Course Title: Managing the New Product Development Process:
                  Design Theory and Methods
Units: 3

SYLLABUS

Purpose, Objectives and Teaching Methods

This course is part of the Management of Technology program at the University of California, Berkeley. It is considered an operationally focused course, as it aims to develop the interdisciplinary skills required for successful product development in today's competitive marketplace. Engineering, SIMS and Business students from Berkeley and students from the California College of the Arts join forces on small product development teams to step through the new product development process in detail, learning about the available tools and techniques to execute each process step along the way. Each student brings his or her own disciplinary perspective to the team effort, and must learn to synthesize that perspective with those of the other students in the group to develop a sound, marketable product. Students can expect to depart the semester understanding new product development processes as well as useful tools, techniques and organizational structures that support new product development practice. Although the course focuses on the application of these principles to new product development, they are more broadly applicable to innovation in general – of products, services, organizations, business strategies and governmental policies.

This is a three-unit graduate course. Accordingly, we have designed the course to demand approximately 12 hours per week of your time. We expect that each student will prepare for and attend all of the class sessions and will participate fully on a project team. This is particularly critical, as a number of the class sessions are "labs" during which we expect you to work with your team on your development project. We have tried to smooth the workload for the course so that it will remain relatively constant throughout the semester, and all requirements are clearly spelled out in this syllabus so that you can readily plan ahead.

Deliverables and Requirements

We encourage full group and class collaboration on all aspects of this course. It is almost impossible to share too much information in product development. We do expect that all team members will contribute substantially to the project efforts, although some students will choose to devote themselves to the projects beyond what is required for the course. Students will be asked to critique and contribute to the development projects of others in the class in a cooperative, supportive environment, and will be asked to submit critiques of their own group and group members during the course of the semester.

Reading Assignments:
Reading assignments and questions to guide your thinking about these assignments are given in the class schedule for each class session. We expect you to come to class prepared to discuss the readings and the suggested questions. In any given class session, a handful of students may be called upon specifically to speak to the readings and questions about them. If you have prepared according to the syllabus, you will have no problem responding when called upon. Your individual class participation grade will be based upon your in-class remarks during discussions and will be judged by the faculty.

Individual Assignments:
We have periodically assigned individual exercises to have you play around with some of the concepts we are teaching. The syllabus makes clear which of these are to be turned in. The others are intended simply to prepare you for class discussion.

ALL INDIVIDUAL ASSIGNMENTS ARE TO BE SUBMITTED VIA CATALYST PRIOR TO THE START OF CLASS ON THE DAY THEY ARE DUE. ALWAYS BRING ONE COPY OF YOUR HOMEWORK TO CLASS, AS WE WILL FREQUENTLY ASK YOU TO SHARE YOUR RESULTS.

Web site Use:

We will make extensive use of the course Web site to both communicate information to you and to converse with you about your homework and your projects. You will find the course listed on http://catalyst.haas.berkeley.edu/. Once you have formed your project groups, we will set up group web pages on which we expect you to store your working documents for your project. The faculty will review the group pages regularly to provide feedback on your work.

New Product Development Project:

The goal of this exercise is to learn principles and methodologies of product development in a realistic context. Most product development professionals work under tremendous time pressure and do not have an opportunity to reflect on the development process. In this course, the stress level will be low enough to allow time to experiment and learn. You will be asked to form project teams of 4 to 5 students, including a mix of Engineering, Business, SIMS and California College of the Arts (CCA) students. You will have opportunities during the first two weeks of class to scope out the possible projects and get to know potential teammates.

Project Background

Your challenge in the project portion of this course is to design a new product, test it on a consumer group, and produce a prototype version of it. The goal of this exercise is to learn principles and methodologies of product development in a realistic context. Guidelines for successful projects are as follows:

- There should be a demonstrable market for your product. One good way to verify a market need is to perform a competitive review and identify existing products that try 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 have to have a tremendous economic potential, but should at least be an attractive opportunity for a small firm.
- If you choose a physical hardware product (rather than a software user interface design), 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 a garlic press fewer than 10.
- You should be confident of being able to build a reasonable prototype of the product. If you choose to make a hardware product, you must have access to prototyping capabilities such as machining processes and the skill sets to run them. Your CCA team member should have access to shop facilities. If a member of your team is interested in using the UCB mechanical engineering student shop, you need to go through safety training in the early part of the semester. Gordon Long is the Senior Lab Mechanic in charge of the student machine shop. You will need to visit him in 1166 Etcheverry Hall or call him at 642-3314 to make an appointment. The qualification training is for education and safety purposes. It consists of three 1-hour sessions and one final 1-2 hour session on an actual hands-on application. In some cases a combination of a non-functioning "appearance" type model and a rough mechanical or electrical "working" prototype may be acceptable. For software user interface products, you should have access to proficiency in Web page design and/or PowerPoint.
- The product should require no basic technological breakthroughs. We do not have time to deal with large technological uncertainties. In fact, we are more concerned that you have a specific market need in mind for your project than that you attempt to develop new technologies.
- You should have access to more than five potential users of the product (more than 20 would be nice.) You will need to talk with them or observe them when you launch your product and visit them with your product prototypes.
- Save any highly proprietary ideas for another context, as we will be open in discussing the projects in class and do not wish to be constrained by proprietary information.
- The most successful projects tend to have at least one team member with strong personal interest in the target market.
- Most products are really not very well designed. (See, for example, the badly designed products documented at www.baddesigns.com.) Thus, if you pick almost any product that satisfies these general guidelines, you will likely be able to develop a product that is superior to everything currently on the market.

Projects adhering to these guidelines will have the greatest probability of success.

