High-Tech Design
as Modern Engineering Entrepreneurship

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The Point

all individuals in society become wealthier

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economic growth

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innovation

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good design

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It’s All About Innovation …

“Innovation and trade: the ultimate engines of growth.”
—Economist, Oct 3, 2009

“We have to choose to do what past generations have done: shape a brighter future through hard work and innovation.”
—Barack Obama, Sep 22, 2009
(ASEE’s “Obama Touts Innovation Agenda At New York Community College”)

“In the new knowledge economy, innovation and knowledge are the most important factors driving economic growth.”

“Innovation is the heart of economic recovery & future prosperity.”
—Roll Call, Nov 20, 2008
... But, Boy, Is Innovation Hard

• “In an era when most technology outfits have tightened their belts to adapt to a slower-growing market, one company stands out for forging ahead on innovation: Apple Computer.” (BusinessWeek)

• “Big companies are losing their ‘A’ players, and they’re struggling to attract ‘B’ players. In an industry where everything is about people, large tech companies are in trouble because they are losing the talent war. And keep in mind, an ‘A’ player in an organization can usually produce the same results as three ‘B’ players.” (VentureBeat)

• “Lots of companies have tons of great engineers and smart people. But ultimately, there needs to be some gravitational force that pulls it all together. Otherwise, you can get great pieces of technology all floating around the universe. But it doesn’t add up to much.” (Steve Jobs, on innovation)
Today’s Talk

1. Despite what we may think, we don’t really teach it here

2. How can you instill it in your business partners/employees?

3. Why #2 matters to you (yes, you)
Talk 1: Thoughts on Teaching Design
What is Design? What is Innovation?

• Can’t define it, but you know it when you see it … 😊

• Close interaction with burnout phenomenon in start-ups

• An inability to eat, think, sleep, care for one’s self while technical problem remains

• Requires staring at one problem for extended period (much like Ph.D. in that regard)
Let’s Look More Closely at that Last Bit

- **Innovation and design requires staring at one problem for extended period**

- Contrast that with academia (undergrad in particular):
  - Attention flits from topic to topic in a scheduled, often frenetic pace
  - Semester concept is both arbitrary and contrived/artificial (innovation recognizes no schedule)

Is it any wonder that **SO MANY successful entrepreneurs/innovators dropped out of school**?

- Larry Ellison
- Bill Gates
- Stephen Spielberg
- Richard Branson
- Michael Dell
- Steve Jobs
More on Grades

Students calculate the effort needed to get the desired (or lowest acceptable) grade. They do the minimum work required. **We (unconsciously) train them** to do this.

Needless to say, this doesn’t fly for design. In design, anything less than full attention = failure.
What Are We Doing?

• Electric Guitar Design Class

• MIPS: sponsored R&D

• Innovative engineering designs

• Coil LLC: Commercial venture involving students
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How do you make them care enough to do it right?
Talk 2: Innovation and the Lion’s Share of Reward
Innovation.

Specifically, *How to Do It in a Business Setting*

... and, you know, like, *regularly* ...
Some Perspective

Big companies cannot innovate, whereas startups must.

Startups are engineer-dominated; founders (engineers) are rewarded for company’s success.

Upon maturity, startups become management-dominated; executives (non-engineers) are rewarded for company’s success.

(thus #1, above)

Goal: break this cycle
Some More Perspective

Middle managers believe themselves innovators.

“Intrapreneurship” (also termed “corporate entrepreneurship” or “corporate venturing”) tries to foster creativity within corporate environment.

Most studies empower middle management. None investigate rewarding engineers. WTF?

The term *managerial creativity*, a common term in the research literature, probably says it all.
What is the Goal, Again? (the point of innovation)

Create Wealth

For you
For others (beneficiaries of your innovations)
For the economy

Wealth is **not** like energy;
it obeys no laws of conservation
What is the Goal, Again?

Create Wealth

Wealth

Not Wealth
What is the Goal, Again?

Create Wealth

Wealth

Not Wealth
What is the Goal, Again?

Create Wealth

Wealth

Not Wealth
The Problem, Again … and a Solution of Sorts

Either you do everything yourself, or you have partners/employees.

Assuming the latter, how do you instill in others the desire to do good design? How do you ensure that your company innovates? How to get partners/employees to go above & beyond on a regular basis? How do you convince the exceptionally talented that it is worth their while to work for you instead of for themselves?

Arrange it so that they are working for themselves.
Reward: Become a *De Facto* Startup

**Novel concept:**
Pay your engineers as if they are in a startup

Good managers, scarce though they may be, are no scarcer than good designers. Great designers and great managers are both very rare. Most organizations spend considerable effort in finding and cultivating the management prospects; I know of none that spends equal effort in finding and developing the great designers upon whom the technical excellence of the products will ultimately depend.

Fred Brooks (*The Mythical Man-Month*)
If You Are a Startup

**Not-so-novel concept:**
Make all participants partners;
make all partners buy in
Bottom Line

• Existing trend is to study innovative exceptions (Apple, Google, Fiat, etc.) and try to emulate them.

• Why not emulate an entire industry instead? In particular, the one industry known for innovating regularly.

• What do startups do? They recognize that engineers are their primary innovators, and they PAY them.

Innovation = Wealth
Talk 3: Design and Modern Entrepreneurship
Important development in last decade:

Manufacturing as a Service
The Basic Idea

You → Design Blueprint → Factory → Manufactured Device
The Basic Idea

Design Blueprints

Factories

Assembled Device

Manufactured Device

Assembly
Some Blueprints
Some (other) Blueprints
Pros & Cons

• Can’t Possibly compete with big companies

• Might fail

• Can’t afford it

• Window of opportunity?

• Idea already proven in marketplace (shareware, boutique electronics)

• Win/win situation (even company failure is good résumé material)

• Low risk/reward ratio

• Start soon

Bottom line: a path well worth exploring
Questions?
(thank you for your attention)

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