Project Guidelines

Central to this class is a team-based approach to conceive and design a new product and present a prototype in the final class session. The goal of this exercise is to learn principles and methods of product development, to improve teamwork skills and to appreciate the inherent multidisciplinary nature of product development. Project ideas come from the students in the class. Guidelines for reasonable projects are given below. The project proposal process is explained in the assignments section.

Project Teams

In the second week of the course, we will form project teams on the basis of expressed student preferences. Teams will consist of about seven students. Once you are assigned to a project team, we expect you to stay in the course for the entire term.

Project Materials and Expenses

Each team will be allocated a budget of $1,000. Under no circumstances will we reimburse for expenses above $1,000. If your project requires additional expenditures, your team is expected to cover these expenses personally. Also, please note that MIT will not reimburse teams for sales tax.

Intellectual Property Rights

The student teams will generally be able to retain the rights to any inventions they develop in this course. If a team should decide to pursue a patent, they may do this on their own. Alternatively, the team can "share" their invention with MIT, which may be interested in patenting it, in exchange for a portion of any licensing royalties. Teams should spend some time during an early meeting agreeing in advance on how to distribute any economic rewards arising from the intellectual property you create. Your project assignments will serve as a dated record of the evolution of your ideas.

Project Constraints

While special cases will be considered, you are strongly encouraged to choose a project satisfying all of the following constraints:

- There should be a demonstrable market for the product. One good way to verify a market need is to identify existing products that attempt to meet the need. Your product need not be a variant of an existing product, but the market need addressed by your product should be clearly evident. The product does not need to have a tremendous economic potential, but should at least be an attractive opportunity for an established firm with related products and/or skills.
- Most products developed in this class are material goods and not services. While many of the ideas in the course apply to services and software products (for example, **customer needs** and

product architecture), many do not (for example, **design for manufacturing**). Nevertheless, the faculty are willing to hear project proposals from students interested in developing software, services, and internet-based enterprises.

- The product should have a high likelihood of containing fewer than 10 parts. Although you cannot anticipate the design details, it is easy to anticipate that an electric drill will have more than 10 parts and that a garlic press can have fewer than 10.
- You should be confident of being able to prototype the product for less than $1000. For example, a razor like Gillette's Mach3 may have about 10 parts, but would require tens of thousands of dollars to create a functional prototype.
- The product should require no basic technological breakthroughs. (Yes, a more compact airbag would be a nice, but can you do it without inventing a new chemical?) You do not have time to deal with large technological uncertainties.
- You should have access to more than five potential users of the product (more than 20 would be nice). For example, you would have great difficulty researching agricultural irrigation systems without leaving Cambridge.

A Few More Hints

- Save any highly proprietary ideas for another context; we will be quite open in discussing the projects in class and do not wish to be constrained by proprietary information.
- Most successful projects tend to have at least one team member with strong personal interest in the target market.
- It is really nice to have a connection to a commercial venture that may be interested in the product. (One group signed a licensing agreement with a major mail order and retail company with which they had made contact during the first week of the course. The product they developed became a commercial success.)
- Most products are really not very well designed. This is evidenced by the seemingly poor quality of common consumer products (utility knives, garlic presses, and ice cream scoops, for example). The experience in this class is that if you pick almost any product satisfying the above project guidelines, you will be able to develop a product that is superior to everything currently on the market. A book titled *The Design of Everyday Things* by Donald A. Norman (Doubleday, 1990) discusses good and bad examples and provides principles and guidelines for good design.
- Just because you have used a lousy product doesn't mean that a better one doesn't exist. Do some thorough research to identify competitive products and solutions.

Assignment Guidelines

Assignment 1: Project Proposal

Assignment 1 is the only **individual assignment** for this class. Only students that complete this assignment will be allowed to stay enrolled in this class. Please refer also to the **Guidelines for Projects** in the projects section, to assist you with both, identifying appropriate project proposals and selecting among the proposed projects. Exercises 2 and 3 in chapter 4 of the textbook can also serve as a starting point for project proposals.

