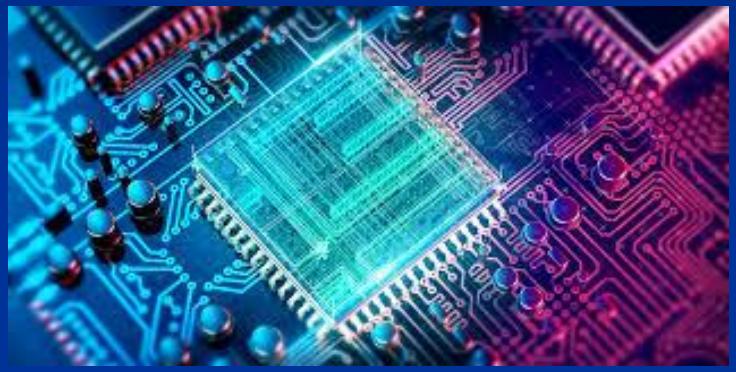
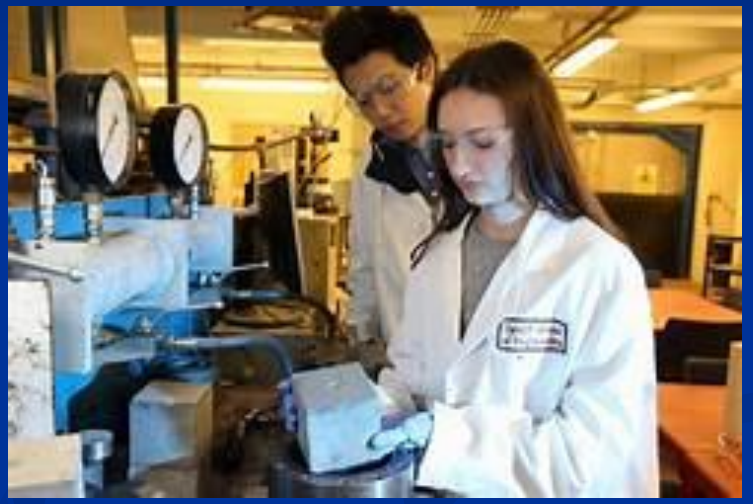
About Engineering

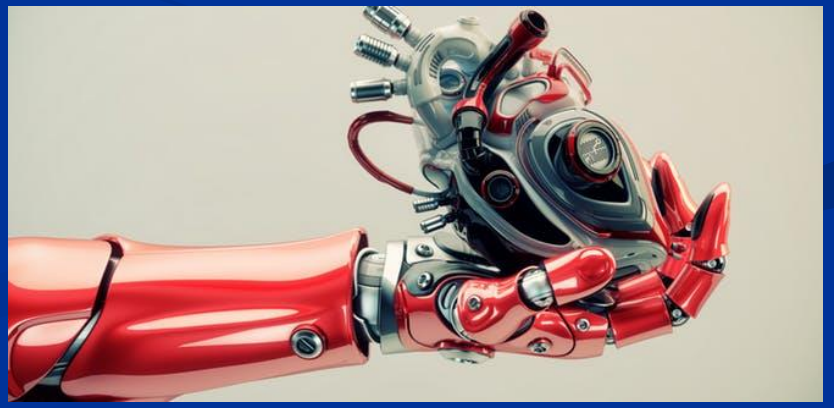
By Harry T. Roman

Engineer, Inventor, Teacher, Author

Engineers Work in All Industries and Business Sectors







Famous Quotes About Engineering

"Engineers operate at the interface between science and society."

-Dean Gordon Brown, MIT, 1962

"The engineer has been, and is, a maker of history."

- James Kip Finch, 1960

Engineers Are……

- Builders of Civilization
- Creators of Wealth
- Organizers of Society
- Agents of Change
- Leaders and Developers of People
- Project Managers
- Inventors and Innovators
- Entrepreneurs
- Continuous Learners

Engineering is One of the Oldest Professions

- Architecture
- Law
- Engineering
- Medicine
- Military

Science Compared to Engineering

"Science is about understanding the origins, nature, and behavior of the universe and all it contains; engineering is about solving problems by rearranging the stuff of the world to make new things *."