Project Assignments

Project assignments are intended to pace the development process for your product. There is virtually no slack in this schedule and so assignments must be completed on or before the scheduled due date in order to maintain the project schedule. All project assignments are clearly spelled out in the class syllabus. There are two types of assignments: review assignments that suggest that you complete certain deliverables by certain lab dates and formal project deliverables that are due at peer reviews. We don't ask you to turn in project review items, but to have them available for us to review at the labs. Project deliverables must be turned in.

All project deliverables (except the project proposal and the sketchbook/journal) are to be completed as a team. Please deliver all assignments according to the following format:

- Please submit all assignments and deliverables electronically. **Individual assignments** are to be submitted through the drop box that is set up on the due date for the assignment. They will be reviewed by faculty members. **Project deliverables** should be posted to your group's page on the class Web site where they will be visible to all members of your group as well as all faculty members and coaches.
- Maintain a history of your project deliverables on your group Web site so that the faculty can review your progress over time, not just your most recent output. You should save formal project deliverables as well as interim documents on the site. We will save these histories on CD-ROM at the end of the semester to reduce the amount of paper we keep.
- Be concise. We like assignments that are 2-5 pages in length when possible. The exception to this guideline is concept sketches where one concept per page is preferred.
- *With each project deliverable, please provide a short (less than one page) description of the process your group adopted in completing the assignment and reflections on its effectiveness*. You should also comment on any lessons learned related to team dynamics or project management. (Individuals may choose to print copies of these reflections to include in their journals.)
- Please develop a naming scheme for the things you post to your group website that makes obvious what those things are. In particular, you should name the links to the files that are intended for faculty review by using as the first word of the name the letters DEL (short for deliverable). Follow DEL with an indication of what the document is. For example, when you submit your mission statement for faculty review, name the link DELmissionstmt.

Journal

Each individual in the class is **required** to maintain a design journal throughout the semester to be turned in at the final project presentation, Saturday, December 17th. The journal will be returned at the beginning of Spring Semester. This journal should include your individual thinking (both imagery and words) pertaining to your project. Think of it as a diary of sorts. You may sketch pictures, paste in pictures, write words, or choose any other approach that works for you to capture your ideas, thoughts, and reflections about your product and your project. The journal should be used both to **capture ideas** about the product itself as you move through the process, but also **to document thoughts and insights** on the process of product development, group dynamics, project process, etc. Inventors do this as it helps to document when they came up with an original idea (useful in the patenting process); engineers do this to work out complex technical details; and designers do this to generate lots of ideas (as ideas feed off of one another); project managers use journals as a management tool to generate "lessons learned" and "best practices" to help run future product development projects more effectively. Only the faculty will see these journals; no one else will see them unless you choose to share. Your design journal will count towards your individual assignments grade.

Working with Your Design Coach

We are privileged to offer you the opportunity to collaborate with some of the leading experts in product development from prominent firms in the Bay Area. Each team will be assigned a "design coach" who will coach you throughout the product development process. The design coach is tasked with giving you a practitioner's viewpoint and advice on all aspects of your product and product development progress. Given the coaches' many years of experience in product development and coaching design teams for this course, you will find their input invaluable.

We recommend that you contact your design coach immediately after he or she is assigned to your team. We recommend that you designate one team member as the contact person. You should plan on having at least two to three meetings with your coach. We recommend meetings at three of the major milestones: mission statement formation, synthesis of customer and user needs/concept generation and first pass prototype development and assessment. Meetings are typically 60-90 minutes long. You should coordinate the meeting logistics with your coach to suit your team's schedule and your coach's availability. You should prepare an agenda for the meeting ahead of time and share the agenda with your coach. At the meeting, we suggest that you not only brief your coach on your progress to date using your deliverables, design journals, and prototypes, but also come prepared with a specific objective. For example, you might brainstorm concepts or review your prototypes. Bring lots of questions and use the coaches' time wisely. Note that this does not mean that you have to have everything completed or answered before you go. In fact, the coaches can be most helpful when you are struggling with a choice or direction.

After each meeting, your team should *submit to the group page minutes of the meeting and a summary of key learning from the meeting*. You may wish to share this with your coach, also.

Working with Your Team
For some of you, this will be your first experience in working on a collaborative, cross-functional team. Others of you will feel that you are old hands at this. Our experience is that many of you have worked on *group* projects in the past, but not necessarily as a *team*. We hope that through this course you will learn to differentiate the two. While there is no definitive evidence that increasing the level of functional integration is truly a guarantee for enhancing the performance of new products, studies have found that 97% of companies have used cross-functional teams at one point. Thus, it is critical to understand the nature of these types of teams. Part of the learning in this course is to assess patterns of cooperation and team dynamics and to reflect on both the behavioral and organizational challenges your team faces. While teams vary from semester to semester, we find that good organizational practices always benefit the entire team. Here are a few suggestions:
1. Commit to a regular meeting time.
2. Use the provided team e-mail listserv to communicate with your team. It will also archive and thread your e-mails so that you can review past conversations. Store shared documents on the group page on the website.
3. Work together not separately. Get to know each other's strengths, e.g., who knows PowerPoint, who's the CAD guru, who's good at running meetings, who's good at eliciting feedback from customers, etc. You will find that, unlike group work, you cannot just split up the work and staple it together when you next meet. There are many decisions you must make as a team.
4. Attempt as much open communication as possible. Discuss the means by which you wish to resolve problems as a group, and what escalation process you will use if problems persist. Decide, for example, when you want to involve the faculty or your design coaches in helping you resolve problems.
5. Use your mission statement to create a shared vision among the team members that will allow you to stay focused and on target.
6. Have fun!

Required Readings and Materials

Required Textbook: Product Design and Development (Third Edition), Karl T. Ulrich and Steven P. Eppinger. In the outline below, CHAPTER X always refers to the readings from the text. The book is available from the campus bookstore, Amazon.com, and other sources. This book is a very basic text that provides a step by step view of how new product development processes are to be conducted. Supplemental required course reading materials are available from a combination of Study.Net and the course website (Catalyst).

