Introduction to SysML

Part 2.0: Blocks and Block Definition Diagrams

With tutorial exercises using MagicDraw

Learning Objectives

- Blocks and their Characteristics
- Block Definition Diagrams
- Hands-on Exercise Organization
- Demonstration of Exercises

Blocks

- Block = the independent concept of a thing
  - Independent = the thing itself, not as part of a larger system
  - Blocks can be abstract or concrete
- A Block can represent a
  - System
  - Subsystem
  - Mechanical Component
  - Software Module
  - User
  - Building
  - Gravity
  - The Supreme Court
- Blocks are defined by their characteristics
  - Blocks can own behaviors
  - Blocks can satisfy requirements
  - Block's user-defined characteristics are called Properties

Properties of Blocks

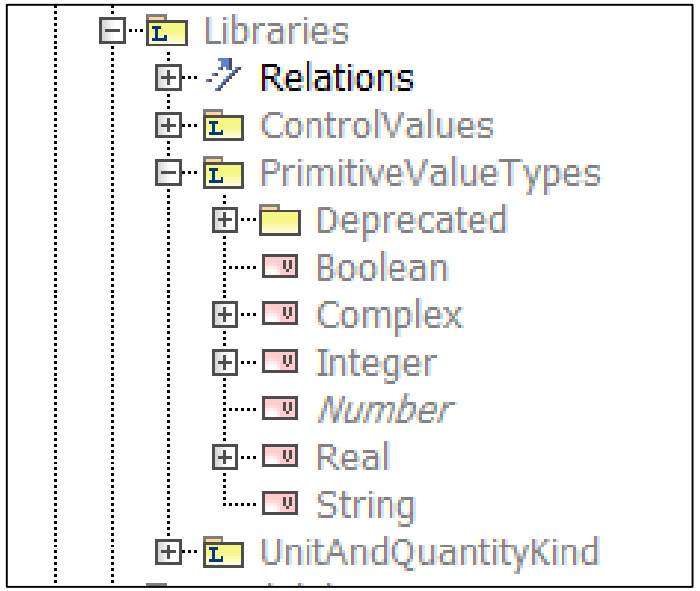
Element Name	Describes	Typed by
Part Property	What parts is a block composed of	Block
Value Property	What values (numbers or strings) are characteristic of the block	Value Type
Flow Property	What items can flow in/out of the block	Item
Item Property	What items flow inside the block	Item
Reference (Shared) Property	What external or common elements must be referred to in order to describe the block	Block
Constraint Property	What quantitative constraints apply to the block	Constraint Block
	Special Cases	
Adjunct Property	deals with activity decomposition	Behavior
Participant Property	deals with ends of association blocks	Block

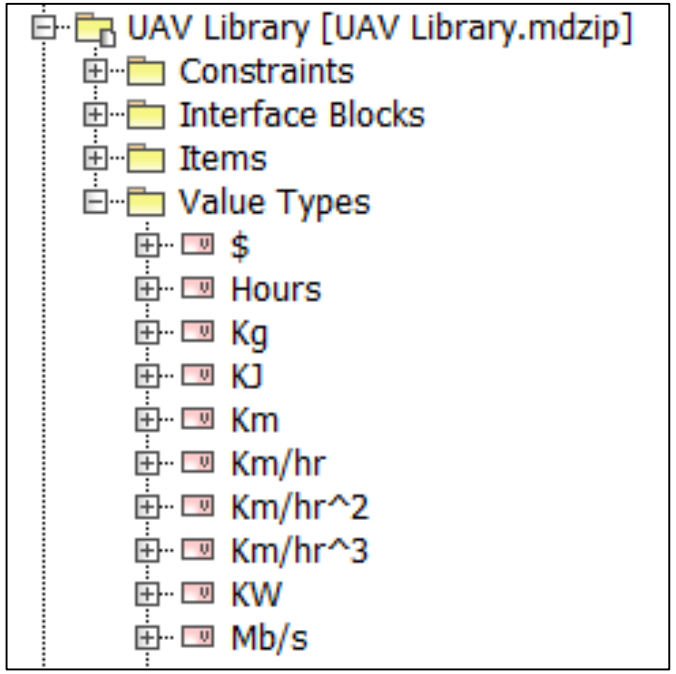
Value Properties of Blocks

- Value Properties = Characteristics of block that can be described by numbers or strings
- Each value property should include a value type
- A value type is a SysML element that provides context or meaning to the value property.
  - Data Type (Real, String)
  - Unit (Kilogram, Meter)
  - More complex data structures
- The value property is shown inside the block as *value property : value type*
- The same value type may be used for multiple value properties within the same block

Value Types

- Typically, the modeler has a library of pre-existing value types that can be used in building the model,
- but the modeler can also create new value types as needed

