



# Chapter 1

# Systems Science and Engineering





#### Introduction

- Why am I here?
- Why are you here?
- What is this course about?
  - What do you think?





# Let's keep pondering ...

- Fundamental distinction between natural and technical systems (human-made)
- Conceptualization tools like hierarchy and dichotomy
- Why Systems Engineering?
  - Hints: Technological Advances, Realistic Constraints





#### What You Will Learn

- Introduction to Systems
- Bringing Systems Into Being
- Conceptual System Design
- Preliminary System Design
- Detailed Systems Design
- Systems Test, Evaluation, and Validation
- Some of these are interrelated
- Systems thinking (and philosophy and evangelism)
- Systems lingo
- What did you think you were going to learn?





## What is a system?

- A system is <u>set</u> of <u>interrelated</u> components <u>working</u>
   <u>together</u> toward some <u>common objective or purpose</u>
- The properties and behavior of each component has an effect on the properties and behavior of the set
- The properties and behavior of each component depends on the properties and behavior of at least one other component
- Each possible subset has the two characteristics above
- Components cannot be divided into independent subsets
- Examples?

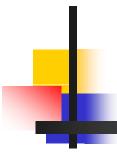




#### The Elements of a System

- Components: operating parts of a system consisting of input, process and output
- Attributes: properties of the components
- Relationships: links between components and attributes





### Relationships

- first order: functionally necessary to each other
- second order: complementary and add to system performance
  - Synergistic
- redundant: duplicate components are present for the purpose of assuring continuation of the system function
- Abstraction: helps us deal with complexity
  - Hide lower-level detail
- Implementation
  - The details underlying and interface
- Systems and subsystems (hierarchy)





# Classification of Systems

- Natural and Human-Made
- Physical and Conceptual
- Static and Dynamic
- Closed and Open
- Examples?





#### Where we are headed

- Systems Tools for Systems Design and Architecting
- Bringing Systems Into Being (Chapter 2)
- Conceptual System Design (Chapter 3)
- Preliminary System Design (Chapter 4)
- Detailed System Design (Chapter 5)
- System Test, Evaluation, and Validation (Chapter 6)
  - What are the differences?





#### Where we are headed

Key to a good grade:
reading the book!
doing the homework!
asking questions!
not procrastinating!