-Henry Petroski, 2010

Famous U.S. Engineer & Author

* Technology is the "know-how" to do this [the creativity-invention thing]; to convert what we have into what we need and want

Equation of National Progress

Science + Market Needs + Creativity + Technology + Engineering + Continuous Improvement = Progress

Engineering is the over-arching "process" that integrates this

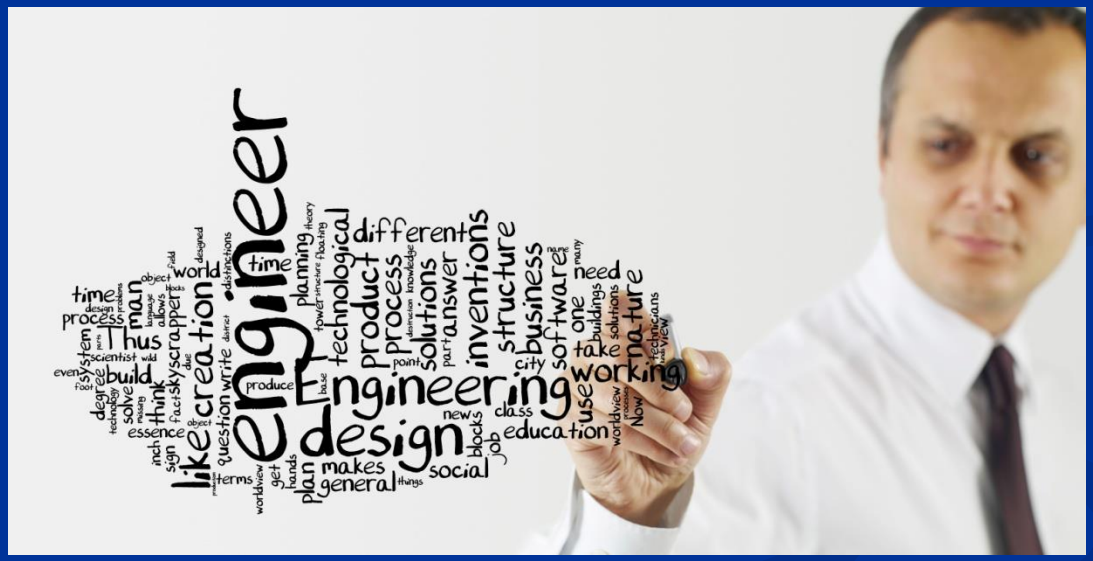
A Composite Profession

- Engineering is a Composite Profession
- Much More than Math and Science
- Economics and Humanities are Important
- Interdisciplinary by Nature
- The Arts Play a Role in Design
- Works Best with Teams Solving Problems
- Heavily Dependent on Good Communications
- Intensely Customer Focused

Engineers Solve Problems In Multi-Dimensional Ways

Engineers solve problems, taking into account the implications and constraints involving:

- Technology
- Economy
- Environment
- Society
- Legalities
- Safety



Engineering problem solving is exactly what STEM education is all about-integrated thinking and decision making. [think engineering design process]

The Engineering Process

Here is a glimpse of the engineering process that is used to tackle new design and problem challenges in the business / industrial world:

- Understand the Problem **and** the Market for the Solution
- Assemble a Multi-disciplinary Team
- Identify and Understand Design Constraints and Tradeoffs
- Develop a Specification for Success and Plan of Action

The Engineering Process [cont'd]

- Creatively Develop the Problem Solution or Design
- Build and Test the Prototype or Pilot System
- Critically Evaluate the Prototype/Pilot and Validate Against Constraints
- Revise Prototype/Pilot into a Commercial Product
- Launch the Commercial Product
- Continuously Improve the Product

Engineers Rely Upon Math to….

- Better understand the world's needs [market]
- Quantify impacts/benefits of their technology
- Compare their work to alternative designs
- Determine the economics of their creations
- Identify areas for improvement
- Explain their work to others; and put their work into perspective

Engineers do Many Things

- Put us on the Moon
- Built our bridges and major structures
- Built and maintain all our utilities
- Protect us with national defense systems
- Harness our natural resources
- Manufacture the goods we use every day
- Improve efficiencies and key infrastructures
- Improve our quality of life

America's Great Engineering Periods

- 1800-1850 - Steam power and textile manufacturing
- 1850-1900 - Railroads and steel
- 1900-1950 - Electric power, automobiles, chemicals
- 1950-2000 - Computers, nuclear power, aerospace, biotechnology, pharmaceuticals, and electronics
- 2000+ nano-technology, advanced manufacturing, green energy alternatives, life extension/advanced health issues….etc.

