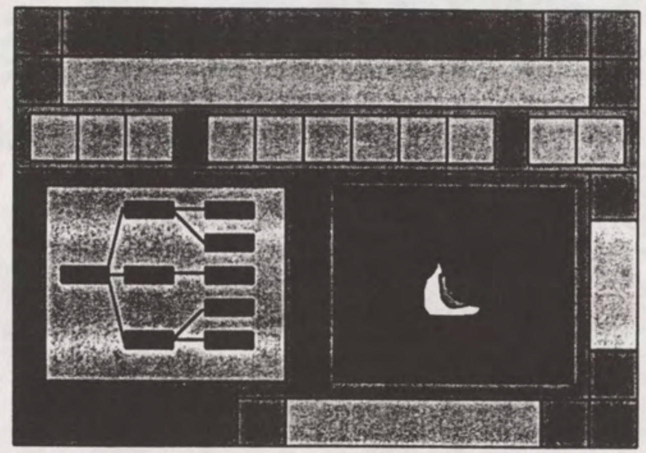


Do it Fast; Do it Right!

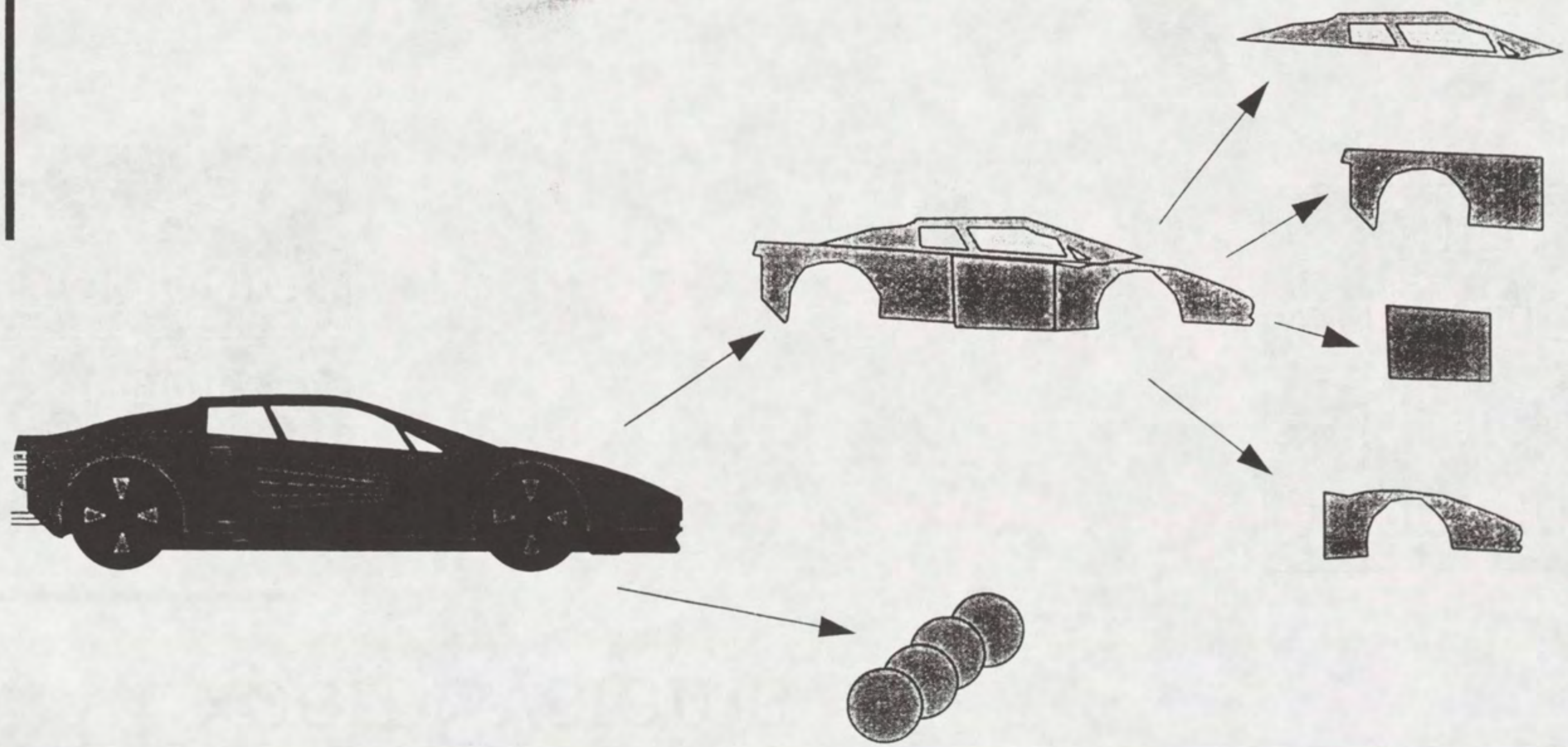
- **Implement High Productivity Tools**
- **Intelligent Tools Produce High Quality Results**

Enabling Technologies
Graphical User Interfaces

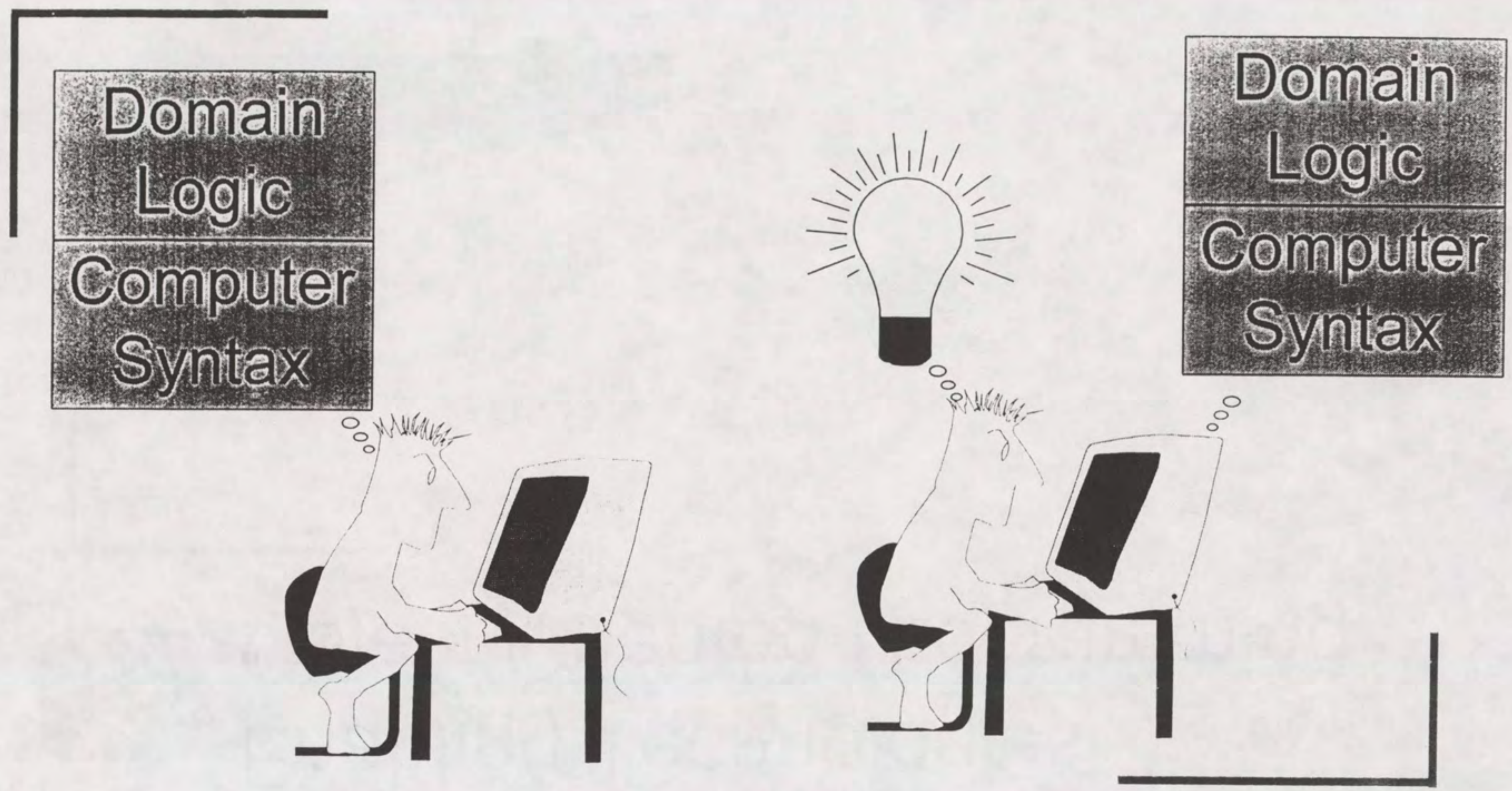




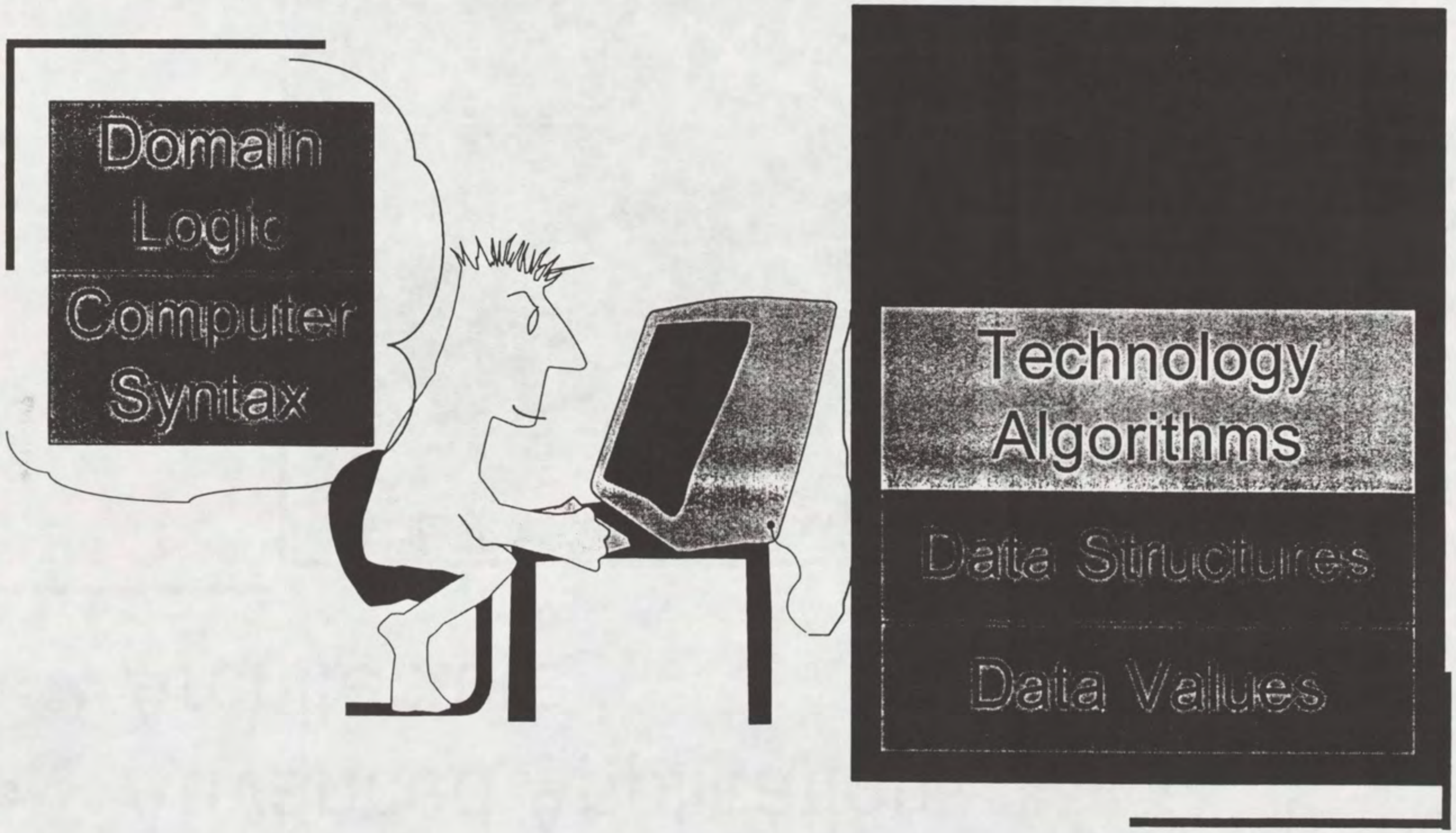
Enabling Technologies
Object Oriented Programming



