Week 3

1. Engineers' Salary Survey
2. Design project (see Design Project Schedule on web)
3. Professionalism and Ethics (chapter 1.10 in book)

Engineering Salary Survey

Source: http://www.abbott-langer.com/asmesumm.html?pn02

Engineering Salary Survey

The median annual income reported in a recent survey (2004) of the compensation of mechanical engineers was $83,236 , with the middle 50% falling between $62,000 and $100,000, according to Dr. Steven Langer, President of Abbott, Langer & Associates, Inc., Crete, IL.

Engineering Salary Survey, cont'd

The composite highest-income practitioner in this field (salary plus cash bonus and/or cash profit sharing) is the Research Vice President/Director with a median income of $135,000. Far toward the other end of the income spectrum, Junior Engineers have a median annual income of $50,000.

Engineering Salary Survey, cont'd

The median total cash compensation of some included in the 2002 survey report are:

Presidents "B"	$130,500
Engr. Directors/Vice Presidents	$110,000
Professors	$106,700
Principal Consultants	$100,000
Environmental Managers	$96,990
Senior Engineers	$79,800
Sales Representatives	$74,000

Engineering Salary Survey, cont'd

Compensation varies considerably. Median incomes are highest for independent consultants ($99,500), and in financial organizations ($118,000), textile mill product manufacturing ($96,000), and petroleum/coal/natural gas extraction & refining firms ($95,000);

Engineering Salary Survey, cont'd

Median incomes are lowest in firms manufacturing home appliances ($63,000) and circuit boards ($63,500), printing firms ($63,800), and state government ($64,000).

Engineering Salary Survey, cont'd

When level of education is taken into account, mechanical engineers with a **doctoral degree** earn a median annual income of $93,750, 32% higher than those with a bachelor's degree ($70,950).
Mechanical engineers with **under one year of experience** have a median income of $49,900, only about one-half that of the 25-plus-year veteran ($100,000).

Chapter 1.9 Engineering Education

Some personal observations:
• Observe market trends continuously. Internet job sites are an excellent resource.
• The highest demand is typically in new technologies (often the most interesting, but also the most challenging)

Design Project Week 3

Your Assignment:
see Design project web page:
http://www.me.unlv.edu/Undergraduate/coursenotes/egg102/proj-sch.htm

Design project (see Design Project Schedule on web)

This week:
Lego Design and Programming 1

Begin Literature Search
*Report 2 due in **Week 3** of the semester*

First part of this week's Lab Assignment: Lego Design and Programming 1

Control and Build a vehicle with one motor and one light sensor. Write a program that lets the vehicle move at a constant speed indefinitely. The vehicle must stop when it encounters a white line.

Second part of this week's Lab Assignment:
Begin Literature Search

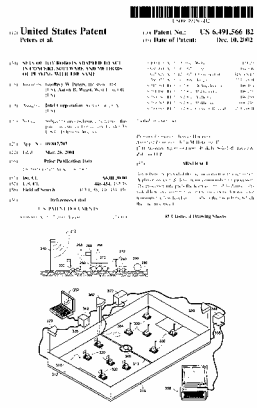
Your Sources:
- **Library**
- **Web**
- **US Patent office**

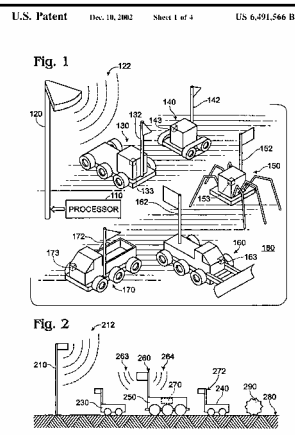
US Patent example:

