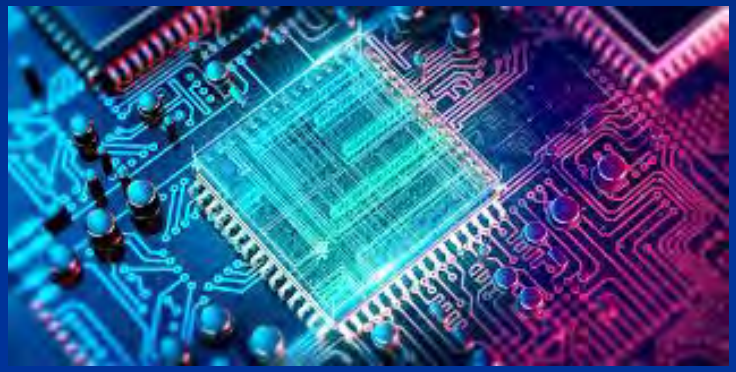
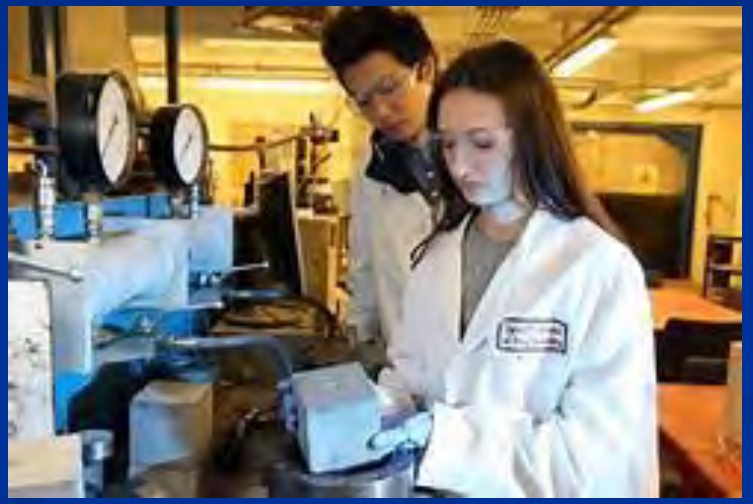
# About Engineering

