2.009 Product engineering processes

people don’t know what they want
they want what they know
how the customer explained it

what the customer really needed
A product opportunity

**idea + user need + market + doable**

3-ideas presentation
Identifying opportunities
idea + user need + market + doable

Processes:
individual creativity strategies

OXYGEN TANK SCOOTER
Scooter for those who are required to roll-around oxygen tank

Has the ability to fold up and act like a traditional scooter

Non-slip surface

Elliot Owen 126
Annie Chen 92
why raise the bar?
“the best way to get a good idea is to get a lot of ideas”

Linus Pauling, 1901-1994
Chemist, Nobel prize winner
Nobel peace prize
Nature of chemical bonds
Identifying opportunities

idea + user need + market + doable

Processes:

individual creativity strategies

brainstorming

1. DEFER JUDGMENT
2. ENCOURAGE WILD IDEAS
3. GO FOR QUANTITY
4. BUILD ON THE IDEAS OF OTHERS
Identifying opportunities

idea + **user need** + market + doable

Processes:

**individual creativity strategies**

**brainstorming**

**one-on-one/few discussions**
Identifying opportunities
idea + user need + market + doable

Processes:
individual creativity strategies
brainstorming
one-on-one/few discussions (idea fair)
secondary research (treasure hunt)
Treasure hunt feedback

first in: Blue B at 9:55 pm Wednesday
last in: Red A at 11:54 am Thursday

Yellow A Team  
Information Treasure Hunt  
September 14, 2017

1. You are investigating using wire rope for a hoisting apparatus to get machinery into your secret HQ. You need to know more about wire rope strengths. Note: if you use different information sources or sections these questions, provide a separate citation for each source you use. Hint: standards and handbooks are great for finding this kind of information.

   a. For 1-inch diameter 6x19 standard hoisting wire rope, what is the breaking strength in tons for rope made with improved plow steel?
      41.8 tons
      (Information found on pg. 3426 of Oberg et al.)

   b. You are making a wire rope sling. What is the minimum number of U-Bolt clips needed to fasten a 1 inch diameter wire rope end?
      4 clips
      (Information found on pg. 3439 of Oberg et al.)


Treasure hunt

feedback

top sections:
incorporated the question into their response
provided all of the requested information
provided correct, consistent citations
provided a nicely formatted, easy to read document
used resources efficiently (and asked for help!)

lower scoring sections:
missed details (such as including section name)
did not provide complete/consistent citations, or were missing citations
did not use easiest source, even when there were hints
Treasure hunt results

top scavengers: yellow a

silver a
Treasure hunt
some design lessons

using the right tool can make a job much easier
simple is good!
Identifying opportunities
idea + user need + market + doable

Processes:
individual creativity strategies
brainstorming
ask, one-on-one/few discussions (idea fair)
secondary research (treasure hunt)
in-context observation of users
why observe users?

you will learn something!
increase your odds for a successful product

right now…
  identify leads for ideas
  clearly define product goals

observing people: optional tutorial, 5 PM today in 3-442
types of user research
Identifying opportunities
observing people, observing things

you are a detective looking for clues
Identifying opportunities
idea + user needs + market + doable

Processes:
individual creativity strategies
brainstorming
ask, one-on-one/few discussions (project fair)
secondary research (treasure hunt)
in-context observation (observation exercise)
engineering (feasibility) estimation
Estimation exercise
some practice

estimate the usable energy in a D size battery

2 minutes
blank index card
name and section on top of page
no computers or mobile devices
hand in to center isle
Identifying opportunities
idea + user need + market + feasibility

engineering estimation
order of magnitude calculations, back of the envelope

explore the feasibility ideas and potential degree of difficulty quickly, even though many details are unresolved

analysis analog of an idea sketch

Something that requires practice (and creativity)
Usable energy in a D cell solution example

Develop a model

simple, familiar, analogous

\[ E = P \times t \]
Usable energy in a D cell solution example

Apply some numbers, check units

\[ E = P \times t \]

Flashlight bulb: 5W
Battery life: 3 hr
\((10800 \text{ s})\)
D cells: 2

\[ 2E = 5 \text{ J/s} \times 10800 \text{ s} \]
\[ E = \sim 3 \times 10^4 \text{ J} \]
Feasibility estimation

general approach

1) you have an idea!

2) what worries you? (critical feasibility questions)

3) develop/ideate analogous models

4) apply quantities, checking units

5) decide if answer seems believable
An idea!
battery powered, hand-held foam cutter

is it feasible?

Step 1
key “is it possible” question

name on index card
1 minute
no computers or mobile
An idea!
battery powered, hand-held foam cutter

is it feasible?
key question?
how big for reasonable use time?
how many batteries?
power?

Steps 2 + 3
develop an analogous model
some numbers
name on index card
1 minute
no computers or mobile
An idea!

Battery powered, hand-held foam cutter

- light bulb 100 W
- sphere dia. ~4 cm
- area ~ 50 cm²
- need ~2 W/cm²

- wire dia. 0.1 cm
- wire length 15 cm
- wire area ~5 cm²

- power: 2 W/cm² x 5 cm² ~10 W

key question?
how big?
power?
An idea!
Battery powered, hand-held foam cutter

power ~10 W
reasonable: yes

what next?
feasibility test
(sketch model)
A sketch model!
battery powered, hand-held foam cutter

what next?
sketch model
and last...

some logistics

observing people: 5 PM today in 3-442

over the weekend:
   read chapters 3 and 4 in text
   read details for the 3-ideas presentation

if you have not received email from me yet…
   add drwallac, drwallace as safe sender
Observation exercise

the opportunity-finding process has just begun!

each person in your section will sign up to observe at one of several places

based on your observations, report at least one new, product opportunity to the team in lab next week

organize as section and complete ‘observation places’ signup form now!

who is going where page in case you want to team up
now!
organize for observation exercise
one section member completes web signup form
who-is-going-where summary online

scored treasure hunt submissions will be emailed