Meeting #6:

Conclusion of Project 0 and Introduction to Project 1
We have learned about many different engineering fields. **The question is what is common behind all these engineering fields? What is engineering?** To get an answer to this question, let make a distinction between an engineer and a scientist. The scientist is linked to theory and the engineer practice, that is, the scientists discover natural laws and engineers use them to build a devices for the benefit of mankind. For example, physicists discover the law of electricity and engineers use that as a basis to create a light bulb. It seems first the scientists then the engineers, **is there any reverse situation?** Well nowaday scientists use very sophisticated equipments to discover new laws, for example particle physicists use multi-million-dollar particle accelerators to check the unified field theory, equipments which were built with engineering technologies.

Engineers in different fields focus different things based on their knowledge and expertise, for example electrical engineers focus on semiconductors, transistors, and smaller chips, chemical engineers on new materials, and civil engineers on longer bridges, and safer tunnels.

How do the they do it? How do they perform such complex and large projects such as a rocket, a space station, or a computer that can defeat a human chess master? Well they do it in teams, applying adequate scientific knowledge, and using computer-related tools. This phrase summarizes the three (or four including physical tools) main categories under which the engineering "tools" can be grouped: the people-related tools; the concepts-related tools; and the computer-related tools. More on these in the script and presentation shown below.

How do I get there? Like a bussinessman uses money to get more money, an engineering student uses tools to get more tools. To solve a complicated problem, use the right tools and a right focus.

Script for What Is Engineering?

Slide #1:

What do engineers do?

Engineers use discovered scientific knowledge and tools to build devices and make things happen. Work is needed for an idea to get materialized, scientists discover a new natural law then engineers find out a way to use this law to help people have a better life, civilization and progress. In this sense, scientists are ahead of engineers in knowing the behavior of nature. However, in finding out ways to apply new laws engineers discover new tools or technology that build better devices to help find new laws. The engineers are ahead of the scientists in new technologies.

Slide #2

Chemical and Materials Science engineers apply knowledge discovered by scientists on how to arrange atoms to obtain certain macroscopic bahaviors to produce new materials which are stronger and lighter.

Slide #3

Electrical engineers apply knowledge on how to dope materials with impurities to achieve certain conducting properties to produce semiconductors and find new technologies to make smaller and faster chips that run computers.

Slide #4

Civil engineers apply knowledge on materials strengths and the environments to build skyscrappers, long underground tunnels, long bridges, and floating airport.

Slide #5

How do they do it?

They do projects in teams applying adequate scientific knowledge, and using computer-related tools, that is, using people-related tools; concepts-related tools; and computer-related tools in addition to physical tools.

Slide #6

People-related tools such as: teamwork, brainstorming, logbook, time management, estimation

Concept-related tools such as Calculus, Linear Algebra, Differential Equations, Fundamentals of Physics, Chemistry, Strength of Materials, Circuit Theory, Quantum Physics, etc., and existing technologies such as Global Positioning System (GPS), Geographic Information System (GIS), Digital Signal Processing (DSP), Micro Electro-machining (MEM), Molecular Motors, etc.

Computer-related tools such as CAD and simulation softwares (LabVIEW, MatLab, Mathematica, MathCad, SolidWorks, etc), spreasheets (Excel), and data modeling and prediction.

