BA 290N-3, ME 290H, INFOSYS 290P-5 and CCA UDIST-300-14

Design for Sustainability

Professors Alice M. Agogino, Sara Beckman and Nathan Shedroff

Fall 2007

GENERAL INFORMATION

Faculty:

Alice M. Agogino, Department of Mechanical Engineering, 5136 Etcheverry Hall, (510) 642-6450, aagogino@berkeley.edu
Sara Beckman, Haas School of Business, F575 Haas School, (510) 642-1058, beckman@haas.berkeley.edu
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nathan@nathan.com

Teaching Assistants:

Celeste Roschini, Mechanical Engineering and the Berkeley Institute of Design, celeste@ethereal.net

Class Meetings and Office Hours:

UC Berkeley -- MW 11:00 a.m. – 12:30 p.m., 220 Cheit Hall
CCA – MW 11:00 a.m. – 2:00 p.m., Room N-15
Office Hours (Beckman): M 12:30 – 2:00 p.m. or by appointment, F575 Haas School of Business
Office Hours (Agogino): W 12:30 – 1:30 p.m., F549 Haas School, W 2:00-4:00 p.m. 5136 Etcheverry Hall, or by appointment
Office hours (Shedroff): MW after class or by appointment

Course Objectives:

The focus of the course is on innovation processes for sustainable products, from product definition to sustainable manufacturing and business models. It is an operationally focused course, as it aims to develop the interdisciplinary skills required for successful design and development of sustainable products or services. Engineering, iSchool and Business students from Berkeley and Industrial Design students from California College of the Arts join forces on small teams to step through the process of understanding stakeholder requirements, designing and developing solutions, and testing those solutions in detail, learning about the available tools and techniques to execute each process step along the way with sustainability in mind. 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 sustainable solution. Students can expect to depart the semester understanding what sustainability means, how companies are approaching it, and a process for generating sustainable solutions in practice. This course is part of the Management of Technology program at the University of California, Berkeley as well as the new Engineering and Business Sustainability Certificate Program (http://sustainable-engineering.berkeley.edu/).

Expectations:

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.

Academic Integrity:

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 Materials:
The primary reading material for the class is the textbook *New Products Management* (Eighth Edition) written by Merle Crawford and Anthony Di Benedetto. (The Eighth Edition has just been released. We will let you know what changes have been made since the Seventh Edition in case you wish to get a used book.) This book takes the perspective of a product or marketing manager who is responsible for developing the strategic positioning of a new product or service as well as for executing the marketing tasks associated with designing and developing the solution and bringing it to market. We will also use *Natural Capitalism: Creating the Next Industrial Revolution* by Paul Hawken, Amory Lovins and L. Hunter Lovins, but all chapters are available on line. We'll supplement the texts with readings on sustainability that will be available from a combination of Study.Net and the course website (bSpace/Catalyst).

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
10% on your final design journal and individual lessons learned
30% 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.

Class Preparation and Participation:
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 THE **BSPACE ASSIGNMENT TAB** WHERE THE NAME OF THE ASSIGNMENT WILL BE LISTED. PLEASE PLACE THE ASSIGNMENT IN THE APPROPRIATE BOX TO RECEIVE CREDIT FOR IT. ASSIGNMENTS ARE DUE 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.

Website Use:
We will make extensive use of the course Website 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://bspace.berkeley.edu/. Once you have formed your project groups, we will set up group Web pages on which we expect you to store the working documents for your project. The faculty will review the group pages regularly to provide feedback on your work. We will use bSpace rather than Catalyst (the MBA system) as Catalyst does not support group projects, nor does it allow access to non-Berkeley students. bSpace is a far more flexible system for our purposes.

PROJECT BACKGROUND AND GENERAL INFORMATION

Sustainable Product or Service Development Project:
The goal of this exercise is to learn principles and methodologies of designing and developing sustainable solutions in a realistic context. You will be asked to form project teams of 4 to 6 students, including a mix

of Engineering, Business, the iSchool and California College of the Arts (CCA) students. You will have opportunities during the first few 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 (a physical product, piece of software or service), 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 or service), 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. In some cases a combination of a non-functioning "appearance" type model and a rough mechanical or electrical "working" prototype may be acceptable. Your CCA and engineering team members 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 Technician 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.
    - For software user interface products, you should have access to proficiency in Web design tools or other software prototyping tools.
- 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 not well designed for sustainability. Thus, if you pick almost any product that satisfies the general guidelines in this list, you will likely be able to develop a product that is superior to everything currently on the market. Clearly, as this class is about design for sustainability, your project must address a sustainability concern in some dimension.

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 ask that you post the project review items before class, and also have them available for us to review at the labs. Project deliverables need only be turned in on your team's project tab on bSpace.

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 ***Assignment Tab*** 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.
- 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 on Saturday, December 15th. It counts 10% towards your individual grade. 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 or business cards, write words, create mindmaps, 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, reflections and insights** on the process of product development, group dynamics, project process, etc. Inventors use journals 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. You can tailor your journal to your own working style and your unique role within your project team. There are copies of exemplary design journals on the bSpace website if you would like to see what one might look like. Only the faculty will see these journals; no one else will see them unless you choose to share.

Working with Your Design Coach

We are privileged to offer you the opportunity to collaborate with some of the leading experts in sustainable design 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 sustainable design 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 stakeholder 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's bSpace 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. For example, late mornings on Friday may be available due to the MW class structure.
2. Use the provided team bSpace e-mail alias 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!

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Design for Sustainability
Class Outline and Assignment Schedule
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Fall 2007