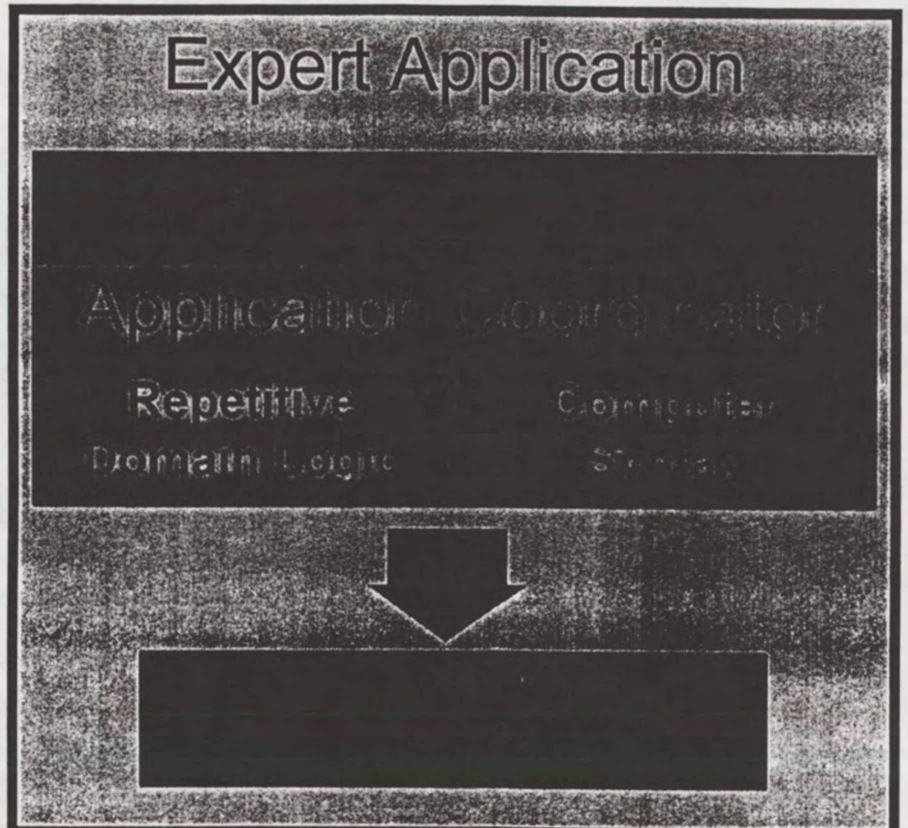
Enabling Technologies
Expert Systems



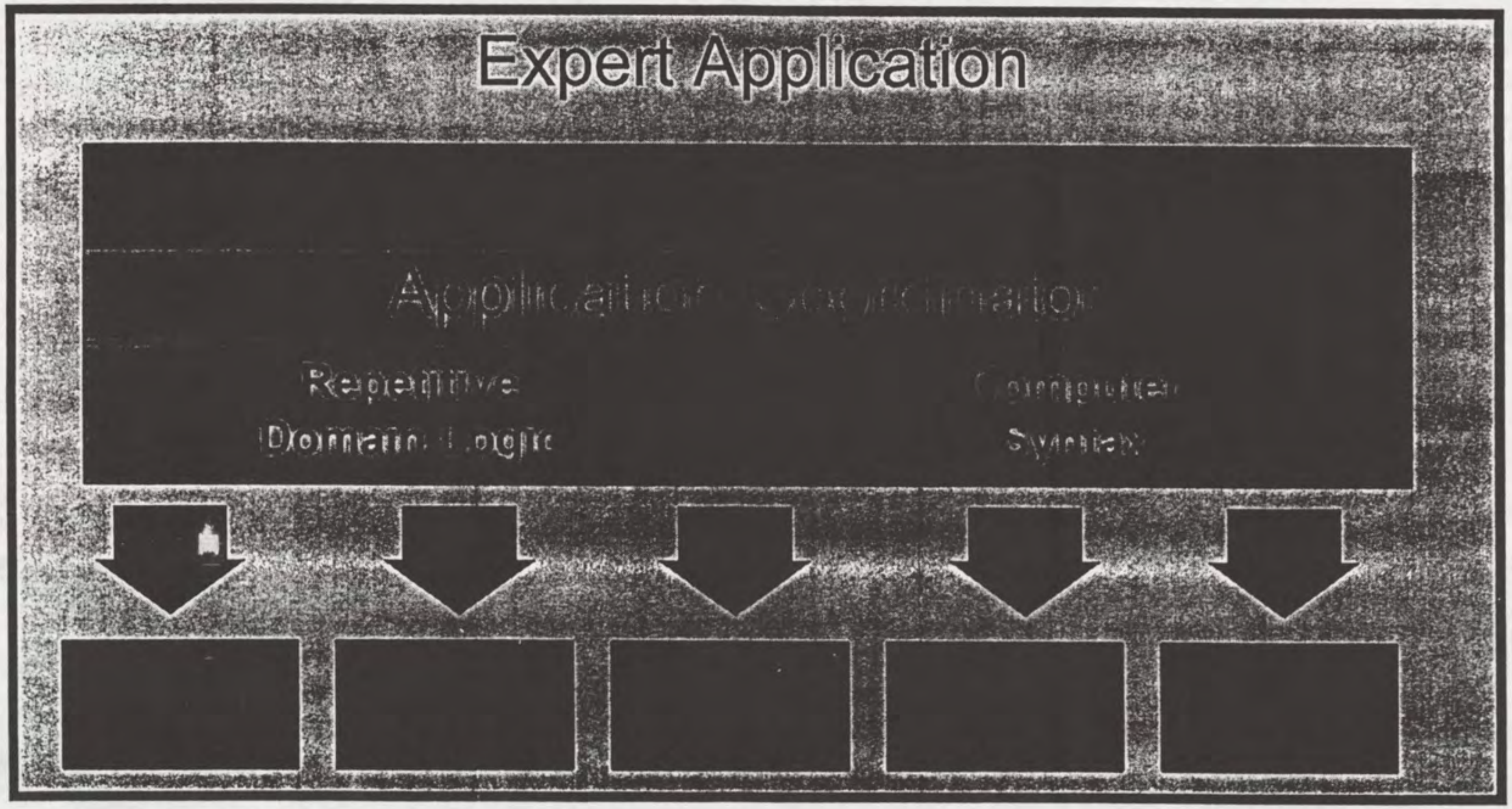
Traditional Architecture for Simple Applications



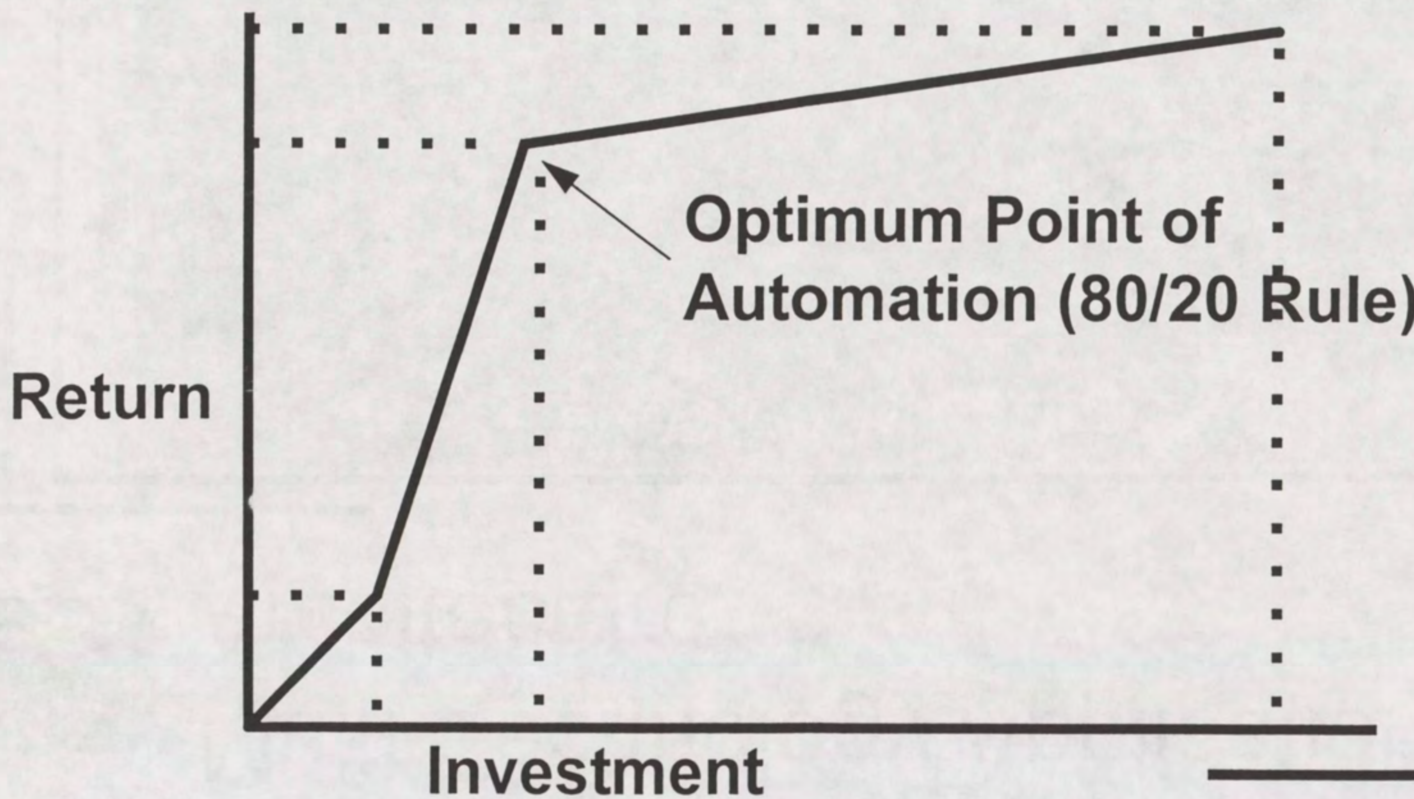
Advanced Application Architecture



Multi-Technology Application Architecture



Incremental Investment in Customization Yields High Returns



Productivity Improves Through Technology

- Capture Information at its Source, and Make it Available Wherever or to Whomever Adds Value;
- Use Each Technology Correctly;
- Create Logically Central, Physically Distributed Systems - Eliminate “Islands of Automation”;
- Purchase and Copy Best Systems and Practices - Create Them When They do not Exist;
- Leverage Current Systems and Tools.

Key Principles
People Make the Difference

- **Involve the Entire Organization: Management, Peer Leaders, Domain Experts, Technology Experts, etc.;**
- **Help People Adapt to Change;**
- **Focus People on Difficult or Creative Tasks and Processes - Let Computers do Routine or Repetitive Tasks and Processes;**
- **Provide Proactive Rather Than Reactive Support for People Using Computer Technology.**

Key Principles
Automate the Process

- Work With a "Desired State" in Mind;
- Focus Automation on Key Business Objectives;
- Automate Processes, Not Isolated Tasks;
- Eliminate Islands of Automation, Capture Data at Its Origin;
- Re-think the Process - Factor in the Impact of Computer Technology;
- Use 80/20 Common Sense to Implement Automation.

Key Principles
Use Technology as a Competitive Weapon

- **Customize and Integrate Automated Tools With People, Work Process, and Products;**
- **Copy Best Practices Wherever Possible; Create Them When None Exist;**
- **Make Applications Easy to Use;**
- **Capture and Maintain Company Knowledge in Automated Tools;**
- **Implement an Application Architecture that Uses Key Technologies Properly.**

Actual Results

Schedule

- **10 week process reduced down to 1 hour**

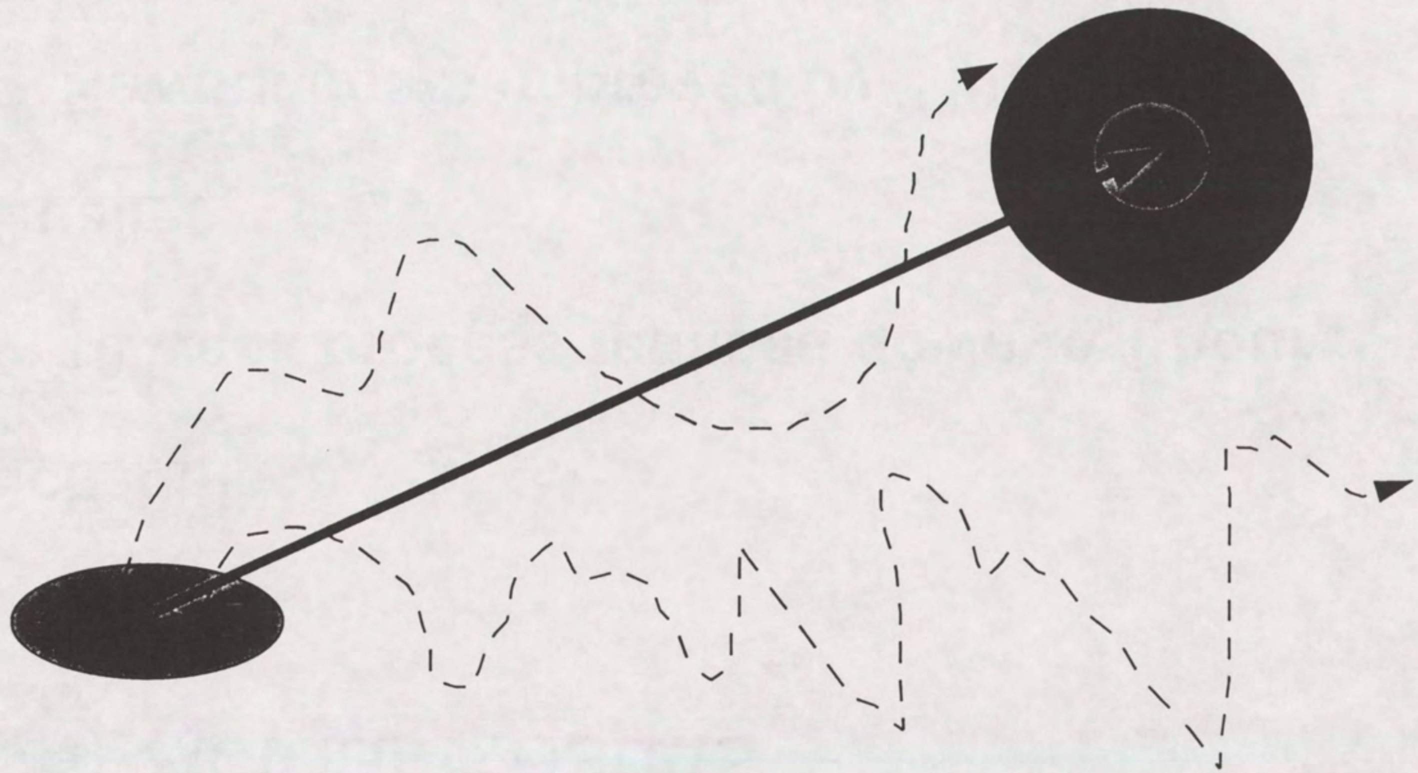
Quality

- **Rework costs improved by 2400 percent**

Productivity

- **Man-hour reduction from 25,000 to 1,500**

Set the Goal and Choose the Best Path



IntegrationPartners, Inc.

KNOWLEDGE BASED ENGINEERING

Integrating People, Process, & Technology

By Paul Lorson

INTRODUCTION AND SUMMARY

A company's efforts toward integrating its activities are typically focused initially on computerizing a particular function or organization such as manufacturing, or engineering. The productivity improvements normally achieved with this initial implementation range from zero to twenty percent. Many companies have reached this plateau of benefits and are searching for further opportunities to use computer technology in competitive or strategic ways. Integration Partners, Inc. (IPI) has found that computer technology, when applied in new and innovative ways, can enable changes to work processes and the value people add during those processes. These changes to people, process, and technology allow you to completely redefine your strategies and ultimately your position in your markets. This paper will focus on some of the changes and methods that enable these results.

During the 70's the concerns for diminishing market share, and decreasing quality forced us to evaluate our business practices and those of our competition. Most companies focused on the integration of people. Work groups were formed, management by committee ideas were implemented. Management teams were sent to classes on group dynamics and understanding motivation. The promise of 20 to 30% improvement in productivity and a "Happier more fulfilling" work environment was heard. As we diligently pursued these goals no revolutionary changes occurred, we achieved minimal improvement and we watched as our competition improved. We had gained no real competitive advantage.

So we looked for something else, something that would produce greater results and we turned to technology. Yes, HP produced the world's fastest computers. We could now do more work faster and throughout the 80's and 90's technology grew. CAD became prevalent, drawing boards vanished, MRP and JIT, Databases Relational and Object Oriented, and Information Systems became everyday terms. The promise of 20 to 30% improvements in productivity were heard along with "higher quality". As we diligently pursued these goals and achieved some improvement we watched as our competition improved and we gained no real competitive advantage.

In the 90's we began another arduous journey. Re-evaluating our people and "right sizing", re-evaluating our technology and upgrading but still no competitive advantage and then we saw our savior "process re-engineering". The promise of 20 to 30% productivity improvement, EPD and PDM were tossed into our vocabulary. And as we progressed and made some improvement so did the competition and we gained no real competitive advantage.

So we have looked at our people and we made some improvement. We have invested in technology and we saw some improvement. We have looked at our processes and we felt some improvement, but few have achieved our necessary improvements and obtained a real competitive advantage. If its not our people, and we have the technology, and we have improved our process why are we not achieving our desired improvements?

The answer can best be summarized as "Integration". The bringing together all the necessary knowledge, experience, technologies, and processes so that decisions can be made early in the product life cycle. Integration allows for more engineering faster, manufacturing and inventory constraints can be utilized earlier and production increased.

Increased productivity of 20 to 30% right? Wrong!!! After implementing an integrated knowledge based solution Mr. Tony Futo of Ahlstom Pyropower Corporation reported an "increase in productivity of 150% in Design & Drafting operation, while field rework on our projects has been reduced more that twenty-fold".