Required Online Course Reader: The course reader contains cases and supplemental readings. Course readers are available through a combination of StudyNet and the course website, Catalyst. StudyNet provides all of the Harvard cases and readings. You can either order a reader to be printed and sent to you, or you can download the cases/readings as you need them and print them on your own. You will be connected to Study.Net through Catalyst. Non-Harvard materials are available on the course website on the days on which you are to have them read.

Evaluation and Grading

Your course grade will be determined as follows:

> 20% on the quality of your preparation for and participation in class discussions
> 20% on the quality of your individual assignment solutions including your final design journal and individual lessons learned
> 40% on the quality of your team's work on project-related assignments and deliverables
> 20% on the quality of your team's final project presentation and deliverables

During the semester, we will periodically ask for individual assessments of the contributions made by members of your team to the team project. These assessments may be considered in preparing your final team grade.

Schedule Overview

DAY	TOPIC and DELIVERABLES
1 M	**Introduction to New Product Development (NPD)** Ch. 1: Introduction StudyNet Reading: "The Discipline of Innovation"
2 W	**Product Development Environment: The NPD Process** Ch. 2: Development Processes and Organizations StudyNet Case: OXO International
3 M	**HOLIDAY**
4 W	**Product Development Environment: Strategic Alignment** Ch. 3: Product Planning StudyNet Case: Linking Strategy and Innovation – Materials Technology Corp. Catalyst Reading: "Delta Design Exercise – The Design Task"
5 M	**Product Development Environment: Delta - A Design Exercise** Prepare exercise: Delta - A Design Exercise *Individual Assignment Due: List of 20 "bugs"*
6 W	**Product Development Environment: Project Management** Ch. 16: Managing Projects StudyNet Reading: "Innovation at the Speed of Information"
7 M	**Project Proposals and Team Assignments** *Individual Assignment Due: Project proposal* *Project Preferences due today by 5 p.m.*
8 W	**Project Organization and Launch** StudyNet Reading: "The Discipline of Teams" Guest speaker: IT Systems developer *Individual Assignment Due: MBTI Personality Test Results*
9 M	**Concept Development: Customer and User Needs Assessment** Ch. 10: Industrial Design Catalyst Reading: "How Increasing Value to Customers Improves Business Results" Guest Speakers: Industrial designers
10 W	**Concept Development: Customer and User Needs Assessment continued** Ch. 4: Identifying Customer Needs StudyNet Case: Innovation at 3M Corporation (A) (9-699-012) *Individual Assignment Due: Customer and user needs interview*
11 M	**LAB: Mission Statement Review and Customer/User Needs Assessment Planning** *Project Deliverable Due: Mission Statement and Customer/User Needs Assessment Plan*

DAY	TOPIC and DELIVERABLES
12 W	**Concept Development: Translating the Voice of the Customer** Ch. 5: Product Specifications StudyNet Reading: "Get Inside the Lives of Your Customers" *Individual Assignment Due: Customer journey map*
13 M	**Concept Development: Concept Generation** Ch. 6: Concept Generation Catalyst Reading: "Creative Thinking Techniques" StudyNet Reading: "Spark Innovation through Empathic Design"
14 W	**Concept Development: Concept Selection** Ch. 7: Concept Selection *Individual Assignment: Assessment of Competitive Products using Concept Selection Matrices*
15 M	**Testing and Refinement: Concept Testing Overview** Ch. 8: Concept Testing StudyNet Case: Bank of America (A)
16 W	**Peer Review: Mission Statement, Competitive and Customer and User Needs Analysis** *Project Deliverables Due: Presentation, mission statement, customer and user needs analysis*
17 M	**Testing and Refinement: Design for Environment** Catalyst Reading: "Mainstream Appliance Meets Eco-Design" Catalyst Reading: "Cradle to Grave – How Products Impact Natural Systems" http://www.howproductsimpact.net/ Catalyst Reading: "Less is More at Interface"
18 W	**Concept Development: Product Architecture** Ch. 9: Product Architecture Catalyst Reading: "Principles from Toyota's Set-Based Concurrent Engineering Process"
19 M	**Testing and Refinement: Building Prototypes and Using Computer Aided Design Tools** Ch. 12: Prototyping Catalyst Reading: "Sports Gear Goes Geek" Tour of Etcheverry Prototyping Labs and Using DfE Software
20 W	**Design for Manufacturability and Cost** Ch. 11: Design for Manufacturing Ch. 15: Product Development Economics
21 M	**LAB: Concept Testing Plan** *Review: Concept sketches, final concept selection and concept testing plan*
22 W	**Testing and Refinement: A Case Study** Ch. 13: Robust Design StudyNet Case: Team New Zealand (A) (9-697-041)
23 M	**LAB: Final Specifications and Prototype Planning**. *Review: Final product specifications and drawings*
24 W	**Peer Review: Concept Prototype and Design Review Tradeshow** *Project Deliverables Due: Updated customer needs, concept generation sketches, concept selection matrices, product specs and drawings, concept prototypes*
25 M	**Supporting NPD: Information Technology for NPD** StudyNet Case: BMW AG: The Digital Auto Project (A)
26 W	**LAB: Finalize Financial Analysis and Review Product Testing** *Review: Financial analysis*
27 M	**Supporting NPD: Intellectual Property Management** Ch. 14: Patents and Intellectual Property Catalyst Reading: "The New Instant Companies" Guest speaker: IP Attorney
28 W	**LAB: Final Prototype Development, Testing and Refinement** *Review: Results of product concept testing*

