Design for Manufacturing

Teaching materials to accompany:
*Product Design and Development*
*Chapter 11*

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Product Development Process

Planning → Concept Development → System-Level Design → Detail Design → Testing and Refinement → Production Ramp-Up

How can we emphasize manufacturing issues throughout the development process?
Design for Manufacturing Example: GM 3.8-liter V6 Engine
Understanding Manufacturing Costs

Manufacturing Cost

- Components
  - Standard
  - Custom
    - Raw Material
    - Processing
    - Tooling
  - Assembly
    - Labor
    - Equipment and Tooling
- Overhead
  - Support
  - Indirect Allocation
Definition

- **Design for manufacturing (DFM)** is a development practice emphasizing manufacturing issues throughout the product development process.
- Successful DFM results in lower production cost without sacrificing product quality.
Three Methods to Implement DFM

1. Organization: Cross-Functional Teams

2. Design Rules: Specialized by Firm

3. CAD Tools: Boothroyd-Dewhurst Software
Design for Assembly Rules

Example set of DFA guidelines from a computer manufacturer.

1. Minimize parts count.
2. Encourage modular assembly.
3. Stack assemblies.
4. Eliminate adjustments.
5. Eliminate cables.
6. Use self-fastening parts.
7. Use self-locating parts.
8. Eliminate reorientation.
9. Facilitate parts handling.
10. Specify standard parts.
Design for Assembly

• Key ideas of DFA:
  – Minimize parts count
  – Maximize the ease of handling parts
  – Maximize the ease of inserting parts

• Benefits of DFA
  – Lower labor costs
  – Other indirect benefits

• Popular software developed by Boothroyd and Dewhurst.
  – http://www.dfma.com
To Compute Assembly Time

Handling Time

+ Insertion Time

Assembly Time
Method for Part Integration

• Ask of each part in a candidate design:
  1. Does the part need to move relative to the rest of the device?
  2. Does it need to be of a different material because of fundamental physical properties?
  3. Does it need to be separated from the rest of the device to allow for assembly, access, or repair?
• If not, combine the part with another part in the device.
Videocassette DFM Exercise

- 2 billion worldwide annual volume
- 7 major producers of 1/2” cassette shells
- JVC licenses the VHS standard
  - dimensions, interfaces, light path, etc
- VHS cassette shells cost ~$0.25 each
- What is a $0.01 cost reduction worth?
DFM Strategy is Contingent

Corporate Strategy → Product Strategy → Production Strategy → DFM Strategy