DAY	DATE	TOPIC
1 M	8/27	**Introduction to Design for Sustainability: Why Sustainability?** Read: The Next Industrial Revolution Read: Making the World Read: Ch. 20: Public Policy Issues
2 W	8/29	**Introduction to Design for Sustainability: The New Products Process** Read Ch. 1: The Menu Read Ch. 2: The New Products Process Read: The Whiteboard Marker *Individual Assignment Due: Bring used object to class to use in design exercise*
3 M	9/3	**LABOR DAY HOLIDAY**
4 W	9/5	**Sustainable Living: Food and Global Health** Read: "The Bakeoff" Read: "Not While I'm Eating: How and Why Americans Don't Think About Food Systems" Skim: "Food for Life" *Individual Assignment Due: Fruit Observation* *Individual Assignment: Personal Carbon Footprint (Food)*
5 M	9/10	**Sustainable Building Design** Read: Building Blocks Scan: Eco-Tecture: Designing and Building with the Environment in Mind Review: LEED - Leadership in Energy and Environmental Design *Individual Assignment Due: Personal Carbon Footprint (Housing and Goods)* *Guest Speakers: Gail Brager, College of Environmental Design and Chris Jones, BIE*
6 W	9/12 CCA	**Sustainable Transportation** StudyNet Case: Toyota Motor Corporation – Launching Prius Read: Reinventing the Wheels – Hypercars and Neighborhoods Read: Human Capitalism Skim: Urban Planning and Transportation sections of Curitiba on Wikipedia Skim: Efficient Transpiration for Successful Urban Planning in Curitiba *Individual Assignment Due: Personal Carbon Footprint (Transportation)*
7 M	9/17 CCA[1]	**Project Proposal Presentations and Voting** *Individual Assignment Due: Project Proposal* *Due at 5 p.m.: Project Preferences*
8 W	9/19	**Understanding Stakeholders: Who are the stakeholders and what are needs?** StudyNet Reading: "Corporate Social Responsibility: Whether or How?" Read: "Needfinding: The Why and How of Uncovering People's Needs" Read: Setting Up Business Stakeholder Interviews, Part 1 Read: Setting Up Business Stakeholder Interviews, Part 2 Read: Interviewing Read: Creating Good Interview and Survey Questions *Guest Speaker: Michael Barry, PointForward*

[1] Note: The "CCA" designation here means that Industrial Design students from the California College of Arts will be joining us for the class at UC Berkeley.

9 M	9/24 CCA	**Team Launch** Read Ch. 14: Development Team Management Read: "The Trouble with Teamwork" Watch: Simple Designs that could save millions of childrens' lives (http://www.ted.com/index.php/talks/view/id/2) *Individual Assignment Due: MBTI and Cognitive Style Profile* *Guest Speaker: TBA*
10 W	9/26	**Understanding Stakeholders: Experience Design and Meaning** Read Ch. 5: Problem-Based Ideation StudyNet Reading: Design Research Read: 15 Meanings Read: Stories of Meaning *Guest speaker: Brenda Laurel*
11 M	10/1	**Understanding Stakeholders: From Underserved Communities** StudyNet Case: Project Impact – The Affordable Hearing Aid Project StudyNet Reading: "Co-creating Business's New Social Compact" Skim: Aqueous Solutions *Individual Assignment Due: Stakeholder Needs Interview*
12 W	10/3 CCA	**LAB: (Product) Innovation Charter, Stakeholder Needs Plan** *Project Deliverables Reviewed: Product Innovation Charter, Stakeholder Needs Plan*
13 M	10/8	**Framing Needs and Choosing Imperatives** Read: "Innovation as a Learning Process: Embedding Design Thinking" (on bSpace) Read Ch. 6: Analytical Attribute Approaches: Introduction and Perceptual Mapping Read Ch. 7: Analytical Attribute Approaches: Trade-Off Analysis and Qualitative Techniques
14 W	10/10	**Concept Generation: Alternative Design Strategies** Read Ch. 3: Opportunity Identification and Selection – Strategic Planning for New Products Read: Eco-Design Strategies Read: Rewiring Global Consumption
15 M	10/15 CCA	**PEER REVIEW: (Product) Innovation Charter, Preliminary Stakeholder Needs and Frameworks Review**
16 W	10/17	**Concept Generation: Tools and Techniques** Read Ch. 4: Preparation and Alternatives Read: "Creative Thinking Techniques" Scan: Creax.com function database for ideas Scan: More Inspiration for ideas Scan: World Changing for ideas
17 M	10/22	**Concept Generation: Materials Choice and Product Architecture** Read Ch. 13: Design (pp. 282-284) Read: Designing a Safer Future (Ch. 2 of The Green Imperative) Read: Dematerialization Scan: Materialization and Dematerialization: Measures and Trends Read: "From Inspiration to Innovation – Nike's Giant Steps Towards Sustainability" Read: "Nike Considered – Hope for the Sinners?" Read: "Nike Considered" (In Sneaker Freaker) Read: "Nike Considered – Long Ball Lace"
18 W	10/24	**Measuring Sustainability Performance: Life-Cycle Analysis** Read: Muda, Service and Flow Read: Eco-design Tools Read: "Environmental Assessment Tools" Friday Lab Tutorial: EIO-LCA model *Guest speaker: Eric Masanet (or Arpad Horvath)*
19 M	10/29	**Measuring Sustainability Performance: Social Return on Investment** Read: "Social Return on Investment – Exploring Aspects of Value Creation in the Non-Profit Sector" Scan: Sample SROI Calculations

		Guest Speaker: TBA *Individual Assignment Due: Assess Competitive Product*
20 W	10/31 CCA	**LAB: Concept Generation** *Project Deliverables Due: Concept Sketches, Evaluation Criteria*
21 M	11/5	**Concept Selection: Using the Integrated Bottom Line** Read Ch. 8: The Concept Evaluation System Read Ch. 9: Concept Testing
22 W	11/7	**Concept Testing** Read Ch. 10: The Full Screen Read Ch. 15: Product Use Testing
23 F	11/9 CCA	**PEER REVIEW: Mid-term Project Review** *Project Deliverables Due: Concept Mock-ups, Concept Selection Matrix* *NOTE: This Friday class is in lieu of class on the Wednesday before Thanksgiving.*
24 M	11/12	**VETERANS' DAY HOLIDAY**
25 W	11/14	**Design for Supply Chain** StudyNet Case: Wal-Mart's Sustainability Strategy Read: "Systems Thinking Primer for Natural Capitalism – The Four Basic Shifts"
26 M	11/19	**Financial Analysis/Business Planning** Read Ch. 11: Sales Forecasting and Financial Analysis Scan: Global Social Venture Cases Review: Advanced E-Team Grant Proposal Self-Assessment Worksheet *Guest Speakers: Greg Wolff, Una Mesa Association*
27 W	11/21	**NO CLASS for Thanksgiving Holiday** (Class made up on Friday 11/9)
28 M	11/26 CCA	**LAB: NCIIA PROPOSALS DUE**
29 W	11/28	**Integrating Sustainable Design and Development** Read: Darfur Stoves Read: The Flames of Hope Read: Berkeley Scientists Work Scrap Metal for Darfur *Guest Speaker: Ashok Gadgil, Energy Researcher at LBNL (who designed the stoves)*
30 M	12/3 CCA	**LAB: PROTOTYPE REVIEW**
31 W	12/5	**Integrating Sustainable Design and Development** StudyNet Cases: Sustainable Development at Shell (A) and (B)
32 M	12/10	**Class Summary: Lessons Learned** *Individual Assignment Due: Updated Personal Carbon Footprint* *Individual Assignment Due: Lessons Learned*
Sat.	12/15 CCA	**FINAL EXAM: 2-5 p.m.**

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Design for Sustainability
Detailed Class Syllabus
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***Required Textbook*:** New Products Management (Eighth Edition), Merle Crawford and Anthony di Benedetto. In the outline below, CHAPTER X always refers to the readings from the New Products Management text. The book is available from the campus bookstore, Amazon.com, and other sources. The seventh edition of the book is just fine; very few changes were made in it for the eighth edition.

