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28 September 2021

SysML Implemented

Sofía Orte
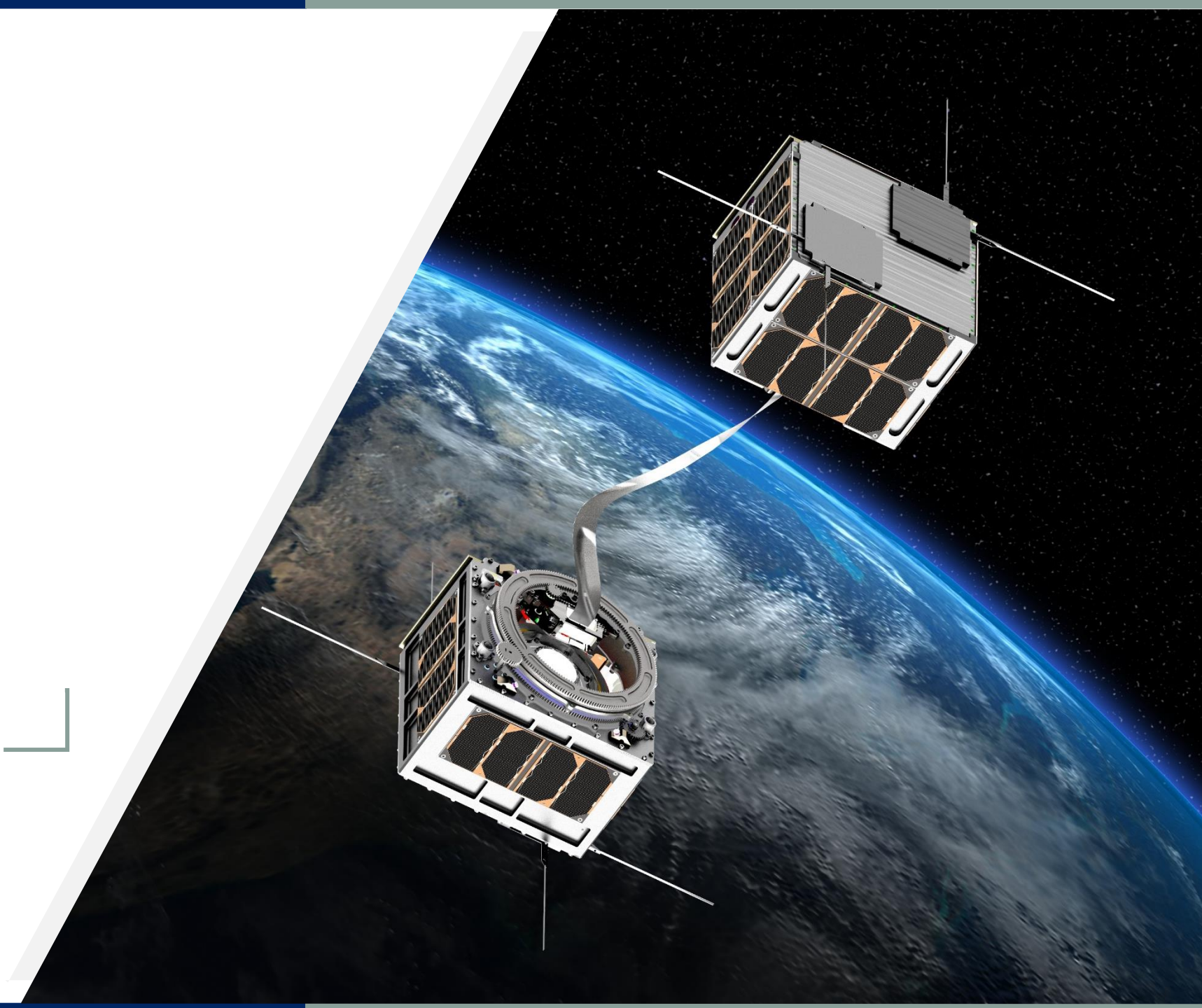Lorenzo Tarabini Castellani
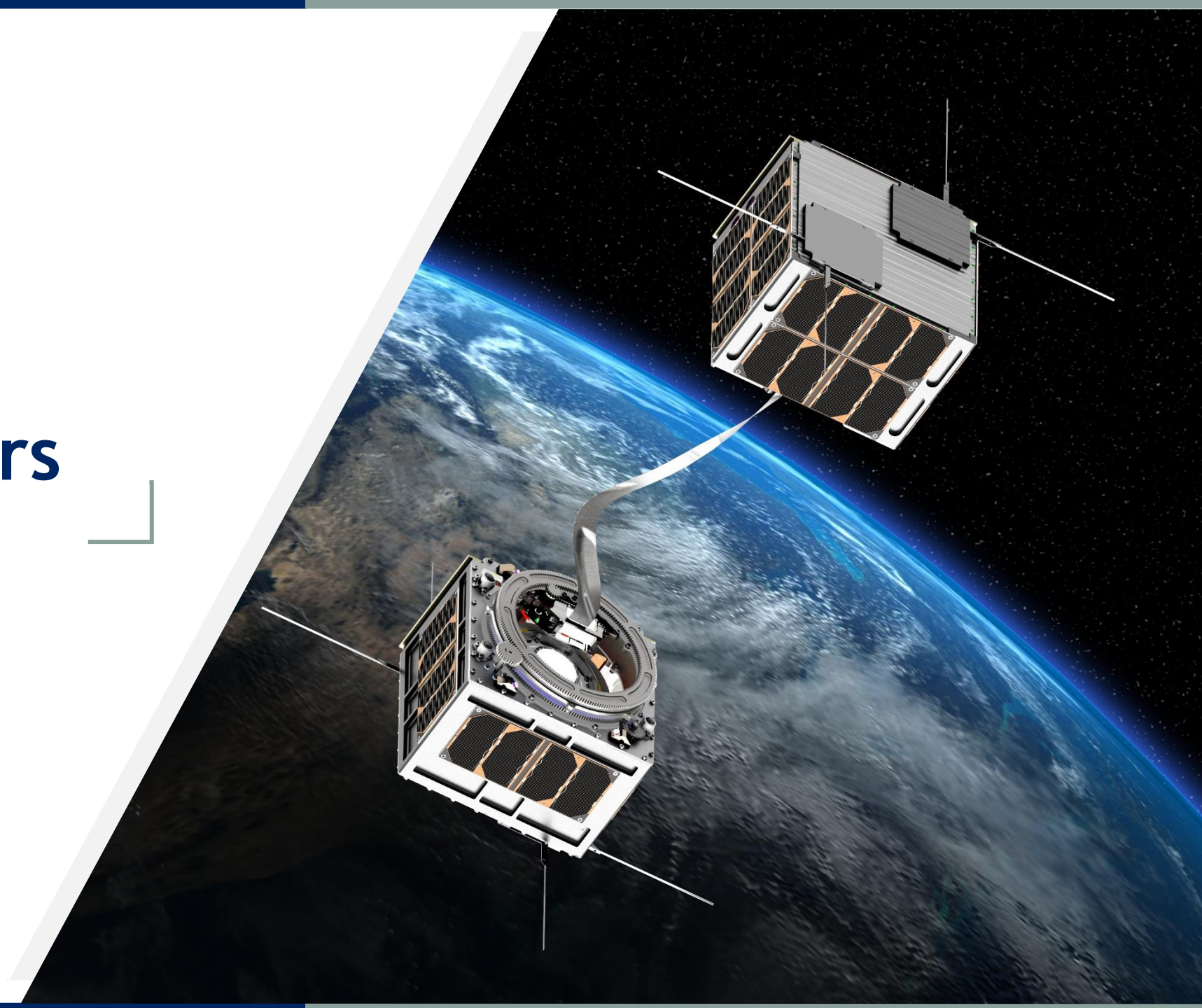
SysML Implemented