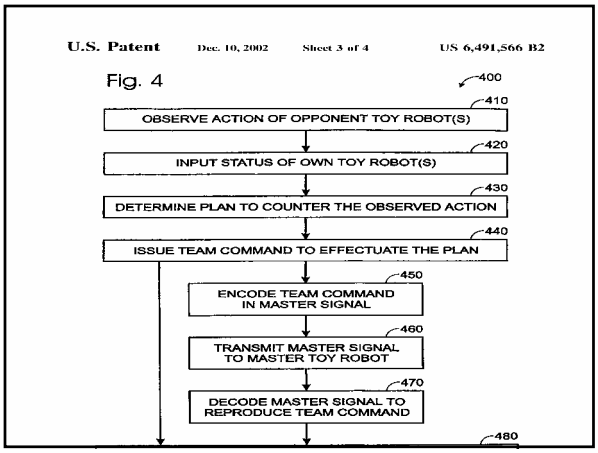
United States Patent 6,491,566
Peters , et al.
December 10, 2002

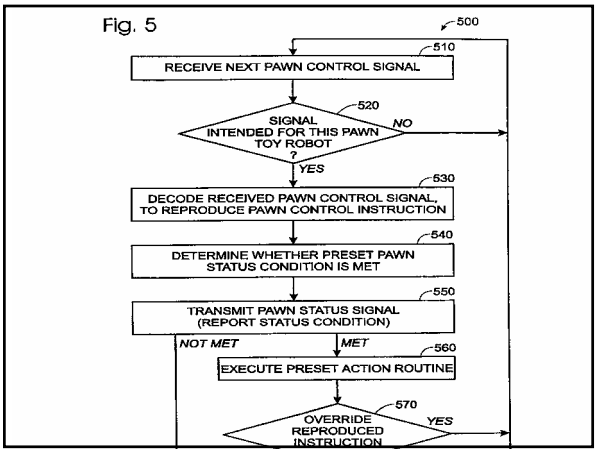
'Toy Robots'
Legally known as:
"Sets of toy robots adapted to act in concert, software and methods of playing with the same "

US Patent 6,491,566





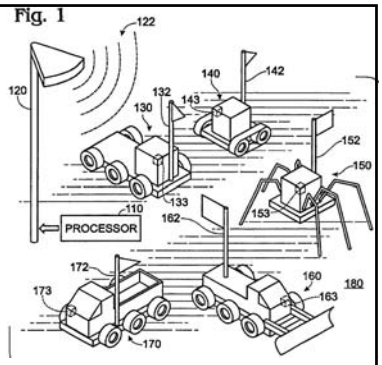




What can we learn?

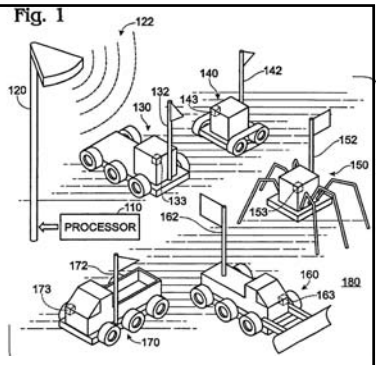
Creativity?

New Ideas?



Conclusion

Patents are an excellent resource for assessing the state of the art, and for generating new ideas.



Second part of this week's Lab Assignment:
Begin Literature Search

Your Sources:
- **Library: Visit the UNLV Library. The library has an on-line catalog. See: http://www.library.unlv.edu/**
- **Web**
- **US Patent office**

Second part of this week's Lab Assignment:
Begin Literature Search

Your Sources:
- Library
- **Web**

Use search engines such as Google. Also use Image search options
- **US Patent office**

A final remark:

Motivation: Study patents and literature for your own benefit. You will come up with new ideas. Knowledge will make you an expert, and will let you enjoy the project a lot more.

Chapter 1.10 Professionalism

Professional Registration

NEVADA STATE BOARD
OF PROFESSIONAL ENGINEERS AND LAND SURVEYORS
1755 East Plumb Lane, Suite 135, Reno, Nevada 89502
(775) 688-1231 1-800-728-2632 (In Nevada only)

Application for Professional Engineer Licensure

(Discipline) .....