IPI's approach provides solutions to issues facing engineering, manufacturing, automation and information system managers. Some of these issues are answered through questions such as: 'How can the knowledge of human experts be leveraged and applied through computerized tools?' 'How can Knowledge-Based Expert Systems (KBES) be made compatible with my other tools?' 'How can several different technologies be merged in single applications'?

Traditional System Architectures Fail to Unleash Major Benefits

The architecture of a typical computer application is shown in Figure 1. The user interacts with the software through a user interface that provides a window to the domain logic and data structures of the application. The results of this interaction are stored in a database of some kind. These application building blocks are wrapped up in an environment that is proprietary to the specific technology or system in use. The designer or engineer must learn the appropriate rules and syntax of operation to accomplish their assigned tasks. This application architecture is commonly used in many proprietary environments such as CAD applications, manufacturing applications, database applications, knowledge-based engineering applications, etc.

Although this configuration is widely utilized, it has the following disadvantages:

1. If the proprietary technology changes significantly or becomes obsolete, the application must be re-encoded in a new language that comes with the new system. Often this means an entire redesign of the application to fit the unique strengths and weaknesses of the new system.

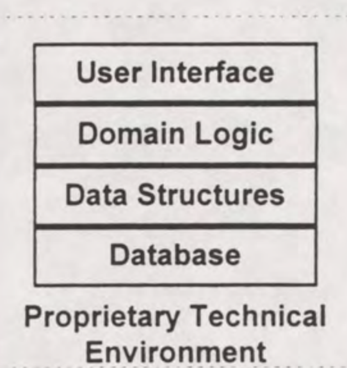


Figure 1
Traditional Architecture for Simple Applications

2. Proprietary systems and applications are usually focused around a single technology (CAD, database, KBE, MRP, etc.), and do not easily allow multiple technologies to interact in ways transparent to the user. This means that CAD systems do CAD functions well, but are not good KBE or database engines. Conversely, KBE systems do KBE functions well, but are not good CAD or database engines. The user is forced to choose a dominant technology and a system arrangement that do not fully

meet all their needs. User's must often spend time re-entering or transforming data from one environment to another.

3. The user is requested to engage in fairly repetitive operational interactions with the computer application that slow down the design process. The ultimate speed at which a design is completed is not related to the high processing speed of the computer or the design skills of the user; it is dictated rather by the relatively slow speed of the man-machine interactions required by the nuances and needs of the computer.

The result of these problems, imposed by the computer and its application architecture is less than optimal performance by both the computer and the person, and, consequently, yields less than optimal technical solutions. The computer is often in an idle state waiting to receive a command, and the users spend most of their time formulating commands and calculations to instruct the computer what to do next. Too much time is spent in routine, repetitive activities and not enough time is spent in value-added activity.

Traditional Architectures Fail to Meet Work Process Automation Needs of Multi-Technology Environments

Before we can proceed to explore the full extent of advantages associated with a new computer application architecture, we need to look at other limitations of traditional architectures that emerge when applied to multi-technology environments. As shown in Figure 2, the traditiona. method of architecting complex applications that use multiple dissimilar technologies, is through a series of interfaces that allow data passing as a means of interaction between the technologies involved. For example, a database technology performs data processing functions of the overall application, a CAD system performs the geometric type functions of the application, and a knowledge-based engineering system or shell performs the rule processing functions of the application. This traditional architecture, however, has some disadvantageous characteristics:

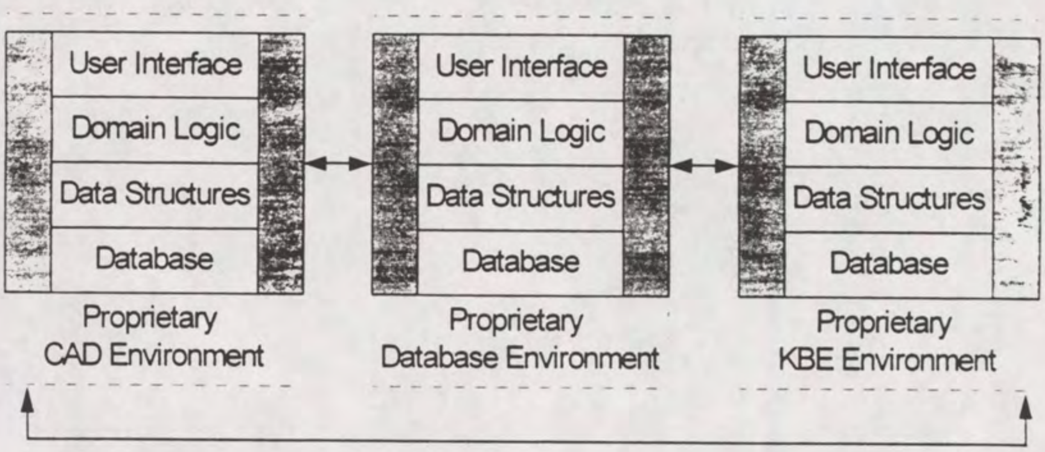


Figure 2
Traditional Architecture For Complex Applications

1. Each program requires input/output interfaces with each one of the other technologies. With 'n' being the number of technologies to be interfaced within a single application, the number of input/output interfaces is equivalent to n(n-1). Thus the programming effort required to make the system operational grows exponentially with

the number of technologies involved. Maintenance of the interfaces becomes a large and complex effort.

2. Duplication is required in each technological module so it will be fully compatible with the overall purpose of the application. This underlying redundancy extends to the logic, the data structures, and the data stored in each technological module. This duplication creates an inordinate amount of cross checking between the different technologies to ensure that they all remain compatible with each other and to ensure data integrity.

3. The traditional approach to interfacing multiple technologies is difficult to change and maintain as new technologies or generations of technology become available. Because of the high cost of making changes to complex applications and the interdependency between the technological modules, adding a new technology or removing an obsolete one is very difficult. Consequently, companies tend to work with the old technologies, until competitive factors force them to upgrade. Then, often the cycle of technology development and implementation starts over from the beginning, at a significant cost.

These problems of duplication, complexity of interfaces, high costs to create and maintain the application and lack of flexibility pose significant challenges when using computer technologies to enable work process changes and improvements. Thus, traditional application architectures actually impede a company who is working to move up to the next plateau of benefits from computer technology.

So far, we have uncovered two major problems with the traditional approaches to implementing computer applications in the engineering environment. First, people spend most of their time doing routine or repetitive tasks using syntax-laden man-machine interfaces, and very little time engaged in truly value-adding activities. Second, applications that are developed as tools in the engineering environment are often expensive to create and maintain, and difficult to incrementally take advantage of new technologies and techniques as they become available. To solve these problems, Integration Partners embraces two concepts of utmost importance. First, automation should be applied at the process level, not at the task level, and second, a new application architecture is required that enables the integration of technology, work processes and people to achieve the results that are required in today's competitive global markets.

**Advanced Applications
Must Consider the Automation of Work Processes.**

IPI staff have analyzed the interfaces of many different technologies, systems and applications, and have found that automated work processes free the user from the difficulties associated with proprietary syntax .

The instructions provided by the computer operator can be divided into a group of low level instructions and a group of high level instructions as shown in Figure 3. Low level decisions are characterized by exact syntax, repetitive reasoning or mundane calculations. This group of decisions and input instructions represent by far the majority of the time spent by a user working with a computer program; in many cases, up to 85%. High level decisions are characterized by creativity, ambiguity and heuristic reasoning processes. This often accounts for less than 10% of the time spent by the user when working with a computer program. Typically, a small amount of time is used by the computer for actually processing the instructions given to it.

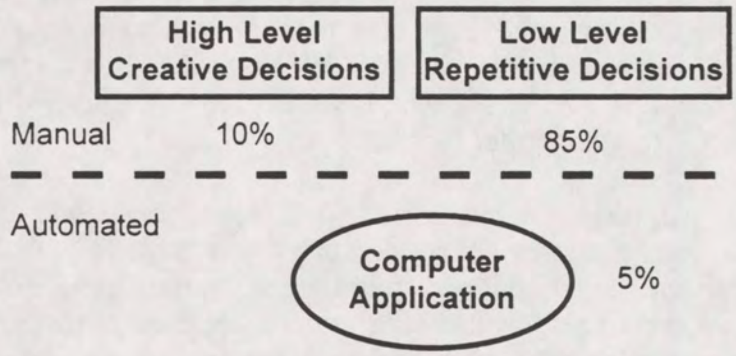


Figure 3
Task-Oriented Automation

As shown in Figure 4, the low level decisions can be encoded and made a part of the computer-aided automation. Only the work requiring the application of professional skills are left with the operator, while the rest of the work is handled by the computer.

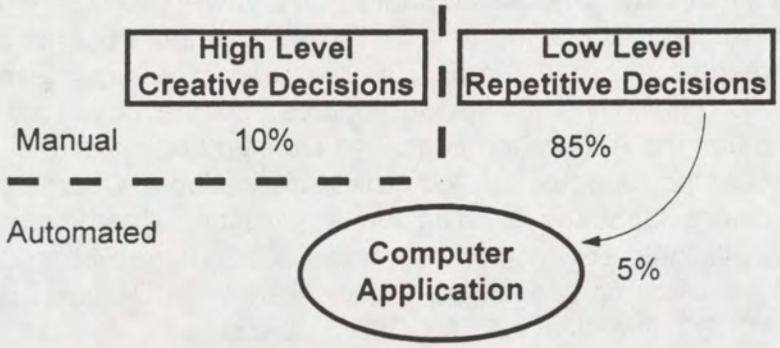


Figure 4
Process Oriented Automation

Figure 5 is a logical diagram that introduces the concept of a new computer application architecture that facilitates this higher level of automation.

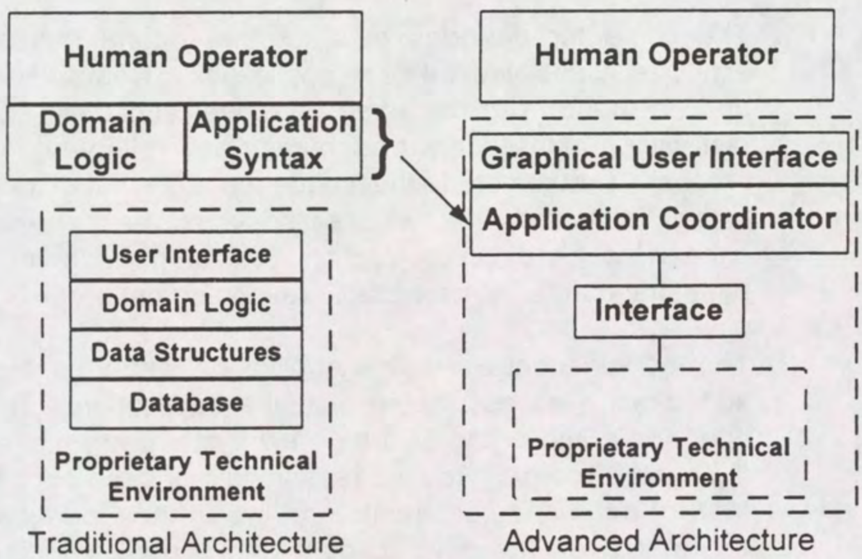


Figure 5

Advanced Application Architecture

In the traditional architecture, the user has detailed knowledge regarding the commands to give the computer, and how to apply them to get the desired results. These are referred to as Application Syntax and Domain Logic, respectively, in Figure 5. They represent the "Low Level Repetitive Decisions" shown in the previous figures. In the advanced application architecture, the Application Logic and Domain Logic are encoded into an object-oriented module called the Applications Coordinator. The programming language used in the Applications Coordinator may be a publicly available environment such as C or C++, or a proprietary object-oriented environment such as those offered by Design Power's D++, Gensym's G2 objects or NASA's CLIPS objects.

The Applications Coordinator is interfaced with the proprietary technical environment through an interface that passes instructions to be executed automatically. IPI has developed several such interfaces to work with diverse technologies such as CAD, KBE, database, and analysis programs. In each case, the syntax and logic of the application are automated and the proprietary technology is directed or instructed what to do by the Application Coordinator. There are several advantages of this architecture.

1. The computer performs most of the routine and redundant activities associated with the application. Computers are very good at performing the same task over and over. They do it fast with a high degree of accuracy and reliability. When the process is automated, the sequence of events, the required calculations and the necessary syntax are pre-determined either through direct instruction sets or through deterministic rules that can follow predictable reasoning patterns.

2. The person controlling the application performs high value-added activities associated with the application. The human operator is interacting with the new system at a higher level of the entire process. Routine reasoning has been encoded in the form of rules and constraints and live in the Coordinator. The operator does not have to deal with syntax anymore; he is focusing his attention to higher level decision making, i.e., those decisions that lead to innovative design improvements. One

may say that, in the new system approach, the computer controls itself and keeps the work process in motion at a high speed. The human operator controls the system from a higher level with much less interaction than before. The human expert is not held back anymore by the difficulty of interacting with the computer.

3. In the traditional architecture, most of the programming for applications is done in a proprietary environment using fourth generation programming languages. In the new applications architecture, a greater degree of automation is achievable using third generation programming languages. This allows greater flexibility in what the application can do and helps prolong the life of the application beyond the life of any single proprietary environment.

4. The new architecture enables computer applications that offer over-all ease of use and high productivity. The work process is completed much faster and the opportunity of operator error is much reduced; the system lends itself to the study of extreme design options, where each option is executed in direct similarity to the other options. As a rule of thumb, design processes that used to take days and weeks, are now accomplished within hours. The work process can be completed in as little as 10% of the previous time. Under these conditions, the human designer now has a tool to really explore innovative design options and can exceed the customer's expectations by delivering superior design value.

Flexible Software Application Architecture for Multiple-Technology Environments

The new application architecture also presents some advantages over the traditional architecture in those instances where it is desirable for multiple technologies to work together in a single application. This situation is illustrated in Figure 6.

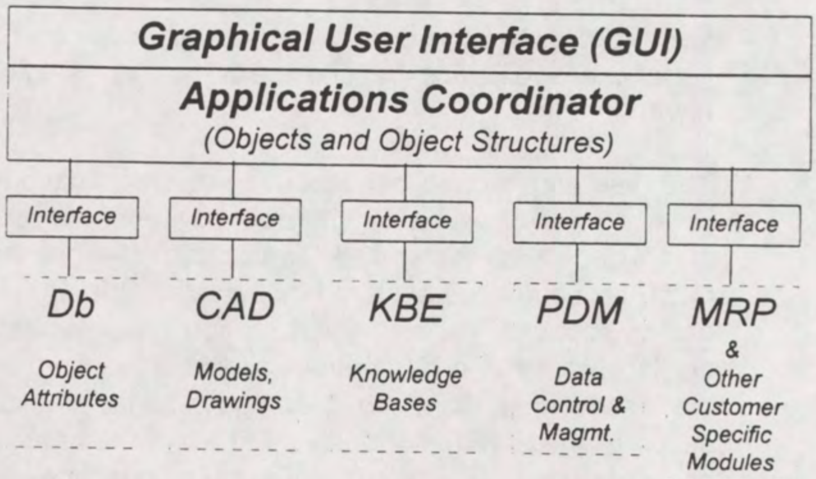


Figure 6
Multi-Technology Application Architecture

The system of several individual technologies has a single Applications Coordinator that forms a "common ground" for all technologies included in the application. A single interface module for transferring data and information in both directions is sufficient for each technology independent of the system size and the number of technologies included in the system.