INDEX

1. MBSE Pillars

1. MBSE Pillars

LANGUAGES

Define the kinds of elements and relationships allowed to put into the model

- **Systems Modeling Language (SysML)**
- UML
- UPDM
- MARTE
- SoaML

TOOLS (Vendors)

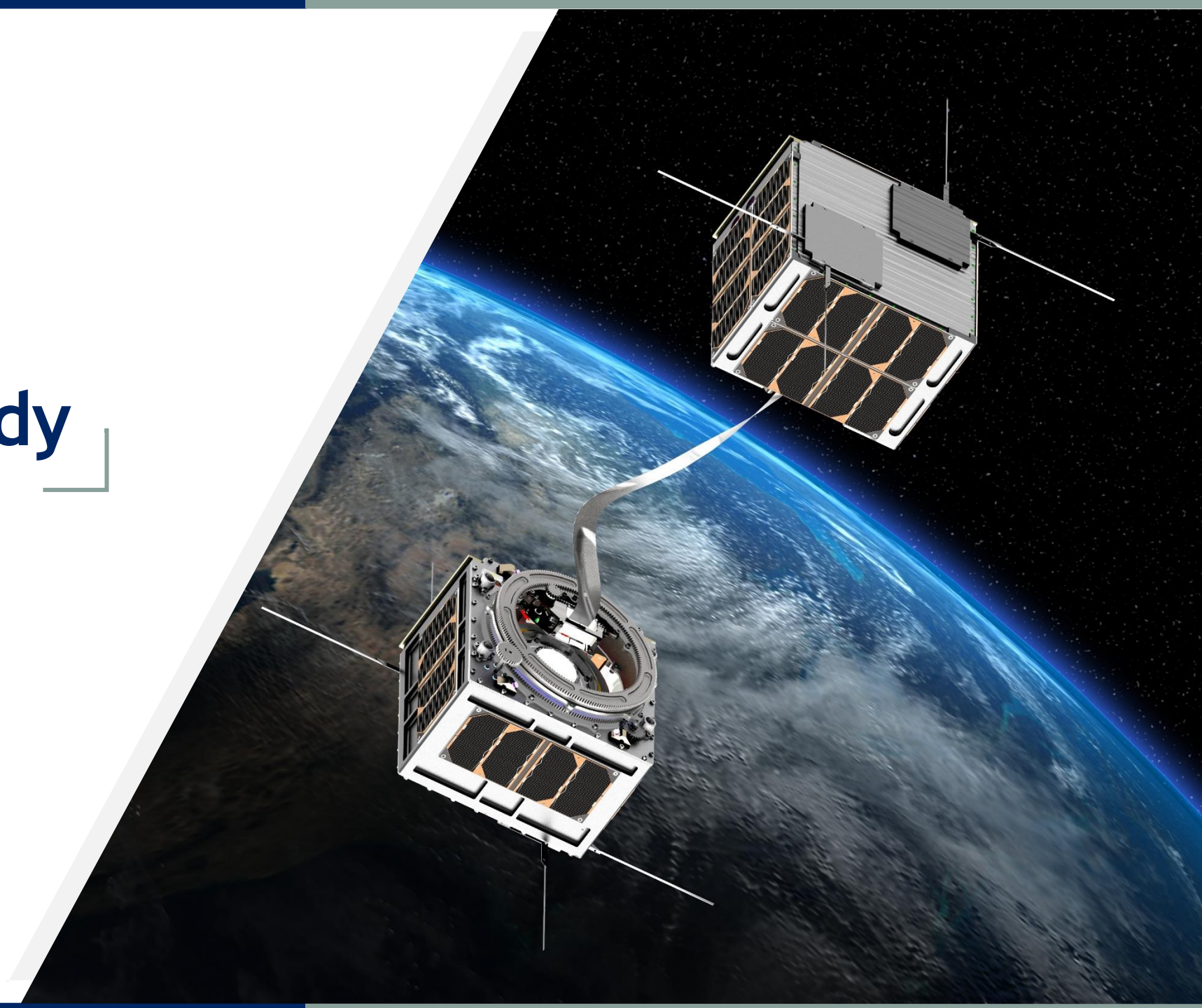*Enable to construct models in the modelling languages*

- Cameo Systems Modeler (NoMagic™)
- **Rhapsody (IBM®)**
- Enterprise Architect (Sparx Systems®)
- Integrity Modeler (PTC®)
- Modelio (Softeam™)

METHODOLOGIES

Set of guidelines and rules to create a system model consistency

- Object-Oriented SE Method (INCOSE)
- Telelogic Harmony SE (IBM)
- **Custom for E.T.PACK needs**

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2. IBM Rhapsody

2. IBM Rhapsody

The IBM Engineering Systems Design Rhapsody for Software and Systems Engineering.