DAY	TOPIC and DELIVERABLES
29 M	**Class Summary: Other Things You Can Do With This Process** Catalyst Reading: "If Managers Thought Like Designers" Guest speaker: Product Design Firm
30 W	**Class Summary: Capturing Lessons Learned** StudyNet Reading: Learning from Projects – Note on Conducting a Postmortem Analysis *Individual Deliverable: Lessons learned*
Sat.	**FINAL EXAM: PRODUCT PRESENTATIONS AND JUDGING** **WELLS FARGO ROOM (HAAS SCHOOL OF BUSINESS)** ***Final Project Deliverables:*** *Summary CD (see details)* ***Individual Deliverables***: *Journal/sketchbook/diary and team evaluations*

Detailed Class Schedule

Class 1: Introduction to New Product Development (NPD)

We will cover course logistics and requirements and then develop the motivation and framework for the course. Read CHAPTER 1: INTRODUCTION and THE DISCIPLINE OF INNOVATION and come to class prepared to discuss why new product development is such a critical process to manage and what the key activities in new product development entail.

Class 2: Product Development Environment – The New Product Development Process

Read CHAPTER 2: DEVELOPMENT PROCESSES AND ORGANIZATIONS and prepare the OXO INTERNATIONAL case. OXO International started in 1989 by leveraging a set of external relationships for its product design and manufacturing. These relationships allowed it to grow quickly without a large internal staff, but became more difficult to manage and control over time. The case considers the question of whether or not to expand product offerings which necessitates expanding product design capacity, and raises strategic questions about the pros and cons of outsourcing critical activities. To prepare for class discussion, please answer the following questions:
1. In your opinion, what was the single most important factor to OXO's success as a business? How did the company create this success?
2. How have the boundaries of the firm been set and how do the critical business processes work? How has OXO developed the skill set for managing its outsourcing? What are the risks inherent in OXO's business model?
3. How does OXO's product design and development process work?
4. How should Alex Lee solve the design/development capacity problem? What should be his next steps? (What, who, when, how?)
5. What advice would you give Lee regarding how projects are selected, how resources are allocated and how the project mix (e.g., new platforms vs. extensions) and product strategy are determined?

Class 3: HOLIDAY

Class 4: Product Development Environment – Strategic Alignment

Read CHAPTER 3: PRODUCT PLANNING and prepare the LINKING STRATEGY AND INNOVATION -- MATERIALS TECHNOLOGY CORPORATION case for class discussion. One of the critical activities that a firm undertakes is planning its product portfolio. This plan in turn drives the definition of the individual product development projects and the firm's investment in them. In this session, we will use the Materials Technology Corporation case to explore product portfolio planning.

Materials Technology Corporation (MTC) is a start-up company in advanced materials that has been extraordinarily successful in its technology development and has devised a compelling strategy that attracted tens of millions of

dollars in investment capital. The company is struggling, however, because it doesn't have a rigorous mechanism for linking its strategy to its new product development process. We'll explore the current process and develop a set of recommendations for how the company might proceed from here. (NOTE: The blank column heading in Exhibit 4 should read Estimated Total FTE Months Remaining on the Project.)

1. What is the strategic direction, i.e., business model, of MTC? Is this strategic direction consistent with their product development strategy?
2. Is the set of projects proposed by Bob Block the right set of projects for MTC? How should MTC prioritize this set of projects?
3. What was the project planning process at MTC? Was this project planning process successful for all the project types that MTC undertook?

Read DELTA -- A DESIGN EXERCISE and come to class prepared with any questions you may have about the exercise. We will assign roles in class and "train" you to play your role.

Class 5: Product Development Environment – Delta, A Design Exercise

Re-read DELTA -- A DESIGN EXERCISE and prepare the role assignment you were given in class. Make sure that you thoroughly understand the role you are to play. If you do not, please ask questions of your trainer to clarify your position. Prepare any materials you believe you will need to play the role. **DO NOT discuss** the other three roles with others in the class. On the day of class, come to the classroom for your room assignment, go straight to that room and convene your team as quickly as possible, as you will find that 1 1/2 hours is quite short for accomplishing this work.

INDIVIDUAL ASSIGNMENT DUE:
List of 20 "bugs"—submit to the drop box available on Catalyst for Monday, September 12th

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List of Twenty "Bugs"
We are all capable of identifying market needs and thus generating ideas for new products, in part by noticing the deficiencies in the products we use in everyday life. To prove to yourself that you can identify market needs, generate a list of at least 20 "bugs." Designers at the product design firm IDEO use "bug lists" to record their observations of products and situations where products failed to meet the actual conditions of use. This list should include any observation or annoyance that comes to your mind. Note that we are looking for a list of "bugs" (e.g., my vegetable peeler hurts my hand when I peel potatoes) rather than a list of product solutions (e.g., a vegetable peeler with a soft handle). In other words, you don't have to invent a solution to a problem you see – just state the problem.

Class 6: Product Development Environment: Project Management

Read CHAPTER 16: MANAGING PROJECTS and INNOVATION AT THE SPEED OF INFORMATION. We'll debrief your Delta Design exercises and introduce some basic tools for managing new product development projects. How would the tools presented in the readings have helped you in your Delta Design exercise? Did you experience any of the feedback loops described in the *Innovation at the Speed of Information* article?

Class 7: Project Proposals and Team Assignments

INDIVIDUAL ASSIGNMENTS DUE:
Single project proposal (submit to class website by 5 p.m. on 9/18)
Project preferences (submit to class website by 5 p.m. on 9/19)

Overview
Following is the process we will use to generate the project ideas for this semester's teams, document those ideas, present them to the class, identify individual project preferences and finally form project teams. Each student is to develop a project proposal. This proposal may be based on one of the bugs on the "bug list" or may be based on a market need that interests the student. The proposal should be based on a *market need*, *not on a proposed solution*.

