Week 4

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)

About Week 3 Lab Assignment:

Begin Literature Search

Your Sources:

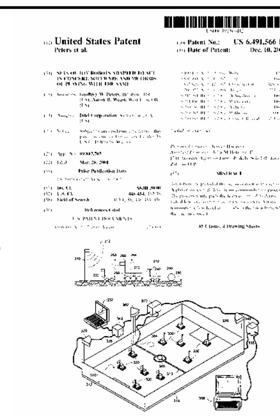
- **Library**
- **Web**
- **US Patent office**

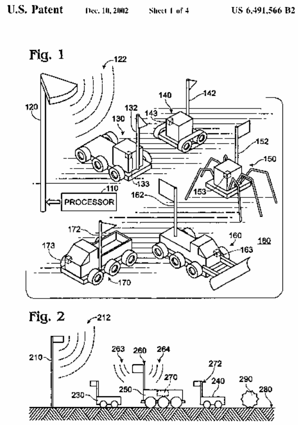
US Patent example:

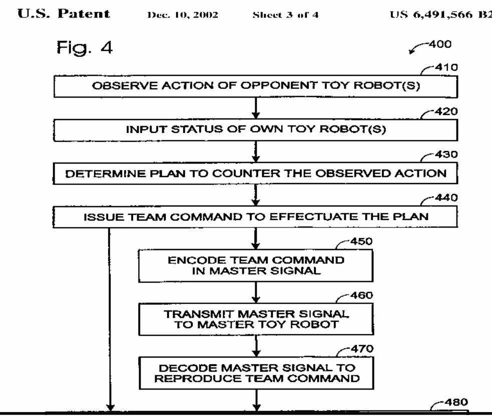
United States Patent 6,491,566
Peters , et al.
December 10, 2002

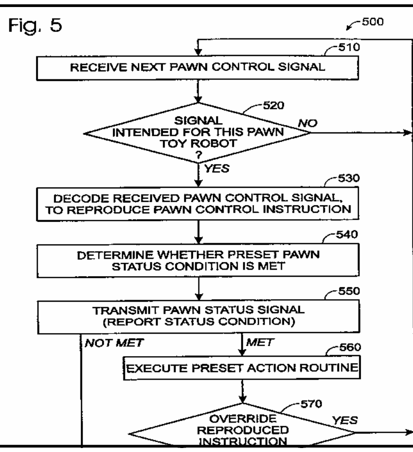
'Toy Robots'
Legally known as:
"Sets of toy robots adapted to act in concert, software and methods of playing with the same "

US Patent 6,491,566





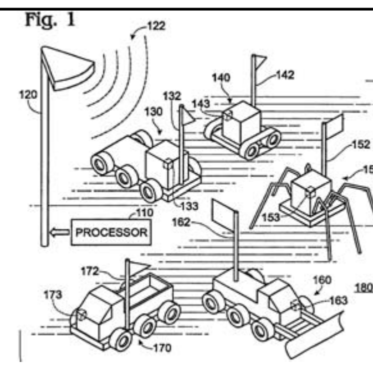




What can we learn?

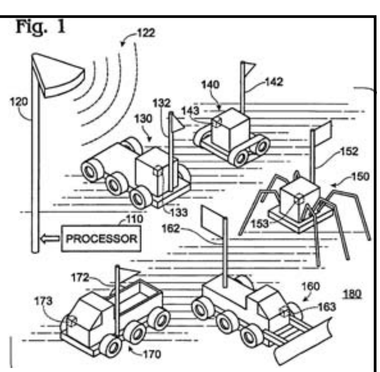
Creativity?

New Ideas?



Conclusion

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



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**

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)?

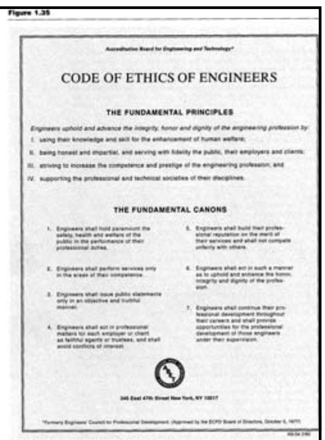
By acquiring a license from its State Board, a Professional Engineer meets a set of minimal requirements for practicing the engineering profession in his/her field.

