

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 set of interrelated components working together toward some common objective or purpose
- 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!