***Required Online Course Reader*:** Contains cases and supplemental readings. Course readers are available through a combination of StudyNet, the course website, bSpace, and on-line sources. 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. Berkeley students will be connected to Study.Net through Catalyst. (Instructions for accessing Study.Net are at the very end of this document.) Others should go to www.Study.Net and follow the directions there to purchase the reader.

Class 1: Introduction to Design for Sustainability – Why Sustainability?
Monday, August 27th

Read: The Next Industrial Revolution (http://www.natcap.org/images/other/NCchapter1.pdf)
Read: Making the World (http://www.natcap.org/images/other/NCchapter4.pdf)
Read: Ch. 20: Public Policy Issues

In the first class, we will define sustainability as we will approach it in this course, present the business case for engaging in sustainability, and provide an overview of approaches to sustainable design and development. Please read *The Next Industrial Revolution* and *Making the World* to get some background on sustainability and how to approach it from one of the groundbreaking sources on the topic, the book Natural Capitalism. Read *Public Policy Issues* in your textbook to get a sense for how sustainability has classically or historically been managed in many organizations. How would you use what you learned in the Natural Capitalism readings to update the views in the New Products Management textbook?

There are a number of excellent web references on the topic of sustainability, many of which are included on bSpace in the "resources" tab. The following site, for example, is a glossary of important terms in the sustainability field: http://www.sustainabilitydictionary.com. We encourage you to visit the resources tab of bSpace to see additional resources that may be helpful to you throughout the class and beyond.

Class 2: Introduction to Design for Sustainability – The New Products Process
Wednesday, August 29th

Read Ch. 1: The Menu
Read Ch. 2: The New Products Process
Read: The Whiteboard Marker (http://www.howproductsimpact.net/)

In the second class, we will focus more on the process of designing and developing new products that we will follow during the course. Read *The Menu* and *The New Products Process* in your textbook to get an overview of the process. In addition, look over the materials on *The Whiteboard Marker* website to get a different view of whiteboard markers than that presented in the textbook minicase.

Individual Assignment Due: Bring a used object to class to use in design exercise. If possible make a visit to Urban Ore (http://urbanore.ypguides.net/), Building Resources (http://www.buildingresources.org/) or an equivalent store and purchase an inexpensive (say under $10)

item. If you can't get to one of these places, find a used item through another means. Dumpster diving is encouraged – see http://www.kuro5hin.org/story/2003/1/29/215523/088 for hints for successful diving! Bring your used object to class. It must be something you are willing to sacrifice for the project we'll do in class.

Class 3: LABOR DAY HOLIDAY
Monday, September 4th

Class 4: Sustainable Living – Food and Global Health
Wednesday, September 5th

We will organize the class projects around three major theme areas:
1. Sustainable Building Design (building features, processes, products associated with work or living spaces)
2. Sustainable Living (food and global health)
3. Sustainable Transportation (modes of transportation, new systems, policy, support structures)

The next three lectures will be devoted to introducing each of the theme areas, starting with Sustainable Living.

Read: "The Bakeoff" (http://www.gladwell.com/2005/2005_09_05_a_bakeoff.html)
Read: "Not While I'm Eating: How and Why Americans Don't Think About Food Systems" (http://www.sustainablefoodlab.org/filemanager/filedownload/php4hCOTv/NotWhileEating.pdf)
Skim: "Food for Life" (http://www.natcap.org/images/other/NCchapter10.pdf)

In this class session, we'll focus on opportunities to create more sustainable models for food and healthcare delivery globally. Please read *The Bakeoff* to get a sense for what the food design and development process can look like, and *Not While I'm Eating* to get a sense of how ethnographic research techniques have been applied to understanding people's attitudes about food and the "frames" they have for thinking about food. Skim *Food for Life* to get some background on the agriculture business, how it has developed, and where it is going from a sustainability perspective.

We will ask you to complete your personal carbon footprint. Start by visiting http://bie.berkeley.edu/files/climatefootprint.swf. Enter data for the "food" calculation. We'll have you turn in your complete carbon footprint in a couple of weeks.

There are additional resources on this topic that might be of interest including:
"Food that Travels Well" (http://www.nytimes.com/2007/08/06/opinion/06mcwilliams.html?_r=1&oref=slogin)
"Sustainable Food Laboratory" (http://www.sustainablefoodlab.org/)

Individual Assignment Due: Fruit Observation
As meals turn into snacks and we move from stationary cuisine to mobile conveniences, many kinds of food and dining experiences have been rethought to meet peoples' needs. Although fruit has long been a staple of every cultural group in the world, teens, young adults, business professionals, and parents are having a more difficult time fitting fruit into their lives. For example, peeling and eating an orange in a meeting is considered a "disaster." Children prefer processed "real fruit snacks" to the real thing. As one seven year old said: "I would rather have fruit without the bones."

Your challenge is to understand how fruit and its consumption may have trouble fitting into current U.S. culture, discover new opportunities, and create new products to satisfy these disconnects.

