



Prototyping

Fail often to succeed sooner.
- IDEO philosophy

What is a Prototype?

- Physical model (whenever possible)
 - Creates immediate visualization for designers and others
 - In some cases can be used to assess functionality or performance
- Virtual model (for very large or complex projects)
 - 3D assembly model or process model
 - Creates immediate visualization for designers and others
 - In some cases can be used to assess functionality or performance

Why Use Prototypes?

- Greater freedom and care in allocating resources
- Reduction of costly iterations
- Acceleration of parallel activities
- Proof of concept (or lack thereof)
- Allows for testing or analysis sooner
- Spawn new ideas for problems or new products

Uses of Prototypes

- Communication
- Demonstration (focus groups)
- Scheduling/milestones
- Feasibility
- Idea generation/Problem solving
- Parametric modeling
- Sales and marketing

Choice of Materials

- Types
 - Wood
 - Plastics
 - Metals
 - Adhesives
 - Other materials (paper, custom polymers, “starch”)
- Influencing Factors
 - Cost
 - Availability
 - Ability to accept changes
 - Ease of use and forming capability
 - Scalable geometry
 - Scalable properties

Important Questions

- Should the team build a prototype(s) at a certain times?
- What is the purpose(s) of the prototyping efforts?
- What are the possible forms of the prototype?

More Important Questions

- What simplifications can be made that are independent of the prototype's purpose?
- What types of tests will be applied to the prototypes?
- What is the risk of constructing prototypes or continuing without them?

Types of Rapid Prototyping

- Laser fusion
 - uses lasers to fuse powder layers
- Stereolithography
 - uses light or laser sources to solidify photosensitive resins into solid shapes
- Extrusion
 - materials from a heated extrusion head are deposited
 - this forms layers of the part being prototyped

Types of Rapid Prototyping

- **Fused Deposition Modeling (FDM) – across the hall**
 - builds shapes using a fine extruded thread of plastic (usually ABS or PC) on an x-y-z platform
 - “support material” used to stabilize the part can be broken away or dissolved
 - Parts have some structural strength and can be easily bonded together to make larger samples
 - Can be used for both visual and functional prototypes (within reason)
- **Laminated Object Modelling (LOM)**
 - builds shapes with paper or plastic by “attaching” layers of the material with an adhesive through a heating process
 - Mainly used for visualization
- **Inkjet (starch) printing**
 - inkjet head prints layers of a “starch” material
 - Parts are fragile and are suitable for visualization only

Rapid vs. Normal Prototyping

- Cost trade-off
- Cycle time (and speed of fabrication)
- Accuracy of the prototyped parts, including tolerances and surface finish
- Material properties (type of materials)
- Part size
- Part strength

For APSC 381...

- Bill of Materials with estimated cost
- Schedule
- Space considerations
- Test equipment
- Team commitment
- My approval (if you want to be reimbursed...)



Process Prototyping...

- Dave Mody will take you through some thoughts on prototyping in the chemical process industry