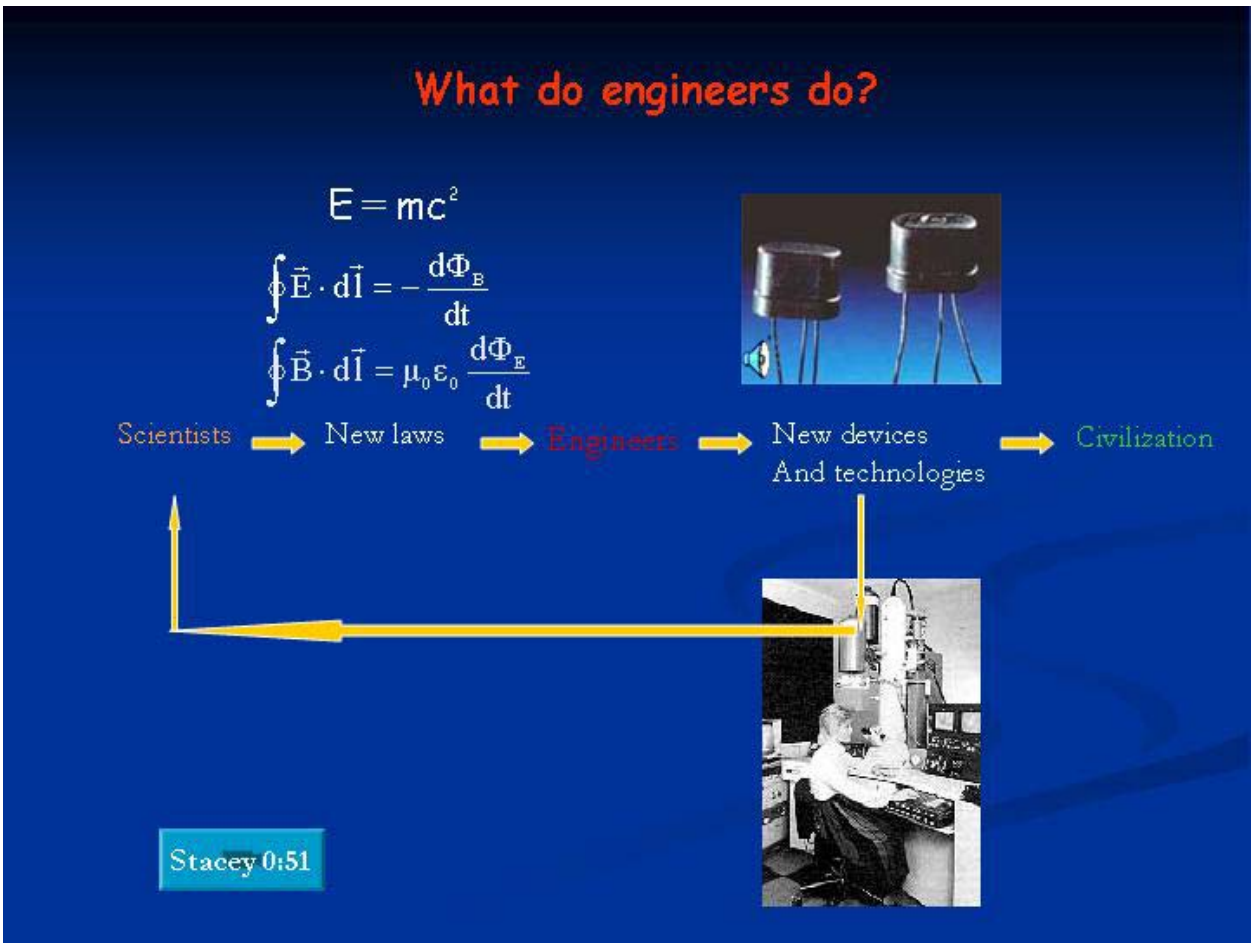
Slide #7
How do I get there?
Use your tools to get more tools

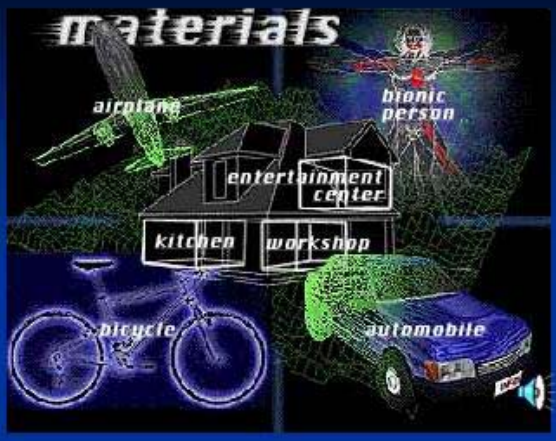
Acquire as many engineering tools as early as possible, use them to acquire more such as science and math courses. Use a goal-oriented and discovery-based approach, put abstract mathematical or physical concepts in a context. The right tools: use teamwork to approach a complicated subject or problem, have good textbooks or notes that you can understand (engineers build upon existing knowledge and technologies), have or build an adequate table of formulas, trigonometric relations, etc. that you can use, spend good amount of time in solving problems, have solutions you can check against, find help whenever needed, use time management to finish assignments on time, use spreadsheets to manage data and produce lab reports.