Types of needs you might uncover:

- Solving a problem (e.g., something to do with those cherry pits other than spitting them on the floor)
- Helping someone with a difficulty (e.g., children, physically challenged, elderly,…)

- Making eating fruit more fun (e.g., juggling, skill challenges)
- Culturally specific (e.g., something that deals with particular fruits, taboos,…)

Food for thought:

- Convenience: Consider Jamba Juice's role in providing real fruit in a "healthy" convenient fashion for people on the go.
- Authenticity: Can you imagine life before "lettuce in a bag"?
- Kid-Friendly: Moms love to travel with Cheerios and seedless grapes.
- Fun: Think about what fruit roll-ups have done to make fruit fun.
- Innovation: Fresh pineapple became an everyday delight after invention of the VacuVin Pineapple Slicer

Decide how you would like to investigate the topic of fruit through encounters with the outside world. Choose one of the following two options to complete your research:

Observations and intercepts:

- Restaurants (Jamba Juice, McDonalds)
- Supermarkets (Whole Foods, Safeway, Trader Joes, Berkeley Bowl)
- Farmer's Markets (SF Ferry Building, Berkeley Farmer's Markets (http://www.ci.berkeley.ca.us/coolthings/Other/farmersmarket.html)

Watch what people do. Carefully note those things that might not be obvious at first. Go up to people and ask them questions. (Say you're a student doing a research project and you can get away with almost anything!). Find some good stories that bring up unexpected issues.

User interviews with fruity people:

- People who try to prepare healthy snacks for themselves or their families
- Teens, kids of all ages
- Fruit-loving fanatics
- Cooks
- Teachers, day care providers,....
- Home fruit growers, canners,...
- .....and use your imagination

Conduct an interview with someone who is fruit-oriented. Find out what they like about fruit, when they choose to eat fruit, where they buy their fruit, their best story about eating fruit, their worst fruit eating experience, etc.

Individual Assignment Due:
Take along digital cameras and snap pictures that will help you to remember what you saw and to tell stories that make your users and their needs real to others in your team and to others in the class. Upload a one-page summary of your key findings along with the photos and other stories to bSpace under the "assignments" tab. Bring your materials to class as well to share.

Individual Assignment Due:
Complete your carbon footprint for "food" at: http://bie.berkeley.edu/files/ConsumerFootprintCalc.swf. You have to scroll your mouse over the numbers on the calculator to make them go up and down. Get as close an estimate as you can. Consider ways in which you might reduce your weekly carbon footprint during the semester. ***Submit your calculations and a short reflection on them to bSpace following the instructions there.***

Class 5: Sustainable Building Design

Monday, September 10th

The topic of sustainable buildings includes not only the actual design of buildings, but also the products and work and living processes in the buildings. Thus this category includes recycling strategies, furniture, appliances, lighting, heating and cooling, supplies and work flow patterns.

Read: Building Blocks (http://www.natcap.org/images/other/NCchapter5.pdf)
Scan: Eco-Tecture: Designing and Building with the Environment in Mind
http://www.nytimes.com/indexes/2007/05/20/magazine/index.html?downloadURL=true&loId=828131CF-0237-41CF-9BD5-68283748FDFE
Review: LEED - Leadership in Energy and Environmental Design
http://www.usgbc.org/DisplayPage.aspx?CategoryID=19

Building Blocks provides a good introduction to the breadth of issues associated with this subject. In order to get a sense of some of the innovative new ideas read some of the articles in *Eco-Tecture*, a recent special issue of the New York Times Magazine. There are also some slide shows and videos that you might find interesting. Also review the *LEED (Leadership in Energy and Environmental Design)* guidelines for LEED certification. How many of the buildings on your campus are LEED certified? It can be expensive to retrofit old buildings to be certified, but why are new buildings not certified?

Individual Assignment Due:
Complete your carbon footprint for "housing" at: http://bie.berkeley.edu/files/ConsumerFootprintCalc.swf.
Bring a copy of your calculations along with your PG&E bill to class. Identify three things you might undertake this fall to reduce your energy consumption (housing carbon footprint). See http://www.aceee.org/consumerguide/ for ideas, but only choose the ones that you believe you can reasonably take on. What savings do you imagine you can achieve? (Some of you may not have PG&E bills. Bring whatever best approximates one or use your building manager's bill or that of a colleague.)
Turn in a copy of your footprint calculations as well as a short description of what you will undertake to reduce your footprint, and how much you think you can reduce it during the semester. You may upload it to bSpace or turn it in during class.

There are many additional reference readings associated with this lecture and with sustainable buildings in your bSpace folder. We highlight a few below.
Guiding Principles for Sustainable Building Design:
Sustainable Building Sourcebook:
EPAs Green Building Website:
Energy Star Program:
Whole Building Design Guide
Green Building Research Center (GBRC) at UC Berkeley
Build-it Green
Berkeley Eco-House

Field Trip opportunity: Check out the Berkeley eco-house: http://www.ecohome.org/

Class 6: Sustainable Transportation
Wednesday, September 12th

StudyNet Case: Toyota Motor Corporation – Launching Prius
Read: Reinventing the Wheels – Hypercars and Neighborhoods
(http://www.natcap.org/images/other/NCchapter2.pdf)
Read: Human Capitalism (http://www.natcap.org/images/other/NCchapter14.pdf)
Skim: Urban Planning and Transportation sections of Curitiba on Wikipedia
(http://en.wikipedia.org/wiki/Curitiba)
Skim: Efficient Transporation for Successful Urban Planning in Curitiba (http://www.solutions-site.org/artman/publish/article_62.shtml)

In this class session, we'll focus transforming various types of transportation into more sustainable solutions. Please read the two chapters of *Natural Capitalism (Human Capitalism* and *Reinventing the Wheels)* to understand some of the issues relating to sustainable transportation. In addition, read the Toyota case study on *Launching the Prius*. Understand, however, that while cars are often a focus of discussion relating to transportation, there are many forms of transportation in our lives that will also benefit from more sustainable solutions. These include:

- Passenger cars and trucks (including rental cars, car sharing programs, taxis, airport shuttles, etc.)
- Public transportation (buses, subways and light rail, trains, ferries, etc.)
- Private boats
- Passenger planes (including commercial air travel, private planes, recreational flying, etc.)
- Commercial trucking, trains, shipping, and air freight
- Government transportation (such as mail and packages, people, and materials)
- Military and police transport of various types (land, sea, air, ground, and aerospace)

Consider the impact of transportation on an entire supply chain of a product or service. Products mailed from a company to a customer (such as from an online commerce site) may travel from various warehouses, through several regional and local distribution centers, and then make circuitous routes on their way to a customer's location. All of this travel adds up quickly and represents a huge impact on sustainability. In addition, the amount raw materials, parts, and assemblies move around during construction before they reach a store or warehouse also creates a substantial impact.

Team projects focused on the transportation theme could take inspiration from any of the above issues.