Main features (full edition):

- SysML (or other languages) modeling
- Document generation
- Simulation internal engine
- Automatic code generation
- Integration with DOORS (req management)
- integration with MATLAB Simulink (design verification)
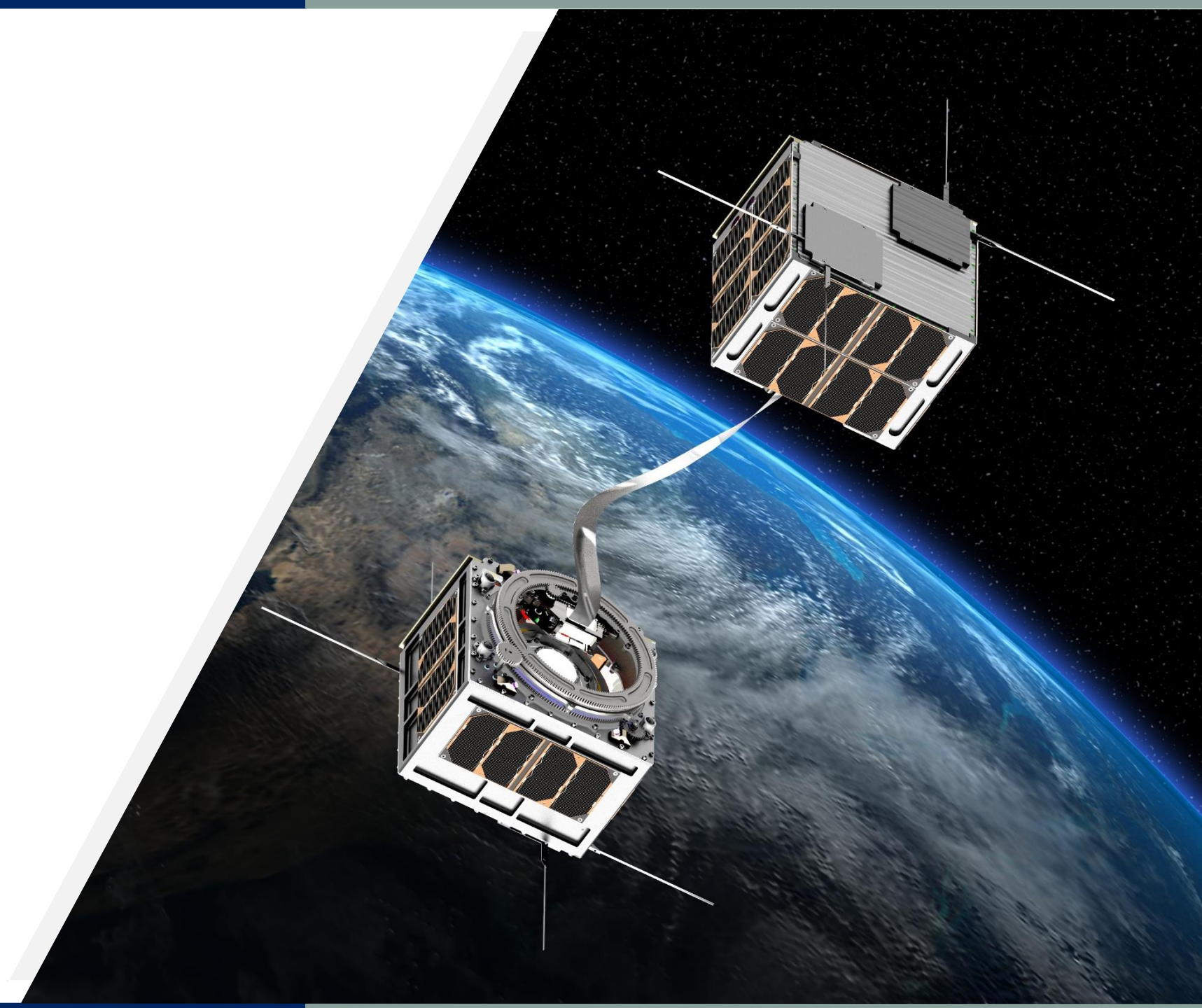- Integration with EWM (change management)
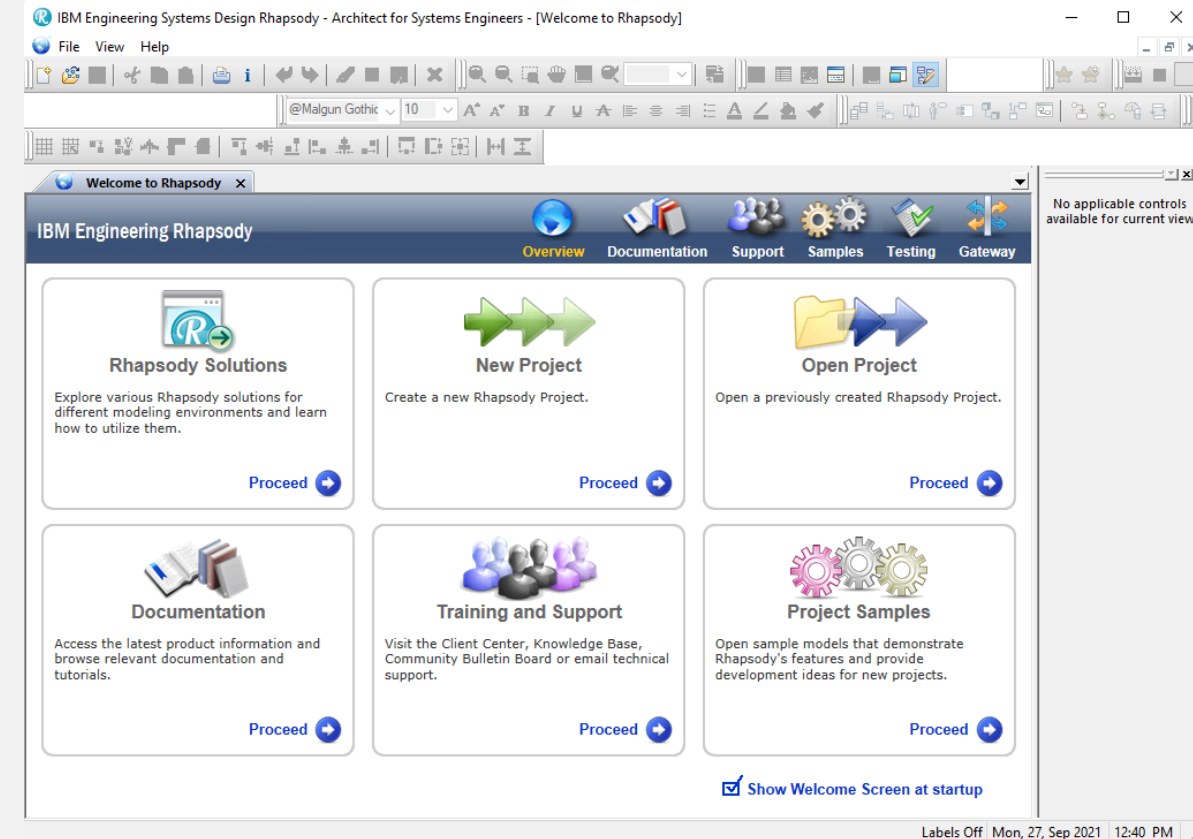
2. IBM Rhapsody
General View
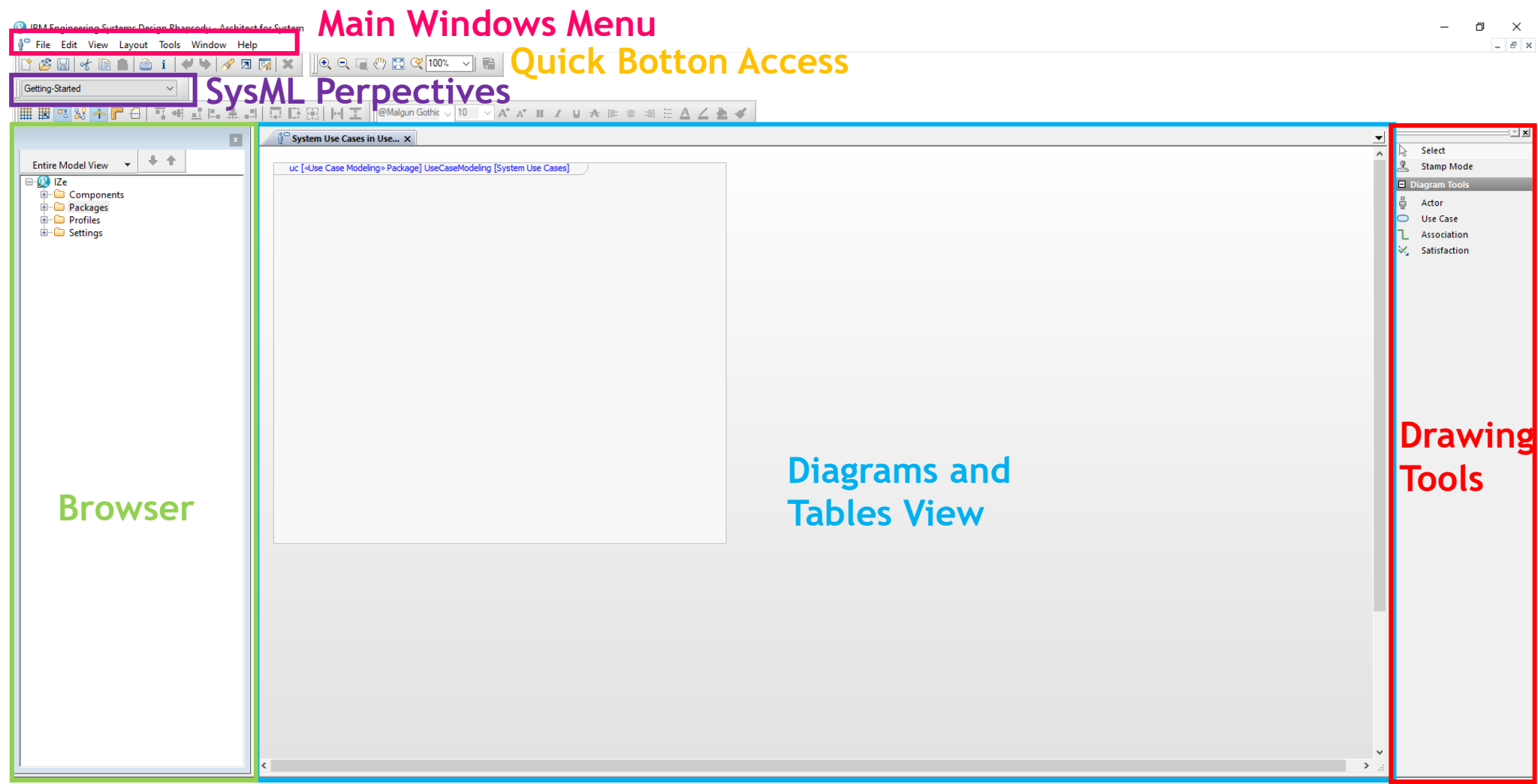
3. Modelling Guidelines
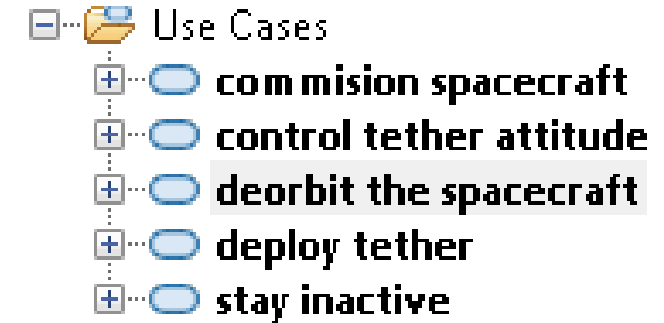
3. Modelling Guidelines
Model vs View

