

# A Problem Needs an Engineering Solution (you think...)

## Engineering Design Process

Adapted from *Engineering by Design* 2<sup>nd</sup> Ed. by Gerald Volland, Prentice Hall, 2004.

### Needs Assessment

Establish need for solution.

- Objective to be achieved
- Who will benefit from solution?
- Where are you going?

### Problem Formulation

Problem defined in terms of design goals achieved by any viable solution.

- Identify as many pathways as possible to solution.
- Acquire and apply technical knowledge.
- Identify design specs including all known constraints.
- Identify resources (TMP).
- Prioritize Design Goals.

### Abstraction and Synthesis

Develop general approaches to solve, then generate detailed alternative designs.

- Has a similar (or the same) problem been solved before?
- What is possible/not possible.
- Choose most valid solutions that solve the problem.
- Is problem statement still the same?
- Use established and appropriate techniques.

### Analysis

Compare and evaluate alternative designs.

- Basis for comparison (quantitative and objective).
- Strengths/Weaknesses of each design.
- Costs and ease of manufacturing.
- Ethics/Safety/Environmental aspects of each design.
- Construct prototypes/computer models and test/evaluate/refine.
- Select best alternative (design candidate).
- Revise and refine the candidate design, eliminate weaknesses.

### Implementation

Develop final solution and distribute it to customers/clients.

- After fabrication/testing/evaluation of design prototype → full production.
- Distribute to users and obtain feedback for the next generation design.