Although the outcome of Toyota's introduction of the Prius hybrid vehicle seems to be an obvious success, the decision to launch the vehicle was far from clear. This case allows us to explore the strategic choice that Toyota faced about entering the hybrid market, and lets us better understand the challenges in implementing sustainable strategies in a company. To prepare the case for class discussion, please consider the following questions:

1. What buyer value is created with the hybrid powertrain as implemented in the Prius?
2. How attractive is the automobile industry? Does the hybrid powertrain technology make the industry more or less attractive? Why?
3. Why is Toyota pursuing the Prius project? What factors are important to make these projects a success?
4. Should Okuda push for an acceleration of the Prius launch?

Individual Assignment Due:
If you have a car, consult any documentation you have on your car mileage, gas, repair, and insurance costs, to accurately estimate your car's annual financial impact. Be sure to accurately estimate your annual mileage if you can and know what kind of fuel and engine your car uses. (You might want to consult with: http://www.fueleconomy.gov/feg/findacar.htm). If you don't have a car, estimate the costs, time, and mileage associated with your use of public transportation, other driving or car rentals, or occasional vehicle use. In addition, research your typical annual mileage for flights.

Use the transportation section of the following online carbon footprint calculators to calculate your annual transportation footprint:

- http://bie.berkeley.edu/files/climatefootprint.swf (the one you have used in the earlier assignments)
- http://www.liveneutral.org/calculator/
- http://www.climatecrisis.net/takeaction/carboncalculator/

Compare the results from the three calculators. ***Turn in your results and a short analysis of them to bSpace or bring a copy to class to turn in.*** You will need the results for class discussion as well...

Class 7: Team Proposals and Project Selection
Monday, September 17th

INDIVIDUAL ASSIGNMENTS DUE:
Single project proposal (submit to class website by 5 p.m. on 9/16)
Project preferences (submit to class website by 5 p.m. on 9/17)

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. The proposal should be based on fulfilling a ***need***, which includes improving the sustainability of an existing product or service, ***not on a proposed solution***. You must be able to gather information about members of your target customer group, preferably by observing them and interacting with them. If this isn't possible, you need to be able to get firsthand information on them and their lives. There are nice examples of sustainable solutions and the market needs they have addressed at http://www.worldchanging.com/. Also refer to UC Berkeley's ongoing sustainable design projects as outlined by the Berkeley Institute for the Environment (http://bie.berkeley.edu/flexinode/table/26). If one interests you, perhaps you can apply methods from the class to enhance or expand on that project by conducting user studies, contributing to the design or redesign, or implementation. See:

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 products or services, and/or definition of the target market and its size. Your written descriptions should be supported by at least one photographic image.
  Example:
  Opportunity – limiting pesticide exposure for farm workers
  Photograph – worker in field as pesticide drift comes by or picking up children from daycare in work clothes
- Please do not present *product ideas* at this point. Our strict focus in this phase of the course is on the *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 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 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 17th, 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 Monday, September 24th (although we hope to let you know earlier). 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: Understanding Stakeholders – Who Are They? What are Needs?
Wednesday, September 19th

The first steps in the innovation process are to define the "product innovation charter" for your team, and then identify the stakeholders for your project and how you will learn about their needs. This lecture will help you get started on your stakeholder analysis.

StudyNet Reading: "Corporate Social Responsibility: Whether or How?"
bSpace Reading: "Needfinding: The Why and How of Uncovering People's Needs"
(http://www.jumpassociates.com/articles/needfinding.pdf)
Read: Setting Up Business Stakeholder Interviews, Part 1
(http://www.boxesandarrows.com/view/setting-up-business)
Read: Setting Up Business Stakeholder Interviews, Part 2
http://www.boxesandarrows.com/view/setting-up-business22
Read: Interviewing (http://owl.english.purdue.edu/owl/resource/559/04/)
Read: Creating Good Interview and Survey Questions (http://owl.english.purdue.edu/owl/resource/559/06/)

The *Corporate Social Responsibility* paper gives a broad overview of who the stakeholders are in a "design for sustainability" project. The *Needfinding* paper speaks to why it is important to understand stakeholder needs, and gives some broad outlines of how to get at needs. The four short web articles get into more of the nitty gritty of getting at stakeholder needs data and provide some guidelines for doing so. Please read all of them in preparation for our guest speaker. Michael Barry, a principal at PointForward, will join us and to talk about needs and how to capture them.

Class 9: Team Launch
Monday, September 24th

Read Ch. 14: Development Team Management
Read: "The Trouble with Teamwork"
(http://www.leadertoleader.org/knowledgecenter/L2L/summer2003/lencioni.html)
Watch: Simple Designs that could save millions of childrens' lives
(http://www.ted.com/index.php/talks/view/id/2)
Guest Speaker: TBA

During this class session, we will talk about team dynamics and interactions as being critical to new product development success. Read *Development Team Management* and *The Trouble with Teams*. What do the say to help your team think about choosing a leader and the roles that other team members will play? Are there different types of leadership roles? We'll launch your teams with some team exercises. Be sure you complete the questionnaire on SurveyMonkey and bring your answers to class with you to share and discuss with your teams.

***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.
- After you have the results of your test, go to the SurveyMonkey website listed on bSpace and complete the survey there. Bring your answers to class to use in a team launch exercise.
- 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.

Class 10: Understanding Stakeholders: Experience Design and Meaning
Wednesday, September 26th

Read Ch. 5: Problem-Based Ideation
StudyNet Reading: Design Research
Read: 15 Meanings (http://www.makingmeaning.org/meanings.html)

Read: Stories of Meaning (http://www.makingmeaning.org/stories.html)

At the heart of innovating to meet user needs is understanding the broader experience that the user has surrounding the product or service you offer. In this session, we'll talk about the "meaning" that users derive from their experiences with products or services, and will link the importance of meaning to sustainability-focused projects.

Exercise/Deliverable?

Class 11: Understanding Stakeholders: From Underserved Communities
Monday, October 1st

StudyNet Case: Project Impact – The Affordable Hearing Aid Project
StudyNet Reading: "Co-creating Business's New Social Compact"
Skim: Aqueous Solutions (http://www.natcap.org/images/other/NCchapter11.pdf)

In this class session, we'll focus on understanding the needs of users from underserved communities and on working with NGOs and other organizations to meet those needs. The *Project Impact* case introduces David Green, a social entrepreneur with the mission of making state-of-the-art medical technology affordable and available to those in the developing world. It describes the growth and success of several projects that he undertook, and presents a direct contrast to the traditional maximum profit model of the medical industry. In doing so, it provides a sense of how one must innovate not only products or services, but complete business models to meet sustainability objectives. In preparation for our class discussion, consider the following questions:

1. How does David Green create value? How and by whom is the value captured?
2. What is the objective function David Green tries to maximize? Is he successful?
3. Is it okay to sell Aurolab products in the U.S. at U.S. market prices?