The technologies work smoothly side-by-side at the applications level independent of their inherent differences. For example, the database is presented here as an external database for executing database related tasks; it is easily accessible by the applications coordinator for the purpose of transferring data as needed to and from the data processing modules. The single database is easily maintained and updated, and it is easily accessed for other administrative purposes as well. The system may include one or more computer-aided design modules for executing design related tasks, one or more computer-aided engineering modules for executing engineering analysis related tasks, one or more modules for executing data management & control related tasks, one or more simulation modules for executing simulation related tasks, or one or more KBE modules for executing tasks requiring rule-based reasoning. The Applications Coordinator is the driver in this advanced system just as the operator who previously performed this function. The application driver allocates tasks to the best suited key technology module through the shared data structures and the interprocess interface.

The Applications Coordinator is the heart of the proposed system configuration. It represents a custom program that represents a company's design process, its know-how, and its expertise. The program is written in either an object-orient style with C or C++, or one of the available rules or constraint-based languages. Designers communicate with the Applications Coordinator through a Graphical User Interface (GUI) arranged in the Motif or another user defined style. Designers fill in the blanks of these forms to create new designs.

The key to the majority of benefits of the proposed system architecture stems from the fact that the operator is now free to focus on the design job at hand from a higher more creative level instead of wasting his valuable time repeatedly on syntax or other procedures needed only by the computer.

While the Applications Coordinator utilizes an expert system to perform its reasoning tasks and to manage its communication with the various programs, other expert systems may be represented in the system to perform specific intelligent functions such as checking the design for design interference's.

The application architecture permits the various technologies to be exchanged without losing the encoded design processes in the Applications Coordinator. If it is decided to replace one or more of the technologies, only the relatively small interface programs need to be rewritten and the encoded company know-how remains untouched during the change-over.

Writing custom software to automate routine design work offers large returns on investment. Computer programs can drive proprietary systems much faster than human operators. The principle to keep in mind is to let computers automatically control redundant or repetitive tasks, while the creative task is left to people.

The proposed applications architecture together with its Applications Coordinator was made feasible by the advent of two distinct technologies: First, object-oriented programming languages and techniques facilitate a higher level of abstraction when planning a computer application. One is not limited to the constraints of procedural programming, but rather objects can be used to perform random actions within boundaries much the same as a person might do in a typical design session. Second, graphical user interfaces (GUI's) allow people to interact with the objects and the object structure in a non-procedural fashion. Code generators called GUI Builders reduce the time required to prepare these interfaces productively for a highly customized application. Previously, because of the high cost of creating them, GUI's were limited to applications intended to be sold in mass markets performing very general tasks. Now, with GUI Builders, highly customized interfaces can be created relatively quickly and easily.

The advantages of the proposed expert applications architecture may be summarized as follows:

1. Computerization is focused on automating the work process instead of performing small disjointed tasks. This enables vast improvements to productivity, quality, and schedule performance. These create competitive advantages not otherwise attainable.

2. Dissimilar technologies work smoothly together at the application level. Each technology is used for those tasks they perform best.

3. Technologies in this architecture can more easily be added and/or exchanged. Since proprietary programming does not take place in proprietary environments, the separate technology environments can be swapped without redesigning and re-coding the entire application. The logic of the program remains intact long beyond the useful life of any single proprietary environment or technology.

IPI's Integrated Solutions have been Used Successfully in Diverse Situations

Integration Partners accepts a rather broad definition of expert systems that includes any system or technology able to perform complete work processes in a manner that frees the human expert from the mundane tasks associated with syntax or other steps they want performed. This new architecture allows integrated expert systems to be developed using a plurality of technologies in diverse domains, achieving a wide range of benefits.

In one instance, a CAD system, database system, KBE system, and selected proprietary technologies have been used to create expert systems that design industrial boilers used for steam generation on commercial scale power plants. Another, uses the same technologies, embodied by completely different proprietary products to design regenerative oxidizers used as pollution control equipment. A third application uses C++ modules, analysis software, and a database system to perform chemical and thermodynamic design and engineering. In all cases, these uses of technology have enabled companies to focus on business issues instead of computer tool issues. The results range from highly accelerated productivity and schedules, to increased product quality and market share.

IPI's experience with larger system applications indicates that design jobs requiring weeks or even months, can be accomplished within a few hours or even less than an hour depending on the particular application and the effort one is prepared to invest in capturing and programming the knowledge of the operator. The payback periods for system development, technology acquisition, and system implementation typically range from 6 to 18 months. However, the greatest benefits are not found in simple man-hour savings. The greatest benefits are found in the enabling changes to work processes and the human resources which are now focused on adding value to the customer and the company rather than diverted by unimportant peripheral tasks.

Integrating People, Process, & Technology a true competitive advantage.

Bouwdienst Rijkswaterstaat

The Pilot & Introduction

of OPTEGRA

within

Bouwdienst Rijkswaterstaat

J.N.Kieft
CADOBE - project

Bouwdienst Rijkswaterstaat

Contents

- ★ Introducing Bouwdienst Rijkswaterstaat
- ★ Background document management within the Bouwdienst
- ★ CADOBE - goals & prior conditions
- ★ CADOBE - conclusions & findings
- ★ CADOBE - future steps

Bouwdienst Rijkswaterstaat

Bouwdienst Rijkswaterstaat

- ★ Civil Engineering office for Rijkswaterstaat
  - Bridges, viaducts, tunnels, sluices, dikes.......
- ★ 840 people staff
- ★ 3 main locations
- ★ 106 seats Dimension III
- ★ 150 trained users
- ★ 20.000 CAD-models
- ★ 12 gigaByte CAD-data

Background document management

Bouwdienst Rijkswaterstaat

- ★ Project TDIS (1994)
  - First pilot of EDM-implementation
  - No implementation because of:
    - Insufficient support by supplier
    - Badly managed on several platforms
    - Bad performance
- ★ **Conclusion** : Supplier plays an important part with implementation
- ★ However within the Bouwdienst:
  - Great need for document management
  - ISO/9000 certification

Bouwdienst Rijkswaterstaat

TreeCM / CADOBE

★ New project: <u>CA</u> d <u>DO</u> cument <u>BE</u> heer

★ Other supplier (Tree C.. Technology)

★ Application TreeCM developed by Tree C.. Technology

★ Based on OPTEGRA: PDM-package of Computervision

★ Integrated with Dimension-III CAD

Bouwdienst Rijkswaterstaat

CADOBE *goals*

★ Management of CAD-models and drawings
- Status, ownerships, rights
- Mutual relations

★ Based on new drawn up workflow
- Elementair 2.0

★ Pilot for wide introduction

Bouwdienst Rijkswaterstaat

CADOBE
goals

- ★ Management of CAD-models and drawings
  - Status, ownerships, rights
  - Mutual relations
- ★ Based on new drawn up workflow
  - Elementair 2.0
- ★ Pilot for wide introduction
- ★ "Step by Step" approach

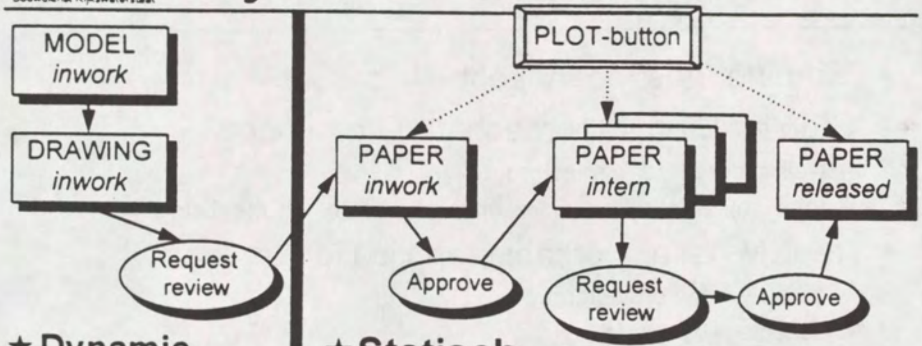
Bouwdienst Rijkswaterstaat

CADOBE
prior conditions

- ★ Pilot limited to CAD-environment on site Tilburg, on 2 construction-projects
- ★ No endangering of progress of these construction-projects
- ★ Common workable and acceptable solution
- ★ Guaranteed reproducability of drawings
- ★ Inform the users well !!

CADOBE
trajectflow

Bouwdienst Rijkswaterstaat



★ **Dynamic**
- Type MODEL & DRAWING
- Always *inwork*

★ **Statisch**
- Type PAPER
- Base voor approval
- Customers:
  - Contractors etc...

CADOBE
data - exchange

Bouwdienst Rijkswaterstaat

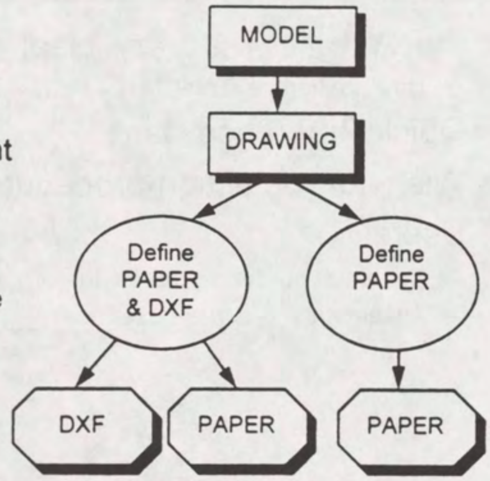
★ Need for digital exchange

★ Procedures drawn up

★ New type of document
- DXF

★ Extra function
- "Define PAPER & DXF"
- PAPER and DXF from the same DRAWING

★ Definition will be registred



CADOBE *conclusions*

Bouwdienst Rijkswaterstaat

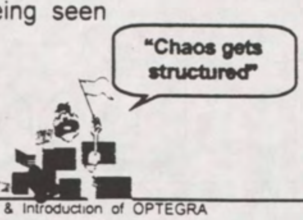
- ★ Planning has been kept !
- ★ "Step by Step" approach the right one
  - well ordered for projectgroup
  - total implementation more understandable for the users
- ★ TreeCM is a workable application
  - accepted by projectgroup
  - accepted by users
- ★ Current possibilities of TreeCM:
  - management of DIMIII models and drawings
  - snapshots
  - relations

CADOBE *findings (1)*

Bouwdienst Rijkswaterstaat

- ★ the "WHY" was very clear
  - How to handle TreeCM
- ★ Quick Reference Card
- ★ Wish for Selection-procedures
- ★ Users:
  - No extra burdening or obstruction in activities
  - Advantages are being seen

I only want to see my "own" models



Bouwdienst Rijkswaterstaat

CADOBE *findings (2)*

- ★ Projectgroup : emphasis on "playing" with possibilities
  - models, snapshots,
  - mutual relations
  - defaults, menu's, error-messages

"*signed out*" , "*update*" "*request review*"

- ★ Pay attention to terminology
  - users not familiar with usage of terms
- ★ Shortlist with wishes regarding future improvements / adjustments

can an user have more than one model "*signed out*"

'every night everything back to TreeCM?

Bouwdienst Rijkswaterstaat

CADOBE Future steps (1) Short notice (before end of 1996)

- ★ Appliance of full OPTEGRA functionality
  - Especially document-workflow
- ★ Closer involvement of projectmanager
  - Reviewer
  - Electronic Sign-off
- ★ Drawing Viewer
- ★ Further appliance of TreeCM
  - More construction-projects
  - More users
  - Multidisciplinair projects
  - Within whole design-unit

CADOBE Future steps (2) Medium notice (1997)

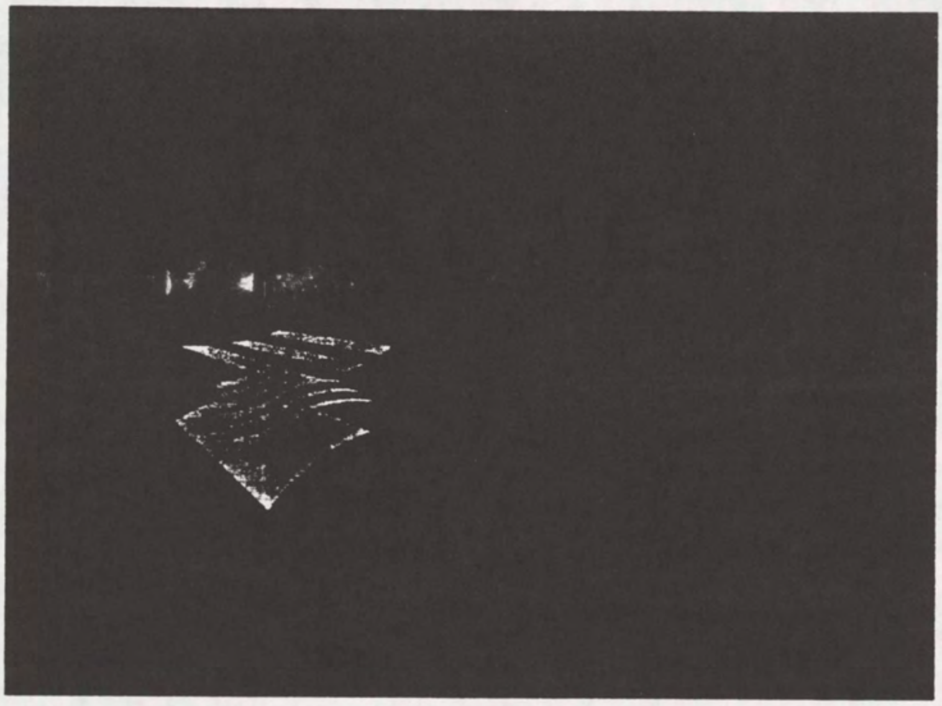
Bouwdienst Rijkswaterstaat

- ★ Document attributes
  - Characteristics
  - Selections
  - Automatically filling of drawing-properties
  - Relation with drawing-registration-form
- ★ Standardization namegiving
  - Models
  - Drawing-registration
- ★ Further completion application-management
- ★ Definition of paths for full introduction on all three locations

CADOBE Future steps (3) Long(er) notice (from 1997)

Bouwdienst Rijkswaterstaat

- ★ Libraries with standard-parts, symbols, etc
- ★ Procedures for archiving
- ★ Appliance of TreeCM (OPTEGRA) for other CAD-applications
- ★ Appliance of EDM for non-CAD applications



VIAdesign (Object Oriented Viaduct)

- Wim Verbruggen

- Department of
  Structural Research

- internet w verbruggen@bwd rws minvenw nl

WV290796 BD. 2

Contents

- Introduction/definitions
- Evolution VIAdesign
- Development
- Conclusions

WV290796 BD/ 3

Civil Engineering Division

WV290796 BD/ 4

What is design ?

- DESIGN is
- SKETCHING considering
- CONSTRAINTS and then
- ITERATE to the optimal
- SOLUTION.

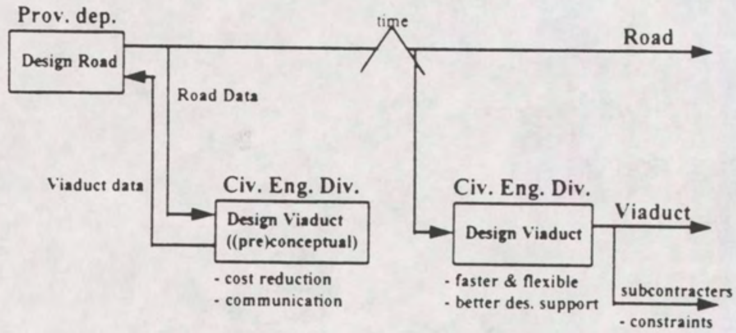
WV290796 BD 5

Why VIAdesign?

