SysML Hands-On Exercises

Exercise 2.2
SysML Blocks and Block Definition Diagrams

MagicDraw

August 2018

OBJECTIVES

The new learning objectives of this exercise are to

- Create value properties in blocks
- Add multiplicities to composition relationships
- Show inheritance relationships in a bdd

In the process, we will create the domain-level composition for the UAV system.

PREPARATION

1. This exercise assumes the student has Cameo System Modeler 19.0 (or MagicDraw 19.0 with SysML plug-in) installed correctly on his or her machine with a valid license for use.
2. The student should load the Part 2 course materials onto the computer, including specifically Exercise 2.2 Starter UAV.mdzip.
3. The student should view the video Introduction to SysML Part 2 Exercise 2.2 in its entirety before attempting the exercise. In lieu of putting many screenshots in this document, we recommend reviewing portions of the video, as needed, during the exercise.

Note that additional software tools will need to be installed to complete Part 7, including a parametric solver and math engine to execute the parametric models created. If not already installed, the student should begin the process of obtaining and installing these tools. For assistance, contact info@intercax.com.

NOTES AND CAUTIONS

We recommend that the student watch the video demonstration of this exercise in its entirety before beginning their own work. The video includes background and explanatory material that is not repeated in the written instructions.

We also recommend that the student read the material carefully. The most common source of error is confusion between blocks, packages and diagrams, some of which have similar names. When the student is not sure what an element is, either in the browser or in a diagram, select that element and look in the Properties tab for the gray label that identifies the element type. Also, be careful in reading the instructions in realizing when an instruction should be carried out in the browser or in a diagram.

Finally, we urge the student to identify an experienced MagicDraw user for questions, especially where the videos and screenshots we provide don't correspond with what the student is seeing. The setting of a preference or a filter that hides a necessary control or element can be a frustrating source of confusion that an experienced user may be able to resolve quickly.

EXERCISE

2.2.1 Start Cameo System Modeler

2.2.2 Open a MagicDraw Project

- Left-click File in menu bar
- Select Open Project
- Browse to Exercise 2.2 Starter UAV.mdzip
- Click Open

2.2.3 Create a Block definition diagram

- In the Containment Browser, right-click the package **UAV Design** and select Create Diagram → SysML Block Definition Diagram.
- Name the diagram **UAV System BDD**.
- Drag all the blocks inside the **UAV Design** package into the diagram.
- Rearrange and resize them roughly as shown in Figure 1.
- Select the **Engine** block (lower right corner in diagram) and click the Delete key. This element was in the **UAV Design** package, but we will not be showing it in this diagram. Note that it remains in the model in the Containment Browser.
- Using the Directed Composition (black diamond) arrow and the sticky button, as in Exercise 2.1, create and rename part properties as shown in Figure 2.
- At this stage, there are no arrows between **Aircraft Platform** and either **Jet Platform** or **Rotary Platform**. If you have accidentally created a black diamond arrow there, do not just delete it from the diagram. You must find the part property created under **Aircraft Platform** in the Containment Browser and delete it there.