We encourage students who want to do something to benefit the local community. Last year, for example, a group worked on protective clothing for farm workers who handle pesticides. Remember, however, that you must be able to visit members of your target customer group, observe them and interact with them.

Individual Project Proposal
Your one-page proposals should include:
- A brief, descriptive project title (2-4 words)
- Your name, phone number, e-mail, and school/department affiliation
- A description of the market opportunity you have identified. Your description may include any of the following: Documentation of the market opportunity, shortcomings of existing competitive products, and/or definition of the target market and its size. Your written descriptions should be supported by at least one photographic image. Example:
  Market Opportunity – coping with long checkout lines in grocery stores
  Photograph: woman standing in line, looking very bored or impatient
- Please do not present *product ideas* at this point. Our strict focus in this phase of the course is on the *market opportunity* and not on solution concepts.

Class Presentation
Come to class prepared to give a VERY SHORT (i.e., one minute), yet convincing, presentation of your project proposal. Your presentation should include:
- Your name and school/department affiliation
- A verbal and visual demonstration of the product opportunity you have described in your proposal. Given that the audience will be able to read your written proposal at their leisure (after class), you might spend your time explaining the richness of the market opportunity or demonstrating existing competitive products.
- Any special skills or assets you have (marketing expertise, access to a multimedia computer, user interface design expertise). Any special skills or assets you need to complement yours in developing this market opportunity.

Submitting Preferences
By 5 p.m. on Monday, September 19th, you must decide on your project preferences. You should list the FOUR projects on which you would most like to work in order of preference. If you would like to work with a particular group of classmates, recalling that your group must contain engineering, MBA and CCA students please submit their names as well. Submit your preferences via the Web site, following instructions available there. We will process your preferences and assign teams. You will be notified of team assignments no later than Wednesday, September 21st. There is a good chance we will ask you to vote a second time after we have eliminated some of the projects in the first round, so stay tuned.

Class 8: Project Organization and Launch

INDIVIDUAL ASSIGNMENT DUE: Complete the Myers-Briggs test available on the Web. (Students may use the prior results of having taken the test if available.)
- The ***Jung Typology Test*** and information about it are available at www.humanmetrics.com. Read the background on the test and then take and score it.
- If you want additional information on how to interpret the results of the test, you may refer to the document "Introduction to Type in Organizations" which is available on reserve in the Haas library. You can also purchase the paper from www.mbti.com if you are interested.
- Complete the questions on the "Team Launch" form available on the class website, and then upload your answers to the drop box. Bring a copy to class to use in a team launch exercise.

During this class session, we will talk about team dynamics and interactions as being critical to new product development success. Read THE DISCIPLINE OF TEAMS. What does the paper say about using information from tests such as the Myers-Briggs test? What roles does the paper suggest that the course faculty should play in your projects? What role should your coaches play?

Class 9: Concept Development -- Customer and User Needs Assessment

Read CHAPTER 10: INDUSTRIAL DESIGN and HOW INCREASING VALUE TO CUSTOMERS IMPROVES BUSINESS RESULTS. What role does industrial design play in increasing customer value? What are the other important elements of providing customer value? What do companies mean when they use the popular term "customer experience?" What do you think it means to engage in "empathic design?"

Class 10: Concept Development – Customer and User Needs Assessment Continued

INDIVIDUAL ASSIGNMENT DUE: Choose a product that competes with or serves a similar purpose to the one your project team is developing. Interview a potential or current user of the product about what they like and dislike about the product. This interview can be done very informally in 5-10 minutes. Record what your interviewee says and interpret the data in terms of customer needs as described in Chapter 4. *Pay particular attention to the guidelines provided for translating customer statements into needs statements.* Prepare a one-page summary of what you have learned about the interview process. Submit both the record and interpretation of customer needs and your page of lessons learned to the drop box.

Read CHAPTER 4: IDENTIFYING CUSTOMER NEEDS and prepare the case INNOVATION AT 3M CORPORATION (A). The 3M case addresses the early phases of product development, and in particular will allow us to talk about how breakthrough products and services are identified, how lead user research works, and how organizations manage change. Answer the following questions in preparation for class discussion:
1. How has 3M's innovation process evolved since the company was founded? Why, if at all, does 3M, known as a "hothouse" of innovation, need to regain its historic closeness to the customer?
2. How does the Lead User research process differ from and complement other traditional market research methods?
3. Has the Medical-Surgical team applied the Lead User research process successfully? Why or why not?
4. What should the Medical-Surgical Lead User team recommend to Dunlop: the three new product concepts or a new business strategy? What are the risks to the new Lead User process at 3M? What are the risks to the Medical-Surgical business unit?

Class 11: LAB—Mission Statement Review and Customer/User Needs Assessment Planning

PROJECT DELIVERABLES DUE: Submit your Mission Statement and Customer/User Needs Plan. As with all project assignments, include a short discussion of the process you used, lessons learned, and any observations you have about your team. Submit this to your group's page..

This is the first "lab" session we will have during the semester. These are times that we are setting aside for work on your product development projects. We expect that you will use this time to meet in your groups, and to interact with the faculty and/or your coaches. The following activities should be done *prior* to the lab.

Prepare a Mission Statement (as shown in chapter 3). Use this assignment to refine the definition of your project and to agree as a team about what your objectives are. We will review your Mission Statement and guide you in any refinements that we believe will lead you to a better outcome at the end of the semester.

Prepare a customer/user needs assessment plan (following the guidelines in Chapter 4) that answers the following questions: Who is your customer? How will you access your customers? What approach will you take to collecting information (e.g., interviews, observation, surveys)? What types of information will you gather? How will you document your information gathering (e.g., words, images)? Your goal is to learn new information about your customers and their needs -- information beyond your original assumptions. If you will be producing a questionnaire, include a draft with your Assessment Plan.