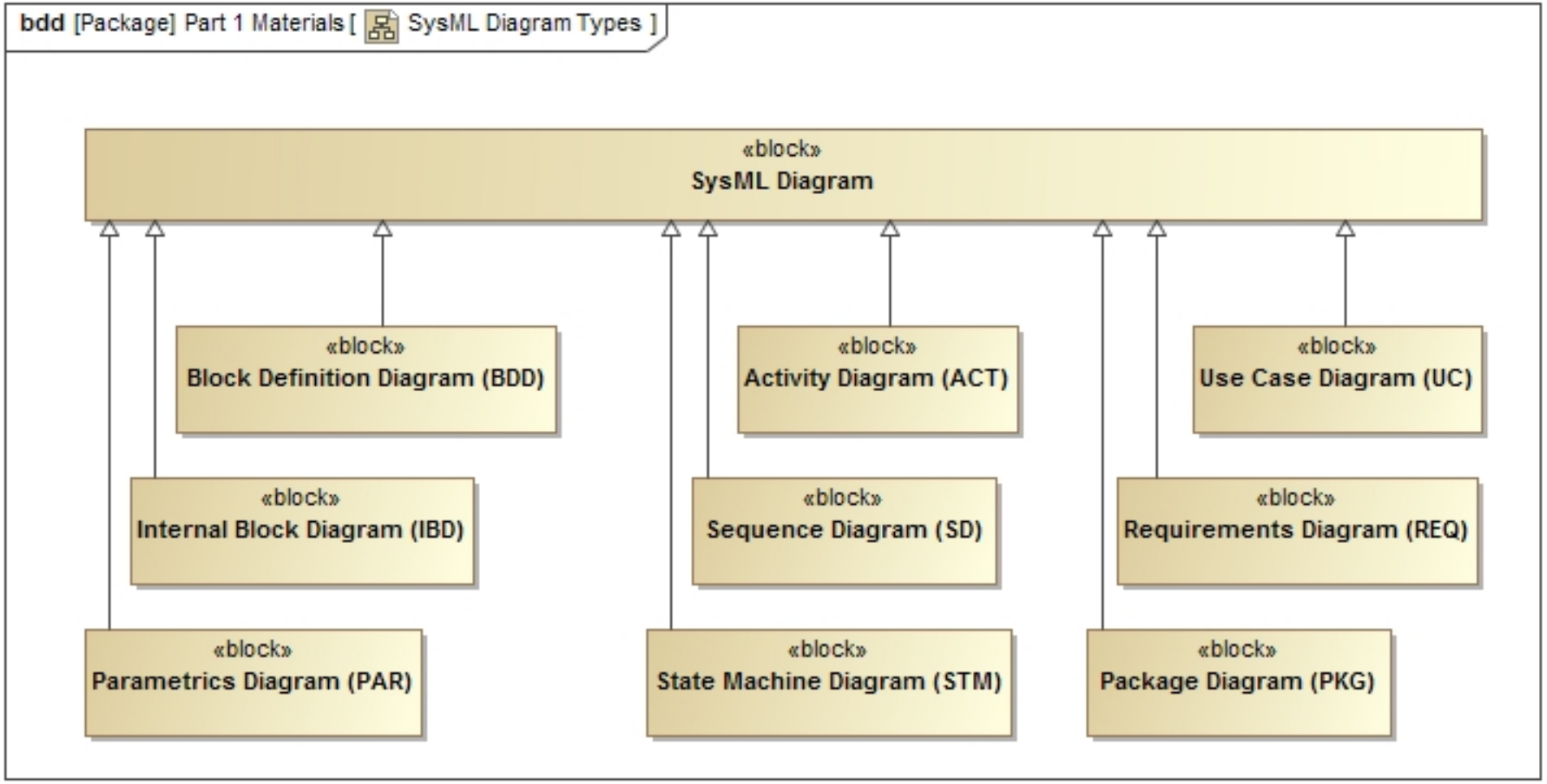




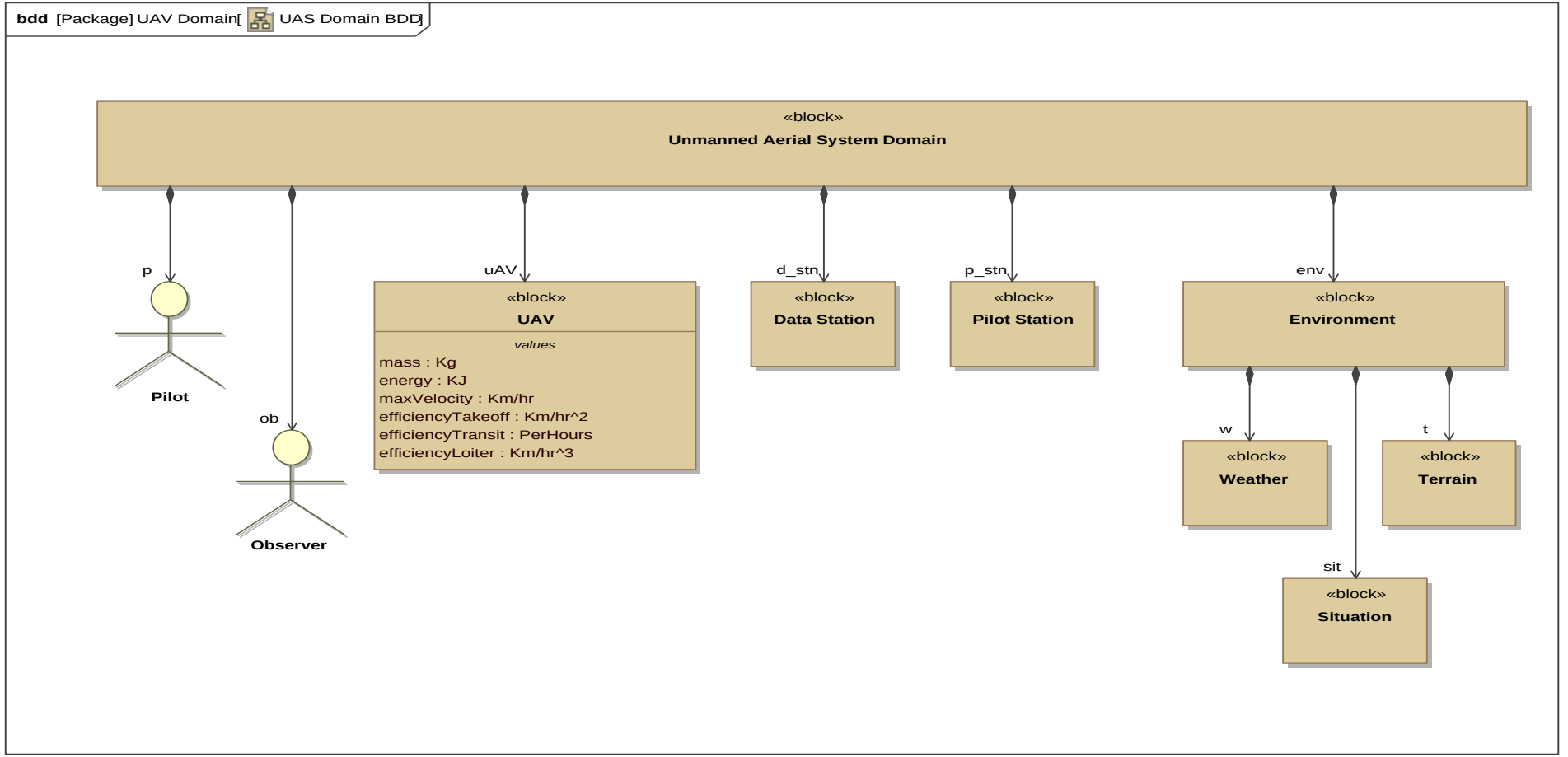
Value Properties of Blocks

- Blocks are abstract → Value Properties do not represent a specific number
- However, value properties can be assigned a default value
- Value properties can represent probability distributions, e.g. interval or normal