Assignment 1a: Proposal Handout

Prepare a project proposal in any format that fits on one 8.5x11 page (one side only). Sample proposals from previous classes are available above. We will photocopy the proposals and distribute them in Ses #3. Proposals should include:

- A brief, descriptive project title (2-4 words). This is critical!
- The 3 nearest competitors (existing solutions) and price.
- Your name, phone number, email, department/degree program, and year.
- A description of the product opportunity you have identified. Your description may include any of the following: Documentation of the market need, shortcomings of existing competitive products, and definition of the target market and its size.
- Please do not present any of your own product ideas or solutions at this point; our strict focus in this phase of the course is on the market opportunity and not on solution concepts.

Assignment 1b: Proposal Presentation

Prepare a 50-second presentation to be delivered in class. Your presentation should include:

- A verbal or visual demonstration of the product opportunity you have described in your proposal. Given that the audience will be able to read your proposal at their leisure, you might spend your time explaining the richness of the market opportunity and demonstrating the existing competitive products.
- Convincing arguments why your classmates should vote for your product proposal.
- Any special skills or assets you have (marketing expertise, access to a shop, materials, electronics wizardry, etc.)

Showing one or two overhead slides is recommended. You may also use video. However, note that the 50-second time constraint will be ruthlessly enforced. A low tech approach is therefore typically more efficient.

Assignment 1c: Project Preferences

Submit your project preferences on a project selection card. List the ten projects you would most like to work on, in order of preference. If you would like to work with a particular group of classmates (up to 4), you should all list the exact same project preferences and clip your cards together. We will assign the rest of the team. Team and project assignments will be sent by email to the class no later than the next week. You are not required to select your own project proposal. However, if your proposal is selected, you will only be assigned to it if you have listed it with a high enough preference.

Team Assignments

With the exception of Assignment 8, all team assignments **must** be handed in at the beginning of the class session in which they are due. Assignment 8 does not require the submission of any written material; instead the teams will show their α-prototype to their advisors. The assignments are intended to pace the development process for your product. Since there is virtually no slack in this schedule the assignments must be completed on or before the scheduled due date in order to maintain the project schedule. All, but the first assignment, are to be completed as a team.

Guidelines for Team Assignments

Please adhere to the following guidelines for your team assignments:

- Be concise. Most assignments can be completed in very few pages. One exception to this guideline is concept sketches, which should be formatted with one concept per page.
- Please provide a short (less than one page) description of the process your group adopted in completing the assignment. However, there is no need to repeat a summary of the textbook if you adopt the exact approach in the text. In particular, please comment on what worked well and what did not.
- Combine all your work in one Microsoft® PowerPoint® file. (Occasionally, we will ask teams to give ad hoc presentations of their homework to exhibit best practices and pitfalls).
- **Hand in three copies** for your team so that the course faculty can provide comments. Keep a copy for your records.

Assignment 2: Mission Statement and Customer Needs List

- Describe your team's processes for getting organized and for identifying customer needs. Comment on this process and on your results.
- Write a mission statement for your project team as described in chapter 3. From now on, please **include your mission statement on all remaining assignments**. If you have decided to change your mission statement, please indicate so and explain your reasoning.
- Develop an organized list of customer needs for your product as described in chapter 4.
- Also hand in a copy of the original project proposal from Ses #3, even if you have already modified the description of this opportunity in your team's mission.
- You do not need to have completed an importance survey by this time, although if you feel the

need to further understand preferences and tradeoffs, you should do this soon and turn it in for review.

Assignment 3: Concept Sketches, Target Specifications and Patent Review

- Describe some of the steps of your concept generation and target specifications processes. Comment on the process and the results.
- Hand in sketches and bullet-point descriptions of 10 to 20 alternative concepts for your product. For each sketch, note which of the important customer needs it addresses and which it does not.
- Choose a few (perhaps 3 or 4) critical customer needs from your list. For these critical few, prepare a list of the target specifications and provide documentation to support these decisions.
- Perform a preliminary patent review searching on United States Patent and Trademark Office for any prior art and related ideas. Briefly describe the 3 closest matches and attach appropriate material from the Web site.