Slide #8
Right tools with the right focus

Quotes:
Achievement: “There is no succeess without hardship”, Sophocles
Goals: “There is no achievement without goals”, Robert J. McKain
Planning: “With a definite, step-by-step plan, you cannot fail, because each step carries you along to the next, like a track …”, Scott Reed
Time management:” Is what I am doing or about to do getting us closer to our objective?”, Robert Townsend
Teamwork: “T.E.A.M.= Together Everyone Achieves More”
Belief: “Whether you think you can or think you can’t –you are right”, Henry Ford
Desire: “All our dreams can come true –if we have the courage to pursue them”, Walt Disney
Persistence: “Our greatest glory is not in never falling, but in rising every time we fall”, Confucius
Responsibility: “Hold yourself responsible for a higher standard than anybody else expects of you. Never excuse yourself”, Henry Ward Beecher
Attitude: “Any fact facing us is not as important as our attitude toward it, for that determines our success or failure”, Norman Vincent Peale

What Is Engineering slides:

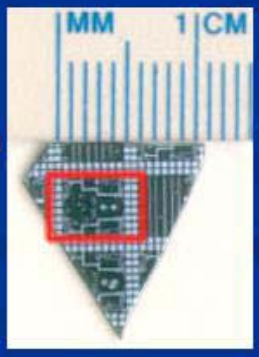




Artificial shoulder

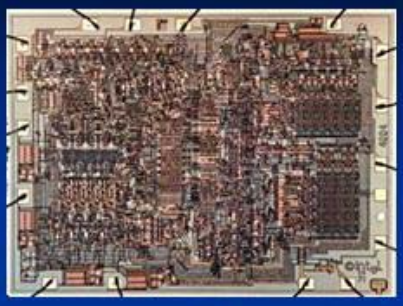
Alumina ceramic

Integrated circuit etching



ENIAC computer

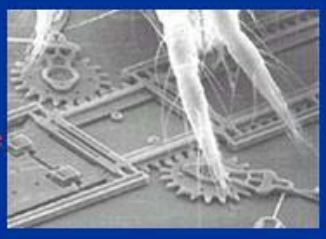
Intel 4004 with 2300 transistors



Moore on transistor

Moore on how many transistors

Spider mite on a nanostructure



Organic LED's

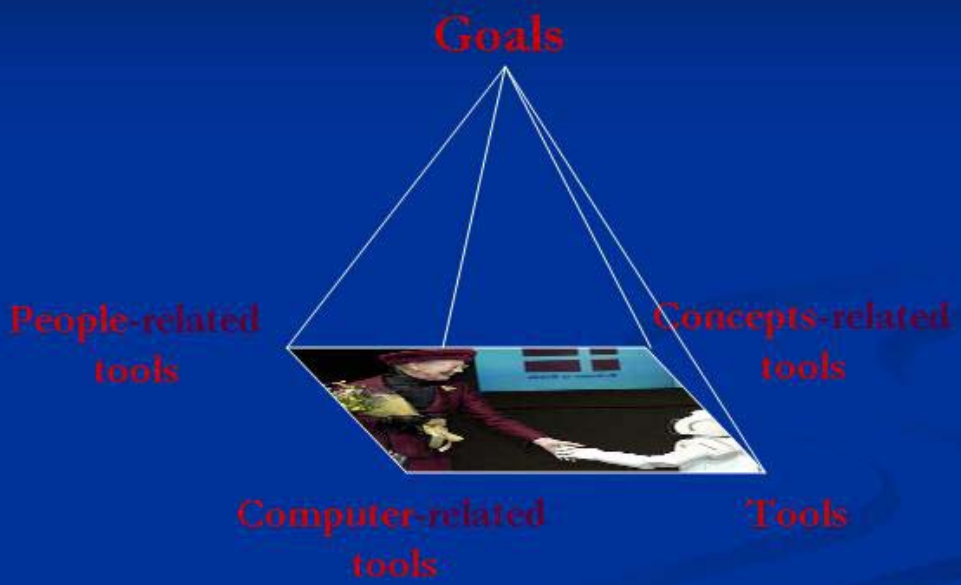
Empire State building

Euro-tunnel

Golden-Gate bridge

Kansai floating airport

How do they do it?

