

Prototyping

Lecture #8

February 9, 2006

*Dr. Marie Guion
University of Minnesota*

Schedule

2/14/06 – Cost and Price of Products

- Full PDS Due

2/16/06 – Team Meeting

- Gantt Chart, Work Breakdown Structure Due

Information

- Please check with your advisors – have they reviewed the mid-term schedule?
- SKYPE

Prototype

Write down your definition of prototype.

Ulrich and Eppinger.....

“Anything which approximates the final product.”

Why prototype?

- Visualization purposes.
- To reduce risk and increase probability of success.
- But....they cost \$\$\$ and time.

Porsche Le Mans Prototype 2



Prototype of Comanche Combat Helicopter



Minos Light case crimping machine



Class Exercise

A furniture maker is considering a new line of chairs fabricated from a new plastic which can be cut, bent and bonded. Using cardstock create at least one prototype chair. You can sketch it first or jump right into creating a prototype.

Algorithm prototypes

- *.exe file
- Computer code that has been commented.

Steps to successful prototyping

- Clearly define the purpose...Why?
- What are you approximating (and not)?
- Determine the form of the prototype.
- Determine cost, construction plan.
- Test, gather data.

Purpose

- Technical feasibility
 - Convincing the team it work?
 - Fine tuning, working out the bugs.
 - Typically done for a subsystem
 - Engineering bench-model, "works-like"
 - Prototype subsystem...what do you have the least amount of confidence in (strength, speed..)

- Concept Communication
 - Focus group, trade show..
 - Testing customer reaction
 - Convincing outside stakeholders.

What/How to prototype

- Purpose defines what.
- Determine: works-like or looks-like
- Determine: does it make more sense to do the equations, put it on autocad or go to the machine shop and build it?
- Consider virtual prototyping.
- Cheap/fast is good and usually sufficient.
- Watch out for time/\$ costs.

Prototyping Thoughts

- Dual prototypes are common.
- All stakeholders need to know what is real and what isn't.
- Do it early and do it often.
- Go for simple and cheap.
- Foam-core or foam carved are effective for looks-like prototypes.
- Don't mix prototype with product.
- Test and gather customer information.
- Try ½ or twice scale models.

Rapid prototyping

- New technology (1990's).
- "Art to part" – CAD model to physical model.
- Good resolution, limited size and strength.
- Best for small plastic parts with complex physical shapes.

U has Stratasys FDM 1650

- Stratasys FDM1650 rapid prototyping machine (www.stratasys.com). Turn your CAD file into a real part by "3-D printing". Parts formed from ABS plastic. Max size approx 6x6x6. Run times typically 2-6 hours. Great resource which you should definitely take advantage of. It is very unusual for an engineering school to have its own RP machine. See TA for details.

WARNING

- Rapid is relative...can take several iterations.
- Time consuming.

Class Exercise #2

- Determine what your design show booth will look like – point out the prototypes.
- Do a perspective sketch.
- TURN THIS IN AT THE END OF CLASS.
One per team.

Pitfalls of Prototyping

- Prototype doesn't contribute to development goals
- Prototype delays time to market
- Schedule is too tight to enable integrating results of prototype
- Excessive cost

02/14/06 Lecture #9

Cost and Price of Products

Dana Lonn from Toro