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


Accreditation Board for Engineering and Technology*

CODE OF ETHICS OF ENGINEERS

THE FUNDAMENTAL PRINCIPLES

Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:

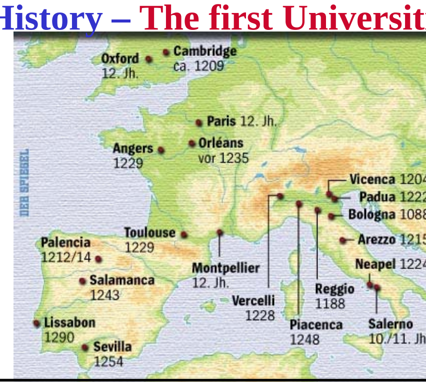
I. using their knowledge and skill for the enhancement of human welfare;
II. being honest and impartial, and serving with fidelity the public, their employers and clients;
III. striving to increase the competence and prestige of the engineering profession; and
IV. supporting the professional and technical societies of their disciplines.

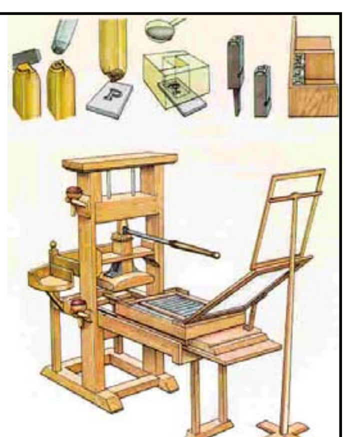
THE FUNDAMENTAL CANONS

1. Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.
2. Engineers shall perform services only in the areas of their competence.
3. Engineers shall issue public statements only in an objective and truthful manner.
4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
6. Engineers shall act in such a manner as to uphold and enhance the honor, integrity and dignity of the profession.
7. Engineers shall continue their professional development throughout their careers and shall provide opportunities for the professional development of those engineers under their supervision.

345 East 47th Street New York, NY 10017

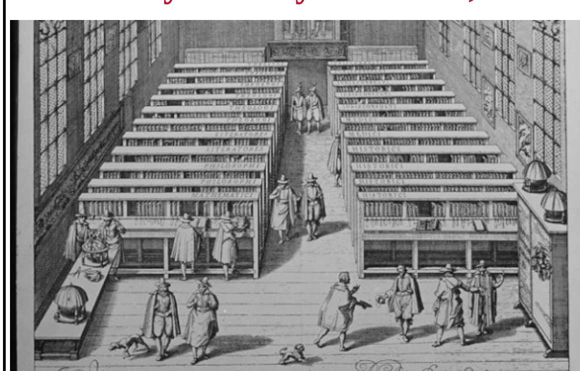
Science and Engineering History – The first Universities





Gutenberg Printing Press ~1450

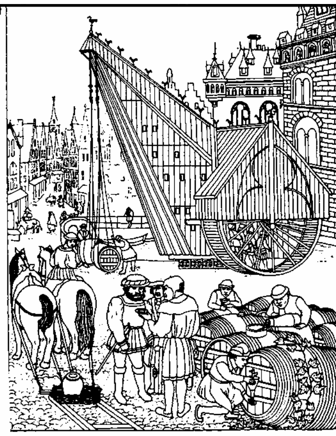
University Library in Leiden, ~1610



Look how far we have come:

Treadmill in Leiden, Netherlands

17th Century

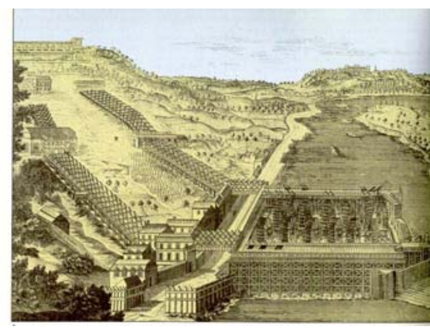


Louis XIV
Roi de France
1638-1715

Louis XIV in Majesty, 1701 , by H. Rigaud

Chateau de Versailles

Thirteen water-wheels powered 225 force pumps, which pumped up to 1 million gallons (5,000 m^3) of river water into the reservoirs daily. The reservoirs were situated 525 ft (160 m) above the river.



