D-Lab

Spring 2005

Design for Assembly

"*a process for improving product design for easy and low-cost assembly, focusing on functionality and on assemblability concurrently*."

--Vincent Chan & Filippo A. Salustri

Design for Assembly

- Reduce cost of assembly
- Improve quality and reliability
- Reduce part inventory
- Reduce production equipment

Special Considerations for Developing Countries

- Job Creation
- Resource Availability
- Scale
- Scope
- Repeatability

Assembly Methods

- Manual assembly
- Fixed automatic assembly
- Flexible automatic assembly

Design Guidelines for Manual Assembly

- eliminate the need for workers to make decisions or adjustments.
- ensure accessibility and visibility.
- eliminate the need for assembly tools and gauges (i.e. prefer self-locating parts).

Jigs & Fixtures

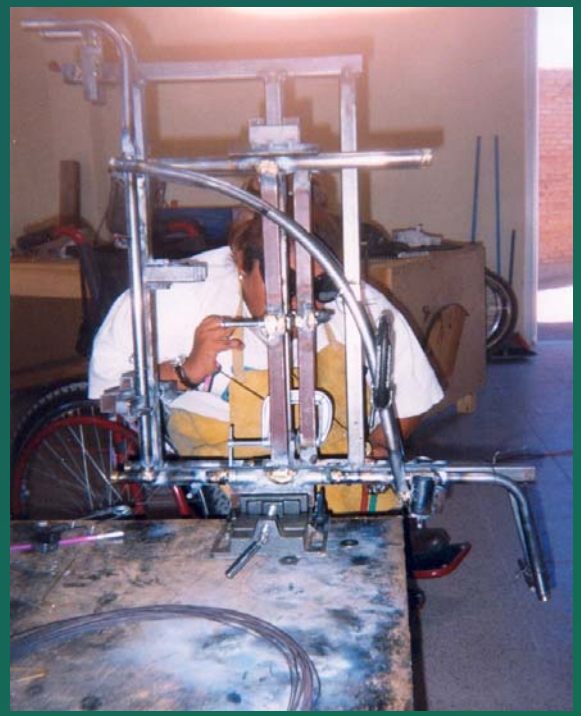

Image courtesy of DISACARE.

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Design Guidelines for Manual Assembly

- minimize the number of different parts - use "standard" parts.
- minimize the number of parts.
- avoid or minimize part orientation during assembly (i.e. prefer symmetrical parts).
- prefer easily handled parts that do not tangle or nest within one another.

Design Guidelines for Automated Assembly

- reduce the number of different components by considering
  - does the part move relative to other parts?
  - must the part be isolated from other parts (electrical, vibration, etc.)?
  - must the part be separate to allow assembly (cover plates, etc.)?
- use self-aligning and self-locating features
- avoid screws/bolts

Design Guidelines for Automated Assembly

- use the largest and most rigid part as the assembly base and fixture.
- Assembly should be performed in a layered, bottom-up manner.
- use standard components and materials.

Design Guidelines for Automated Assembly

- avoid tangling or nesting parts.
- avoid flexible and fragile parts.
- avoid parts that require orientation.
- use parts that can be fed automatically.
- design parts with a low centre of gravity.

Basic DFA Guidelines

- Minimize part count by incorporating multiple functions into single parts
- Modularize multiple parts into single subassemblies
- Assemble in open space, not in confined spaces; never bury important components
- Make parts such that it is easy to identify how they should be oriented for insertion
- Prefer self-locating parts

Basic DFA Guidelines

- Standardize to reduce part variety
- Maximize part symmetry
- Eliminate tangly parts
- Color code parts that are different but shaped similarly
- Prevent nesting of parts; prefer stacked assemblies
- Provide alignment features

Basic DFA Guidelines

- Design the mating features for easy insertion
- Insert new parts into an assembly from above
- Eliminate re-orientation of both parts and assemblies
- Eliminate fasteners

Basic DFA Guidelines

- Place fasteners away from obstructions; design in fastener access
- Deep channels should be sufficiently wide to provide access to fastening tools; eliminate channels if possible
- Provide flats for uniform fastening and fastening ease
- Ensure sufficient space between fasteners and other features for a fastening tool
- Prefer easily handled parts