INDIVIDUAL ASSIGNMENT DUE:
Choose a product or service 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. Pay attention as well to the sustainable performance of the solution in your interview. 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 follows:***

Create a table with three columns is in the following example.[2] In the first column, indicate the question or prompt that elicited the customer statements. In the second column, record the statements your customer or user made as close to verbatim as possible. In the third column, write your interpreted need for that statement.

Question/Prompt	**Customer Statement**	**Interpreted Need**
Typical Uses	I need to drive screws fast, faster than by hand.	The product drives screws faster than by hand
	I sometimes to duct work; use sheet metal screws.	The product drives sheet metal screws into metal duct work.
Likes – current tool	I like the pistol grip; it feels the best	The product is comfortable to grip.
	I like the magnetized tip.	The product tip retains the screw before it is driven.
Dislikes – current tool	I don't like it when the tip slips off the screw.	The product tip remains aligned with the screw head without slipping.
	I would like to be able to lock it so I can use it with a dead battery.	The product can be used manually when the battery is

[2] Example drawn from "Product Design and Development" by Karl Ulrich and Steve Eppinger.

		dead.
Suggested improvements	An attachment to allow me to reach down skinny holes.	The product can access screws at the end of deep, narrow holes.
	Would be nice if it could punch a pilot hole.	The product can be used to create a pilot hole.

Interpreting needs is very difficult. It may feel burdensome to interpret needs per the following directions, but you will find that having done so increases the clarity of your needs, allows you to share them more readily with your teammates, and lets you sort them later as you start to analyze them for the framing and imperatives steps of the design process. ***So, pay particular attention to these guidelines provided for translating customer statements into needs statements.***

Guideline	Customer Statement	Need Statement – Right	Need Statement – Wrong
"What" not "how"	"Why don't you put protective shields around the battery contacts?"	The screwdriver batter is protected from accidental shorting.	The screwdriver battery contacts are covered by a plastic sliding door.
Specificity	"I drop my screwdriver all the time."	The screwdriver operates normally after repeated dropping.	The screwdriver is rugged.
Positive, not negative	"It doesn't matter if it's raining; I still need to work outside on Saturdays."	The screwdriver operates normally in the rain.	The screwdriver is not disabled by the rain.
An attribute of the product	"I'd like to charge my battery from my cigarette lighter."	The screwdriver battery can be charged from an automobile cigarette lighter.	An automobile cigarette lighter adapter can charge the screwdriver battery.
Avoid "must" and "should"	"I hate it when I don't know how much juice is left in the batteries of my cordless tools."	The screwdriver provides an indication of the energy level of the battery.	The screwdriver should provide an indication of the energy level of the battery.

Prepare a one-page summary of what you have learned about the interview process. Submit that summary along with the record and interpretation of customer needs to the bSpace assignments box.

Class 12: LAB: (Product) innovation charter, stakeholder needs plan
Wednesday, October 3rd

PROJECT DELIVERABLES DUE: Submit your Product Innovation Charter and Stakeholder Needs Assessment 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 on bSpace.

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. As the Industrial Design students are from CCA in San Francisco, and the logistics of getting teams together (physically) for all the Labs may be difficult, we ask that everyone get a free Skype account in order to have "virtual" team meetings for these labs as needed. The following activities should be done ***prior*** to the lab.

Prepare a Product Innovation Charter (see Chapter 3 and Figure 3.4 in particular, of your book). 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 Product Innovation Charter and guide you in any refinements that we believe will lead you to a better outcome at the end of the semester.

Prepare a stakeholder needs assessment plan that answers the following questions: Who are the key stakeholders for your project? How will you access them? 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 stakeholders and their needs -- information beyond your original assumptions. If you will be producing a questionnaire, include a draft with your assessment plan.

Class 13: Framing Needs and Choosing Imperatives
Monday, October 8th

Read: "Innovation as a Learning Process: Embedding Design Thinking" (on bSpace)
Read Ch. 6: Analytical Attribute Approaches: Introduction and Perceptual Mapping
Read Ch. 7: Analytical Attribute Approaches: Trade-Off Analysis and Qualitative Techniques

In this class session we will talk about ways in which you can capture and analyze stakeholder needs. Your book offers a number of analytical models for assessing needs. We'll also talk about more qualitative methods of framing user needs.

Class 14: Concept Development – Alternative Design Strategies
Wednesday, October 10th

Read Ch. 3: Opportunity Identification and Selection – Strategic Planning for New Products
Read: Eco-Design Strategies
(http://www.idsa.org/whatsnew/sections/ecosection/pdfs/designandenvironment.4.pdf)
Read: Rewiring Global Consumption
http://www.idsa.org/whatsnew/sections/ecosection/pdfs/sustainablesolutions.2.pdf

Your project teams will likely still be in data collection mode, but we will introduce concept generation approaches in this class and the next one to prepare you to engage in that step of the process after the peer review. Your book offers some general background on how to frame a project, and thus the concept generation process. The readings, *Eco-Design Strategies* and *Rewiring Global Consumption*, lay out a set of strategies or options for creating sustainable products and services that may help launch your concept generation work.

Class 15: PEER REVIEW – PRODUCT INNOVATION CHARTER, PRELIMINARY STAKEHOLDER NEEDS AND FRAMEWORKS
Monday, October 15th

PROJECT DELIVERABLE: Submit a digital version of your presentation your group page by 9 a.m. on 10/15. In addition, submit a summary of your stakeholder needs.

Your project should now have completed the following activities: Gather raw data on stakeholder needs (through whatever means you deem most appropriate to your potential market). Identify three or four needs that you feel are important, but latent and not addressed by current products. Create a framework that structures your needs in an interesting way from which you can derive an imperative to guide concept generation. Note that you should not need to have designed a product yet – we are still focused on understanding customers and use environments.

Note that most of you will find that your Product Innovation Charter 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 Product Innovation Charter as you gather new inputs (archiving the old ones on bSpace).