Versailles: The King's Waterworks (supplying his fountains)

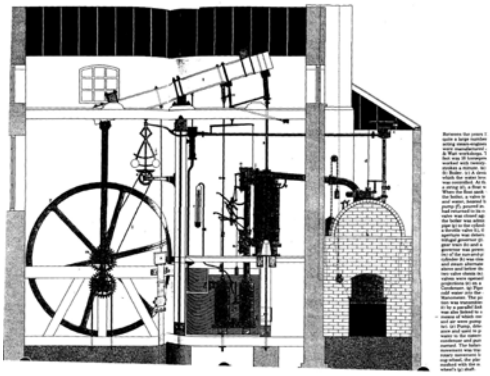
Total Output: approx. 50 hp

Isaac Newton

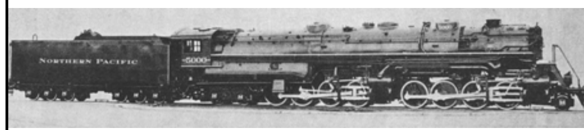
Scientific Inquiry takes time and effort. Newton's law:

$$F = m*a$$

- **From Galileo's fall experiments in Pisa, it took 100 years until Newton finally formulated it.**
- **Science is analytical and systematic, but generally NOT intuitive**



Boulton &Watt Steam Engine, ~1800



Northern Pacific class Z-5

The first Yellowstone was built in 1928 by ALCO for the Northern Pacific for running throughout the high speed plains of North Dakota. The Yellowstone was designed with the largest firebox ever.

The Yellowstone was the largest steam locomotive in the world (at that time) and ALCO celebrated by serving dinner to 12 people seated in the firebox! The NP Yellowstones produced 5,000 HP.

The First IC Engine

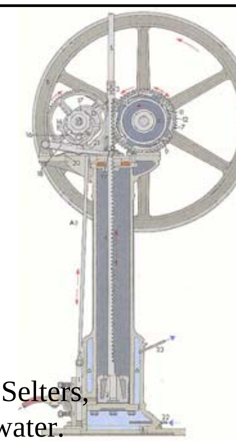
Used coal gas,
About 10 m tall,
Free-flying Piston

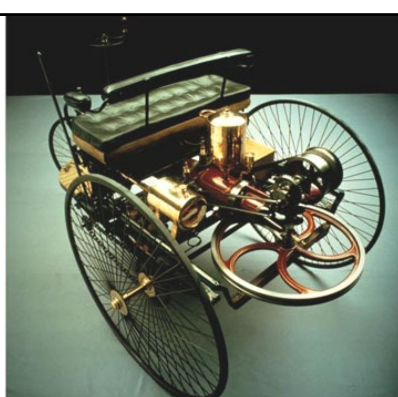
Operation

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

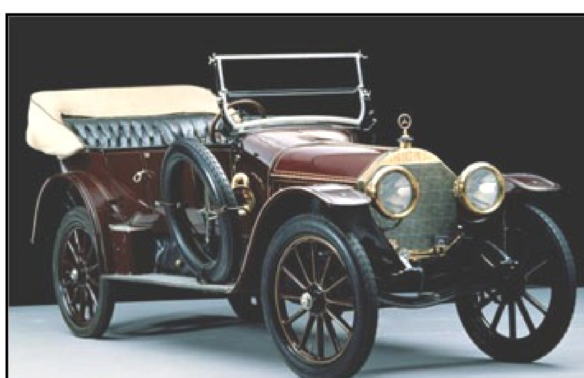
Step 2 : The compressed gas/air mixture is ignited, driving the piston up. (the work stroke)

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





Carl Benz's First Motor car, 1886



Mercedes Motor car, 1910

Olds Assembly Line

Model T Ford

Ford’s Assembly Line

Mass-production techniques changed the way people work and live throughout the world.

The Model T put America on wheels. But the real revolution was the production technique developed in 1913. Ford Motor Co.'s moving assembly line, and the rapid spread of its mass-production methods, profoundly changed the way people work and live world-wide.