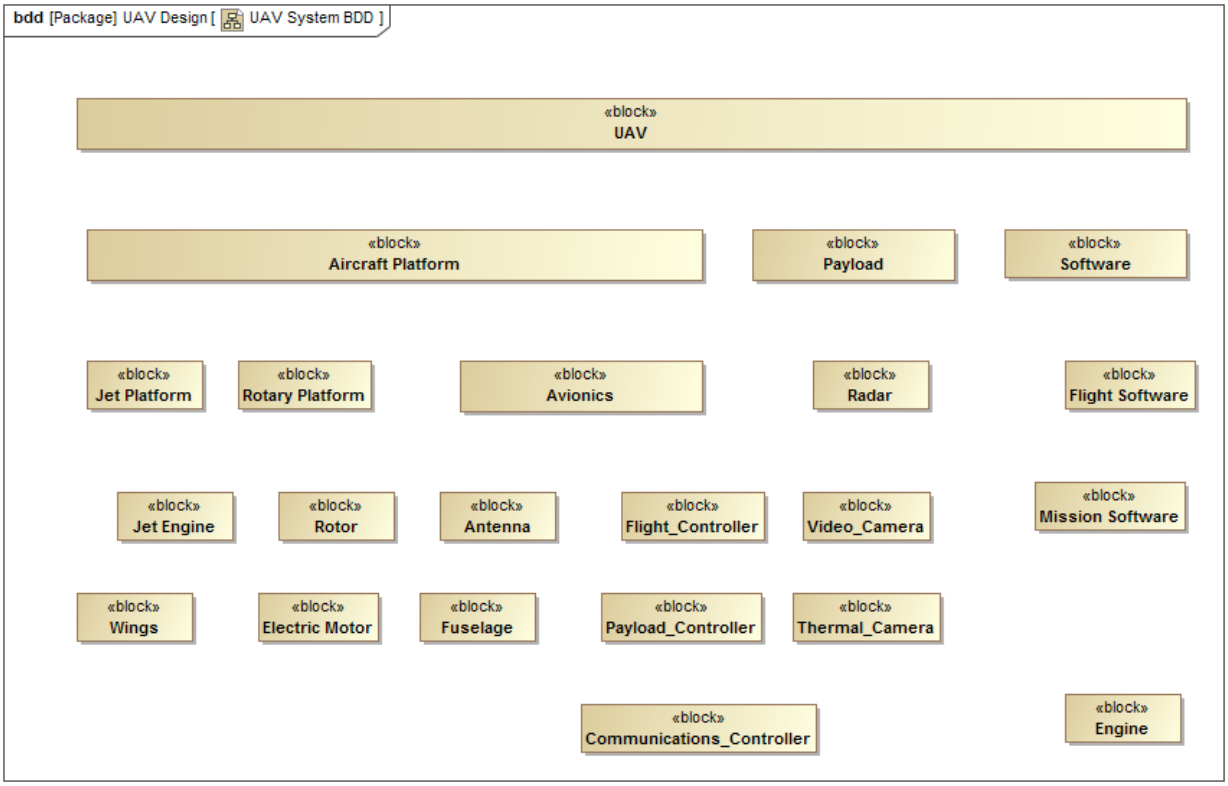

Figure 1 Creating the UAV System BDD, Step 1

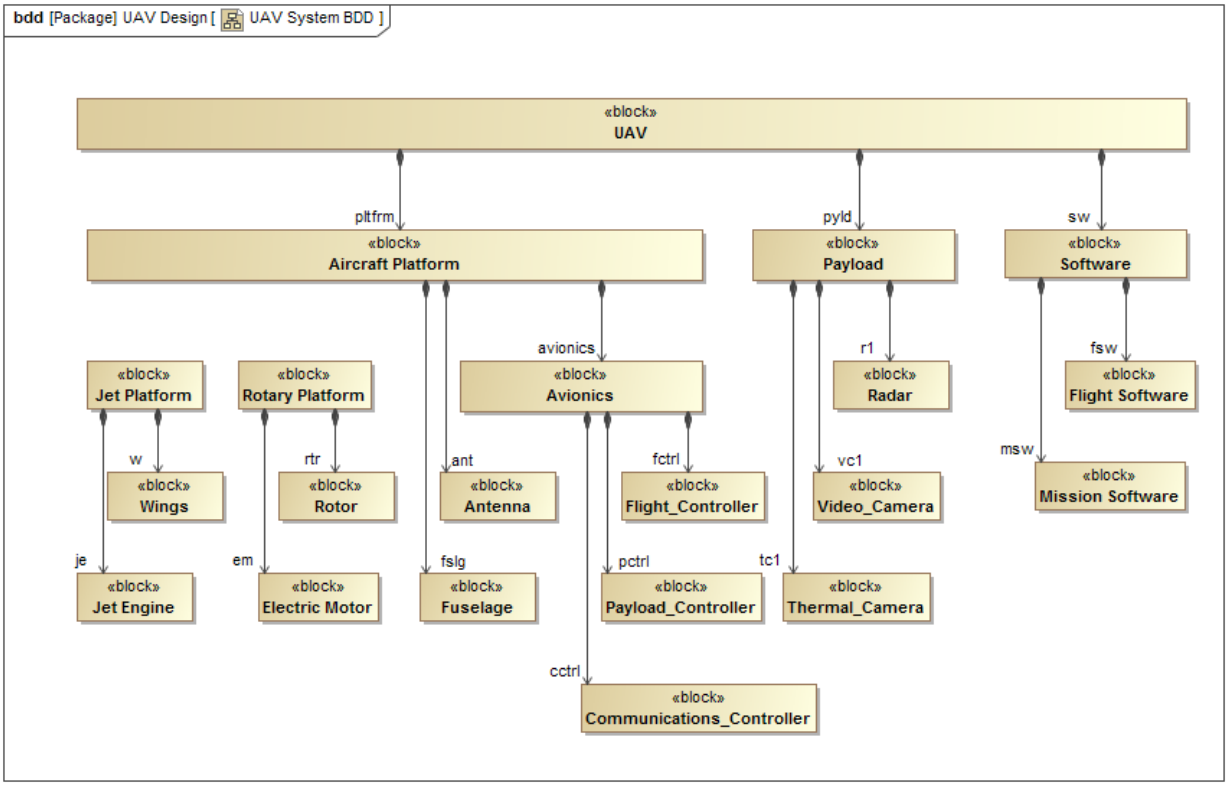

Figure 2 Creating the UAV System BDD, Step 2

2.2.4 Create an Inheritance Relationship

- Select the **Aircraft Platform** block in the diagram and show the floating toolbar.
- Select the Generalization icon (Figure 4).
- Drag the end of the relationship to **Jet Platform** block and click to set.
- Repeat the process for the **Rotary Platform** block.
- This section of the **UAV Design BDD** diagram should appear as shown in Figure 5.

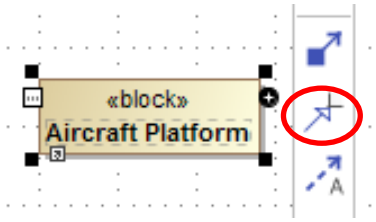

Figure 3 Generalization

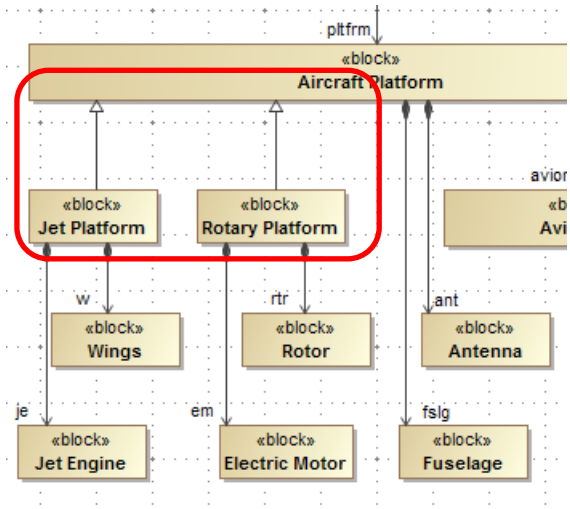

Figure 4 Inheritance relationships

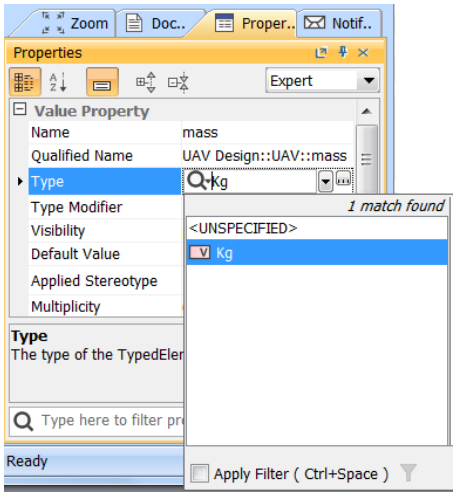

Figure 5 Properties tab for new value property

2.2.5 Create Value Properties in Blocks

- In the browser, select the **UAV** block.
- Right-click to Create Element→ Value Property.
- Go to the Properties tab (Figure 5).
- Rename the value property Name to **mass**
- Set the value property Type to **Kg**.
  - Click to the right of Type in the table
  - Start to type in the name of the Value Type desired, here “Kg”.
  - The search function will identify all available value types starting with Kg. Make sure that the Apply Filter box is unchecked at the bottom of the list (see Figure 5).
  - Select **Kg** where it appears so that Kg [UAV Library::Value Types] appears in the Type field
- Repeat this process to create a Value Property **cost** with Value Type **$** under the **UAV** block.