☐ **Reciprocity** (Fee $200)

☐ **Exam** (Fee $225 – Structural see Fee List)

The Appropriate Application Fee Must Accompany This Application

PE

Nevada State Board of Professional Engineers and Land Surveyors
1755 E. Plumb Lane, Suite 135 Reno, NV 89502

Applicant's name: _____

Address: _____

_____

is seeking licensure as a (discipline) _____ Engineer in Nevada and has sent you this request for a professional reference. We understand that you are a Licensed Professional Engineer (license may be in any state) and have personal knowledge of the applicant's engineering work, character and ethics. Please complete, sign, then stamp or seal this form. Place it in an envelope; seal and sign the envelope according to the instructions, then return the envelope to the Board office. ***This Reference is confidential*** and will not be accepted by the Board if not properly completed as instructed. *THE NEVADA BOARD HAS ON FILE A NOTARIZED AFFIDAVIT RELEASING ALL REFERENCES, EMPLOYERS AND FORMER EMPLOYERS, NAMED BY THE APPLICANT, FROM ALL LIABILITY FOR ANY DAMAGE WHATSOEVER FOR GIVING INFORMATION AS REQUIRED ON THIS FORM.*

Applicant*: Describe up to 3 projects you had full or partial responsibility for while working with this professional engineer. Include dates, locations, and descriptive statements defining design work performed. (Attach an additional sheet if more space is needed)*

(1) _____

What is a 'Professional Engineer (PE)?

Licensing
Obligations

What is a 'Professional Engineer (PE)?

By acquiring a license from its State Board, a Professional Engineer meets a set of minimal requirements for practicing the engineering profession in his/her field.

What is a 'Professional Engineer (PE)?

Obligations: As other licensed professionals, the PE must protect the 'safety, health, and welfare of the public'

Caution: Your PE stamp of approval makes you legally responsible for the safety of the design bearing your signature. As you shall see, this is a significant responsibility.

Source: Page 70 of your textbook

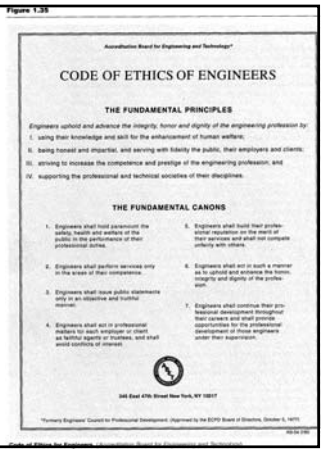


Figure 1.35

CODE OF ETHICS OF ENGINEERS

THE FUNDAMENTAL PRINCIPLES

THE FUNDAMENTAL CANONS

Design problems are as old as engineering

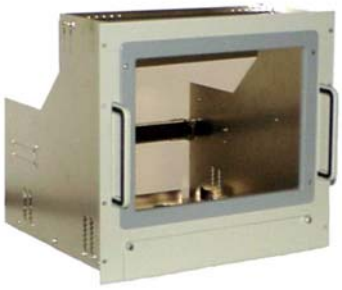
Chapter 2
Engineering Design – A Process

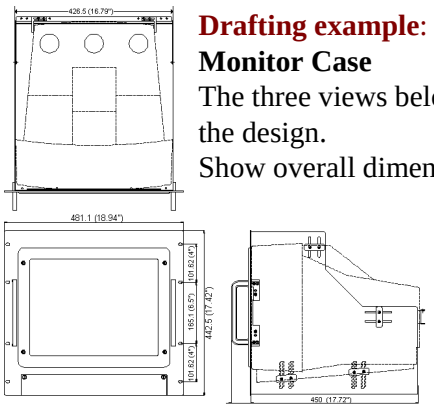
For your information:

Wright Brothers: You can find a collection of short movie clips in Quicktime format on your WebCT page and the web (NASA). See: http://wright.grc.nasa.gov/webcast.htm

I'll show some of these movies in class. See also links to *women in aviation* and other related topics.

Drafting example: Monitor Case





Drafting example:
Monitor Case
The three views below define the design.
Show overall dimensions!

Engineering Design – A Process

When is a design complete?

When is a design complete?

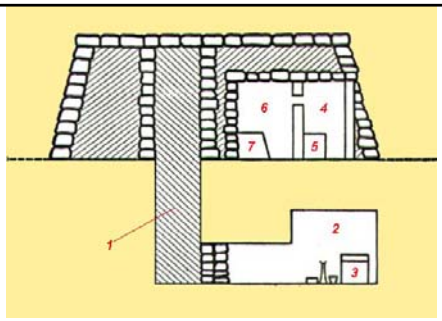
Perfection takes both time and effort.

