Virtual Factories

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Virtual Enterprises

- Definitions
- Strengths
- Virtual Manufacturing in a Virtual Enterprise
- Optimal Selection of Partners for Agile Manufacturing
- Forming a Virtual Enterprise
- Requirements
- Challenges
Definitions of a Virtual Enterprise

- Several smaller companies that cooperate to design and manufacture a product
- A large manufacturer and its supply chain
- A global partnership that integrates its activities via computer communication
- A flexible organization that changes when new opportunities appear

Virtual Enterprise Strengths

- Adaptive: reacts quickly when market conditions change or a military threat appears
- Customized: includes manufacturing resources selected for their abilities
- Efficient: low-cost, low-volume production
- Effective: supporting technology enables it to manage the supply chain better
  » Increase on-time deliveries
  » Compress lead times
  » Reduce inventory, freight, changeover costs
Virtual Manufacturing in a Virtual Enterprise

- Need to select partners to develop and manufacture a product
- Which comes first? Product design or partner selection?
- Designers should consider partner capabilities
- Virtual enterprise should have optimal partners

Optimal Selection of Partners for Agile Manufacturing

- **Vision**
  - Design for manufacture by multi-enterprise partnerships
  - Assign production tasks to most suitable partners
  - Perform design evaluation and partner selection early in product life cycle

- **Technical Objectives**
  - Retrieve similar designs already developed by partners
  - Detect infeasible design attributes
  - Evaluate design manufacturability with respect to partners’ production capabilities
  - Integrate solid modeling and Internet technologies
Integrated Design Evaluation and Partner Selection

- Design (STEP OODB)
- Critical Design Information
- Infeasible and Difficult Design Attributes
- Selected Partners: Cost, time, yield
- Similar Products, Cost, time, yield

Design Processor

Product Search & Sort

Feasibility Assessment

Manufacturability Assessment

Partners: Products

Manufacturing Resource Model

- PARTNER 1
  - OHIO PLANT
  - ASSEMBLY PROCESS
  - EQUIPMENT: GANTRY ROBOT

Plant:
- financial data,
- systems,
- processes

Process:
- equipment

Equipment:
- capabilities,
- performance
High-level Process Planning

Mechanical Product

Primary Process
- Primary Plant
Secondary Process
- Secondary Plant
Tertiary Process
- Tertiary Plant

MWM Product

Through-hole Process
- Through-hole Plant
Machining Process
- Machining Plant
Artwork Generation Process
- Artwork Generation Plant
Assembly Process
- Assembly Plant
Testing Process
- Testing Plant

Critical Design Information

null

Sand casting

Machining
- Baltimore (all features)
  - Pittsburgh (one pocket)
  - Baltimore (both pockets)
  - Baltimore (both holes)

Machining
- Baltimore (pocket, holes)

Machining
- Baltimore (both holes)
Forming a Virtual Enterprise

Alternatives  Requirements  Partners

Select an alternative and partners simultaneously

Evaluate how well partners meet requirements

Requirements

- Business Practices
- Communication
- Shared Manufacturing Information
- Technology

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<th>Challenges</th>
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<tr>
<td>- Changing corporate culture (security, trust, perspective, integration)</td>
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<td>- Protecting proprietary information while allowing potential customers</td>
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<td>access</td>
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<tr>
<td>- Developing standards</td>
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<td>- Using heterogeneous legacy databases</td>
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<td>- Communicating complex engineering knowledge</td>
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<td>- Creating robust technology</td>
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