- faster and more flexible design process
- cost reduction total construction
- better design support
- better communication (systems, projectpartners)
- more exact constraints when design subcontracted
- most designed product

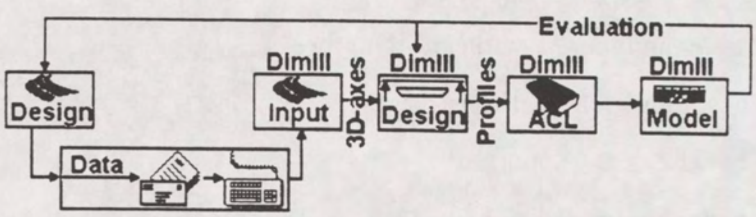
WV290796 BD 6

Design Process



WV290796 BD/ 7

Existing Situation



- DimIII road-application
- DimIII ACL-application (Advanced Concrete Layout)

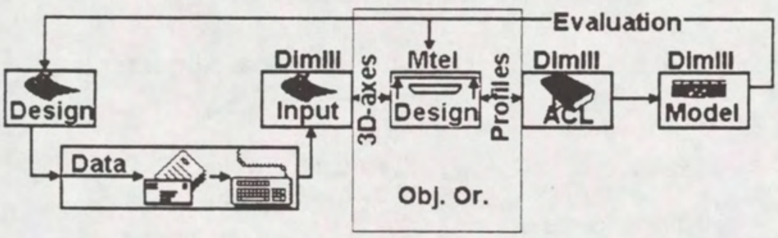
WV290796 BD/ 8

Ideas first OO-prototype VIAdesign

- solution based on existing environment
  - Dim III incl. road and ACL-application
- existing OO-package --> Mtel-Toolkit
  - OO-cad, AI-module, Programming language
- no "parametric" solutions
  - "I don't like to design the same viaduct again."

WV290796 BD/ 9

Layout first Prototype VIAdesign



- Basic prototype only OO-system (3 months)
- "Go" from management
- But ....

WV290796 BD/ 10

Evaluation first prototype

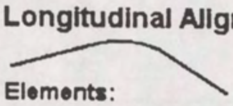
- cumbersome to change road data (3D-axes)
  - not enough design support
- too much communication Mtel <-> DimIII
- datamodel mix of Road and Viaduct
- Conclusion: not flexible enough !!!!!

WV290796 BD 11

Principles Road-/Viaduct design

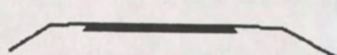
- Shape controlled by set of 2D-alignments
  - alignment = set of elements
- longitudinal alignments
  - horizontal, vertical, ...
- transversal alignments
  - profiles

Longitudinal Alignments



Elements:
Straight, Circular
Clothoid, Parabola

Transversal Alignments



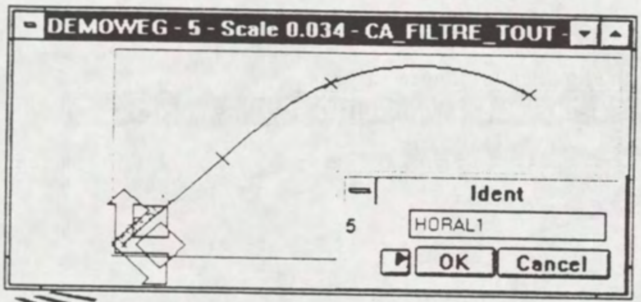
StraightElements of type:
Slope, Verge, CarriageWay

WV290796 BD 12

Example design process 1

1 Read or design/sketch an horizontal alignment.

- X- and Y- Coordinates, Z-Coordinate = 0;

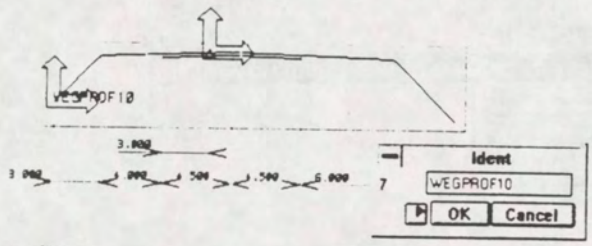


WV290796 BD 13

Example design process 2

2 Read or design/sketch profile(s).

- X- and Z-Coordinates, Y-coordinate = 0;
- add connection point to horizontal alignment

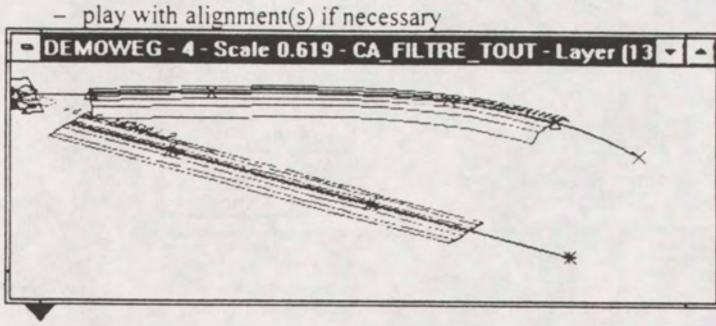


WV290796 BD 14

Example design process 3

3 Create the road(section)

- connect profile to horizontal alignment
- create a ‘sweep’ with specific modeller
- play with alignment(s) if necessary

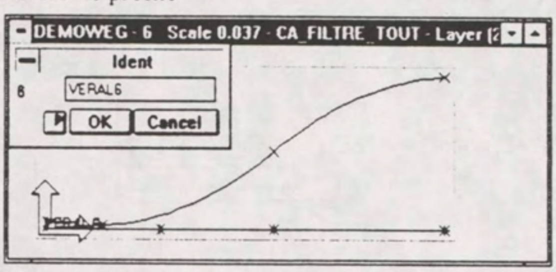


96 BD 15

Example design process 4

4 Read or design/sketch vertical alignment(s).

- length dependend horizontal alignment
- correction to Z-Coordinates
- connect to profile

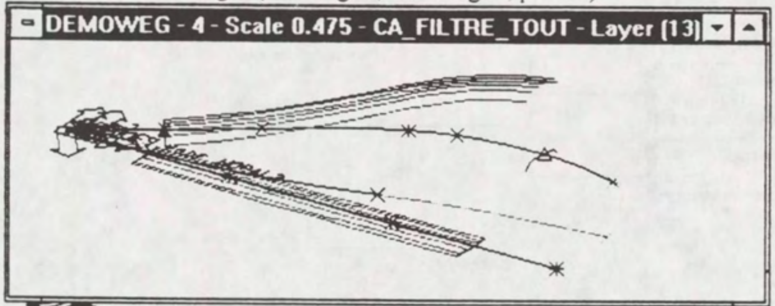


WV290796 BD 16

Example design process 5

5 Evaluate the changed road.

- create sweep with specific modeller
- make changes (hor. align. , vert. align. , profile)



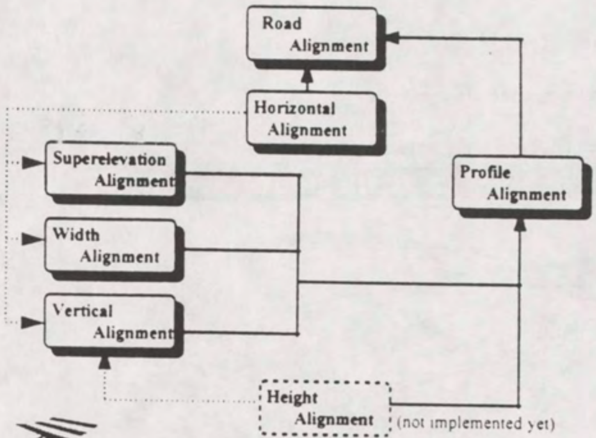
WV290796 BD/ 17

Example design process 6

6 Add other alignments

WV290796 BD/ 18

Road Alignments



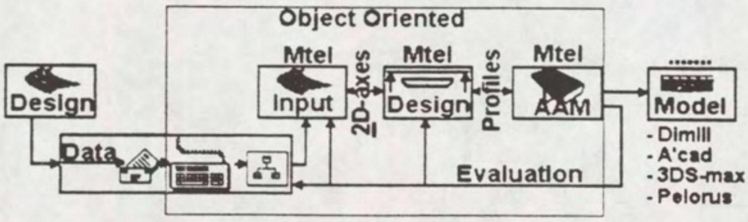
WV290796 BD 19

Constraints for "new" VIAdesign

- all 2D-alignments in OO-environment
  - change of one parameter
  - less communication with DimIII
- modeller for alignments (design)
- seperate datamodels for Road and Viaduct
- connection to more other systems

WV290796 BD 20

Present Layout VIAdesign



- Characteristics:
  - design with all 2D-alignments (elements)
  - support design process
  - 'intelligent' modeller for alignments (IAM)

WV290796 BD 21

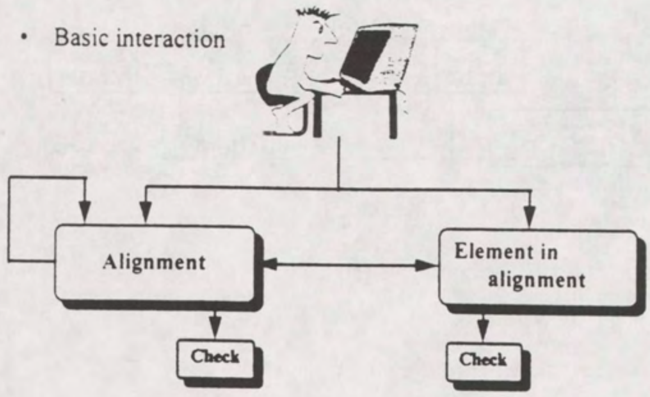
Development datamodels

- Express-model for Road(alignments) by TNO
  - implemented in march 1995
- Express-model for Viaductsupports by TNO
  - implemented in august 1996
- Both models based on data transfer
  - models extended for shape design
- Mtel can read Express-models

WV290796 BD 22

Development behaviour & UIF

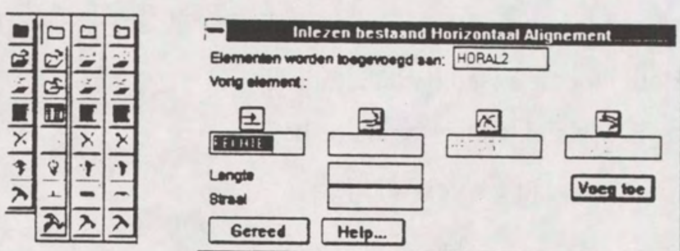
- Basic interaction



WV290796 BD 23

Development behaviour & UIF

- In-house development for:
  - behaviour of objects (methods)
  - UIF



WV290796 BD 24

Development process

- regular demo-meetings with viaduct designers
  - viaduct-experts drive development
  - discuss next step(s) in design process
  - demo previous step(s) in design process

WV290796 BD/25

Development dates

- started in: march 1995
- version 1.0: januari 1997
  - ((pre)conceptual Viaduct
  - 2,5 - 3 men years
- version 2.0: ????????
  - depends on designers/users

WV290796 BD/26

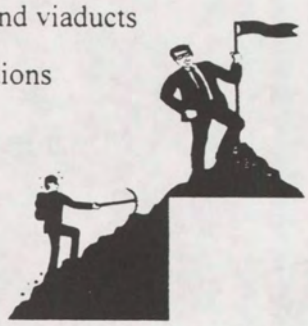
Conclusions 1

- VIAdesign supports the design (DESIGN is SKETC....
- correct datamodels important
  - extend data models for transfer to task
  - for every main object one model
- it takes time to learn OO, but ...
- .. it takes more time to understand process and decissions
  - during prototype change of ideas

WV290796 BD 27

Conclusions 2

- spin-off to other (development) projects
  - better exchange of road data
- need for "dictionary" for roads and viaducts
- be carefull with existing applications



WV290796 BD 28

Follow up ????

WV290796 BD 29

Visualisatie van civieltechnische constructies ter ondersteuning van het ontwerpproces

Hans Kieft

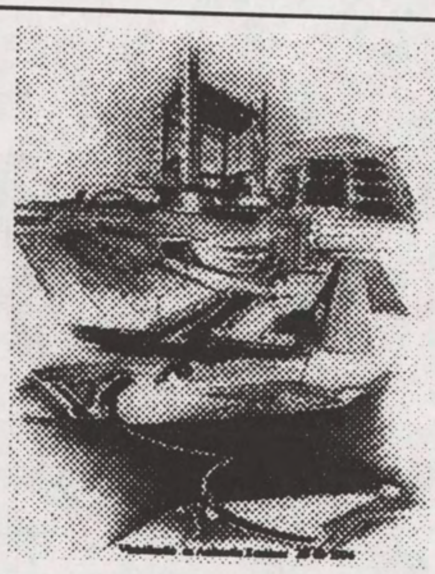
Bouwdienst RWS

Inhoud

- Introductie Bouwdienst RWS
- Achtergronden visualisatie
- 3D-Studio
- 3D-Studio MAX

Bouwdienst Rijkswaterstaat

- "Ingenieursbureau" voor Rijkswaterstaat
  - Bruggen, viaducten, tunnels, sluizen.......
- 850 personeelsleden
- 3 hoofdvestigingen
- 106 workstations Dimension III
- 150 gebruikers



Werkwijze Bouwdienst

- Opdrachten van de regionale directies
  - ontwerp nieuw verkeerstrace
  - kruisingen met verkeers- en vaarwegen

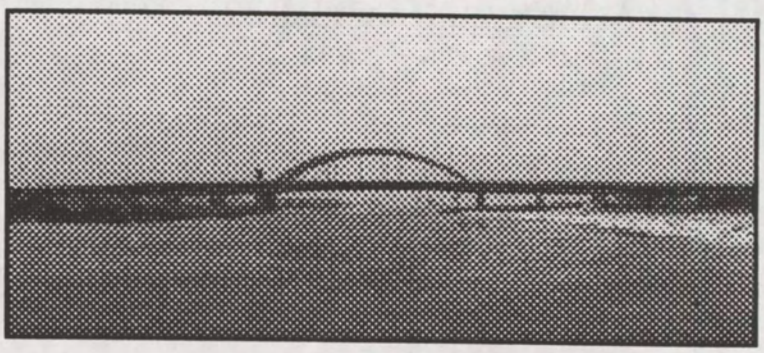
- varianten, incl. kostenraming
- variant wordt gekozen
  - verkeers- en milieutechnisch
  - esthetisch
  - politiek
  - inspraakprocedures

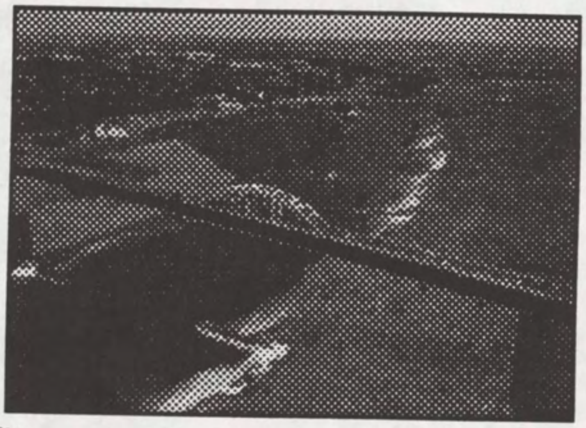
Achtergronden visualisatie (1)