A Design Example

Gizah: Khufu Pyramid and Sphinx

The Mastaba:

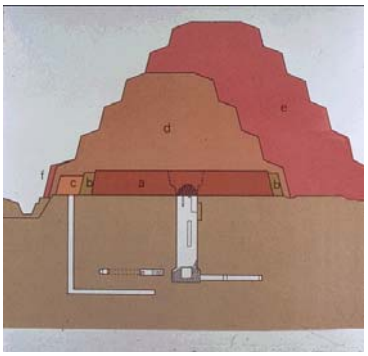
Rectangular tomb-chapel belonging to ancient Egypt, beginning from the earliest dynastic era (around 3500 BC). The mastaba both represents the forerunner of the Pyramids, and the simpler alternative to Pyramids. Mastaba are structures with flat roofs, and normally built from mudbrick or stone.



Mastaba Cross Section

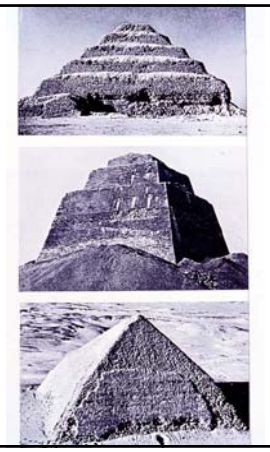
Zoser's Pyramid

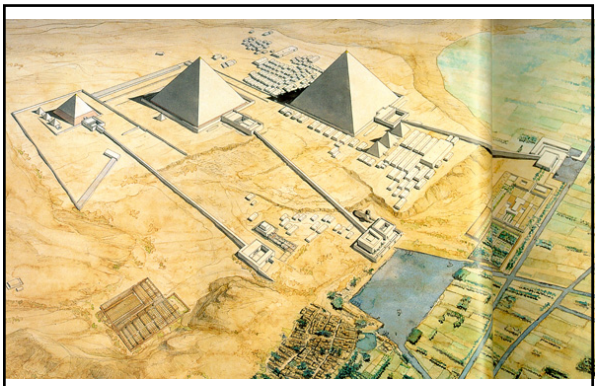
Pharaoh Zoser decided he wanted a final resting place more grand than the underground tombs or low, flat brick buildings (mastabas) in which most previous kings had been buried.
Zoser had in his service a brilliant architect, Imhotep. Imhotep kept stacking mastabas until Zoser's tomb became a six-tiered pyramid 62 meters (203 ft) high, built of thousands of carefully cut stones and encased in a fine limestone shell.



Zoser Step Pyramid, Construction Stages

The Evolution of Pyramids





Reconstruction of Gizah

Gizah: Khufu (Cheops) Pyramid Detail

Gizah: The Sphinx

Engineering Design –

Engines and Automobiles

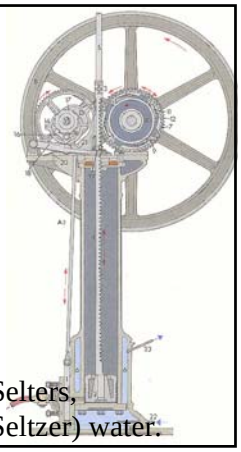
The First Otto Engine

Used coal gas,
About 10 m tall,
Free-flying Piston

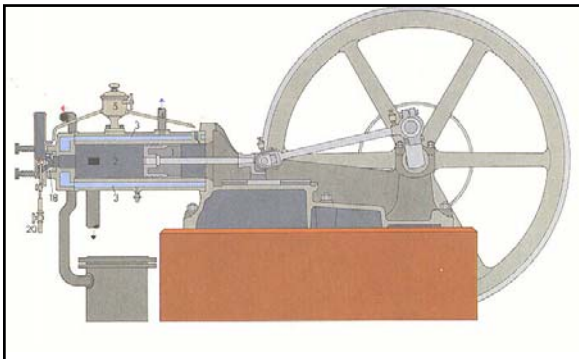
Operation

Step1: The gas/air mixture is compressed as the piston falls under its own weight.