1 model with infinite views (diagrams and text artifacts), where changes made in the model are automatically propagated to all the views → **Consistency**
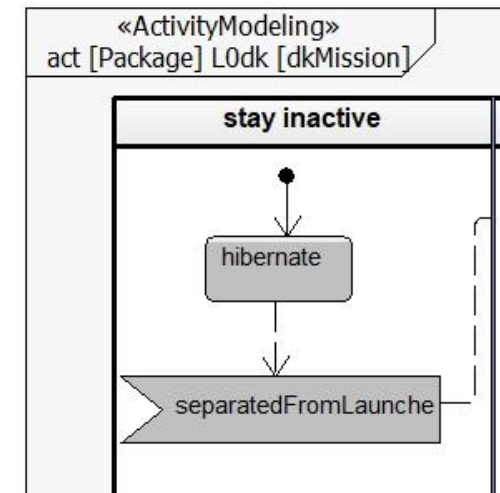
Each view displays exclusively the relevant information for that representation, and not all the information included within the element → **Readability**

The view of an element is not the element, just a representation of it.


MODEL ELEMENT

VIEWS OF THE ELEMENT

3. Modelling Guidelines
Standarization

- Elements should include a brief description
- Naming convention:
  - Do not use spaces nor underscore
  - Start with small letter and separate words with capital letter
  - Use short but precise names
  - Additional convention for each element type
- Color code for each diagram
- ESA profile (to tailor SysML)
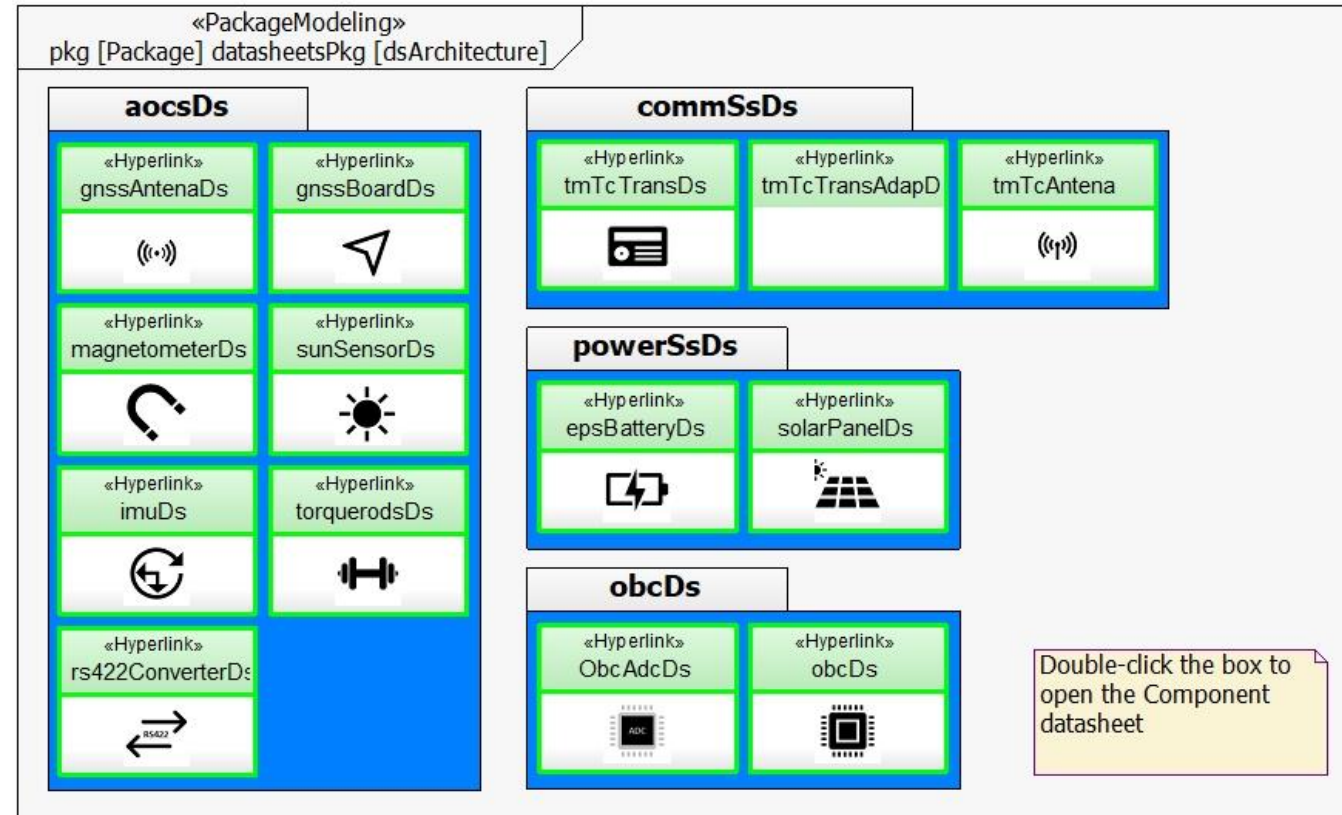
3. Modelling Guidelines
SysML ETPACK Training Activities

delivered material

SysML Training 1: **Getting Started with SysML**
- Theory 2021-Feb-22 (4h)
- Practice 2021-Feb-22 (4h)

➤ ETPACK-SEN-SysML-0001 Theory
ETPACK-SEN-SysML-0001 Practice

SysML Training 2: **ESA Profile & ETPACK Model**
- 2021-May-11 (4h)

➤ ETPACK-SEN-SysML-0003 Training-Session-II
ETPACK-SEN-TN-0005 Design Approach with Rhapsody
ETPACK-SEN-TN-0007 SysML ESA Profile Installation And Customizations
ETPACK-SEN-SW-0001 ESAprofile
ETPACK-SEN-SW-0002 ETPACKv1

SysML Training 3: **Collaborative Development Environment**
- 2021-October-TBC (4h)

➤ ETPACK-SEN-SW-0002 ETPACKv3
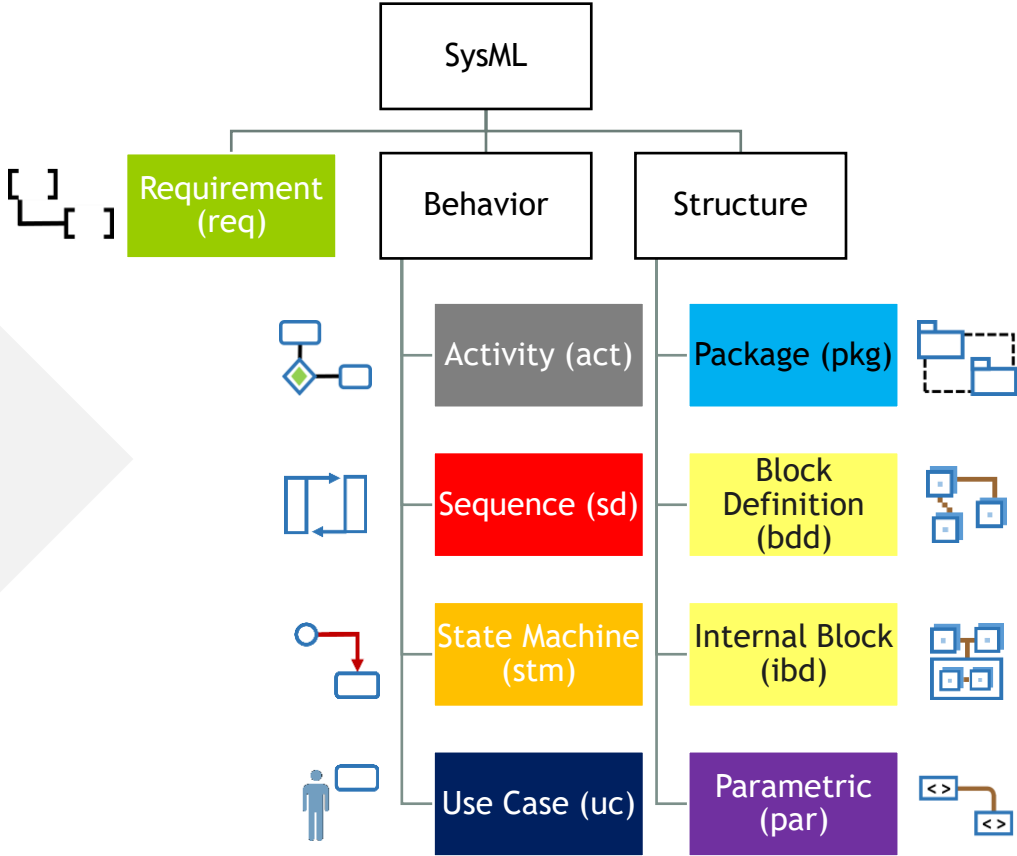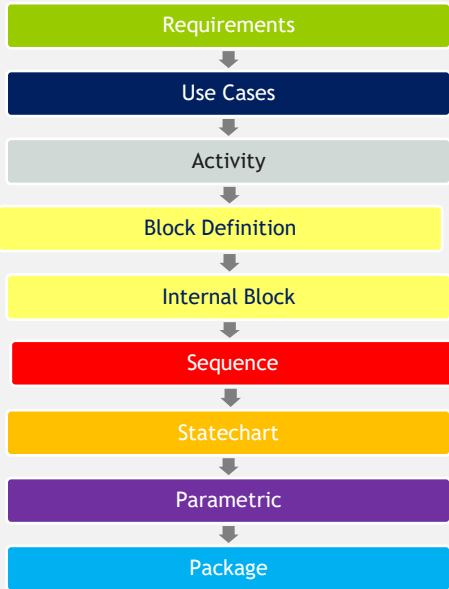ETPACK-SEN-TN-0009 Collaborative Development Environment