- Vroeger:
  - Constructietekeningen
  - Ingetekende foto's
  - Artist's impression

Achtergronden visualisatie (1)

- Vroeger:
  - Constructietekeningen
  - Ingetekende foto's
  - Artist's impression
- Heden:
  - Belangrijk hulpmiddel bij informatie-overdracht
  - Gelijkwaardige communicatie
  - 3D-visualisatie zegt meer dan 40 constructie-tekeningen

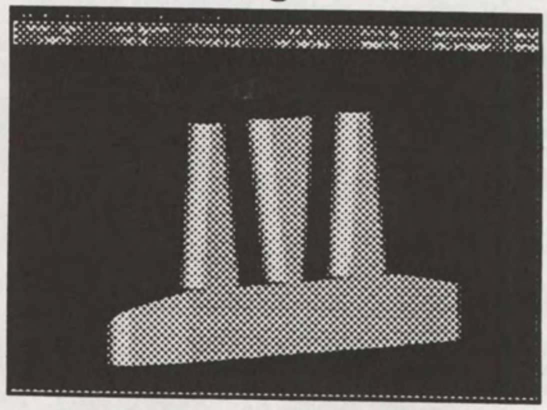




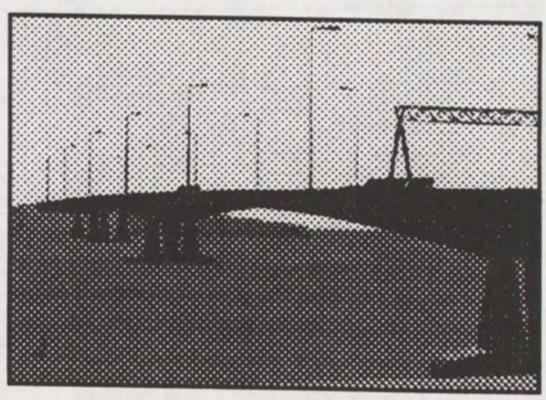
Achtergronden visualisatie (2)

- Bouwdienst gebruikt Dimension-III (CV)
  - shaded images
  - hidden line images
- Transfer van modellen naar Optegra Visualizer (CV)
  - op basis van grafische ascii-file
  - 1 op 1 weergave 3D-modellen
  - "lopen" door modellen mogelijk
  - Snelle communicatie met opdrachtgever

Dimension III shading



Still vanuit Optegra Visualizer

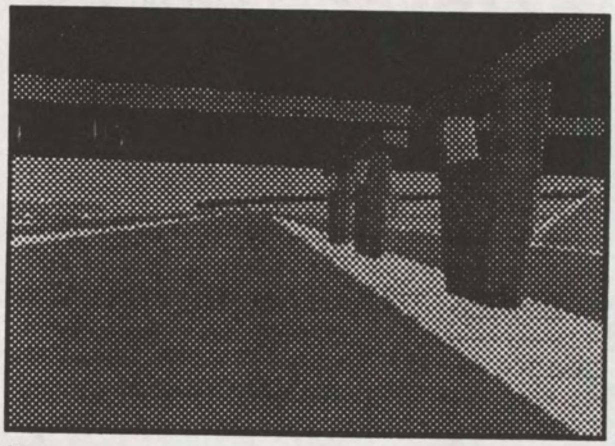


Achtergronden visualisatie (3)

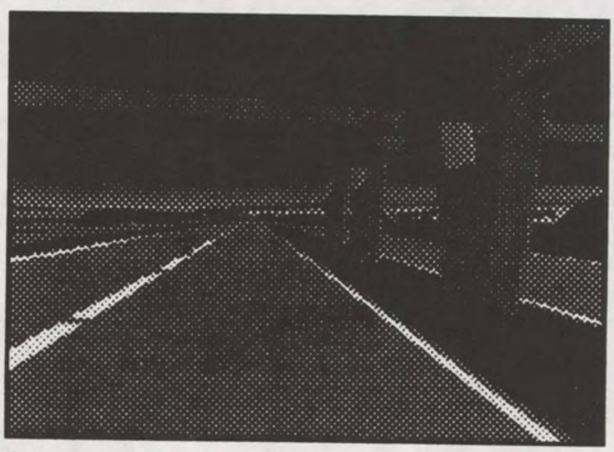
- Optegra Visualizer:
  - redelijk realistisch beeld
  - ook nadelen:
    - Uitvoermogelijkheden
    - Maken van composities niet mogelijk
    - Toekennen eigenschappen aan materiaal
  - NIET echt geschikt voor PR-presentaties

Achtergronden visualisatie (4)

- Uitbesteden visualisatiegedeelte
  - op basis van bitmaps
  - tijdrovend en onbevredigend
  - onbekendheid met vakgebied
  - overdracht via DXF en IGES
    - nauwkeurigheid modellen
    - grote files
  - **HOE VERDER ???**



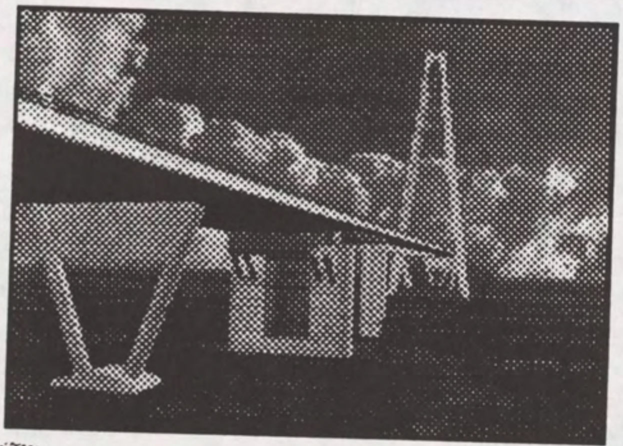
J.N. Kleft   Visualisatie en Animatie Seminar 26-09-1994   sheet 15



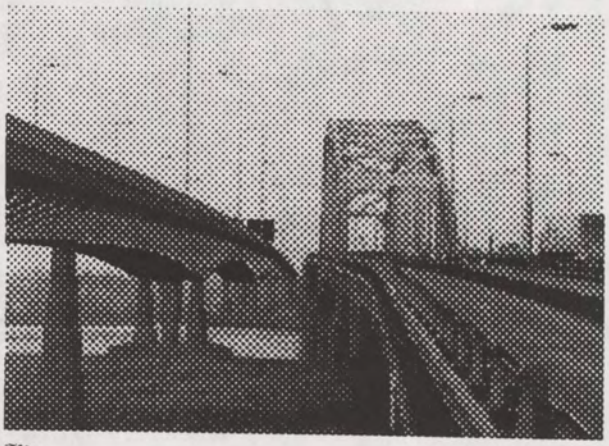
J.N. Kleft   Visualisatie en Animatie Seminar 26-09-1994   sheet 16

3D Studio

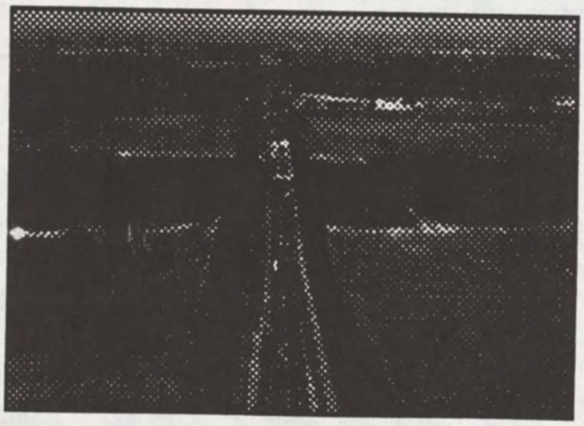
- Converter Dimension-III naar 3D Studio
  - Greenock
  - grafische ascii files
  - natuurgetrouwe presentaties mogelijk
- Eerste stap naar optimalisering
  - werkwijze
  - presentatie resultaten



J.N. Kleft Visualisatie en Animatie Seminar 26-09-1996 sheet 19



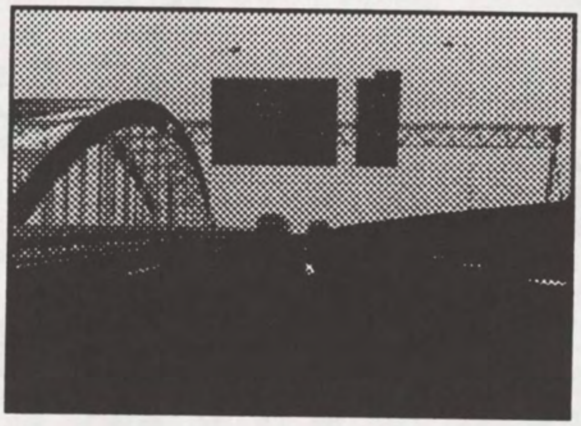
J.N. Kleft Visualisatie en Animatie Seminar 26-09-1996 sheet 20



J.N. Kloft

Visualisatie en Animatie Seminar 26-09-1996

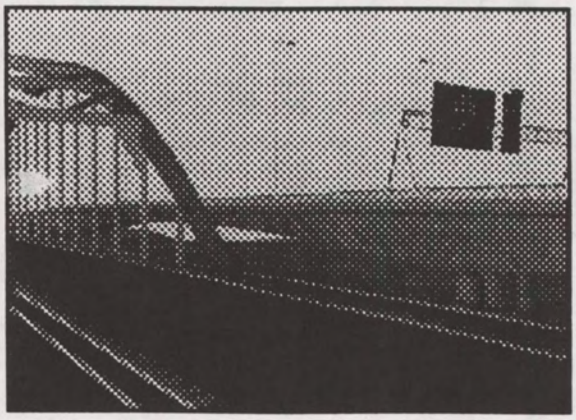
sheet 21



J.N. Kloft

Visualisatie en Animatie Seminar 26-09-1996

sheet 22



3D Studio MAX

- Converter geschikt te maken
- Vormgestuurd ontwerpen
- Momenteel in "test" fase bij Bouwdienst
- Eerste resultaten veelbelovend

Experiences & Challenges in moving Dimension III from DEC VMS to HP-UX

Frans van Dam

Bouwdienst RWS

Why migrating ?

- No development of Dimension III on VMS
- Less applications on VMS (dying)
- More software on Unix, more future
- Cheaper and scalable hardware

How organized

- Usergroup
- Systemgroup
- Starting at one site

Actions to be done (1)

- Trying out DIM III on Unix, course
- Purchase of hardware, benchmarking
- Migration strategy
  - plot-environment, education)
- Conversion of user environment
  - logon, plotting and printing

Actions to be done (2)

- On line documentation
- MDI userinterface
- Migration of 1200 DAL and FORTRAN routines
- Migration of data (cleaning up to 50%)

Selection criteria hardware

- Economic
- Applications on platform
- Proven technology
- Ergonomics and performance
- Technologic perspective
- Link to VMS

Fulfillment of goals

- Price / performance
  - performance + 40% goal 20%
  - UNIFORM environment
  - cheaper hardware 30 Kfl. goal 24.5 Kfl
  - lower maintenace costs hardware 50%

Quality

- On line documentation
- OSF/MOTIF project login
- More applications PVS, GIS, AutoCAD

Communication

- Link to PC-environment
- Better communication over sites (NFS)

Present situation

- 27 UNIX seats Tilburg
- 35 UNIX seats Utrecht
- 5 UNIX seats Zoetermeer
- 42 VMS seats Zoetermeer

Planning 1997 (1)

- Optegra
- Move to Dimension III rev. 11
- New type of HP-stations
    - (testing of ALFA-station)
- Migration of Zoetermeer

Planning 1997 (2)

- Integration to Windows NT
- Same projectlogin on pc's for
    - AutoCAD, Softdesk
- Very Big File system
- Stress calculation on HP
    - DIANA, Supertab

Advise

- Organisation
- Testing application on new operating system
- Benchmarking
- Pilot environment first

Ministerie van Verkeer en Waterstaat

Directoraat-Generaal Rijkswaterstaat

Bouwdienst Rijkswaterstaat

DDM - DXF converter problems

Date: september 13 1996
Author: Eddie Smit

Level 1 problems must be solved before the Bouwdienst Rijkswaterstaat can take the DXF converter in production.
Level 2 problems must be solved as soon as possible
In the next weeks the DXF converter workgroup will do some extensive testing on the current version of the DXF converter. If we find any problems we will pass them as soon as possible to Computervision.

Level 1 problems

1.1	All linefonts are converted to separate line segments of linefont 1. So a line like "- - - - -" is converted to 5 line's like "-". This happens only in drawing mode. Computervision solved this problem for line's but we have still a problem when converting lines of for example font 3. When generating a DXF file from a drawing whit lines in font 3 the lines are broken in two parts.	
1.2	When windows in a drawing do not have a picture scale factor (psf) of 1, symbols in this windows are not scaled correct	
1.3	Points are not converted from a drawing	
1.4	Crosshatching is not always correct converted from DDM to DXF	
1.5	When one want to convert a window, and the concerning window is not in the picuremode the DXF converter jumps to the first window in the model. The geometry in this first window is written to a DXF file. When the picture mode is on the converter really converts the window	

Level 2 problems

2.1	GLBL's with more than one cross-reference line are converted whit only one cross-reference line	
2.2	Rotated windows on drawings give strange results. For example: the arrows of Reference Note's (RFN) are not at the correct position	
2.3		
2.4	When one starts the DXF converter DDM does not check if there is a license available. This means that one can fill in al the necessary data as filename, swap file, map file to find out that one first has to get a license. DDM should first check for a license.	
2.5	If a DXF file already exits, one is not able to overwrite it. The converter should ask if one wants to overwrite an already existing file.	

Ministerie van Verkeer en Waterstaat

Directoraat-Generaal Rijkswaterstaat

Bouwdienst Rijkswaterstaat

Memo

Aan
TreeC.. Technology
t.a.v. A. Vonk
afschrift: F.van Dam

Van
B.van Vlimmeren

Doorkiesnummer
013-322562

Datum
23 mei 1995

Bijlage(n)
-

Onderwerp
Bug's en mogelijke verbeteringen PVS versie 3.0 + A.R.

In het afgelopen half jaar ben ik in de gelegenheid gesteld om gebruik te maken van de nog niet vrijgegeven versie van PVS (Virtual Explorer). Deze versie is een stap in de goede richting voor het gebruik van een visualisatiepakket binnen de bouwdienst.
Ik ben echter toch een aantal onvolkomenheden, m.b.t. de funtionaliteit van het huidige PVS-pakket, tegengekomen die zijn te verdelen in Bug's en Enhancements.

Bug's:

-Core Dump ontstaat soms bij het opgeven van de camera positie en target indien digitize in niemandsland gegeven wordt.
-Core Dump na het exploden van een met PVS bewaarde .XWD-file, ik denk probleem alleen indien .XWD groter is dan 1Mb.
-Core Dump bij Path Editing indien veel punten veranderd worden.
-Stop button bij ray-trace funtioneert niet (Stop buttons werken op meerdere plaatsen niet)
-Camera traversal-Set Options-Turn Angle, Help informatie geeft dat instelling op nul een direkte hoekverdraaiing tot gevolg heeft; dit-geeft echter alleen een view onder het maaiveld, instelling op 90 graden geeft nog de beste resultaten.
-Instelling op Boxes of Edges bij Preferences geeft een gigantisch tijdverschil, lijkt erop dat de opvolgende selekties het geheugen geheel in beslag nemen en niet gecleaned wordt na een selektie.
-Cirkelvormige doorsneden die in de dim.III shading geen problemen te zien geven, komen in PVS niet goed over, de vlakken lijken niet goed aan te sluiten, je kijkt ertussen door.