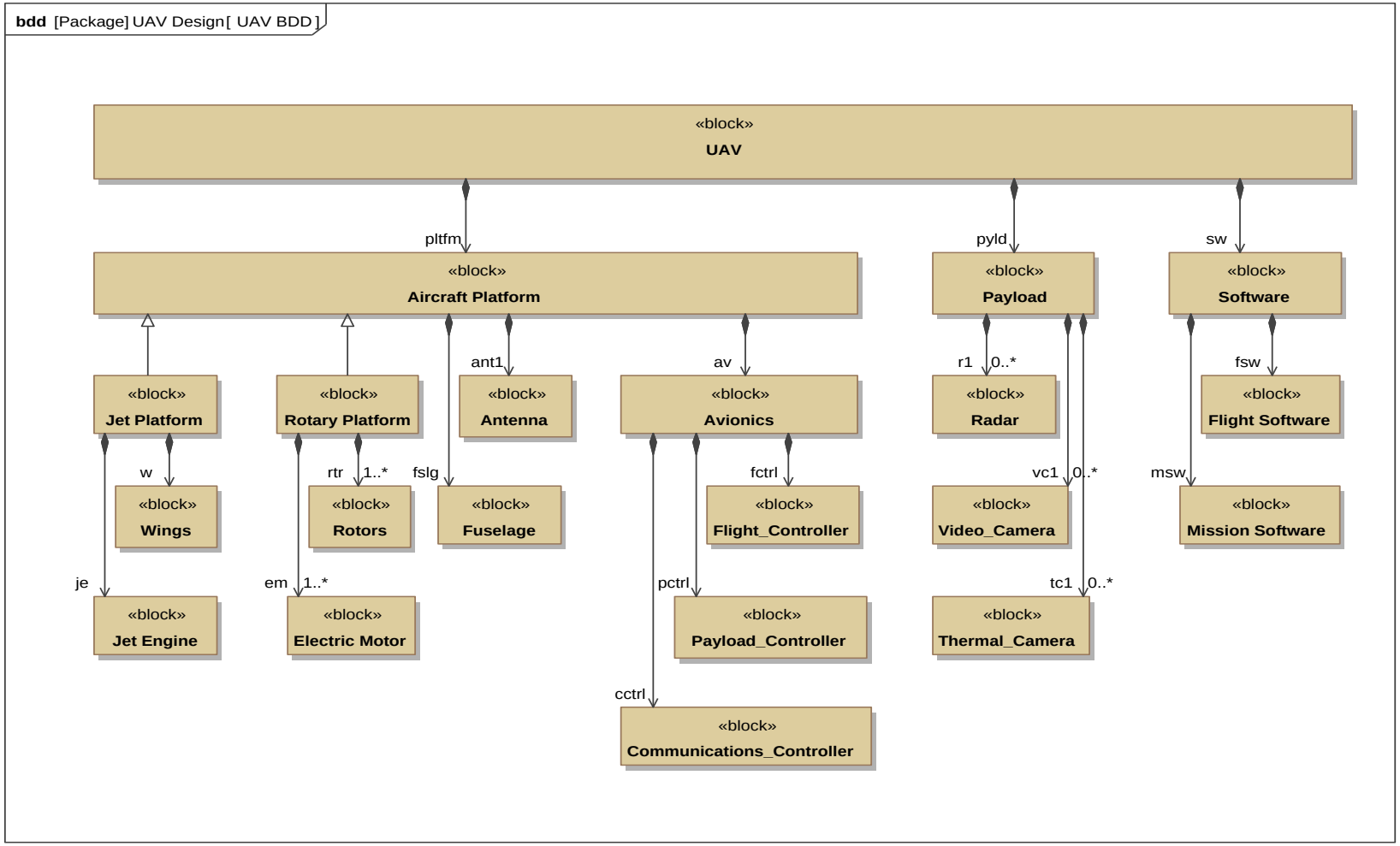
Block Definition Diagrams



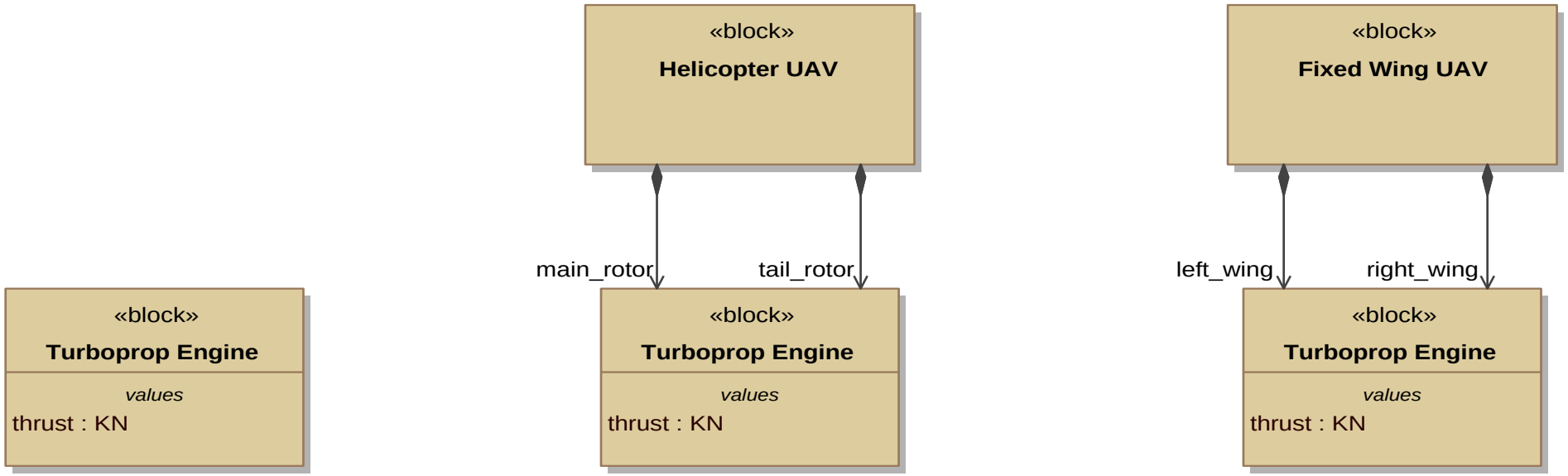
Block Definition Diagrams



Block Definition Diagrams



Blocks and Part Properties



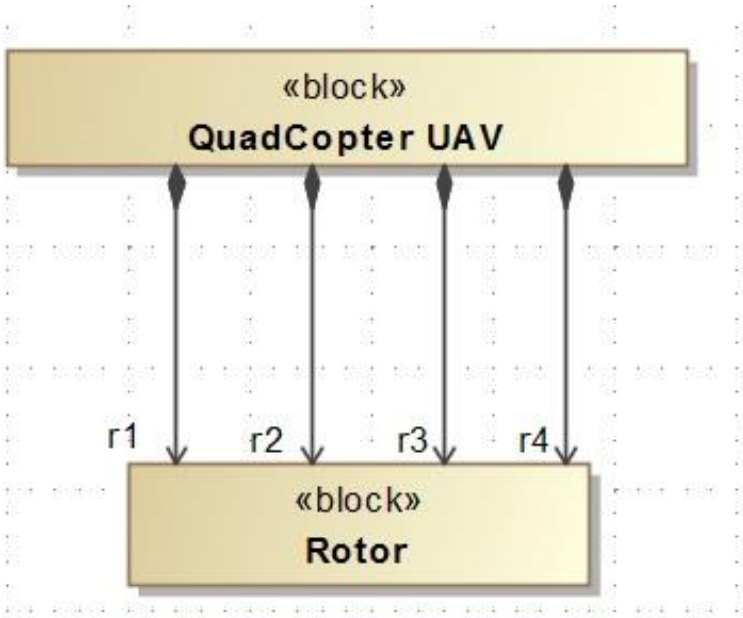
Block

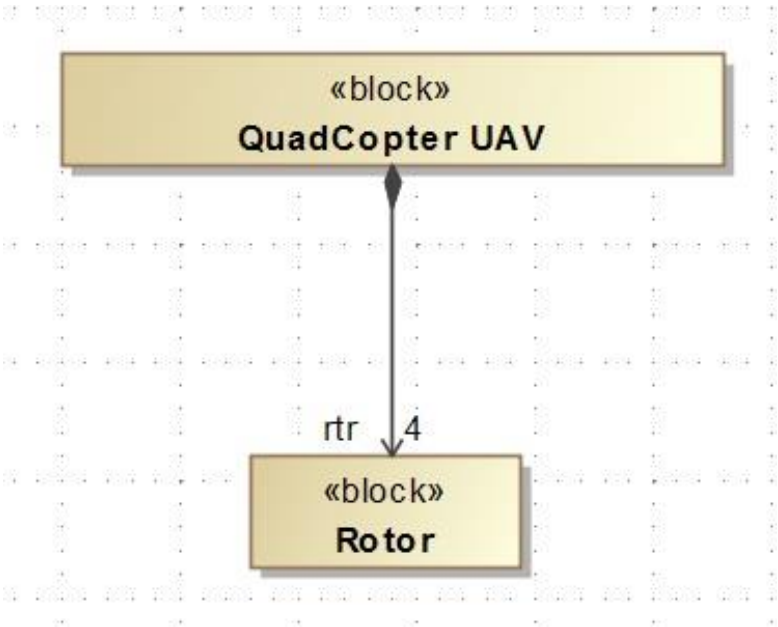