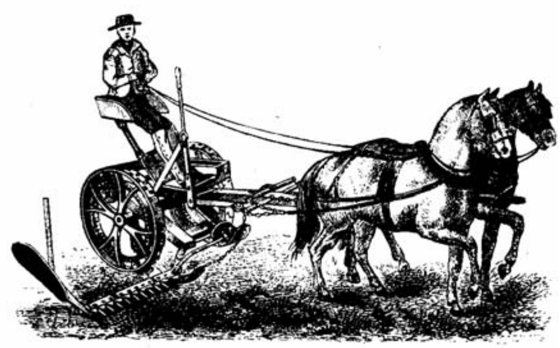
Ford’s Assembly Line II

As William C. Klann, a foreman in Ford's engine-assembly shop, told it, he and his colleagues had visited slaughterhouses and had been impressed with how conveyors carried hogs and cattle through a disassembly process.

Why not use the same idea to speed up an assembly system? Mr. Klann and his colleagues began experimenting with a **conveyor** to speed up the assembly of one component of the Model T engine.

The body drop on the assembly line of the Highland Park Plant.

Nighthawks
by Edward Hopper



McCormick's Reaper

Many inventions from the Industrial Revolution period are still used today:

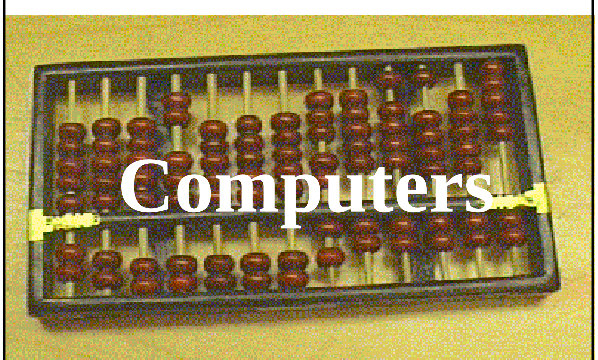
the sewing machine (invented by Elias Howe),

the steel plow (invented by John Deere),

the reaper (invented by Cyrus McCormick),

vulcanized rubber (inv. by Charles Goodyear),

The Industrial Revolution greatly transformed the economies and societies of the U.S. and the other industrial countries.



Computers

A computer automatically performs logical (mathematical) operations on input information and puts out answers, according to a predetermined ´ program ´ of instructions.

Herman Hollerith's Punchcard Machines

Hollerith won the competition for the delivery of data processing equipment to assist in the processing of the data from the 1890 US Census

Zuse and the Z1

From 1936 to 1938, Konrad Zuse developed and built the first binary digital computer (Z1). A copy of this computer is on display in the Museum for Transport andTechnology in Berlin.

Zuse completed the first fully functional program-controlled electromechanical digital computer in the world (the Z3) in 1941, but it was destroyed in 1944 during the war.

The machine used electromechanical relays rather than vacuum tubes.

Eniac, 1946

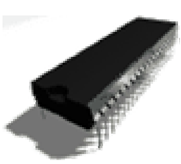
Eniac, 1946

The Eniac

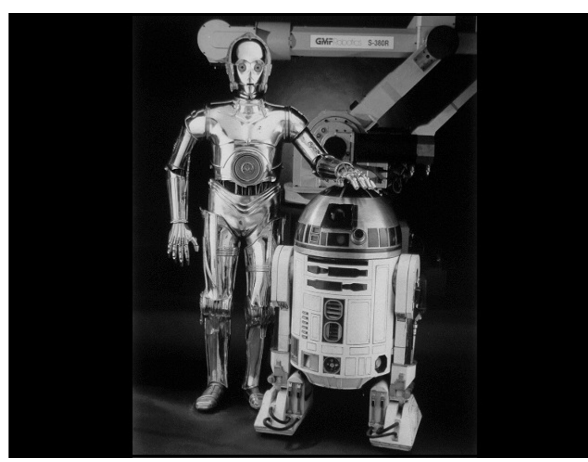
The ENIAC was a large-scale, general purpose digital electronic computer. Built out of some 17,468 electronic vacuum tubes, ENIAC was in its time the largest single electronic apparatus in the world. The ENIAC combined very diverse technical components and design ideas into a single system that could perform 5,000 additions and 300 multiplications per second.