2.2.6 Hide Values Compartment in Diagram

- In the diagram, note that the new value properties have shown up in the **UAV** block.

- To hide this compartment, click the icon on the left edge of the **UAV** block in the diagram and uncheck Values (Figure 6). Resize the symbol as necessary.

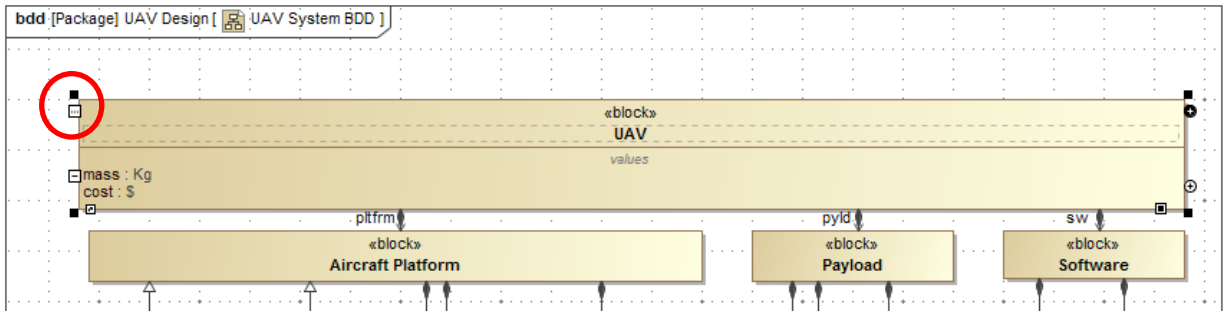

Figure 6 Top of UAV System BDD showing UAV block with value properties

2.2.7 Add mass Value Properties to Payload and Aircraft Platform blocks

- In the Containment browser, right-click **mass:Kg** and choose Copy.
- In the browser, right-click the **Aircraft Platform** block and choose Paste.
- In the browser, right-click the **Payload** block and choose Paste.
- Expand the **Payload** and **Aircraft Platform** blocks in the browser and check that each contains the value property **mass:Kg**.
- Modify the diagram to hide these properties if desired.

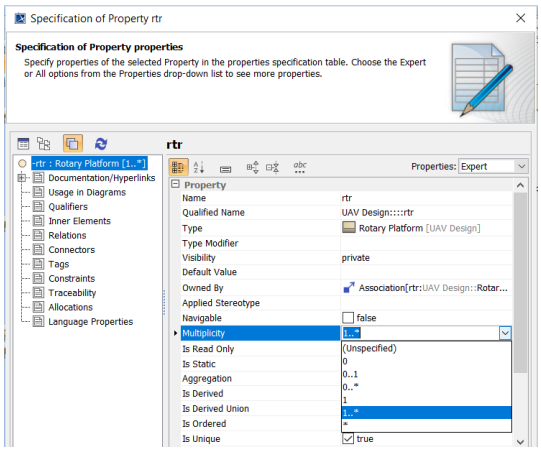

Figure 7 Specification window, part property multiplicity

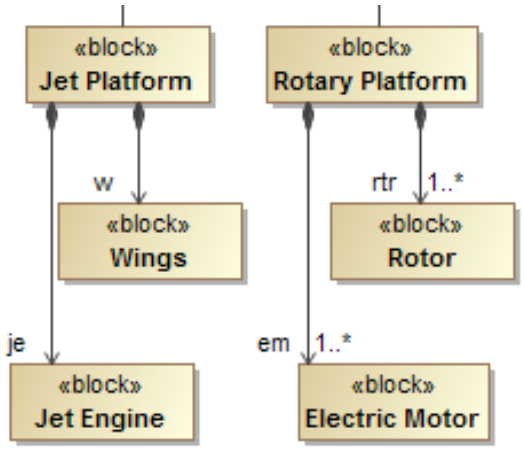

Figure 8 Part properties with 1.. multiplicities*

2.2.8 Add Multiplicities to Part Properties

- In the Containment browser, expand the **Rotary Platform** block, right-click the part property **rtr:Rotor** and choose Specification.
- In the Specification window, click on the down arrow to the right of Multiplicity.
- Choose 1..* (Figure 7).
- Repeat the process for **em:Electric Motor**.