Class 12: Concept Development – Translating the Voice of the Customer

> ***INDIVIDUAL ASSIGNMENT DUE:*** Develop a process flow diagram like those presented in "Get Inside the Lives of Your Customers" for the process that surrounds the product you are developing. You can do a flow diagram for a specific customer if you like. In fact, as a group you may want to split up and each take a different type of customer so that later you'll be able to compare flow diagrams. Submit the diagram to the drop box, or if you have drawn it, bring it to class to turn in.

Read CHAPTER 5: PRODUCT SPECIFICATIONS and GET INSIDE THE LIVES OF YOUR CUSTOMERS. Seybold describes an approach to modeling customer needs using a "customer scenario." What are the salient elements of this method? What is the relationship between customer scenarios and product specifications?

Class 13: Concept Development – Concept Generation

This class session will focus on brainstorming and "ideation" techniques used by new product development teams to generate product ideas from their understanding of customer wants and needs and of the available technologies. Read CHAPTER 6: CONCEPT GENERATION, CREATIVE THINKING TECHNIQUES (WWW.VIRTUALSALT.COM) and SPARK INNOVATION THROUGH EMPATHIC DESIGN. Consider thought questions 2 and 3 at the end of Chapter 6. How do the various methods of concept generation presented in these readings vary? How would you decide which to use when?

Class 14: Concept Development – Concept Selection

> ***INDIVIDUAL ASSIGNMENT DUE:*** Chapter 7 describes concept screening and concept scoring matrices as a means of selecting among competing ideas for products you might develop. In this assignment, we ask that you apply these screening and scoring tools to assess products that might compete with the product you are developing. Identify 3-5 products that might address the customer needs you have identified.. (You and your teammates might choose different product categories or features to focus your individual assessments, which will give you more information when you get together.) Prepare screening and scoring matrices to evaluate those products, identifying the best of the bunch. Submit to the drop box. Bring a copy to class to share.

Once you have generated a set of possible product concepts, you must identify the one or ones that you will actually work on. During this class session, we review methodologies for choosing from among the options. Read CHAPTER 7: CONCEPT SELECTION. The concept selection process as described in the chapter seems quite straightforward. Was it as straightforward when you applied it to actual products? What do you like and dislike about the method?

Class 15: Testing and Refinement – Concept Testing Overview

Read CH. 8: CONCEPT TESTING and prepare the case BANK OF AMERICA. What are the fundamental characteristics of a good concept testing approach? How did Bank of America follow them in its work? The case describes how Bank of America is creating a system for product and service innovation in its retail banking business. It emphasizes the role of experimentation in some two-dozen real-life "laboratories" that serve as fully operating banking branches and as sites for testing new ideas and concepts. As senior management is applying the discipline of formal R&D to its services, it faces serious questions around its experimentation strategy, incentive systems and the management of development risk.
1. How would you characterize Bank of America's new system for new developing services?
2. Compare Bank of America's approach to other product development systems. What are the differences? What are the similarities? Does it matter if it is a product or service that is being developed?
3. What is the role of experimentation? How can companies maximize their learning from experimentation?

Class 16: Peer Review – Mission Statement, Competitive and Customer and User Needs Analysis

> ***PROJECT DELIVERABLE:*** Submit a digital version of your presentation your group. In addition, submit your hierarchical list of customer needs and the shorter list of important needs as well as your first-pass competitive analysis. If you have done a needs importance survey, submit the results of that as well. Include a short discussion of the process you used, lessons learned, and any observations you have about your team.

Your project should now have completed the following activities: Gather raw data on customer needs (through whatever means you deem most appropriate to your potential market). Generate a list of customer needs for your product and organize it hierarchically into primary, secondary and tertiary needs. Identify three or four needs that you feel are important, but latent and not addressed by current products. Create a persona or personas that represent your typical customer, or some "corner cases" who you think will cause you to think creatively about your product design. Create 10 likely use scenarios in which your customer will likely want to use your product. Note that you do not need to have designed a product yet – we are still focused on understanding customers and use environments. You do not have to have the importance survey done by now, although you should do so soon if you envision hard trade-offs among different needs.

Note that most of you will find that your Mission Statement continues to evolve throughout the product development process as you learn more about your target market and gather feedback from faculty and others. You should continue to update your Mission Statement as you gather new inputs (archiving the old ones on the Web site).

This will be the first of three presentations you will give on your product development project. (The second will be in a tradeshow format, the final in a group presentation format.) Plan *10 minutes MAXIMUM* for the presentation so that we can fit all projects into one class session. (We'll split the class and conduct presentations in two rooms.)

Your presentation should cover the following: a mission statement, such as is shown in your textbook, a brief review of the means used to collect customer and user needs information, a summary of the identified customer and user needs, one of your most interesting use scenarios, a short summary of your competitive analysis and a summary of lessons learned in the process to date.

This is an opportunity to receive feedback from and give feedback to your classmates. It is also an opportunity to learn about new product development processes by observing what others have done on and learned from their projects. Come to class prepared to actively listen to your peers talk about their projects, ask them constructive questions and provide them feedback on the direction their projects are taking.

Class 17: Testing and Refinement – Design for Environment

Read MAINSTREAM APPLIANCE MEETS ECO-DESIGN and LESS IS MORE AT INTERFACE. What knowledge does a product developer need to design a product for sound environmental performance? What is sustainable design? Visit http://www.howproductsimpact.net/, CRADLE TO GRAVE – HOW PRODUCTS IMPACT NATURAL SYSTEMS, and click through each of the six stages and read the first page that pops up. Following the links on each page is encouraged but entirely optional, except for the three additional links under the "emissions" page, which you should follow. What does designing products for environmental soundness entail? How might you make tradeoffs among cost, quality, features and environmental soundness when designing a product?