Although slow by today's standards - current microprocessors perform 100 million additions per second - this was two to three orders of magnitude (100 to 1,000 times) faster than existing mechanical computers or calculators.

1971: INTEL 4004



The first single chip CPU was the Intel 4004, a 4-bit processor meant for a calculator. It processed data in 4 bits, but its instructions were 8 bits long. Program and data memory were separate, 1K of data memory and a 4K of program memory (in the form of a 4 level stack, used for CALL and RET instructions). There were also sixteen 4-bit general purpose registers.

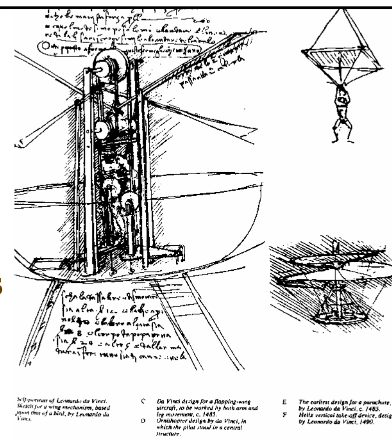


IBM PC 1981

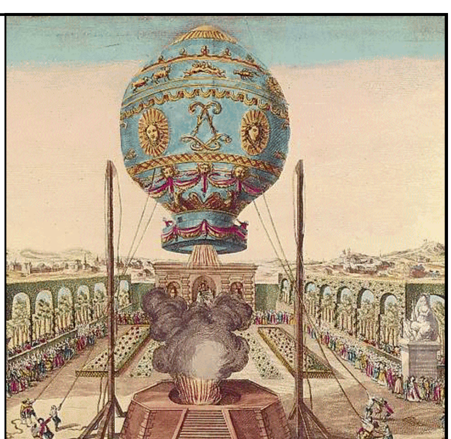
Aviation

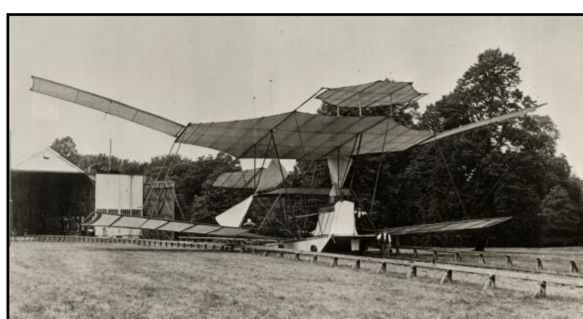
What does he have to do with Aviation?

Leonardo's Helicopter 1485 A.D.