Abstract Independent
Concept
(generic) Definition, Classifier, Type
name begins with upper-case letter

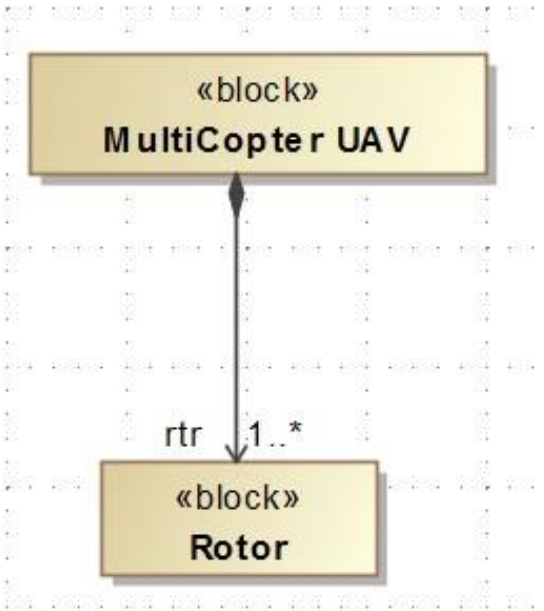
Part Properties

e.g. main_rotor:Turboprop Engine
Block in the context of a larger system
(generic) Property, Usage, Role
name begins with lower-case letter