Step 2 : The compressed gas/air mixture is ignited, driving the piston up. (the work stroke)



This engine was installed in Selters, Germany, to pump mineral (Seltzer) water.



"Silent" Otto Engine

First Designs are often crude.

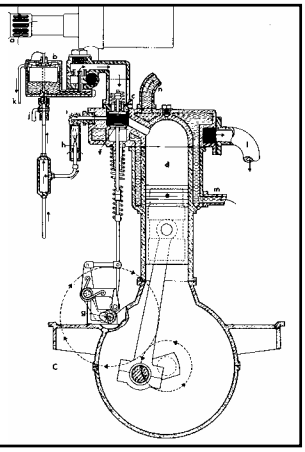
The Otto engine improved rapidly. Even 140 years after its invention, it is still the dominant power source for automobiles.

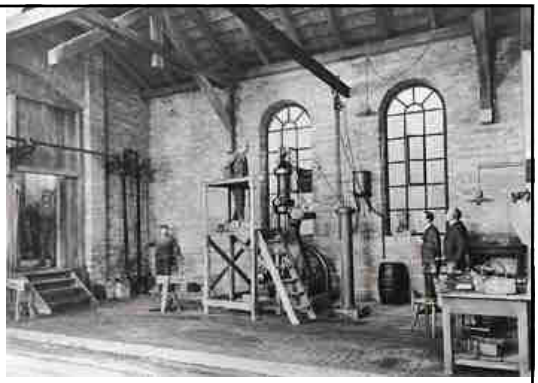
A Daimler Engine

A compact and high-speed (900 rpm) version of the Otto engine.

This engine runs on *Benzin*, a liquid fuel which at the time was used mostly as a cleaning fluid and sold by druggists.

Daimler invented the hot-tube ignition.





Rudolf Diesel in his Laboratory, 1896

Science makes for better Engineering: Rudolf Diesel's "Rational Heat Engine"

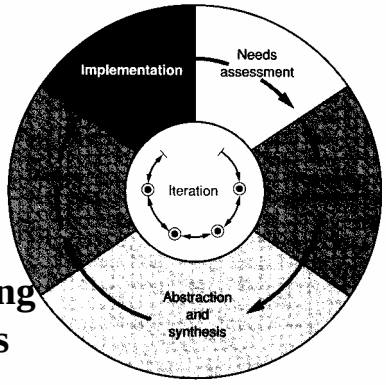
- The 2nd law of Thermodynamics predicts the maximum efficiency of a **Carnot** process.
- Diesel attempted to improve the existing thermal engines of the day on the basis of purely theoretical considerations.
- Diesel **raised the temperature** of pure air to a very high degree through vigorous adiabatic compression. Diesel engines are approx. 25% more efficient than Otto engines.

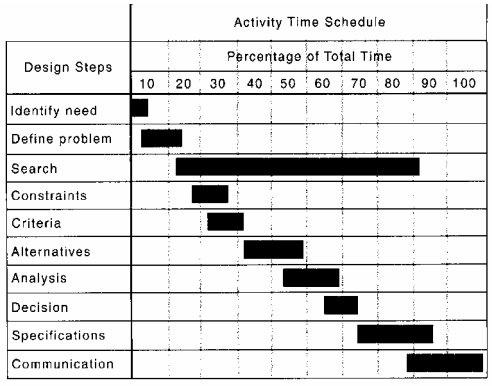
Engineering Design is iterative:

You start with an idea, Encounter obstacles, and seek to overcome them until you arrive at the desired product.