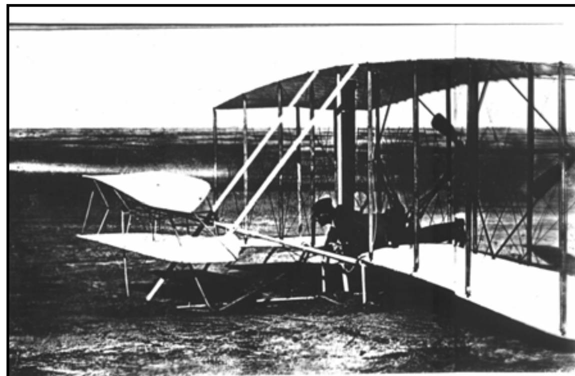
La Montgolfière 1783



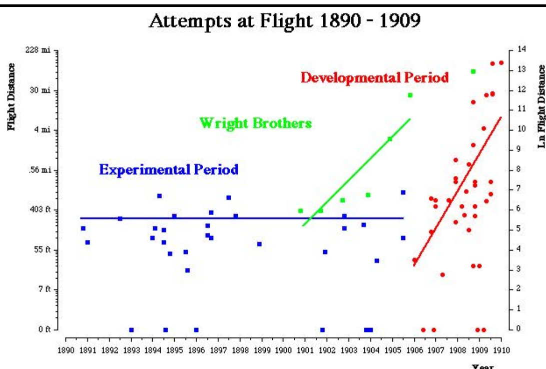


Hiram Maxim 1893

Otto Lilienthal 1895



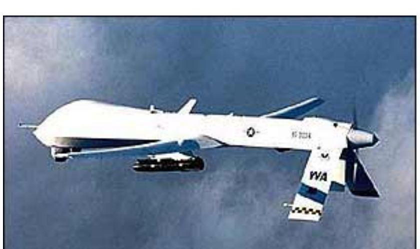
First Flight: Wright Brothers 1903



First Flight: Attempts and Accomplishments

The Airplane as Computer

The Future of Aviation



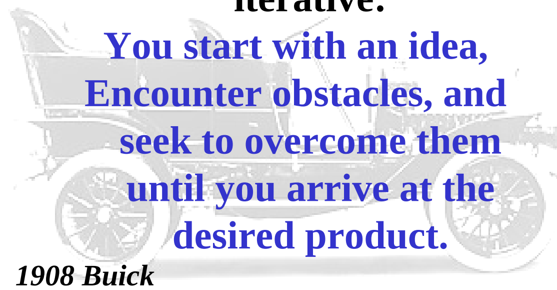
The Future of Technology

- More Automation. Why?
- How will automation shape future technologies?
- What do future technologies mean for YOU as future engineers?

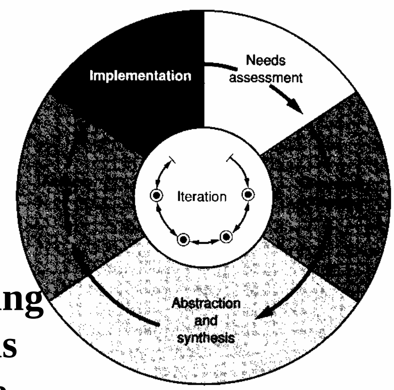
Chapter 2
Engineering Design

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

The Wright Brothers systematically addressed every design problem.

FIGURE 1.5 Complete design process led to the Wright brothers' success.

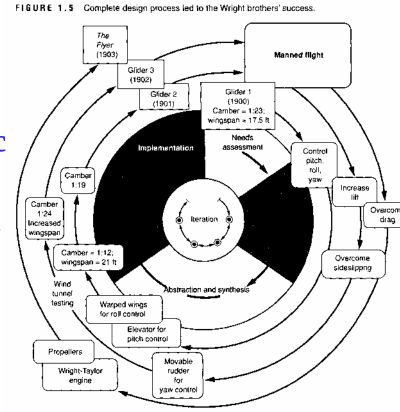


Figure 2.3

he design process is iterative in nature.

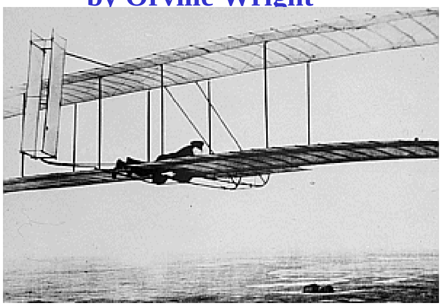
Design Project Schedule:

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. "

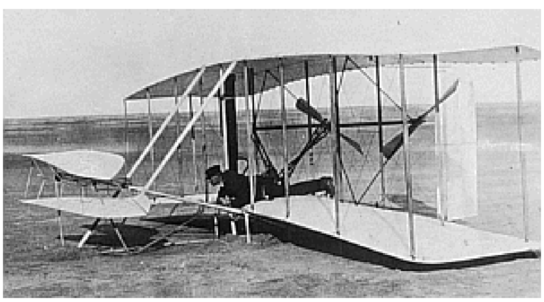
How We Made the First Flight
by Orville Wright



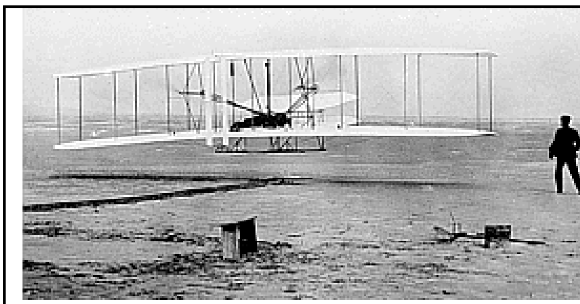
1902 Glider

How We Made the First Flight
by Orville Wright

"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 "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