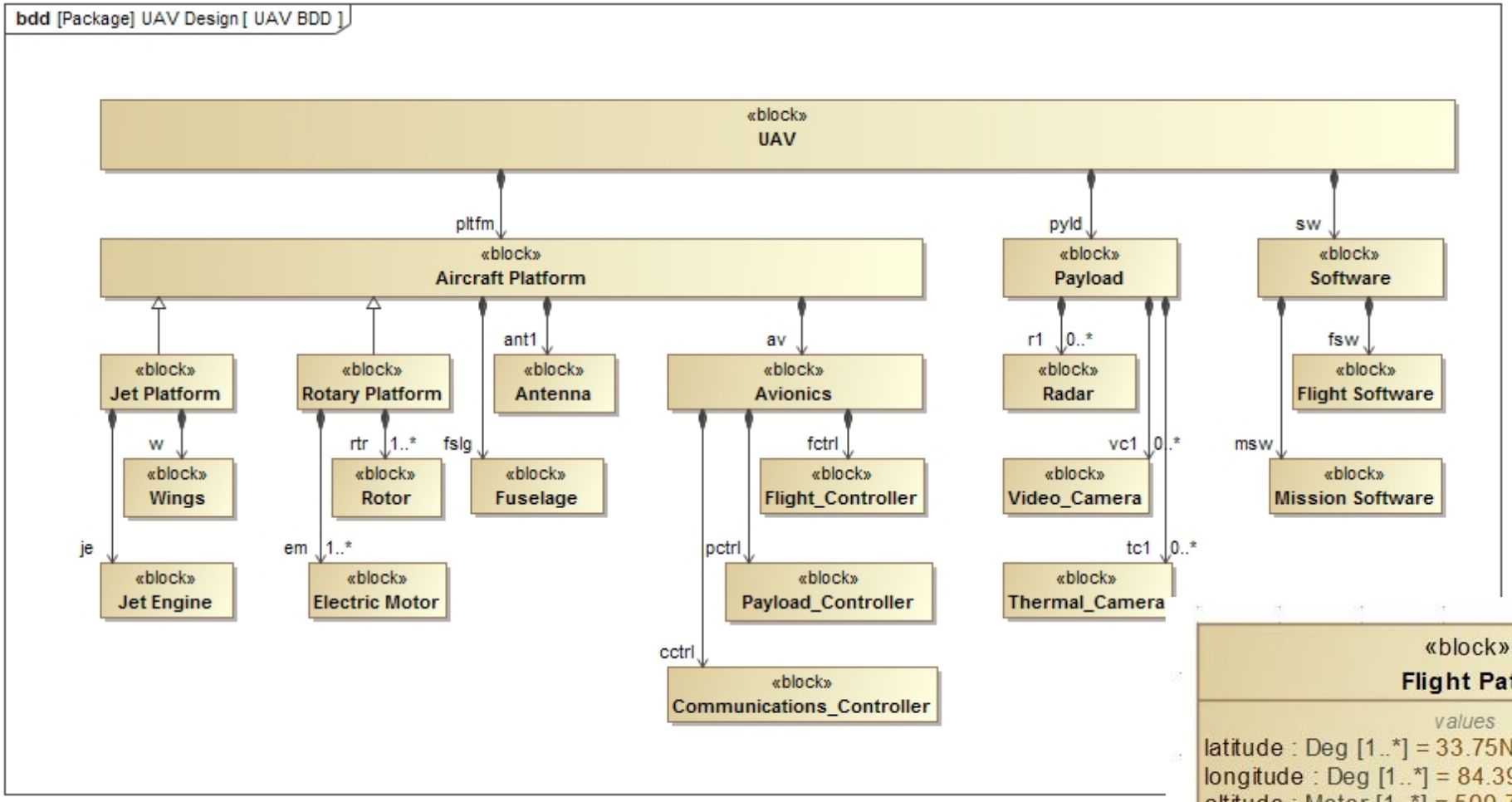
Multiplicity



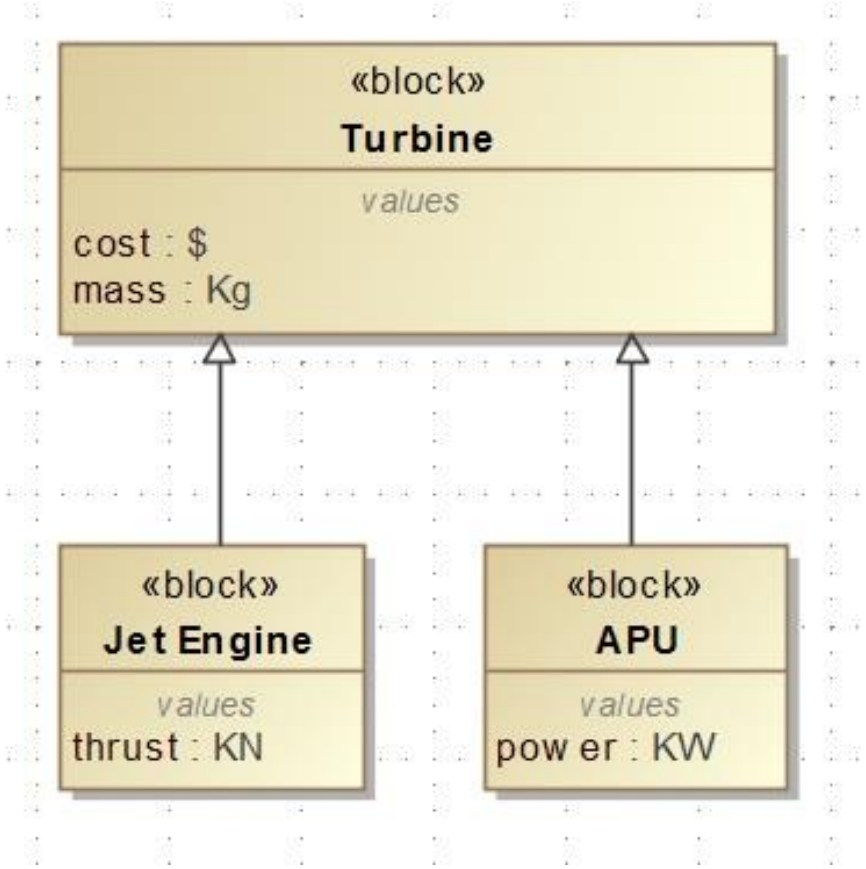




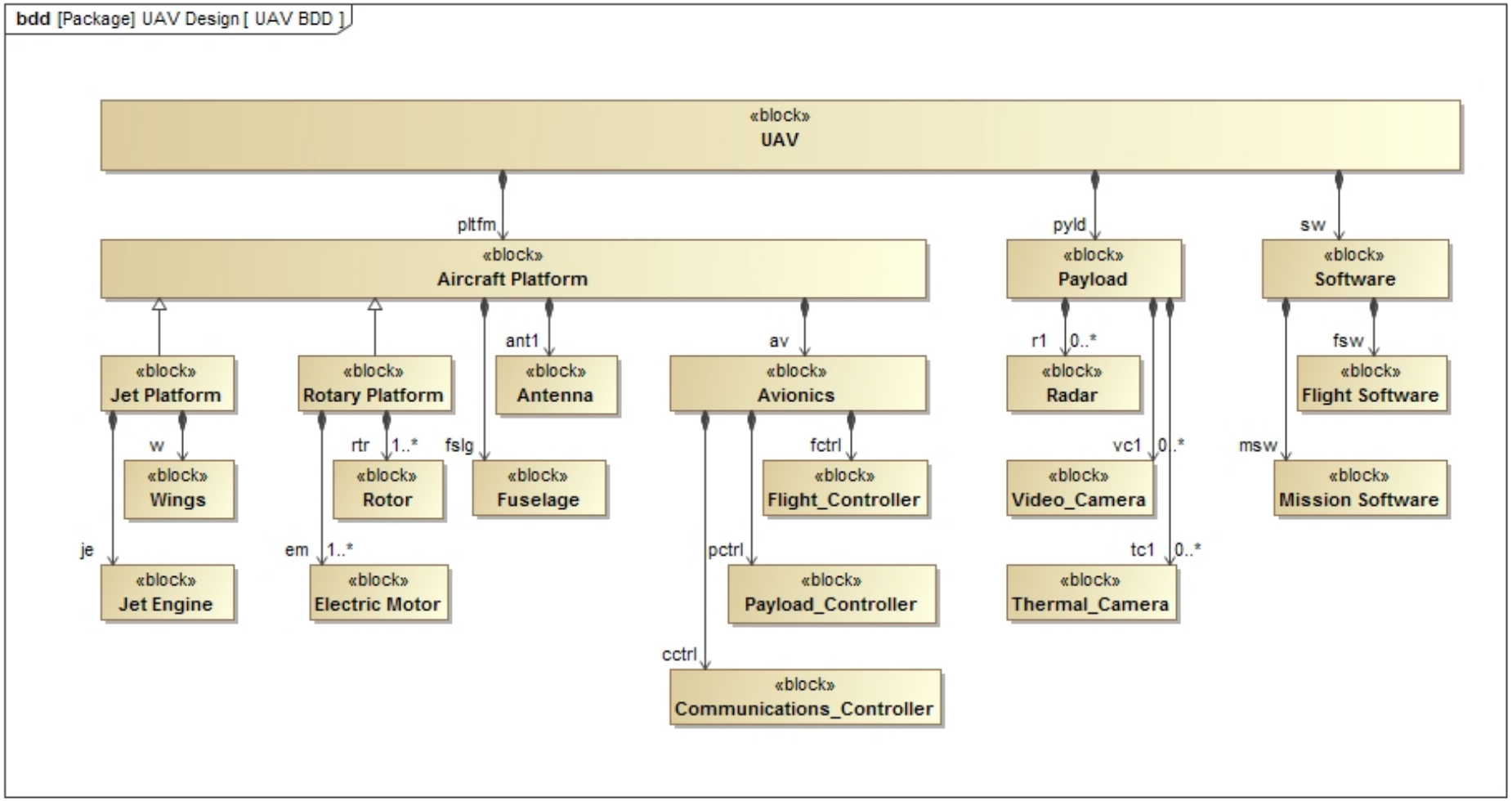
Multiplicity



Inheritance



Inheritance

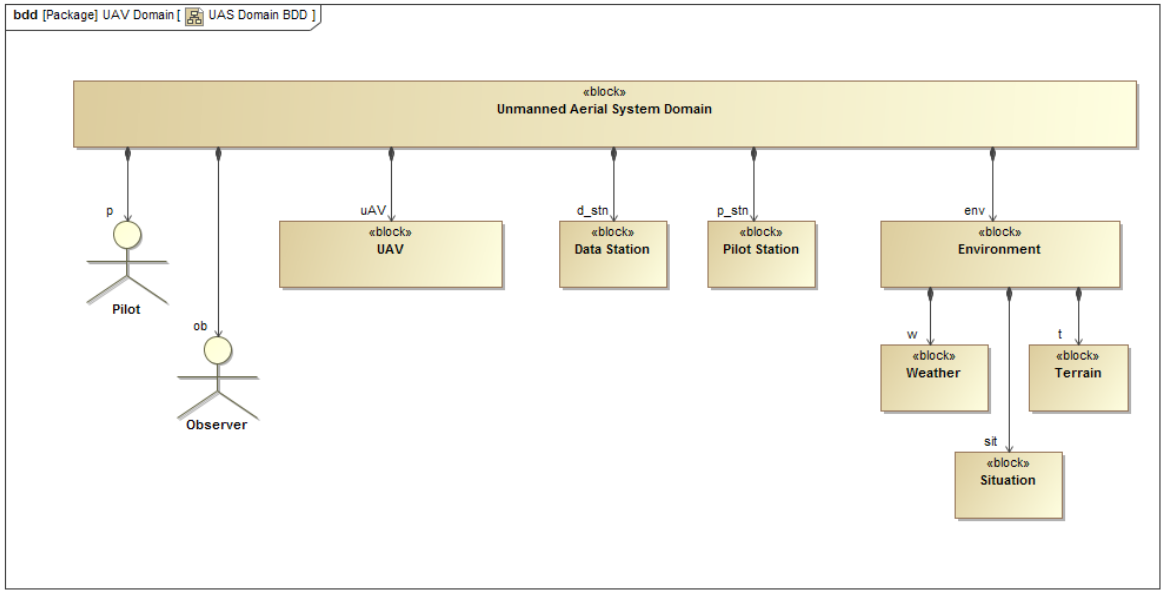


Exercise Model Organization

- Each hand-on exercise has four components
  - A Video demonstrating how to do the exercise
  - An Instruction Set (PDF) describing the exercise step-by-step
  - A Final Model
    - The final model show the exercise after completion. It should open displaying the diagram to be created in its final form. The student should not modify this model
  - A Starter Model
