

Product Specifications & Concept Generation

Lecture #4
January 26, 2006

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Information

- Prototype Lab, ME 1134.
 - Blue lockers and roll-about cages (BYOL).
 - See Wei (cell #612-205-7772).
- Student Shop for serious construction.
- Industrial espionage.
- SAIL team?
- See Lab Manager in ME308 for printing problems.

Today

- Product Specification
Chapter 5
- Concept Generation
Chapter 6

Progress Reports

- Be specific.
 - What did you do?
 - What day?
 - When will you be done?
 - Did you work with anyone? Name names.
- Be direct.
- Be honest.
 - Paperwork counts!
- Be succinct.
- Most important things go first...not in chronological order!
- Use Timelines.
- If you put a problem in writing – it becomes permanent.

Process for Generating Product Design Specification (PDS)

<u>Task</u>	<u>Deliverables</u>
Define Metrics	Initial metrics list Competitive
Benchmarking	Benchmarking chart (Metrics list with columns appended)
Set Ideal and Acceptable Targets	Target PDS
Review Results	Refined PDS (Completed during detail design)

Initial Definition of Metrics

- Two example metrics for a hand-held electric grass trimmer:

<u>Need #</u>	<u>Metric</u>	<u>Importance</u>	<u>Unit</u>
6	Battery life	3	hrs
18	Unit manufacturing cost	4	USD \$

Metric Guidelines

- Dependent attributes (mass is metric; material isn't)
- Practical (Can you measure it?)
- Some not quantifiable ("Looks sleek" units = "subj")
- Some units may be binary (UL safety test: pass / fail)
- Include popular criteria (Consumer Reports?)

Class Exercise #2 (5 minutes)

- Convert 3 of the statements generated in Exercise #1 (from Tuesday) to Metric - Unit Specifications

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Competitive Benchmarking

- Purchase
- Test
- Disassemble
- Estimate costs

Example Benchmarking Chart (2 rows)

Need #	Metric	Importance	Units	Milwaukee	DeWalt	Mikita
6	Battery Life	3	Hrs	3	3	2.5
18	Unit Manufacturing Cost	4	USD	50	45	30

Target Product Design Specification (Setting Ideal and Acceptable values)

Value Type	Example
> low	$k > 5 \text{ N/m}$
< high	cost < \$100
low - high	preload 100 - 200 N
binary	UL Safety = "Pass"
list	size = 1.00 in, 1.25 in, 1.50 in

Example Target PDS:

Ready for Concept Generation!

Active Detector Manifold PDS
(1/3 of complete PDS)

Need #'s	Metric	Importance	Units	Marginal	Ideal
2	Minimum fiber bend radius	5	mm	> 120	> 125
3	Crushing force	4	N	> 75	> 100
4	Light leakage	5	binary	none	none
9	Fiducial volume loss	4	%	< 2	0
7	Hair height	4	mm	< 250	< 200
5	Maximum fiber length	3	mm	< 1500	< 1000
11	Manufacturing cost	4	USD	< 100	< 75

Review the PDS

- Missing specs?
- Specs = commercial success?
- Refine target & ideal values to single specification during detail design

Contributions to Your Report

- **Customer Needs Statement**
(Ulrich & Eppinger Exhibit 5-2)
- **Benchmarking Chart**
(Ulrich & Eppinger Exhibit 5-6 or 5-7)
- **Target Product Design Specification**
(Ulrich & Eppinger Exhibit 5-8)
- **Refined Product Design Specification**
(Ulrich & Eppinger Exhibit 5-12)

Concept Generation

Chapter 6, pg. 97-120

- What are all of the possible ways to implement a design?
- Which one is the best?

Introduction

- A concept is an idea that addresses the PDS.
- Can be fragmented, complete, abstract or detailed.
- Concept generation is cheap and easy.
- Concept selection is hard.
- Use a process!

Concept Generation

- Goal: To find ALL of the ideas.
- It's more than brainstorming.

Steps: Concept Generation

- Review the PDS.
- Divide the problem.
- Gather Information.
- Idea Sessions (group and individual).

Ideation

- Is a process.
- Can be learned.
- Is not predictable.
- Is easy if attitudes are positive.

What is half of 8?

8 → 0

8 → 4

8 → 3
8 → ε

Document

- Index cards
 - Thumbnail sketch.
 - Trigger words (2-3 max)
- Design notebook
 - Number and date pages.
 - Witness for good ideas.
 - 2 witnesses for really good ideas.

External Search

- Reverse engineer existing products
 - Direct and indirect competitors.
- Patent search
- Interview experts
- Trade journals, handbooks, magazines, text books.
- Consult vendors

Internal Search

- Brainstorm (group)
- Brainstorm (individual)

The GOAL is to find ALL of the ideas.

Brainstorming

- Generate lots of ideas.
- Wild ideas OK.
- Withhold judgment.

Brainstorming Process

- Assign facilitator
- Define topic
- Agree on stop time
- Agree on recording method (index cards)
- Build on ideas of others
- No stopping to evaluate
- Interruptions are okay

Resist the urge to judge

- "Oh that will never work..."
- "That's way too expensive..."
- "Gee, where are we going to get an anti-gravity machine..."
- "The sponsor will think that's ridiculous.."
- "That will never be light enough..."
- "That's not going to be the idea we end up with..."

Brainstorming exercise

- Get into your groups.....
- Ways to join these two objects.

Brainstorming....paradigm shift

- Analogous tasks.
- Change the scale.
- Combine ideas.
- Relax one spec.
- Imagine new technologies.
- Invert.

What do you do with the ideas?

- Catalog
- Sort ...affinity grouping
- Combine
- Post on the wall
- Preserve
- Revisit

Mistakes your teams WON'T make

- All ideas generated before requirements set.
- Judgment mixed into generation process.
- Too few.
- Going with first idea.
- Equating brainstorming with concept generation.

What will your team be doing other than brainstorming to generate concepts....

- Patent search
- Trade magazines
- Consult experts
- Consult lead users..(customer-based)

01/31/06 Lecture #5 Concept Selection

- Product Design Specification (due 02/02).
- After receiving feedback from your advisor update and resubmit Mission Statement (due 02/02).

Paper copy to Pat Meyer
Electronic to Wei and to
guio0001@umn.edu

- Read Ulrich and Eppinger Text,
Chapter 7, pg. 124-141. SHORT QUIZ on Tuesday.