MEG 100 Lab
Design Project

Your Assignment for
Week 5
Alternative Chassis Designs

MEG 100 Lab
Design Project

Your Assignment for
Week 6
Design Criteria

How to judge the design

MEG 100 Lab
Design Project

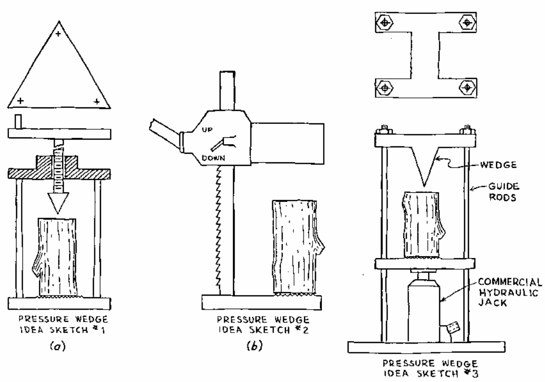
Your Assignment for
Week 6
Design Criteria

How to judge the design

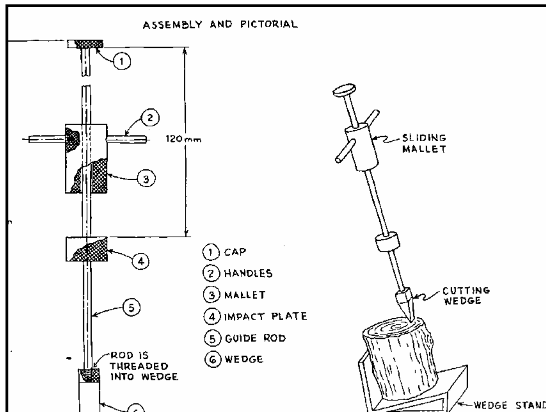
MEG 100 Lab
Design Project

Your Assignment for
Week 7
Decision

Use Decision Matrix to identify the best design



Decision Matrix: Wood splitter example



Decision Matrix: Wood splitter example 2

Decision Matrix

Decision Matrix

Criteria	Weight W, percent	Selected concepts (see below) 1	2	3	4	5	6
Cost	30	6 / 180	7 / 210	7 / 210	7 / 210	9 / 270	
Ease of operation	20	10 / 200	7 / 140	9 / 180	10 / 200	7 / 140	
Safety	15	9 / 135	7 / 105	6 / 90	5 / 75	8 / 120	
Portability	15	6 / 90	5 / 75	4 / 60	10 / 150	10 / 150	
Durability	10	8 / 80	9 / 90	10 / 100	9 / 90	9 / 90	
Use of standard parts	10	7 / 70	8 / 80	8 / 80	6 / 60	9 / 90	
Total	100	755	700	720	785	860	

Rating scale R	
Excellent	9–10
Good	7– 8
Fair	5– 6
Poor	3– 4
Unsatisfactory	0– 2

Rating 6, 180 = R × W

Selected concepts
1. Auto-jack principle (item # 2)
2. Drop wedge from elevation (item # 10)
3. Spring-powered wedge (item # 8)
4. Wedge driven by explosion (item # 12)
5. Sliding mass (item # 9)
6. Additional concepts

Fig.15.23 Each concept was rated on a scale of 0 to 10 for each criterion. The rating was multiplied by the criterion weight and then summed. Concept 5 was chosen as the optimum even though it did not receive the highest rating on three of the six criteria.

Chapter 1.10 Professionalism

ethos
n. the distinctive character, spirit, and attitudes of a people, culture, era, etc.: the revolutionary ethos.
[from Late Latin: habit, from Greek]

Why **Ethics?**

Professionalism?

What do you expect when consulting a professional, e.g. a surgeon?

•Complexity**: We cannot control every aspect of our lives. We depend on others in multiple ways.**

•Interdependence: Our society is based on trust. Sometimes that trust is broken.

•Examples: Business: ENRON
Medicine: Malpractice
Law: Malpractice

Ethics failures range from the criminal (e.g. bribery, falsification) to neglect (failure to ascertain relevant facts) and ignorance.

There will always be failures that are NOT the result of crime or negligence. Sometimes failures result from insufficient knowledge about the behavior of engineered products.

The End