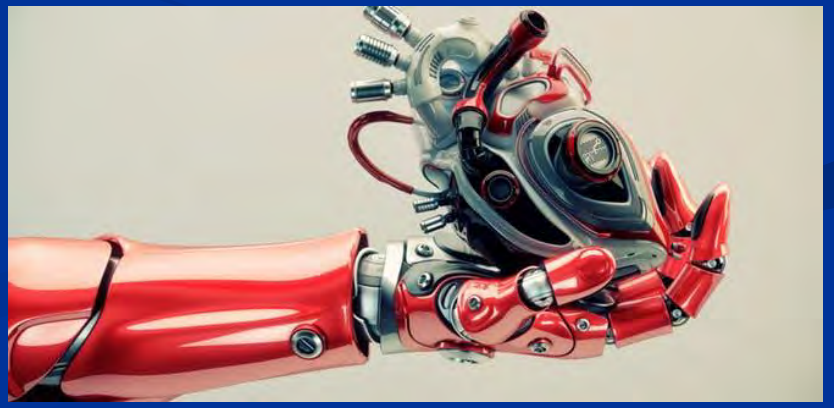
By Harry T. Roman

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

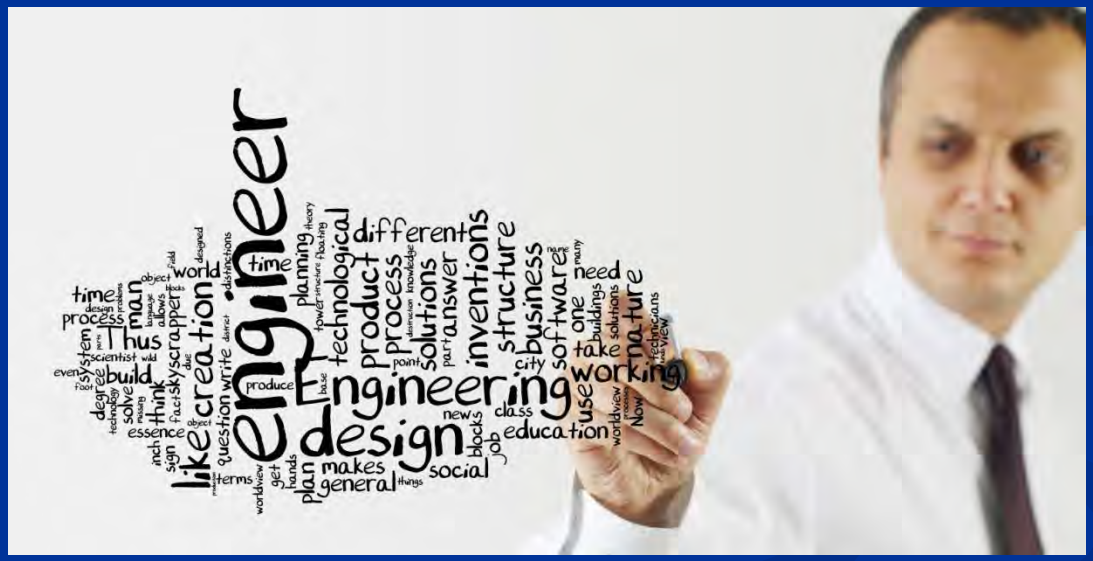
# A Composite Profession

- 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

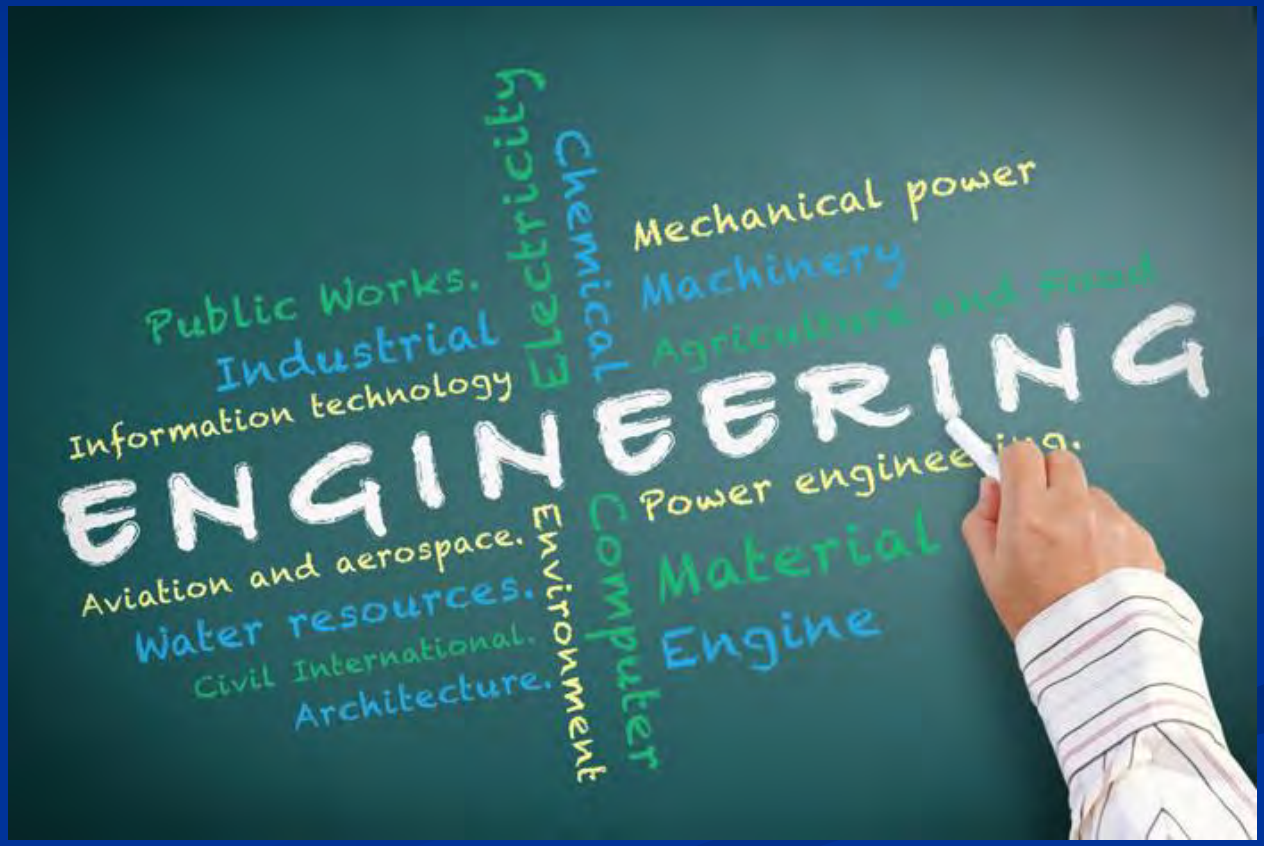
# Original Engineering Disciplines

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!