    - The student should do the exercise inside this model. Many SysML elements necessary for the work have already been created. The model should open to an index diagram.

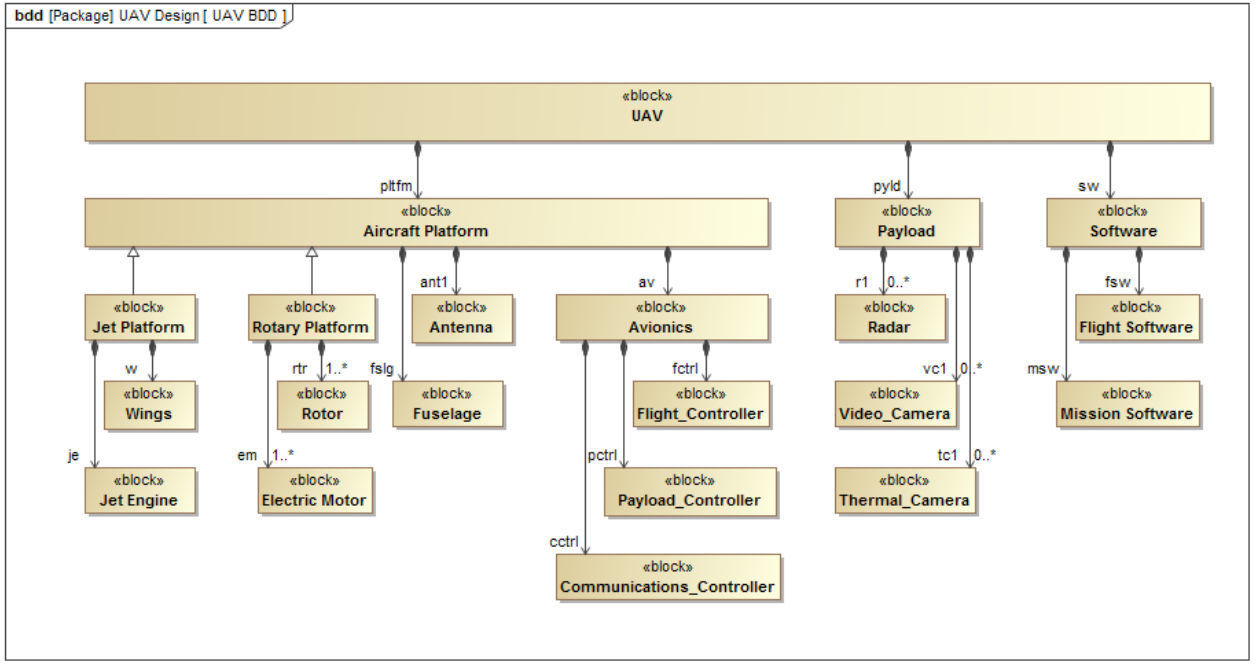
Exercise 2.1

- Purpose – To create a Block Definition Diagram from existing blocks and add Part Property relationships to the model
- After completing this video (Part 2.0), go to
  - Video Part 2.1 Block Definition Diagrams
  - SysML Model Exercise 2.1 Final
  - SysML Model Exercise 2.1 Starter
  - Exercise 2.1 Instructions.pdf



Exercise 2.2

- Purpose – To create a lower-level Block Definition Diagram with Value Properties and Inheritance relationships
- After completing this video (Part 2.0) and the first exercise, go to
  - Video Part 2.2 Block Definition Diagrams
  - SysML Model Exercise 2.2 Final
  - SysML Model Exercise 2.2 Starter
  - Exercise 2.2 Instructions.pdf



Recap

- At the end of the hands-on exercises, you should be able to
  - Explain the following terms: block, value property, value type, part property, multiplicity, inheritance
  - Create a block, a block definition diagram or a part property relationship
  - Create a value property and assign a value type
  - Identify the principle purpose(s) of a block definition diagram

Questions?

www.intercax.com

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