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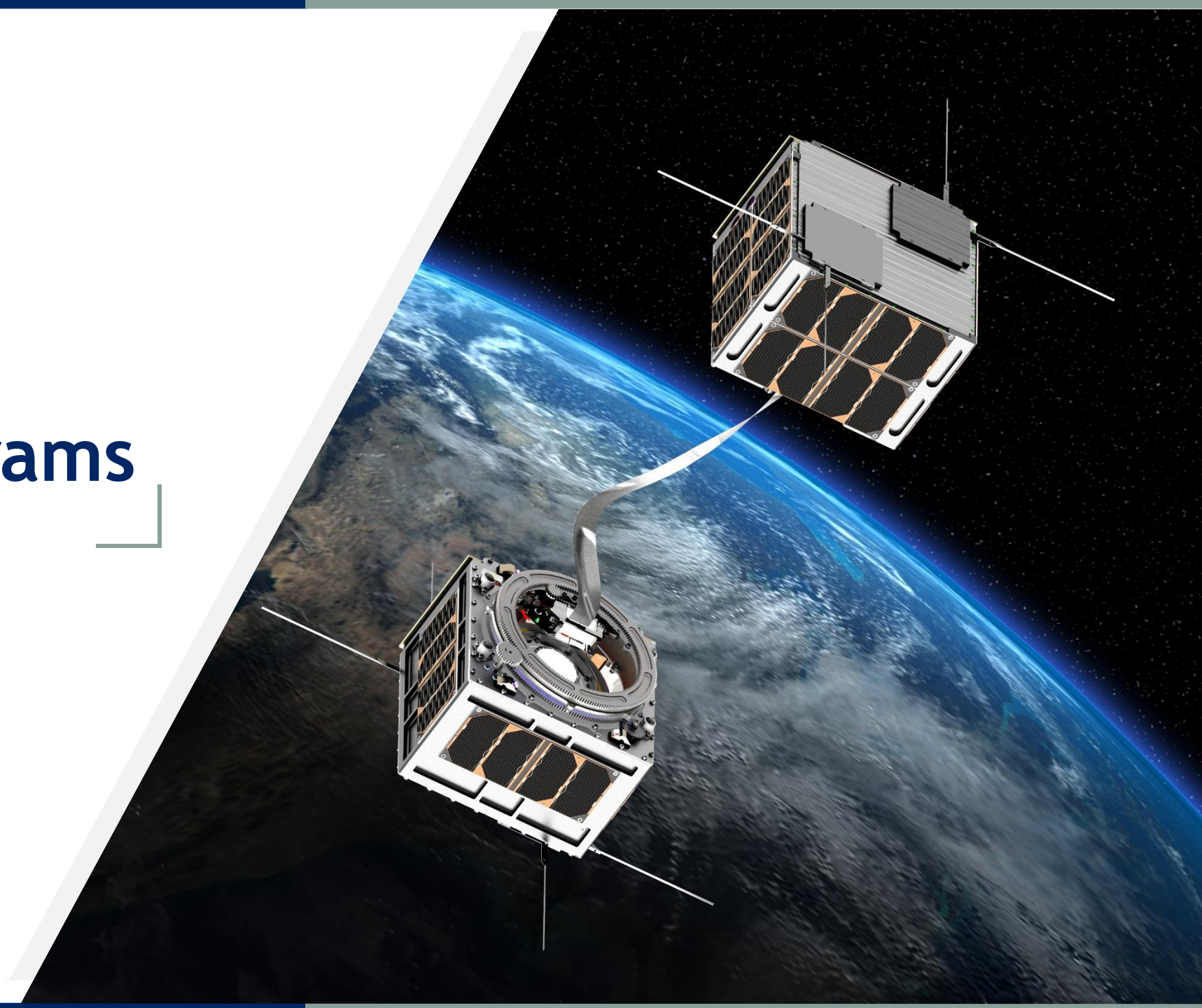
4. SysML Diagrams

4. SysML Diagrams

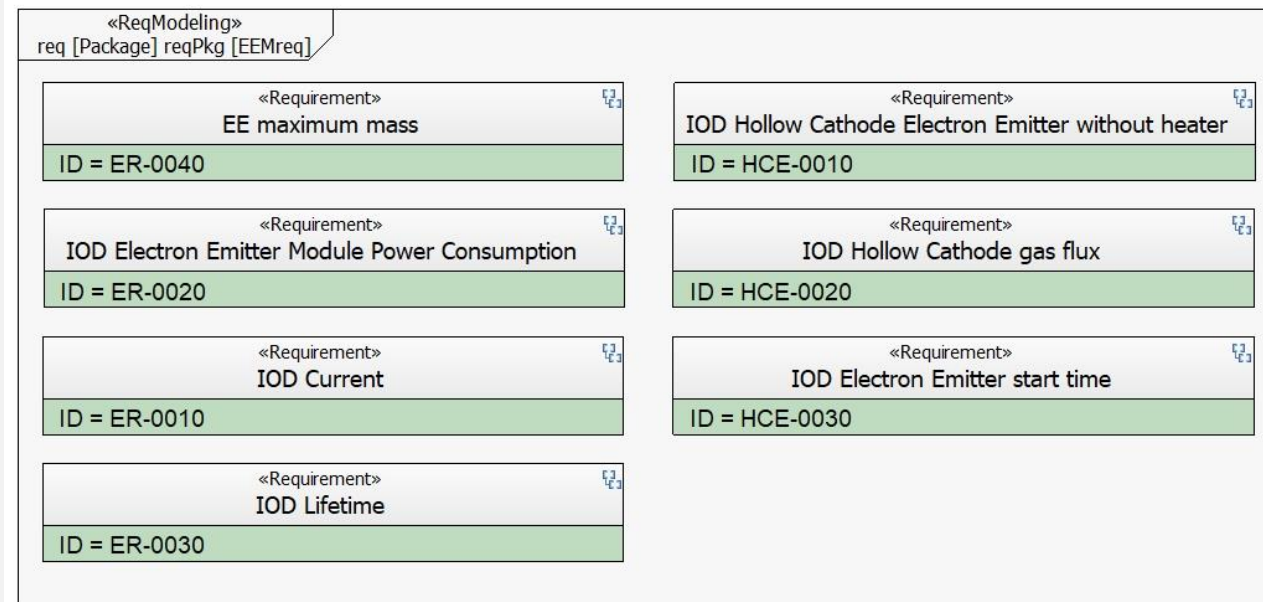Every system can be graphically described using only 9 diagrams!

