What is an Engineer and What Do They Do?

- An engineer applies the principles of science (i.e. physics) and the tools of mathematics to nature and materials to produce devices, systems, and processes which serve mankind.
  - In other words, an engineer is an applied scientist.
- What we do as engineers has an extensive impact on society.
  - Many impacts are desired and anticipated
  - Many times this impact is unanticipated
Examples of Engineering Solutions with Significant Societal Impact

• Problem: Need for instantaneous, ubiquitous communication
  – Partial solution: The Internet
  – Intended impact: Increased global information sharing
  – Unintended impact: Social isolation in some cases, socially unacceptable uses

• Problem: Dwindling energy supplies
  – Partial Solution: Nuclear power
  – Intended impact: Provide additional sources for world energy needs
  – Unintended impact: Nuclear waste, concerns over nuclear weapons capability

Examples of Engineering Solutions with Significant Societal Impact (continued)

• Problem: Disease and human suffering
  – Partial solution: Biomedical advances, genetic engineering
  – Intended impact: Improved health and standard of living
  – Unintended impact:
    • Debate over ethics of cloning
    • Stem cell research
    • Increased health care costs
Conclusions (so far)

• What we do as engineers has an **extensive impact** on society
• The impact will have both positive and negative implications
• As engineers we have a responsibility to:
  – Inform society of the positive and negative implications of particular technological solutions
  – Obtain societal approval before implementing a solution

Group Exercise

• Provide three (3) real-world examples of proposed engineering solutions which have had a significant impact on society
• Briefly discuss the original problem which inspired each proposed solution and the positive and negative impacts of each of the solutions
• You cannot use the specific examples which have just been discussed
Examples of Proposed Engineering Solutions with Significant Societal Impact

• Dynamite/explosives
• Cell Phones
• GPS
• Internal Combustion Engine
• Asbestos
• Light Bulb
• Space Travel/Rocket Engine

• Video Games
• Gene Mapping
• TV
• Automobile
• Pesticides
• Plastic

Kudzu and the Law of Unintended Consequences

• Original Problems:
  – Soil Erosion
  – Need for inexpensive food for livestock
Kudzu and the Law of Unintended Consequences

• Proposed Solution:
  – A fast growing, hearty vine from Japan
  – First introduced to the US in 1876 at the Centennial Exposition in Philadelphia
  – High protein - used as livestock forage in the 1920s and touted as “the miracle vine”
  – Strong root structure
  – Promoted by the US Government during the Great Depression for erosion control (planted by the Civilian Conservation Corps)

Kudzu and the Law of Unintended Consequences

• Unintended impact

• New problems:
  – Kudzu grows TOO WELL in the Southern U.S.
  – Up to 60 feet per year
  – Covers trees and plants, blocking their sunlight and choking them out
The Law of Unintended Consequences

No matter how good a proposed solution seems to be, it will have some unintended consequences.

Why Weren’t the Problems with Kudzu in the Southern US Anticipated?

- Problem didn’t exist in Japan
  - Japanese climate wasn’t as good for growth
  - U.S. didn’t have Kudzu’s natural insect enemies
- Populace was not environmentally aware
- Scientists were not as well trained to anticipate unintended consequences