OUTLINE

- About Us
- Course Information
- Introduction to Engineering Design
My

- Born 1963
- Arrived in U.S. 1978
- B.Sc. from UC Davis 1980-1983
- Engineer at National Semiconductor & Hewlett-Packard
- Discovered Computer Networking
- Ph.D. from UC Berkeley 1990-1996
- Caught the First DotCom Boom 1996-2000
- Teaching Part-time at Stanford since 2002
- Consult to & Invest in Start-ups/Involve in Multiple NGOs
- 2 Kids: Jessica (18) & Zoe (16)
Andrea

- ME Professor Dad (UCB), Cartoonist Mom
- Undergrad at UC Berkeley 1982-1986
- Worked in Silicon Valley 1986-1989
- Fell in love with wireless.
- Ph.D. from UCB: 1989-1994
  - Summers at AT&T Bell Labs
- Taught at Caltech 1994-1999
- Moved to Stanford in 1999
  - Lots of stuff in addition to research, teaching:
    - PM advisor, Ugrad/Grad Education Committees, Faculty Senate, Budget Group, PPB, Women's Leadership Task Force, EE Student Life Committee
- Founded two wireless companies: Quantenna (QTNA, 2006) and Accelera/Plume WiFi (2010)
- Much work on women in STEM (in academia, industry, and the IEEE)
- Best Results: Daniel (19) and Nicole (17)
COURSE INFORMATION

- COURSE GOALS
- ADMINISTRATIVE INFORMATION
- COURSE SCHEDULE
- ASSIGNMENTS
- PROJECT
COURSE GOALS

- To introduce freshmen to the design process of an engineering project.
- To present the different functions that people play in a project.
- For students to consider what role in a project is best suited to their interests and skills.
- To introduce to students the diverse people and projects that comprise the engineering profession.
- To have fun.
LEARNING ENGINEERING DESIGN

As Marketing Requested It

As Sales Ordered It

As Engineering Designed It

As Plant Manufactured It

As Crew Modified It

What the Customer Wanted
INTRODUCTIONS

- Introduce yourself.
- Say why are you interested in this course.
- Share any thoughts on your future career.
ADMINISTRATIVE INFORMATION

- Instructors:
  - Andrea Goldsmith, Packard 371, andrea@ee, 766 8317, OHs: after class and by appointment.
  - My T. Le, drmytle@gmail.com, 224 1351, OHs: by appointment.
- Class Homepage: http://web.stanford.edu/class/ee15n/
- Admin: Julia Gillespie, Packard 365, jvgill@stanford.edu
- Grading: Class Participation 20%, Assignments 20%, Project Assignments, Presentation, and Final Report: 60%
- See Class Home Page and Handout for More Details.
COURSE SCHEDULE

- **WEEK 1 – JAN 11:**
  - Lecture: Introduction to Engineering Design
  - Speaker: Martin Casado, Andreessen Horowitz

- **WEEK 2 – JAN 18:**
  - The Design Process
  - Speaker: Lee Redden, Blue River Technology

- **WEEK 3 – JAN 25:**
  - Lecture: Design Teams and Management
  - Speaker: Ellen Levy, Silicon Valley Connect

- **WEEK 4 – FEB 1:**
  - Lecture: Defining an Engineering Problem: Requirements and Objectives
  - Speaker: Sam So, Asian Liver Center
WEEK 5 – FEB 8:
- Lecture: Defining an Engineering Problem: Constraints and Design Specs
- Speaker: Pejman Nozad, Pear Ventures

WEEK 6 – FEB 15:
- Lecture: Generating Design Ideas and Choosing a Design
- Speaker: Laurie Yoler, Board Member (Zoox, Accenture, Computer History Museum) and Investor. Previously with Qualcomm, Tesla, Visa, Sun, ....