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 product innovation charter, a brief review of the means used to collect stakeholder needs information, a summary of the identified stakeholder needs, one of your most interesting use scenarios, 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 innovation 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 16: Concept Generation – Tools and Techniques
Wednesday, October 17th

Read Ch. 4: Preparation and Alternatives
Read: "Creative Thinking Techniques" (http://www.virtualsalt.com/crebook2.htm)
Scan: Creax.com function database for ideas (http://function.creax.com/)
Scan: More Inspiration for ideas (http://www.moreinspiration.com/)
Scan: World Changing for ideas (http://www.worldchanging.com/)

We'll continue discussing concept generation in this class session, focusing this time more on the techniques you can use to generate ideas. Your book provides some general background for concept generation work, Creative Thinking Techniques provides detailed guidance for conducting a concept generation session, and the other two websites are potential sources of ideas.

Class 17: Concept Generation – Product Architecture and Materials Choice
Monday, October 22nd

Read Ch. 13: Design (pp. 282-284)
Read: Designing a Safer Future (Ch. 2 of The Green Imperative)
(http://www.idsa.org/whatsnew/sections/ecosection/pdfs/thegreenimperative.pdf)
Read: Dematerialization http://www.corp.att.com/ehs/ind_ecology/articles/dematerialization.html
Scan: Materialization and Dematerialization: Measures and Trends
http://phe.rockefeller.edu/Daedalus/Demat/
Read: "From Inspiration to Innovation – Nike's Giant Steps Towards Sustainability"
(http://www.mcdonough.com/writings/inspiration_innovation.htm)
Read: "Nike Considered – Hope for the Sinners?"
(http://www.treehugger.com/files/2005/03/nike_considered.php)
Read: "Nike Considered" (In Sneaker Freaker) (http://www.sneakerfreaker.com/articles/864/)
Read: "Nike Considered – Long Ball Lace"
http://www.coolhunting.com/archives/2007/08/nike_long_ball.php

We'll close our conversation on concept generation with a discussion of the importance of product architecture and materials choice to sustainability. The three articles on dematerialization will give you a good sense of approaches to dematerialization. The four Nike websites will give you a sense of both how Nike approached dematerializing its shoes as well as how those shoes are doing in the market today. Come to class prepared to discuss what Nike has done, what has worked and what hasn't in its approach.

Class 18: Measuring Sustainability – Life Cycle Analysis
Wednesday, October 24th

Read: Muda, Service and Flow (http://www.natcap.org/images/other/NCchapter7.pdf)

Read: Eco-design Tools
(http://www.idsa.org/whatsnew/sections/ecosection/pdfs/IDSA_Business_Ecodesign_Tools.pdf)
Read: "Environmental Assessment Tools"
(http://www.idsa.org/whatsnew/sections/ecosection/pdfs/designandenvironment.4.pdf)

One of the most difficult issues today in implementing sustainable product, services, and processes, is measuring the degree to which sustainability has been achieved. In this class session, we introduce one of the most important tools – Life Cycle Analysis (LCA). Muda, Service and Flow will introduce you to the basic issues associated with measuring sustainable performance. The two websites will give you an overview of LCA tools. We'll have a guest speaker who is an expert in LCA tools tell us more about their development and use.

There will be an optional lab on a Friday around this lecture date during which you can learn how to use a specific LCA tool. In preparation for that lab, go through the tutorial on the EIO-LCA model at:
http://www.eiolca.net/tutorial-j/tut_1.html

Class 19: Measuring Sustainable Performance – Social Return on Investment (SROI)
Monday, October 29th

Read: "Social Return on Investment – Exploring Aspects of Value Creation in the Non-Profit Sector"
http://www.redf.org/download/boxset/REDF_Vol2_8.pdf
Scan: Sample SROI Calculations
http://socialvc.net/index.cfm?fuseaction=Page.viewPage&pageId=108&parentID=58&nodeID=1

We'll continue our conversation about measuring sustainable performance in this class session, focusing on the broader business measures around social return on investment. The article *Social ROI* nicely lays out the need for SROI measures, and then tells how to do the SROI calculations. (If you are interested, there is also an SROI primer available with a video tutorial at
http://socialvc.net/index.cfm?fuseaction=Page.viewPage&pageId=96&parentID=58&nodeID=1
A quick review of the *Sample SROI Calculations* will give you some sense as to how startups and other companies are approaching measurement.

Individual Assignment: Assess Competitive Product
You have been exposed to a number of tools for assessing businesses, products and services for their sustainability performance. Select two products or services that compete to fulfill the stakeholder needs you have identified on your project. Create a competitive assessment matrix for those solutions that shows the criteria against which you are evaluating them down the left side, and the solutions across the top. Evaluate each solution against the criteria with at least a +/0/- differentiation, if not with a scaled (e.g., from 1-7 with 1 = worst and 7 = best) assessment of their performance. You will likely want to coordinate with your team on the evaluation criteria and selection of competitive solutions so you maximize the amount of competitive data you collect, and can integrate your results. Upload your assessment to "competitive analysis" on bSpace.

Class 20: LAB – Concept Generation
Wednesday, October 31st

Project Deliverable Due: 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.

In addition, please prepare a list of the criteria you will use to evaluate the concepts you have generated. You should start the evaluation process during this lab and plan an extended team meeting within the next few days to complete concept selection. Our experience is that this process takes considerable time together as a team to hash through both the evaluation criteria and the concepts. If you have worked through your evaluation criteria before this lab, you will have a good head start.

Class 21: Concept Selection – Using the Integrated Bottom Line
Monday, November 5th

Read Ch. 8: The Concept Evaluation System
Read Ch. 9: Concept Testing

In this class session, we will address specific tools and techniques for completing your concept selection work. Your book provides background on both how to evaluate concepts as well as on how to test concepts to get early feedback from stakeholders.

Class 22: Concept Testing
Wednesday, November 7th

Read Ch. 10: The Full Screen
Read Ch. 15: Product Use Testing

We'll talk more about concept testing in this class session. Concept testing is a good way to get early feedback from users that allows you to iterate on your concepts before you have cast them in concrete in a full-fledged prototype. We'll talk about different means of creating mock-ups or representing concepts.

Class 23: PEER REVIEW – Concept Prototype and Design Review Tradeshow
FRIDAY, November 9th

PROJECT DELIVERABLE: *Updated customer needs, concept generation sketches, concept selection matrices, product specifications and drawings, photos of concept mock-ups*

Session objectives:
- Update your classmates as to progress on your product development effort.
- Make the first "public" presentation of your concept mock-up
- Gather feedback from classmates on your concept(s)

For this session:
1. Prepare a ONE-PAGE summary of your:
    - Product Innovation Charter
    - Target market
    - Salient customer needs

Plan to present this one page summary briefly at the beginning of the class in 2-3 minutes. (Assume this is an oral presentation – no slides.) This will bring the entire class up to speed on your project before they review your work.