- In the Containment browser, expand the **Payload** block, right-click the part property **r1:Radar** and choose Specification.
- In the Specification window, click on the down arrow to the right of Multiplicity.
- Choose 0..*.
- Repeat the process for **vc1:Video Camera** and **tc1:Thermal Camera**.
- The final **UAV System BDD** diagram should appear similar to Figure 9.
- Save and close the project and proceed to Part 3 of the series.

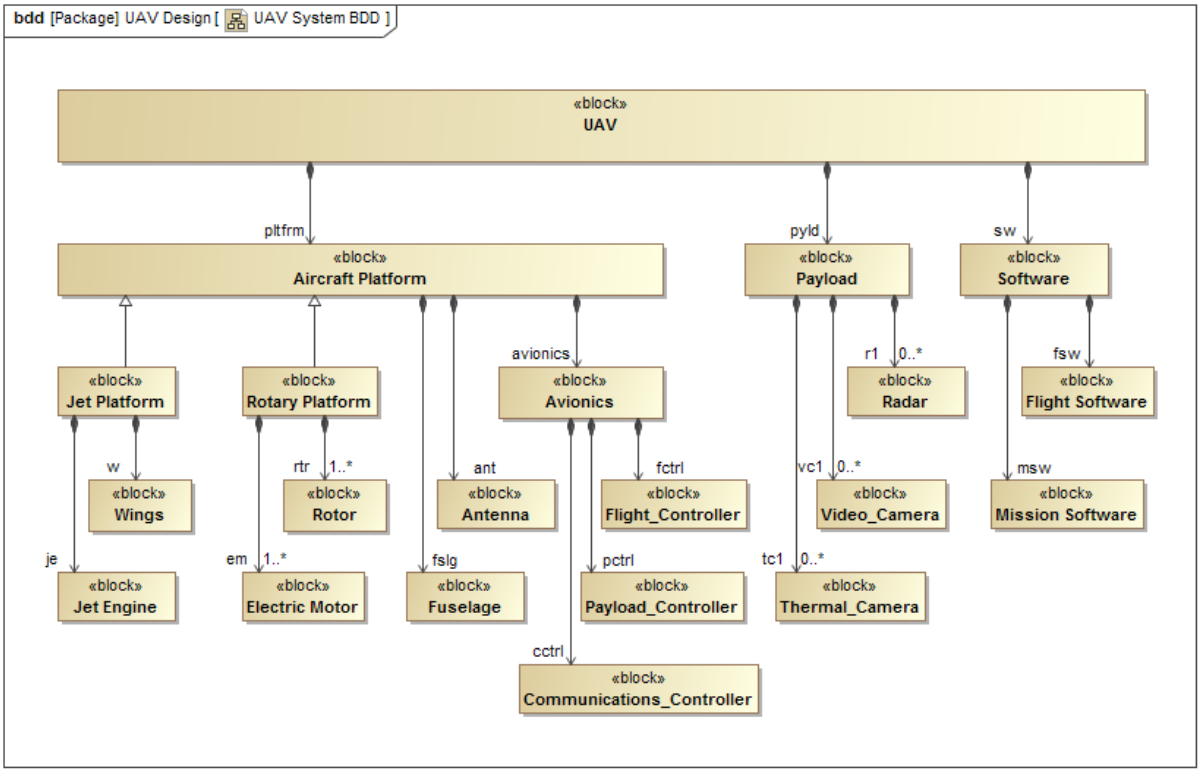

Figure 9 Creating the UAV System BDD, Step 3