Class 18: Concept Development – Product Architecture

Read CHAPTER 9: PRODUCT ARCHITECTURE and PRINCIPLES FROM TOYOTA'S SET-BASED CONCURRENT ENGINEERING PROCESS. Complete exercise 1 or 3 at the end of Chapter 9. We will focus our discussion in this session on the definition of product architecture and the implications of product architecture decisions for product development, marketing, customers, etc.

Class 19: Testing and Refinement – Building Prototypes and Using CAD Tools

Read CHAPTER 12: PROTOTYPING and SPORTS GEAR GOES GEEK. Today, we will tour the rapid prototyping facilities and examine software used to do design for environment in Etcheverry Hall.

Class 20: Design for Manufacturing and

Read CHAPTER 11: DESIGN FOR MANUFACTURING. Design for manufacturing is one of the many "design fors" that a product development team must undertake. In this class session we'll talk about the various "design for x" activities, including manufacturing. Consider thought questions 1 and 2 at the end of Chapter 11. Read CHAPTER 15: PRODUCT DEVELOPMENT ECONOMICS. Consider thought questions 1 and 2 at the end of the chapter.

Class 21: LAB – Concept Testing Plan Cost

Your team should have completed the following items, and have them available for review at this lab meeting:

Concept Sketches
A minimum of 20 concept sketches. These should be 20 different "design" solutions for a single concept direction. The generation of concepts is an important part of the product development process. The goal is to get as many ideas on the table as possible, thereby having a richer range of ideas to choose from. We recommend that each member of the group produce 10-20 concept sketches individually. The group should then review these sketches and modify, combine, or change them in order to produce a minimum of 20 concepts for the assignment. It seems like a lot, but you will be impressed by the progress on your project in a short period of time.

Final Concept Selection
Your final concept sketch/rendering (with as much detail as possible) Include as much description as possible of how the product will be used, who will be using it, technical/mechanical details, specific technologies that you wish to incorporate, potential materials, etc. Show the concept selection matrix (screening or scoring or both) and describe any concept testing that you used to make these choices.

Concept Testing Plan
A Concept Testing Plan. Who will you be testing? Will it be the same or a different group from your Customer/User Needs Assessment? What is your survey format? Phone, in person, Internet? How will you communicate the concept? Sketches, mock-ups, photos, renderings, storyboard, etc.? How will you get feedback from your customers? What method will you use to interpret the results? Chapter 8 will be useful in framing your plan.

Class 22: Testing and Refinement – A Case Study

Read CHAPTER 13: ROBUST DESIGN and prepare TEAM NEW ZEALAND (A). The focus of this case is on the role of experimentation in new product development. It exposes the subtle challenges of using simulation as an experimentation tool. It also highlights issues associated with integrating knowledge gained through experimentation with knowledge gained from experience. Address the following questions as you read the case:
1. How would you evaluate Team New Zealand's use of simulation in the design process? What are its advantages and disadvantages? How did their approach to simulation differ from that used by other syndicates?
2. Which yacht construction strategy should Team New Zealand follow? Why? How much improvement would you expect from each?
3. What would you advise Team New Zealand to do: Two similar boats now, two different boats now, or one boat now and one boat later?

Class 23: LAB – Final Specifications and Prototype Planning

The work you do for this lab will depend to some extent on the type of product you are developing. All teams should document the final specifications they intend to achieve and provide any documentation needed to support these decisions (as described in Chapter 5).

Those developing physical products should prepare final product renderings, assembly drawings of the product and a bill of materials indicating whether parts will be standard purchased parts or custom fabricated. An assembly drawing shows the overall product with each part in its "assembled" position. If it is clearer, you can use an "exploded" view instead. You will also want to prepare dimensioned sketches of each piece part and photocopies of vendor literature (e.g., catalog pages) for the standard purchased components. Indicate the material and process you have selected for each part, both for your prototype and for the final production version. The parts should be designed to be as close as possible to the intended final production version as possible.

Those developing software (web-based) products will prepare an overview of the modules contained in the product, the interfaces between them, and their primary functions. Indication should be made as to whether the module functions are available in existing software (e.g., database query software) or whether they will have to be custom designed. Specifications at this stage should be relatively clear – such that a programmer could work from them to develop code.

Class 24: PEER REVIEW – Concept Prototype and Design Review Tradeshow

> **PROJECT DELIVERABLE:** *Updated customer needs, concept generation sketches, concept selection matrices, product specifications and drawings, photos of concept prototypes*

Session objectives:
- Update your classmates as to progress on your product development effort.
- Make the first "public" presentation of your "proof-of-concept" prototype
- Gather feedback from classmates on your prototype

For this session:
1.   Prepare a ONE-PAGE summary of your:
- Mission statement
- Target market
- Salient customer needs

Plan to present this one page summary briefly at the beginning of the class in 2-3 minutes. This will bring the entire class up to speed on your project before they review your work.

2.   Prepare your "proof-of-concept" prototype. Come to class prepared to show it in a "tradeshow" environment during which your fellow students will wander around the room reviewing your work. You are welcome to bring portable computers to set up your displays. You should plan to handle any arrangements for using computers on your own. We will assign locations in the room.

In addition to your prototype, you should have the following materials available. (Each team will likely have done different versions of these. Use what you have already developed.)
- Customer/user needs hierarchy
- Mapping of customer needs to specifications
- Concept sketches
- Product renderings
- Concept screening and scoring matrices
- Reason for choosing the concept(s) you have developed for today

You should plan to have group members rotate responsibility for showing the prototype so that other group members can circulate. We should have about 50 minutes for this session. Think about the best way to efficiently and effectively collect feedback from your classmates. You may wish to have a mini-survey available for them to complete. Remember that each student will only have about 5 minutes to spend reviewing your work; so make your presentation as succinct as possible.