2. Prepare your concept mock-up(s). 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 mock-up, 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

- 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 stakeholder 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 24: VETERAN'S DAY HOLIDAY
Monday, November 12th

Class 25: Design for Supply Chain
Wednesday, November 14th

StudyNet Case: Wal-Mart's Sustainability Strategy
Read: "Systems Thinking Primer for Natural Capitalism – The Four Basic Shifts"
(http://www.sustainabilityinstitute.org/pubs/Seville.Nat.Cap.html)

One of the biggest challenges company's face in the implementation of sustainability improvement programs is that they often require cooperation by various members of the supply chain. The Wal-Mart case describes the many challenges of implementing sustainability programs across a range of companies, and in concert with governmental agencies. The case describes Wal-Mart's recent efforts to engage its suppliers in sustainability initiatives and allows us to compare and contrast the efforts in different areas. In preparation for the class discussion, please consider the following questions as you read the case:

1. Given the fact that Wal-Mart's customers generally are unwilling to pay a premium for environmentally friendly products, how is the company deriving business value from its sustainability strategy, or if not, how can it ensure that it does?
2. Imagine that you are Andy Ruben or Tyler Elm evaluating the progress of the electronics, seafood and textiles networks. Which networks have been most successful? What factors explain the success (or lack of success) of these networks?
3. How is Wal-Mart motivating its supplier to share information about and continuously reduce the environmental impacts of products and processes? How can the company stimulate the development of disruptive, breakthrough innovations?
4. As evidenced by Exhibit 12 in the case, Wal-Mart's sustainability strategy has generally been very profitable. Two initiatives described in the case, however, benefit society and the environment but apparently decrease Wal-Mart's profits. Imagine that you are their internal champion. How would you justify pursuing those initiatives?

Class 26: Financial Analysis/Business Planning
Monday, November 19th

Read Ch. 11: Sales Forecasting and Financial Analysis
Scan: Global Social Venture Cases
http://socialvc.net/index.cfm?fuseaction=Page.viewPage&pageId=211&parentID=58&nodeID=1
Review: Advanced E-Team Grant Proposal Self-Assessment Worksheet (http://nciia.org/grants_self-assess.html)

In this class we'll focus on putting together a rough business plan and the high level financial statements that are required to launch a new product or service. The book gives you good background on some of the basics of forecasting sales and revenues as well as projecting costs. The cases on the Global Social Ventures site will give you some sense as to what student teams have put together in the past. The NCIIA

worksheet highlights important questions that a business plan should address. We hope to have a guest speaker or two who will address these issues with you in the class.

Class 27: THANKSGIVING HOLIDAY – NO CLASS
Wednesday, November 21st

(We made up for this class session on Friday, November 9th.)

Class 28: LAB – NCIIA PROPOSALS DUE
Monday, November 26th

Using the format of the NCIIA (National Collegiate Inventors and Innovators Alliance) student "Advanced E-team" grants, prepare a draft proposal to obtain continued funding for your project. The instructors will review the draft proposals and will make recommendations as to which ones might be sent forward to seek continued funding.

Advanced E-Team Grants support commercial outcomes by moving innovative products or technologies from the idea stage to prototype, as well as helping collegiate innovators secure Intellectual Property. E-Teams' grant proposals must demonstrate an idea's technical feasibility, potential for commercialization and social value. See: http://nciia.org/grants_eteam.html

This draft proposal should be no more than 4 pages. The format is as follows:

* A description of the project and its innovative features.
* A discussion of your project's market potential, including
    - o the size of the potential market,
    - o competitive advantages
    - o the project's consumer appeal
    - o a survey of the existing art, basic competitive intelligence, and a clear development strategy.
* A description of the project's social and environmental impact.
* A work plan and timeline for the project. (Note this should be for 12-18 months starting in March 2008)

The process of generating at least a first draft effort at this four page document will help you move towards your deliverables for the final tradeshow as well. In addition, please complete a 1-2 page self-evaluation using the NCIIA evaluation worksheet at: http://nciia.org/grants_self-assess.html. In particular, identify the items that still need work on your project.

Class 29: Integrating Sustainable Design and Development
Wednesday, November 28th

Read: Darfur Stoves (http://darfurstoves.lbl.gov/benefits.html)
Read: The Flames of Hope (http://www.msnbc.msn.com/id/19649897/site/newsweek/)
Read: Berkeley Scientists Work Scrap Metal for Darfur
(http://www.reuters.com/article/inDepthNews/idUSN0720940120070808?feedType=RSS)

As the class draws to a close, we will step back up to a higher level and look at how sustainability is being integrated in efforts by both entrepreneurs and large companies. In this session we are honored to have as our guest Ashok Gadgil who was instrumental in the Darfur Stove project about which you can read in the assigned readings.

Class 30: LAB – Concept Testing Feedback and Concept Finalization
Monday, December 3rd

You should have completed some testing with your stakeholder community prior to this lab. Come prepared to share what you have learned and your plans for completing your final proof-of-concept

prototype. Show us your current developmental prototype and tell us how you will change it in response to stakeholder feedback.

Class 30: Integrating Sustainable Design and Development
Wednesday, December 5th

StudyNet Cases: Sustainable Development at Shell (A) and (B)

In our last class session, we focused on entrepreneurial ventures whose objective is improved sustainability. In this session, we focus on the implementation of sustainability objectives in a large, established corporation. Read the two Shell cases and consider how the company has developed its social measurement and reporting systems. For the (B) case, evaluate the pros and cons of the CLC project and develop your own recommendation as to what Shell should do with the project.

Class 31: Class Summary – Capturing Lessons Learned
Monday, December 10th

INDIVIDUAL ASSIGNMENT DUE: 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. Write the notes on a one page paper and upload it to bSpace as well.***

INDIVIDUAL ASSIGNMENT DUE: Update your carbon footprint for food, housing and transportation. Compare your results to the one you did at the beginning of the semester. How did it change? What do you believe you did differently to cause it to change? ***Upload your new and old footprints and a one-page summary of your reflections on the changes to bSpace.***

Final Tradeshow
Friday, December 15th

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.

Group Presentation of Process and Prototype – Reception
The New Product Development Trade Show will take place Saturday, December 15th, 2006 from 3 p.m. – 6 p.m. 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 product innovation charter
A summary of your stakeholder 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

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