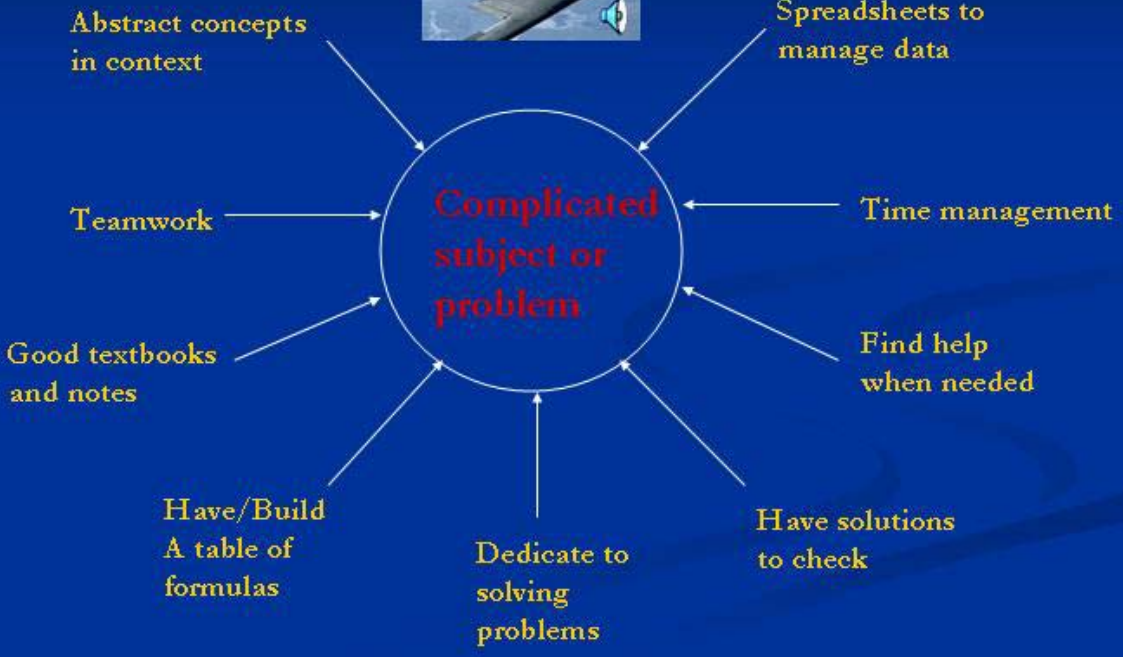


Right tools

People-related	Concepts-related	Computer-related	Physical tools
Teamwork	Calculus	MatLab	GPS
Brainstorming	Linear algebra	Mathematica	DSP
Logbook	Differential eqs.	MathCad	MEM
Estimation	Statistics	LabVIEW	Molecular motors
Time management	Physics	PSPICE	…
	Chemistry	SolidWorks	
	Strength of Materials	AutoCad	
	Circuit Theory	Spreadsheets	
	Quantum Physics	Data modeling and prediction	
	Existing technologies: GPS, GIS, DSP, MEM, Molecular Motors, etc		

How do I get there?

Use your tools to get more tools



The class did classwork 1 (CW1) as related to what is the difference between an engineer and a scientist, as related to the materials in these first 6 meetings, and today discussions.

Project 1 is introduced: meetings 6-12 will be dedicated to Project 1, which will be due in meetings 10 and 11, and the report and webpage will be due in meeting 12 along with the logbook. Each team should have new leader and webmaster for this new project