From this point forward, your focus will be on testing your product concept with your customer base, obtaining feedback, incorporating it into your product, and preparing the final product prototype. You will also perform a financial analysis of the product.

Class 25: Supporting NPD – Information Technology for NPD

Prepare BMW AG: THE DIGITAL AUTO PROJECT (A). In this session, we'll focus on the tools engineers use to model and design products. The BMW case focuses on the conceptual methods, technologies, and managerial leadership necessary to drastically speed up product development processes for successful firms that may not see the need to change. The case will allow us to talk through the dynamics of developing automotive products, the process of reengineering product development and the means by which managers effect change in successful organizations. Please prepare the following questions for class discussion:

1. What are the competitive challenges in the automotive industry in 1997 and beyond? How is BMW affected?
2. How would you evaluate the evolution of product development at BMW? Why does BMW's senior management feel that there is an immediate need to slash development time by 50%?
3. Is senior management giving the organization enough time to carry out these radical changes? Or are they moving too slowly? What are the risks if BMW changes its development process and/or organization too quickly? What are the risks if they change too slowly?
4. As Peter Ratz, what would you recommend to senior management? Should BMW's styling department go "digital" all the way? Please be prepared to discuss your specific plans on BMW's styling process and the role that computer-aided styling (CAS) technology should play.

Class 26: LAB – Finalize Financial Analysis and Review Product Testing

Come prepared to review a draft financial model like that described in Chapter 15. Follow the guidelines provided in Chapter 15 of the book. Some questions that may guide your thinking about the costs associated with your product: How many stages do you expect your distribution process to have? What is the target price of your product? What is its target cost? Those of you developing physical products should construct a bill of material for the product that you can cost. You should be able to prepare a simple cost/price model that relates the delivery (manufacturing) cost of your product to the price that the end user will pay given specific margins at each stage of the channel. Perform a sensitivity analysis of the key economic uncertainties you face.

Often we find that students feel that they must make the product they are developing look profitable. We prefer realistic estimates! You can make any assumptions you like about how the product will come about – it can be produced and sold by a standalone company, or you can assume that it will be sold to and delivered by a larger concern. Most of you will want to assume that a fair amount of work (especially manufacturing) is outsourced.

Class 27: Supporting NPD – Intellectual Property Management

Read CHAPTER 14: PATENTS AND INTELLECTUAL PROPERTY and THE NEW INSTANT COMPANIES. Intellectual property protection can be an important issue in new product development efforts. We'll have a guest lecturer speak with us about how to get intellectual property protection and what strategies various firms might choose. If you are interested in doing a patent search, see http://www.patents.ibm.com/ibm.html. "The New Instant Companies" also provides practical guidance if you think you might like to start a company around your product.

Class 28: LAB -- Final Prototype Development, Testing and Refinement

You will probably have built and tested several prototypes during the semester. The final prototype is primarily intended to communicate to an investor audience. Therefore, it must deliver two messages:

- The product has great customer appeal (i.e., Wow! That's a great concept!!)
- The product is technically feasible (i.e., Gee, it works!)

In the ideal world, a single prototype can deliver both of these messages (i.e., the prototype both "looks like" and "works like" the real thing.) However, in some cases a development team can more feasibly deliver these messages with two or more separate prototypes.

Document the final specifications you intend to achieve. How will you evaluate how well your design meets the final specifications? Come prepared to review the results of testing your prototype with potential users, and to discuss plans for implementing their suggestions in your final prototype.

Class 29: Class Summary – Other Things You Can Do With This Process

Read IF MANAGERS THOUGHT LIKE DESIGNERS. We will have a guest speaker who will talk about the process of design and how it can be applied much more widely than just to product development.

Class 30: Class Summary – Capturing Lessons Learned

> *INDIVIDUAL ASSIGNMENTS:* Reflect on the experience you have had working with your team in developing your product this semester. Capture 8 – 10 key lessons you have learned from the experience on post-it notes (one per post-it). ***Bring those notes to class with you to share.***

Read LEARNING FROM PROJECTS – NOTE ON CONDUCTING A POSTMORTEM ANALYSIS. We will spend the last class session sharing lessons learned and synthesizing those lessons across the projects.

Final Tradeshow

> *INDIVIDUAL DELIVERABLES:*
> - Turn in the journal you have been keeping throughout the semester. It will be returned at the final presentation.
> - Team evaluations

> *PROJECT DELIVERABLES*:
> - Financial analysis
> - Summary of the results of product testing and the changes to your product that you have made as a result of what you learned
> - Softcopy of your presentation slides
> - A photo of your final prototype. (We ask that you document your prototype in some way that will allow us to archive it with our other projects. This could mean that you take 35mm slides of your prototype, or that you take digital pictures.)

Group Presentation of Process and Prototype – Reception
The New Product Development Trade Show will take place Saturday sometime between 8 a.m. – 3 p.m. (We'll decide on the time as we learn what finals schedules students in the class have. Attendance at the final exam IS MANDATORY. During the Trade Show, you will have the opportunity to display your product prototype to your peers, course faculty, the design coaches and a group of invited judges and guests.

Prepare a 10-minute presentation that describes your final product and the process you went through to arrive there. The presentation should be of the quality to convince a top management group to purchase the rights to your product or to fund its final development and launch. An effective presentation includes a slide presentation along with a display of the prototype. Your presentation should not only attempt to sell your prototype to the audience, but should also make clear the process you went through to develop the prototype. We suggest that you present:
> Your mission statement
> A summary of your customer/user needs analysis
> A couple of concepts you considered as alternatives to the one you developed
> A summary of your financial analysis
> A demonstration of your product prototype
> A list of the most important lessons you learned about the NPD process and teams