Engineers in U.S. Workforce

Young Engineers Starting Salary…. $70,000-$80,000

Mature Engineers……..$120,000-$150,000

Top Paying Fields……..Petroleum /Chemical Engineering

2.5 Million Engineers in USA

Engineers Must Communicate Well so They Can

- Sell new ideas
- Clearly explain what they are proposing
- Convince technology users of benefits
- Develop clear, concise plans
- Obtain funding for technology development
- Manage and lead team members
- Report on progress

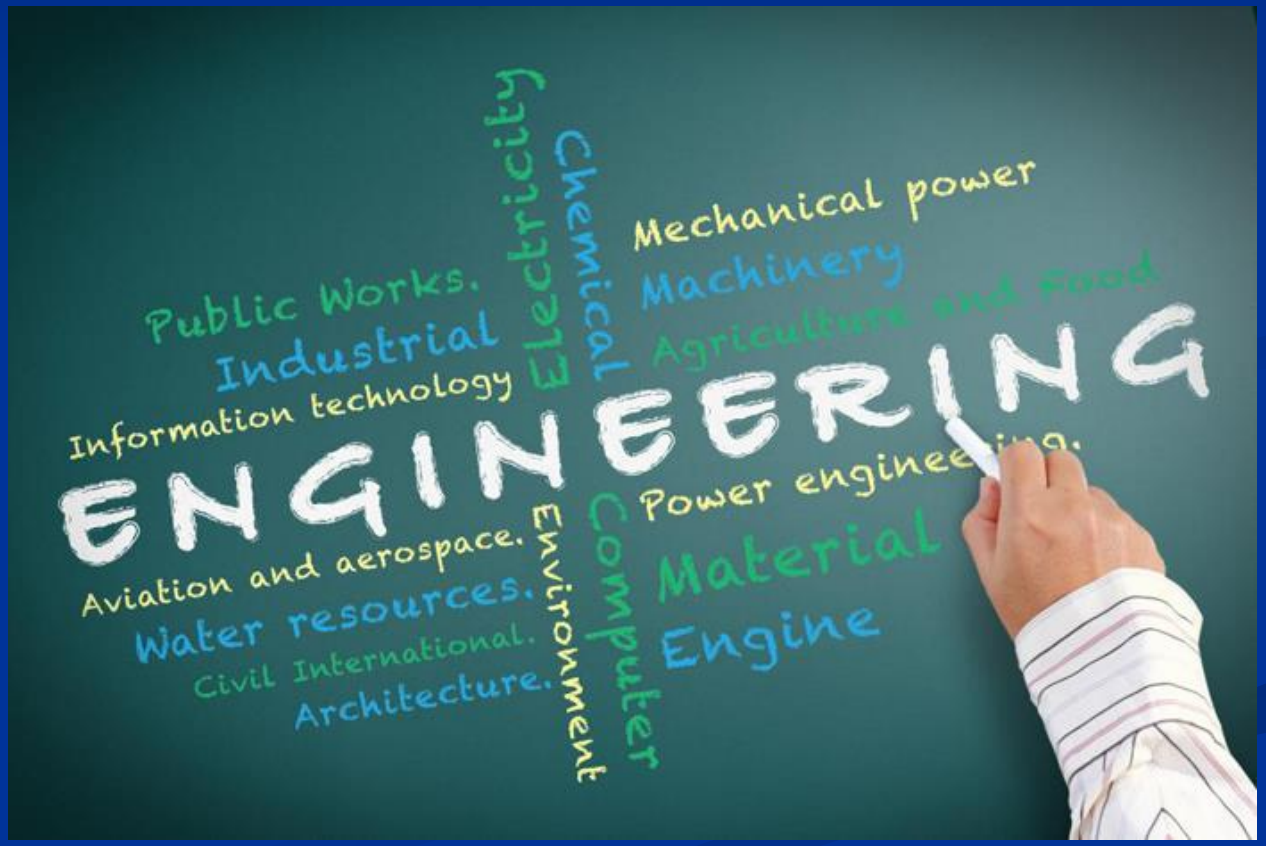
Original Engineering Disciplines

In our nation's early history, these were considered engineering disciplines:

- Surveying
- Mining
- Canal and road construction
- Military arms, defenses, fortifications, and navies

By early 1900s-Five Basic Kinds of Engineering had Emerged

- Civil
- Mechanical
- Electrical
- Chemical
- Industrial



Today, Engineering Specialties are Inter-disciplinary

- Biomedical, Prosthetic, Acoustics
- Ceramic, Materials, Manufacturing
- Aeronautical, Aerospace
- Computer, Robotics, Software
- Petroleum, Transportation, Lubrication
- Energy Systems, Solar/Alternate Energy Systems
- Nuclear, Environmental, Sanitary

There are over 100 different kinds of engineering specialties!

The Versatile Engineer-Can Easily Change Jobs if Need Be

Because of their strong problem solving skills, engineers often move into varied professions:

- Inventors
- Doctors
- Lawyers, Patent Attorneys
- Executives, Entrepreneurs
- Teachers, Professors
- Authors, Musicians, Artists

And….Engineers Often Leave to Become STEM Teachers

Presidents and Engineering

"To the engineer falls the job of clothing the bare bones of science with life, comfort, and hope."

-Herbert Hoover, Engineer and President

5 U.S. presidents were engineers:

Washington,* Jefferson*, Lincoln*, Hoover and Carter

* Were surveyors

Thanks for Listening!