Bouwdienst Rijkswaterstaat
Postadres: Postbus 10028, 5000 JA Tilburg
Bezoekadres: Spoorlaan 394, 5038 CG Tilburg

Telefoon 013 322580
Telefax 013 350295

Op loopafstand bereikbaar vanaf station Tilburg

Enhancements:

-Mogelijkheid geven om plaatjes in een hogere resolutie te maken en naar een printer te sturen bijv. min. 3000*2200 pixels, dit staat los van de mogelijke resolutie van het scherm wel belangrijk bij het bewerken van deze plaatjes met andere pakketten en bij uitwisseling via .TGA-files.
-Ruwheid van materialen toekennen (gras, beton water etc.) liefst uit een meegeleverde bibliotheek.
-Samenvoegen van in PVS gemaakte plaatjes met werkelijke situatie (compositiefoto maken).
-Opgeven van plaats en datum en tijd voor een reële lichtbron-plaatsing in het model, eventueel t.o.v. een verschoven assenstelsel.
-Automatisch invullen van de extentie bij Grafische uitvoermogelijkheden zoals .TGA en .XWD.
-Langs een vloeinde kromme een camera traversal mogelijk maken, zonder allerlei schokeffecten, mogelijk een selectie van een volledige begrenzing opgeven.
-Objecten langs eenzelfde vloeiende kromme plaatsen met opgegeven h.o.h. afstand en aantal (bijv. array principe).
-Verandering van Item Colors in een .GAF-file bij opnieuw inlezen van dezelfde .GAF-file automatisch (na vraagstelling) regenereren.

Enhancements PVS-movie:
-Movie Recoder sneller (misschien Hardware afhankelijk?).
-Delay van meer dan 200 miliseconden mogelijk maken, flexible scale instelling.
-Blending van de movies geeft soms een zeer vreemde kleur aan de lucht (achtergrond), dit lijkt alleen te ontstaan bij stapgrootte van 6m of minder.

Verdere opmerkingen zullen misschien nog volgen.

DESIGN AUTOMATION

A Technology Transformation

Short Brothers Productivity Study

Short Brothers plc., a company known for design innovation and world-class product development, has undergone a significant change in the way they approach the process of product development of large, complex products. An acknowledged pioneer in many aspects of aircraft design and manufacturing, Shorts has identified and put into practice a total-process-oriented approach to substantially raise the development productivity associated with complex projects.

When Short Brothers plc. delivered the fuselage for the newest executive Learjet, the Learjet 45, it represented a true milestone in the advancement of design automation technology in the aerospace industry.

The fuselage was one of the most sophisticated in existence, and yet it had been developed in 40 percent less time than its predecessors. Further, it demonstrated a tenfold improvement in part quality and part-to-part assembly quality.

Other statistics suggested how Shorts had been able to achieve its design and manufacturing success. Overall part count had been reduced by 60 percent, while first-article rework had been reduced by 90 percent over their previous experience.

Most important, the client, Learjet, was extremely pleased with the fit, finish and end-to-end quality of the fuselage. For its part, Shorts was also pleased, but was already hard at work identifying where new improvements could be made in the design automation process for the company's next major project.

Around the world and through every industrialized country, manufacturers are striving to compete in ever-more-difficult environments and with ever-shrinking resources. Many of these companies are now beginning to learn what Shorts has already proven — that exponential improvement is possible first of all, and that significant reductions in time to market can be accomplished in parallel with improvements in parts and product quality.

An overview of how Shorts created its own technology transformation can thus be instructive to companies in a range of industries that are currently striving to compete through improved design methodologies.

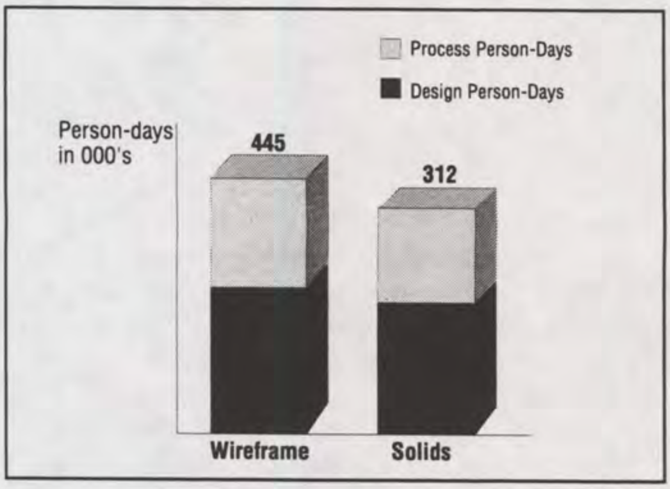
DESIGN BASELINE: MODELING TECHNIQUES

As with many other companies, Shorts' early experience with design automation technologies involved wireframe modeling of component parts. Shorts, with experience in aircraft design that goes back more than 86 years, had progressed to wireframe modeling in the 1970-1980s.

Previous regional aircraft fuselages built by Shorts would typically require up to 9,500 structural parts. Based on historical data, these projects required a first-article parts rework ratio equal to 150 percent of person-days, and could require over 445,000 person-days to complete over a four-year period.

At the time they undertook the Learjet 45 project, Shorts had invested substantial research resources investigating alternative methods to improve design and manufacture. The company had developed experience with new technology including parametric and explicit solid modeling.

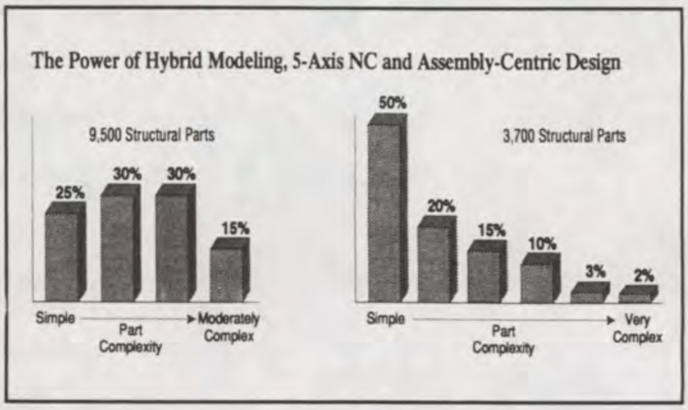
Solid modeling could offer a potential improvement of better than 30 percent in time saved, from 445,000 to 312,000 person-days. Many manufacturers use solid modeling today, and have experienced similar improvements over wire-frame techniques. However, as these companies know, the benefits of parts-based solid modeling does not extend to part-to-part assembly quality and the resulting rework from assembly interferences. Because of this, a parts-rework ratio of 150 percent would remain constant and consistent with previous experience. Shorts were determined to identify a better solution.



CHANGE TO HYBRID MODELING

Shorts knew that to achieve greater-than-incremental improvements, the company would have to implement farther-reaching technology changes. To do that, Shorts ultimately adopted hybrid modeling, a technique that permits integration of multiple model technologies. This provides the opportunity for engineers to combine subassemblies containing numerous parts into fewer numbers of more complex parts.

Hybrid modeling is an important trend in design automation because of this ability to reduce parts count. For instance, most complex 5-axis parts are hybrid models defined from bounding explicit surfaces and with reference to many other complex and moderately complex parts. While the fully constrained, parametric solids modeling approach is more productive for low- to medium-complexity parts, it is either less productive or unable to complete the complex parts. Thus, to gain the advantage of parts-count reduction, the hybrid modeling approach must be employed. As CNC machine tool and CAD/CAM technology has developed, it has provided the opportunity for manufacturing companies to increase the complexity for components by combining what was previously a multipart assembly into a single, very complex machined component.

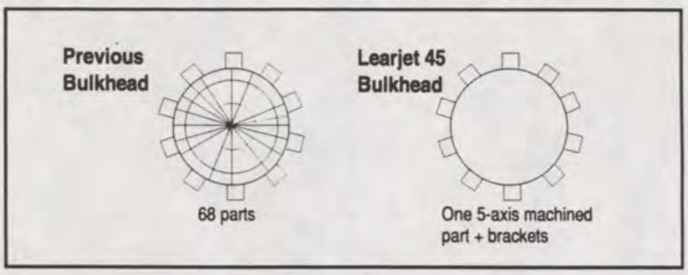


Recommended Approach Using Hybrid Modeling

	Part Complexity					
	Simple					Complex
Parametric Productivity Factor	105%	115%	130%	125%	90%	80%
Explicit Productivity	100%	100%	100%	100%	100%	100%

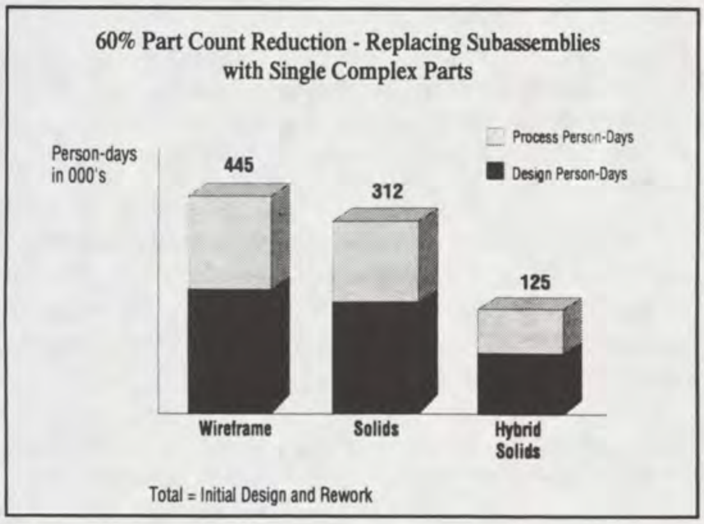
Hybrid modeling thus permits the replacement of moderately simple/complex parts with very complex and very simple parts, and this reduces part count. By reducing part count, a manufacturer also saves time and costs in other areas — in assembly, in documentation, and in many other "process" disciplines. The part-count reduction/hybrid modeling strategy proved to significantly reduce the development cycle of the Learjet 45 fuselage.

The pressure bulkhead of the Learjet 45 fuselage serves as an example of lowered part count. In previous fuselages, this bulkhead was an assembly of 68 moderately complex parts; however, on the Learjet 45, this was replaced by a complex 5-axis machined part plus simple, less critical parts; e.g., brackets, supports, etc.



In addition, reducing an assembly to a single part also simplifies manufacturing, production, assembly, and maintenance because there is only one part to manage through the production processes and its ongoing life cycle. This significantly reduces the risk of delay to the program caused by part shortages and eliminates all potential problems with multipart fit through poor quality. (In addition, because these new complex parts are designed within the multidiscipline Design-Build-Team and Digital Pre-Assembly environment, their manufacturability and ease of assembly have already been considered.)

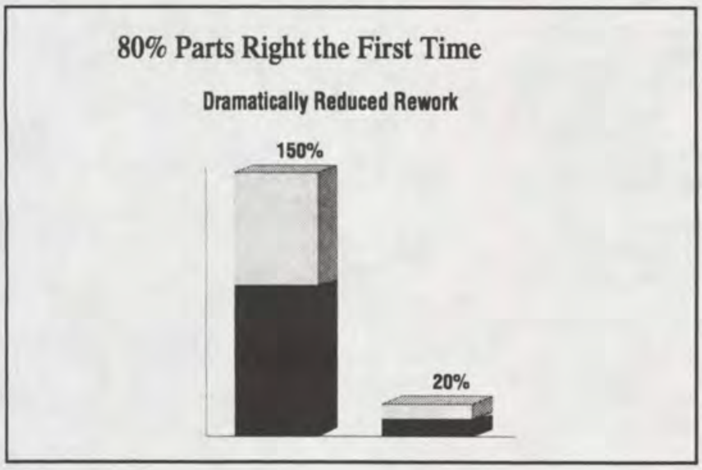
Overall, Shorts found that by implementing hybrid modeling, the company could, and did, cut parts count from approximately 9,500 to 3,700, a 60-percent reduction. As a result, total design/manufacturing time would be cut to 125,000 person-days. However, first-article parts rework would remain at 150 percent if the traditional approach was used due to the inherent limitations of the serial discrete parts-based design approach.



DIGITAL PRE-ASSEMBLY

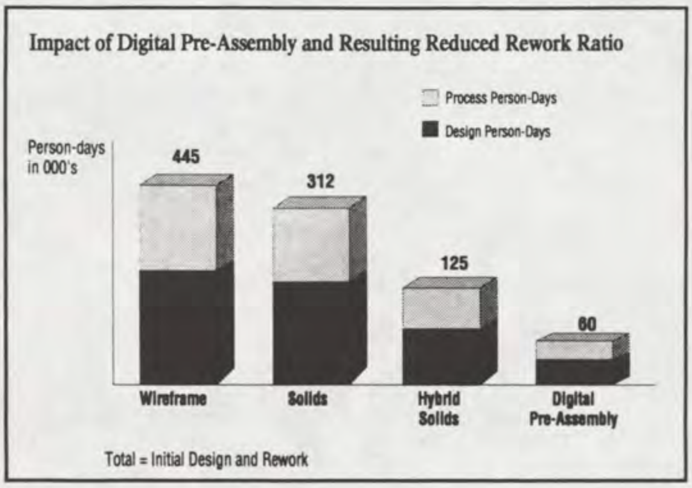
For the development of the Learjet 45, Shorts ultimately embarked on a concurrent digital pre-assembly strategy in an attempt to significantly decrease the typical parts rework ratio. This strategy would combine Computervision's CADDS® 5 hybrid modeling technology with the company's CAMU (Concurrent Assembly Mock-Up) digital pre-assembly and EDM (Enterprise Data Management) software.

The CAMU environment gave Shorts' multidiscipline design build teams (structural, piping, wiring, stress, tooling, manufacture, inspection, assembly and support) capabilities to work concurrently, identifying and resolving multisystem problems as design development evolved. As a result, first-article rework was reduced to only 20 percent of the original person-days, rather than the 150 percent of person-days that had been typical. And, in fact, the first-article production fuselage was the best aerostructure ever produced at Shorts.



Concurrent digital pre-assembly is particularly effective in reducing design time while improving parts quality because it gives engineers a powerful tool for resolving design conflicts — and thus automating change — earlier than ever before in the overall product development cycle. Typically, concurrent designers are in conflict because they are competing to use the same limited space. Digital pre-assembly minimizes the cost of these conflicts as measured in time and dollars by creating an electronic definition which allows team members to see each other's work, thus making conflicts obvious.

Shorts has demonstrated that a digital pre-assembly strategy can and did drastically reduce the typical rework ratio. As a result, total design/manufacturing time would be cut to an impressive 60,000 person-days.



For the Learjet 45 fuselage Shorts also used the project management and control capabilities of Computervision's EDM as a means of tracking all data and documentation as well as coordinating the activities of the team members. EDM promises to play an even greater role at Shorts in the future, as the company continues its transformation toward full workflow automation.