1908 Buick

Engineering Design is iterative



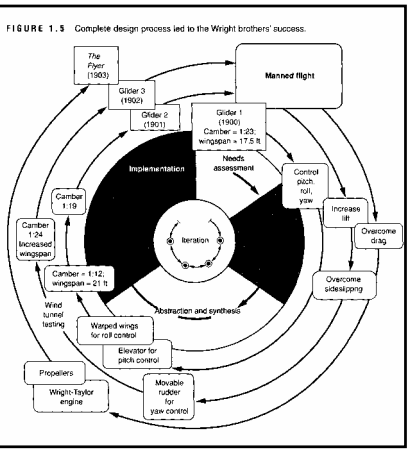


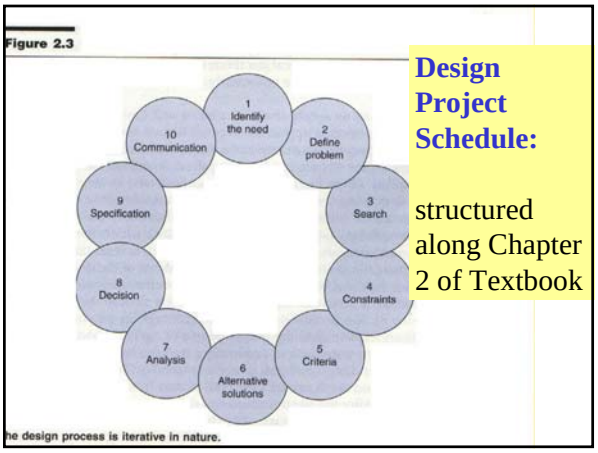
A time schedule must be developed early in order to control the design process.

Exemplary engineering: **The Wright Brothers**

Wright Brothers bike shop in Dayton, OH

The Wright Brothers systematically addressed every design problem.





Design Project Schedule:

structured along Chapter 2 of Textbook

How We Made the First Flight by Orville Wright

"The flights of the 1902 glider had demonstrated the efficiency of our system for maintaining equilibrium. We felt that we were prepared to calculate in advance the performance of machines. Before leaving camp in 1902 we were already at work on the general design of a new machine which we proposed to propel with a motor. "

How We Made the First Flight by Orville Wright

1902 Glider

How We Made the First Flight by Orville Wright

Please watch movie:
WRIGHT_01glidbg

Glider

How We Made the First Flight by Orville Wright

Please watch movie:
WRIGHT_01glidbg

Engine

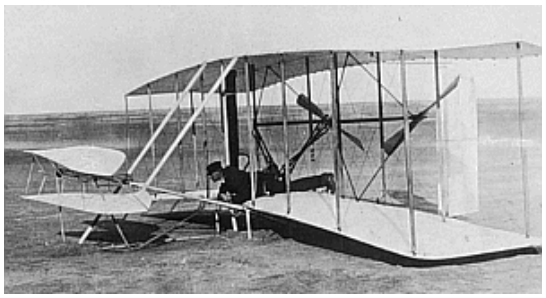
How We Made the First Flight by Orville Wright

"Immediately upon our return to Dayton, we wrote to a number of automobile and motor builders, asking whether they could furnish one that would develop eight-brake horse power, with a weight complete not exceeding 200 pounds.
Finally we decided to undertake the building of the motor ourselves. "

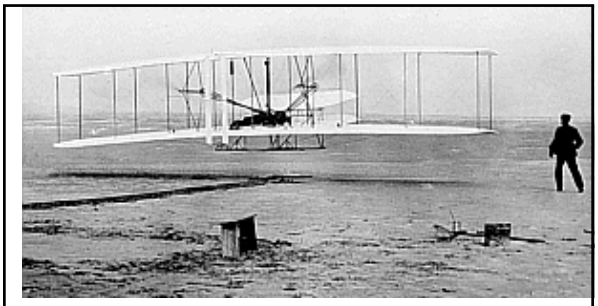
The Wright Brothers designed and built their own lightweight engine because a suitable engine was not available form manufacturers.

Please watch movie:
WRIGHT_mow_03

1903 Flyer



***The "Flyer" after it's first 3 1/2 second flight,* a failure.**



The first manned flight : December 17, 1903. At 10:35 a.m. Orville Wright takes off into a 27 mph wind. The distance covered was 120 feet

First Flight

Please watch movie:
WRIGHT_mow_03_f

Aircraft Development continued. The movie
WRIGHT_mow_05
discusses innovations until 1905