WEEK 7 – FEB 22:
- Lecture: Why Things Fail
- Speaker: Steve Rummage, David Wright Tremaine LLP
WEEK 8 – MAR 1:
- Lecture: Communicating the Design and Prototyping
- Speaker: Benoit Schillings, Yahoo

FRIDAY MAR 3: Field Trip to TBD (IDEO/Tesla)

WEEK 9 – MAR 8:
- Lecture: Looking Beyond the 1st Generation. Engineering Products that Changed the World
- Speaker Panels: Wren Dougherty, Nathan Hall-Snyder & Sally Thornton

WEEK 10 – MAR 15: Final Presentations

Finals Week: Project Reports Due March 21 at midnight
WRITING ASSIGNMENTS

- Two writing assignments are required
  - 3-5 pages
  - Include references
- Deadlines:
  - First Report due February 1 (Week 4)
  - Second Report due March 1 (Week 8)
- Topics of the assignments should be from different categories
WRITING ASSIGNMENT CATEGORIES

- Report on how society shapes technology or vice versa.
  - Examples: stem cell research, cell phones, nuclear power, the Internet, Twitter, Facebook,…

- A case study of a complex engineering project.
  - Examples: the IPOD/iPhone, Google search, the space shuttle, the power grid, MRIs, electric or self-driving cars.

- Describe in more detail an engineering project executed by one of our guest speakers.

- Pick your own topic related to engineering design.
A term project will be used to illustrate the design concepts introduced in the course.

The project will be designed by a team of 3 to 4 students

- Form teams, decide project, 1 paragraph Problem Statement that your project will solve due 1/25.
- Revised Problem Statement, Preliminary list of project roles and tasks and Objective tree for your project due 2/8
- Other project assignments: morph chart and gallery method sketches (Feb 22), final design choice and related charts (Mar 1), detailed design (Mar 8)
- Projects from last class posted on course website

Project requirements include interim documents, a final report, and a final presentation

We will help with the formation of project ideas and teams
What would you like to do a project about?
INTRODUCTION TO ENGINEERING DESIGN
What is engineering design?

Who participates?

What processes are needed?

How is success measured?
Textbook definition: A thoughtful process for generating plans or schemes for devices, systems, processes that attain given objectives while adhering to specific constraints

- Design is a thoughtful process that can be understood
- There are formal methods for this process
- The form and function of a design are separate yet related
- Design specifications:
  - Detail how the design should perform
  - Provide a metric for success
HISTORY OF ENGINEERING DESIGN

- People have been designing things for a long time
- Examples of great designs from antiquity:
  - Great Pyramids in Egypt
  - Mayan Cities and Temples
  - Great Wall of China
- No records survive from these projects
- Basic design method in the past (and present)
  - Trial and error
  - Excessive resources
DESIGN EVOLUTION: PYRAMIDS & CELL PHONES

Mastaba

1st analog (1G) cell phone aka “the brick”
DESIGN EVOLUTION: PYRAMIDS & CELL PHONES

Step Pyramid

Analog “Flip” phone (birth of mobile devices)
DESIGN EVOLUTION:
PYRAMIDS & CELL PHONES

Bent Pyramid

iPhone 3GS
(birth of the smartphone)
What is common to both design evolutions?
Device to be built of wood, reeds and taffeta. "A small model can be made of paper with a spring like metal shaft that after having been released, after having been twisted, causes the screw to spin up into the air."
FAILURE IN COMMUNICATION

EXAMPLE: COLLAPSE OF A WALKWAY

Place: Regency Hyatt Hotel, Kansas City
Date: July 17, 1981
Result: 114 deaths
more than 200 injuries

http://www.youtube.com/watch?v=_lOav24Bfzs
Design problems are ill-defined
  - The purpose of the design is not always clear
Design problems are ill-structured
  - Cannot directly apply formulas or algorithms
  - Use-cases and operating environments not fully known
Design problems are open-ended
  - Problems usually have several acceptable solutions
  - Tradeoffs change as technology evolves
TODAY’S SPEAKER

MARTIN CASADO, PH.D.

ANDREESSEN HOROWITZ