FUTURE: WORKFLOW MANAGEMENT

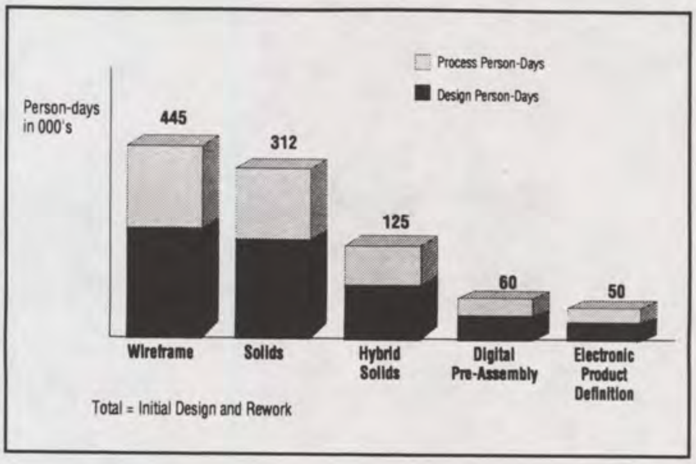
In fact, in reviewing the Learjet 45 project, it was clear to Shorts that too much time was spent on processing part information. Part-processing person-hours were equivalent to part-modeling person-hours. This happened because the status of information relating to parts and product configuration was not visible in the process.

For the new Global Express program, Computervision is working with Shorts to develop a new EDM workflow strategy to improve information flow and visibility and to establish much tighter integration of the key design and manufacturing systems using a framework. The EDM workflow system will provide a much improved product structure modeling and information attribute capability using EDMVault™, CAMU and Configuration Access, a process workflow capability based on EDMProjects™ to ensure users have better visibility of the status of the evolving product definition and a change control capability to completely automate the processing and notification of change. Integration of EDM with Shorts' MRP II project planning and process planning systems will ensure that all product information is instantly available to relevant users.

These new capabilities will help eliminate wasted time, and the associated costs of wasted time, from overall product development processes. In terms of this analysis, the EDM workflow capability is projected to reduce the process time required to check and release parts by at least two engineer-days for every simple part, and up to five engineer-days for complex parts. Overall, it will have the effect of taking a further 10,000 engineer-days out of the product development process of a fuselage.

CONCLUSIONS

The following chart documents the improvements associated with the various transformations Shorts undertook. Not satisfied with incremental improvement, Shorts has clearly realized significant return from its product development process transformation.



The Shorts' analysis shows why world-class manufacturing organizations are increasingly focusing their strategies on the following:

- The importance of part-count reduction and to what extent the feasibility of designing complex parts in lieu of part assemblies can have on reducing cost and cycle time.
- The crucial role of digital pre-assembly in the complete product development cycle and the impact of "right first time" on the current level of design change from manufacture, assembly and support, including a view of the extent of wasted engineering time, the cost of scrap and the extent of delay because of poor quality information.
- The extent of information gathering and thinking time in the total part design cycle and an understanding of how EDM can provide better visibility of, and access to, this information; i.e., on-line standards, best practices, etc.
- The extent to which an integrated EDM configuration management, development process attribute (planned cost, schedule, etc., vs. actual) and information workflow capability would reduce development cost and time to market by improving information flow and visibility.

It is in these areas that many industry leaders are increasingly focusing attention. Addressing these issues will bring the most significant product/process improvements possible today and will give these companies the ability to continually grow and improve the competitiveness of their product development processes.

Printed on recycled paper.

ACKNOWLEDGMENTS

This material owes its existence to the professionals at Short Brothers, Belfast, UK. The vision and the accomplishments of the Shorts' team demonstrate an example of a true "step-change" in product development.

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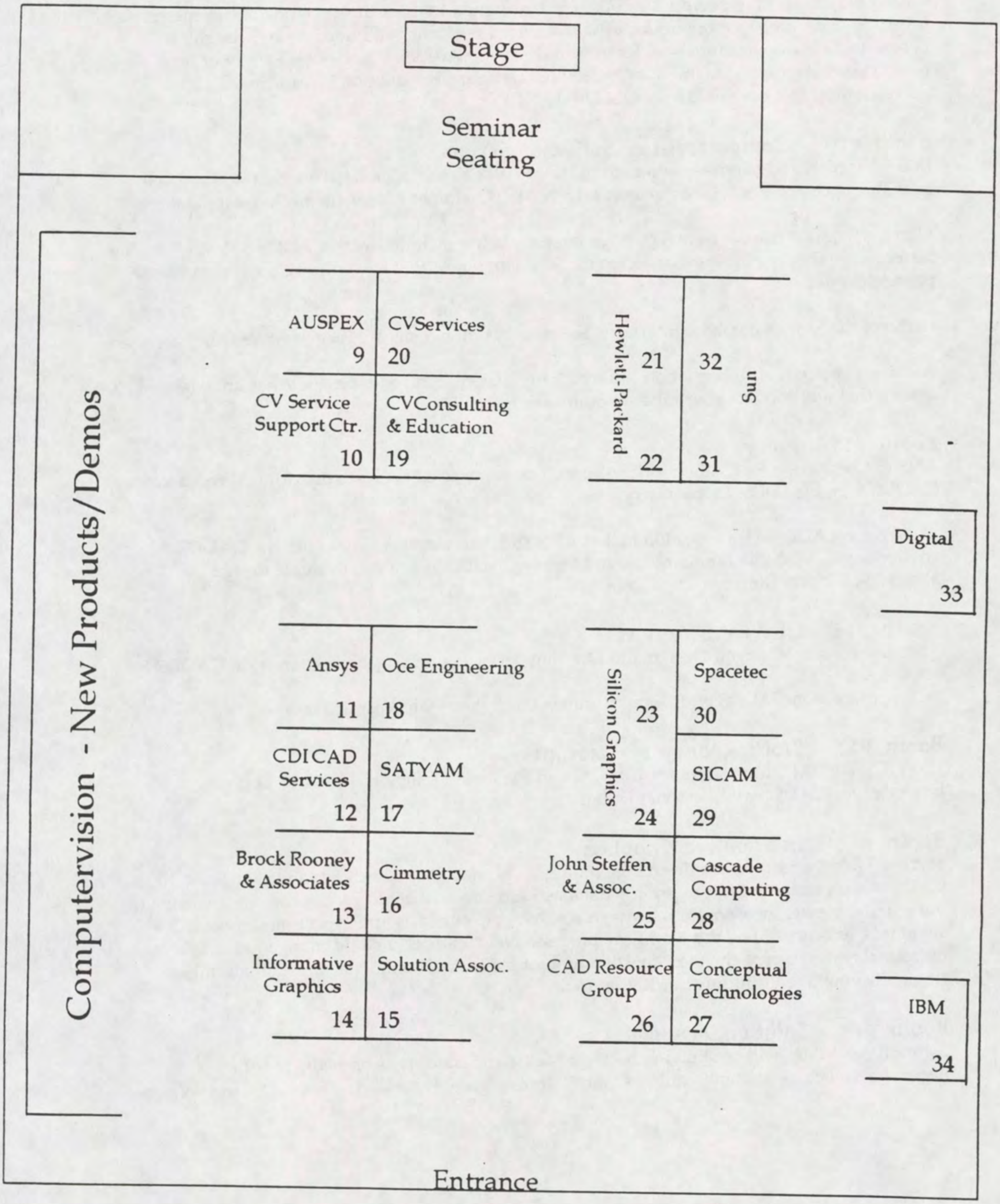
Vendor Fair

Sunday, September 15 - 6:00 pm - 9:00 pm
Monday, September 16 - 5:15 pm - 8:30 pm



Booth #9 - AUSPEX

The AUSPEX NS7000 NETSERVER FAMILY delivers the highest NFS (Network File System) performance and reliability in demanding, real-world production environments. The NS7000 family includes an entry level system, the NS7000/150, configured for small work groups; a department level server, the NS7000/250, addressing the needs of large work groups and branch offices; and the powerful NS7000/650, designed to meet the demands of the enterprise. If getting more data to more desktops with assured reliability and maximum throughout performance is important to you, let us introduce you Auspex's NetServer Family of high performance data servers, and our Continuous DataServices solutions - DataGuard and ServerGuard. We deliver DATA ON DEMAND.

Booth #10 - Computervision Software Services

Demonstration and hands-on access to the CV WWW Knowledge database that will soon be available to customers. Hands on access the CMS (Customer Management System) database.

Plotting Demos - See the new RTL filter which is being included with CADDS 5 Rev. 6. It plots raster image files to plotters that accept the RTL language. Plot to a color Lazerjet postscript plotter/printer.

Demo of the Scopus database interface. See how customer calls are logged, stored, and accessed.

Archive Tape convert information. Convert any CGOS archived tapes. CV has an extended service that will convert your tapes to 8mm, 4mm, or CD.

Booth #11 - Ansys

ANSYS Connection for CADDS - This solution customizes ANSYS 5.3, providing direct access to CADDS 5 and CADDS 4X geometry.

ANSYS for CADDS - This solution makes ANSYS 5.3 accessible from within the CADDS environment. With the familiar look and feel of CADDS 5, you can evaluate design alternatives and optimize your concept.

Booth #12 - CDI CAD Services

* On and off site Managed Design and Drafting Services utilizing Computervision CADDS 5 Software.
* Computervision CADDS 5 Job Opportunities throughout the West Coast.

Booth #13 - Brock Rooney & Associates

DXF, IGES, VDAFS translators for CADDS and Personal Designer. Rapid Prototyping interfaces for CADDS and Personal Designer.

Booth #14 - Informative Graphics

Myriad 3.0 is the fast way to do change requests. Myriad views, redlines and plots over 100 CAD (vector), raster, word processing, database and spreadsheet formats. The latest version of the popular viewer incorporates new features that help cut costs and cycle times, meet ISO 9000 standards, and streamline the workflow process. New features include changemarks, which indicate the most recent changes, consolidation of individual comments and changes into a single document, and intuitive redlining tools.

Booth #15 - Solution Associates

Solution Associates will be showing back-up Media and other type of media for other peripherals, such as Media Syquest, Optical, 4mm - 8mm, Data Cartridges, CD's and software.

Booth #16 - Cimmetry Systems Inc.

Cimmetry Systems Inc., the leader in document viewing and markup solutions for the enterprise, will be showing the latest version of AutoVue Professional. The software lets users view and markup over 160 file formats outside their originating application. Available in Windows, DOS, and UNIX platforms, AutoVue can view and markup CAD, engineering vector, raster, hybrid, word processor, spreadsheet, database, fax and other formats. Formats supported include: CGM, CALS, HPGL, HPGL2, TIFF, PostScript, AutoCAD, MicroStation, ME10, IGES, Microsoft Word, Microsoft Excel, WordPerfect, Lotus 123, PCL5, and many others.

Booth #17 - SATYAM COMPUTERS

1. Video of the "SATYAM Technology Center
2. Presentation on "Engineering Services" offered by SATYAM (India Design Center)
3. Examples of Designs carried out by the SATYAM Design Team

Booth #18 - Oce Engineering Systems

Oce Engineering Systems will be demonstrating the 9400 Multi-function Plotter/Copier with Scan to File. Oce Engineering Systems manufactures and sells wide format analog copiers, digital multi-function plotter/copiers, stand along scanners and imaging supplies.

Booth #19 - Computervision Customer Education

Stop by our booth and pick up a new Customer Education Catalog, ask about our Seminar Series and our customized training courses.

Booth #19 - Computervision Productivity Services

Productivity Services would like to discuss with you how Computervision can increase productivity within your organization.

Booth #20 - Computervision Services

Computervision Services would like to discuss Capacity Planning and Optimization with you. As your network infrastructure expands, or as you migrate from host-based applications to client/server architecture, Capacity, Planning and Optimization can help you reduce or eliminate performance, integration, reliability, or management problems. And if you want to determine how new Computervision applications will affect your systems, we can model and simulate the impact of the new traffic and recommend solutions to optimize performance.

Booth #21 & 22 - Hewlett-Packard Company

Wanna' trade up to a faster system than the UltraSparc? and get it easily? and have it upgradeable to the INTEL/HP future CPU called "Merced"? Visit HP's booth to "Ask the Expert" how Hewlett-Packard will make this all possible. Find out why Hewlett-Packard is your best choice today . . . *and for the future.*

Booth #23 & 24 - Silicon Graphics

Silicon Graphics will be hosting two booths in conjunction with John Steffen Associates. On display, will be Indigo2 IMPACT and Indy R5000 Modeler Workstations demonstrating the latest in 3-D visual computing for CAD/CAM users, CADDS to WEB (VRML) Translators, full-featured Multi-media WEB Collaborative Tools, easy-to-use Desktop Features, as well as the Incredible graphics technology for which SGI is world renouned. Stop by, and get your FREE CV/SGI Crew Shirt and register to WIN a Suede SGI Jacket.

Booth #25 - John Steffen Associates

John Steffen Associates is back again for the 4th straight year, and once again is showing the best technology and most valuable solutions. The Optegra family of products have a lot to offer, and JSA is showing the hottest. See how to interface the WEB to your Optegra Vault, See how Workflow can work for you, and see how to interface your custom applications right to the Vault. Another JSA tradition is showing the latest in MEDUSA. With all of the buzz about MEDUSA NT and NG 3.0, you can count on JSA having the scoop on MEDUSA Integration and education.

Booth #26 - CAD Resource Group

CAD Resource Group (CRG) is a full service provider for Computervision products and service. CRG is also a full service provider for CAD Centric Systems Integrators (CCSI), the developer of Onscreen Model Access, FlashRas and Raster Worx LT.

Booth #27 - Conceptual Technologies

Conceptual Technologies is one of the leading CAD/CAM Value Added Reseller/Systems Integrators in North America. Conceptual is a technology partner to it's customers, helping them select the appropriate technology/products for their needs and assisting in successful implementation. (Training, Customization, Consulting). We offer Computervision's full range of Optegra and CADDS 5 products/services. We have a proven track record of delivering customized solutions to customers in aerospace, automotive, industrial machinery and consumer product industries.

Booth #28 - Cascade Computing

We will show Cascade FM a facility management application based on PELORUS™. We will also show Cascade Visual Expert, a tool where you can import and assembly different graphic formats plus export to internet/intranet.

Booth #29 - SICAM Corporation

SICAM is a full service engineering firm which specializes in CADDS 5 solid modeling, rapid prototyping and new product development. As one of the early Rapid Prototyping service bureaus, SICAM has developed advanced methods for producing rapid models, functional rapid prototypes and rapid tooling. SICAM will be exhibiting the latest in Rapid Prototyping.

Booth #30 - Spacetec IMC Corporation

With a sleek, new design and enhanced functionality, the Spaceball 3003 is the next generation 3D input device designed for the 3D mechanical design and engineering market.

Booth #31 & 32 - Sun Microsystems

Sun Microsystems will demonstrate the improved performance of CADDS 5 on Sun's new UltraSPARC workstations. Sun will also demonstrate an implementation of CADDS 5 using Sun's new compiler technology to further increase performance on all Sun workstations.

Booth #33 - Digital Equipment Corporation

Digital will be presenting MEDUSA on Alpha NT and also will be showing CADDS 5 Rev. 6.0 on Alpha UNIX.

Booth #34 - IBM Corp.

Several models of the RS/6000 will be showing the CADDS 5 Rel. 3.2 and Optegra Visualizer as well.