Assignment 4: Preliminary Concept Selection and Schedule

- Hand in sketches of the two or three concepts you believe are most promising.
- Show the concept selection matrix (screening or scoring) that you used to make these choices. Include a simple description or sketch of each of the concept alternatives considered.
- Prepare a list of the key uncertainties or questions you still need to address to determine the viability of your product. For each one, specify an associated plan of action (such as analysis, mock ups, interviews, experiments, etc.).
- Draft a schedule in Gantt-chart form (see p. 335 of the text) showing the plan of work to complete the project over the next two months. Include at least the following activities: detail design, materials and components selection, vendor selection, procurement of materials and components, testing, and completion of assignments.
- Describe your team's process. Comment on the process and the results.

Assignment 5: Review: Final Concept and Model

- For the Faculty Project Consulting in Ses #13, bring in and discuss some form of proof of concept to demonstrate that you will be able to overcome your key challenges.
- Prepare a 15-minute presentation of your (single) selected product concept. The presentation should include a review of your mission statement, customer needs, selected concept, and your key target specifications.
- As part of your presentation, demonstrate some form of "proof-of-concept" prototype model.
- Hand in a one-page description and sketch of your selected concept.
- Describe your team's process. Comment on the process and the results.

Assignment 6: Drawings, Plans, and Revised Schedule

- Prepare an assembly drawing of the alpha prototype you intend to build. An assembly drawing

shows all the parts in their assembled positions.

- Prepare dimensioned sketches of each piece part for your planned prototype. Include documentation showing how you arrived at critical dimensions (a stress calculation may be needed, for example).
- Include a bill of materials indicating whether the prototype parts will be purchased or fabricated, and a description of the assembly process. Indicate the material and fabrication process you have selected for each prototype part.
- Provide photocopies of the vendor specification sheets for the purchased materials and components. On catalog pages, identify which items you have selected for purchase.
- List the Web resources and vendors you have found to be helpful.
- Make a drawing or sketch of the production version of the product. Describe the differences between the prototype you will build and the production product. Briefly explain how the production product would be manufactured.
- Summarize the important decisions you have made since the previous assignment. Describe your prototyping plans. By this time, you should have price quotes and should be ready to place orders for any parts to be fabricated or purchased.
- Revise the schedule of your project work for the remaining weeks. Include your planned design work, vendor interactions, prototyping, testing, redesign, photography, and preparation of the presentation.
- Describe your team's process. Comment on the process and the results.

Assignment 7: Financial Model

- Prepare a financial model. Explain the scenario you are analyzing (startup activity, established manufacturer, etc.). Document the assumptions you have made in the analysis. Note that you will require estimates for the production tooling and variable costs.
- Perform a sensitivity analysis of the key financial uncertainties you face.
- Describe your team's process, including a brief status report on your prototyping and testing progress.

Assignment 8: Alpha Prototype

- You should be testing your product prototype by this time. Show your prototype hardware to your team advisor and faculty during the Faculty Project Consulting. No report is to be turned in this week.

Assignment 9: Final Presentation and Demonstration

- Prepare a 20-minute presentation describing and demonstrating your product. Your presentation should concentrate on the product itself, although you may wish to emphasize any particularly impressive portions of your development process. An effective presentation includes color photographs or video presentation along with a live display of the hardware. This presentation

should be of the quality you would make to convince a top management group to purchase the rights to your product or to fund its final development and launch. A panel of experts will observe your presentations and evaluate the products. Be prepared to answer questions about all aspects of your project.

- Create and demonstrate a Web page designed to promote your product (optional).
- Turn in a copy of the (slide) presentation (and files for the optional Web page).
- Turn in several high-quality digital photos of the prototype hardware. Be sure to include photos of the product in use.

Team Surveys

In the middle and at the end of the semester, each student must fill out a survey of his or her team and its members. The purpose of the evaluations is threefold. First, they help teams spot unbefitting team dynamics early on and take corresponding corrective action. Second, they present an opportunity to provide and receive individual feedback and determine personal strength and growth opportunities. Third, they are part of a long term study on the effectiveness on product development teams.