4. SysML Diagrams
Requirement Diagram

Requirement Diagram:

"Set of requirements (necessity imposed on the future system by the end user) and their relationships to other elements".
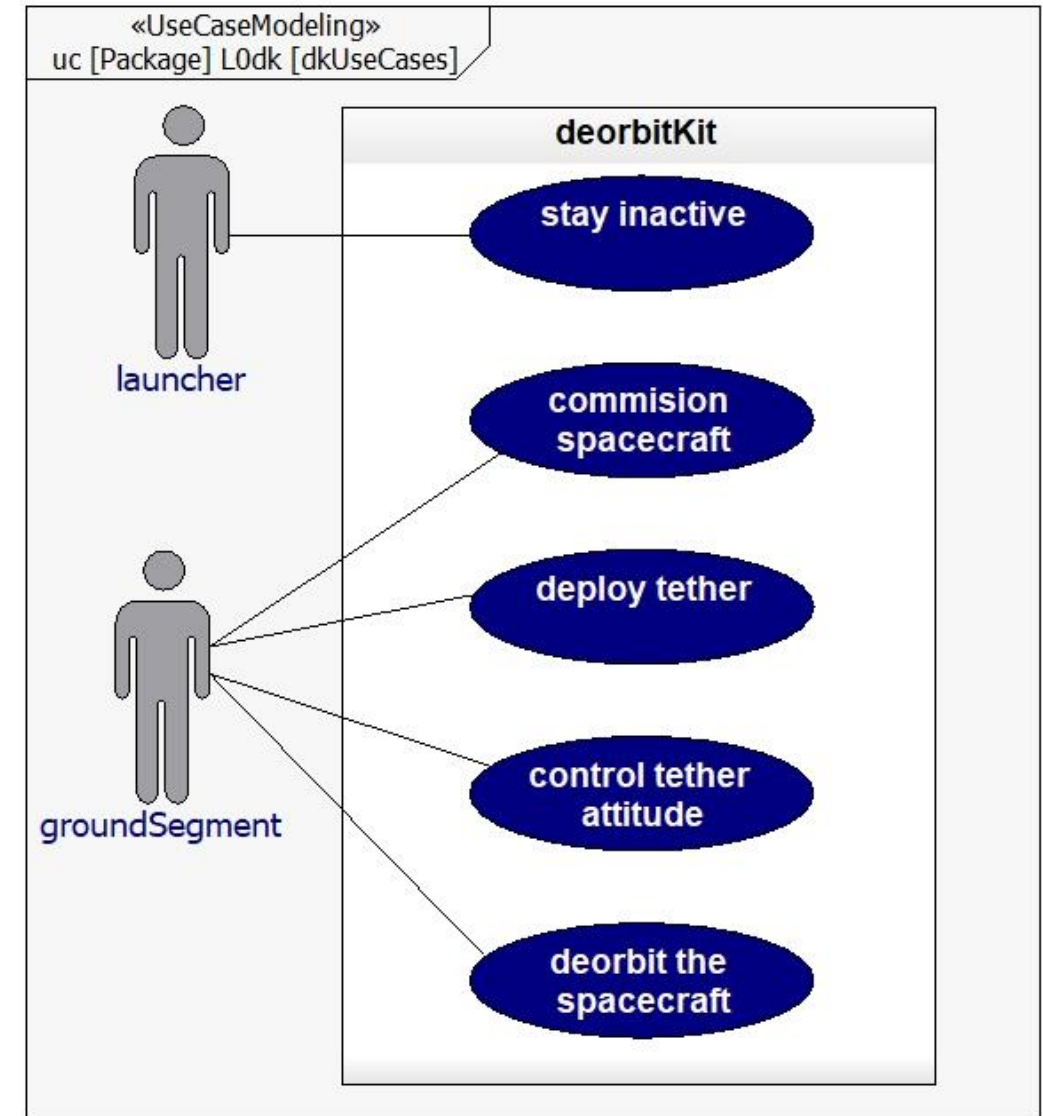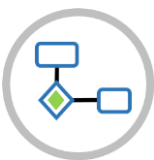
4. SysML Diagrams
Use Case Diagram

Use Case Diagram:

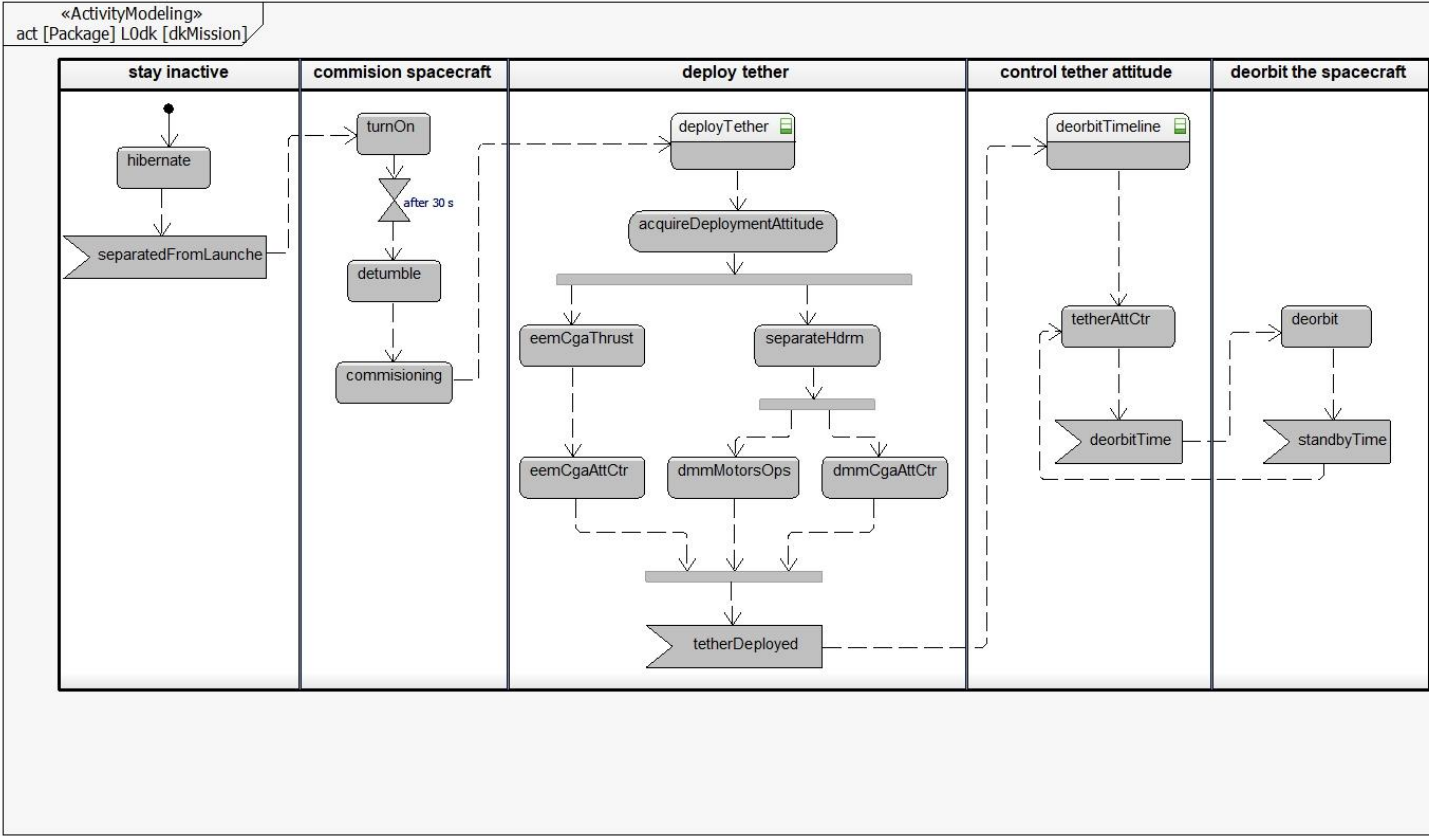*"Set of services the system provides under request of an external actor."*
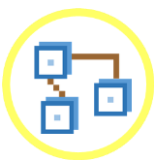
4. SysML Diagrams
Activity Diagram

Activity Diagram:

"Flow of actions, behaviours and event occurrences over time"
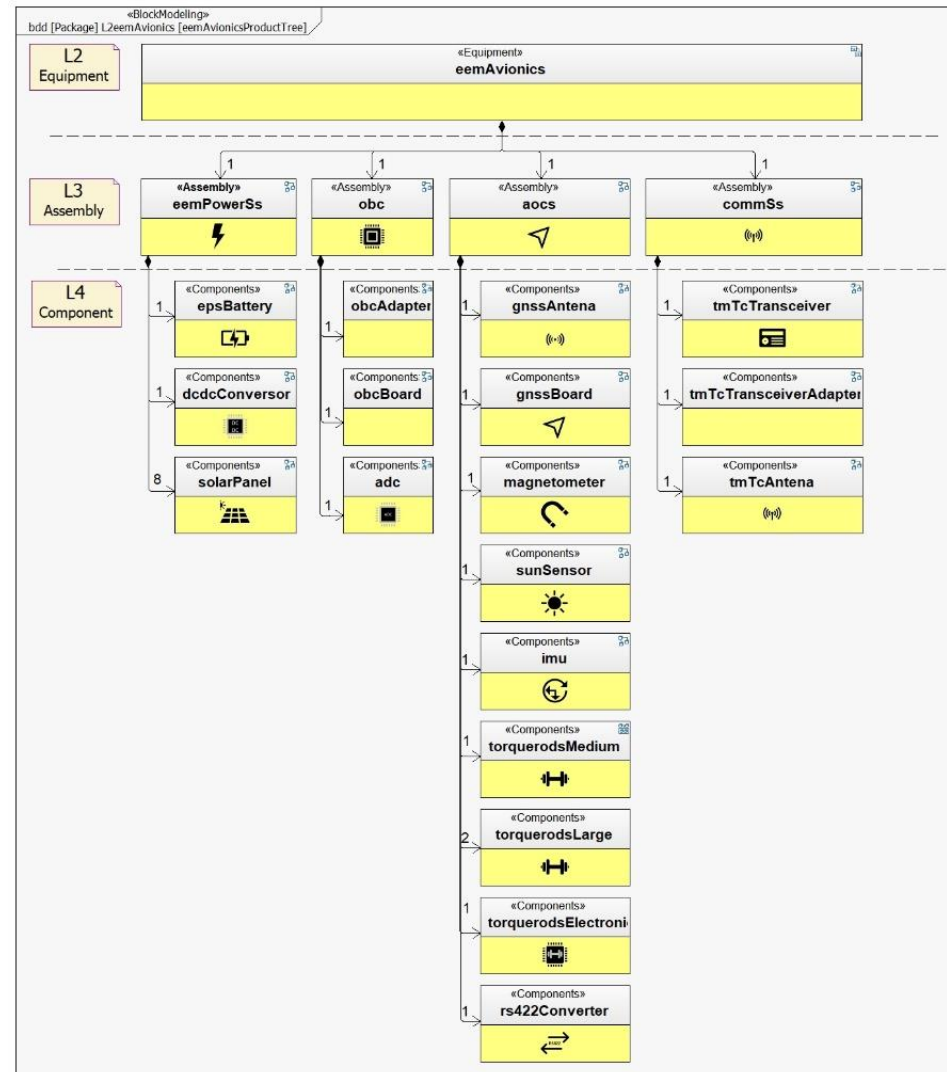
4. SysML Diagrams
## Block Definition Diagram

Block Definition Diagram:

"System decomposition, displaying the structural relationships between them"

Elements populated with Properties (mass, cost, power, etc)

4. SysML Diagrams
Internal Block Diagram

Internal Block Diagram:

"Internal structure of a system, representing the connections and interfaces between the internal parts of it"
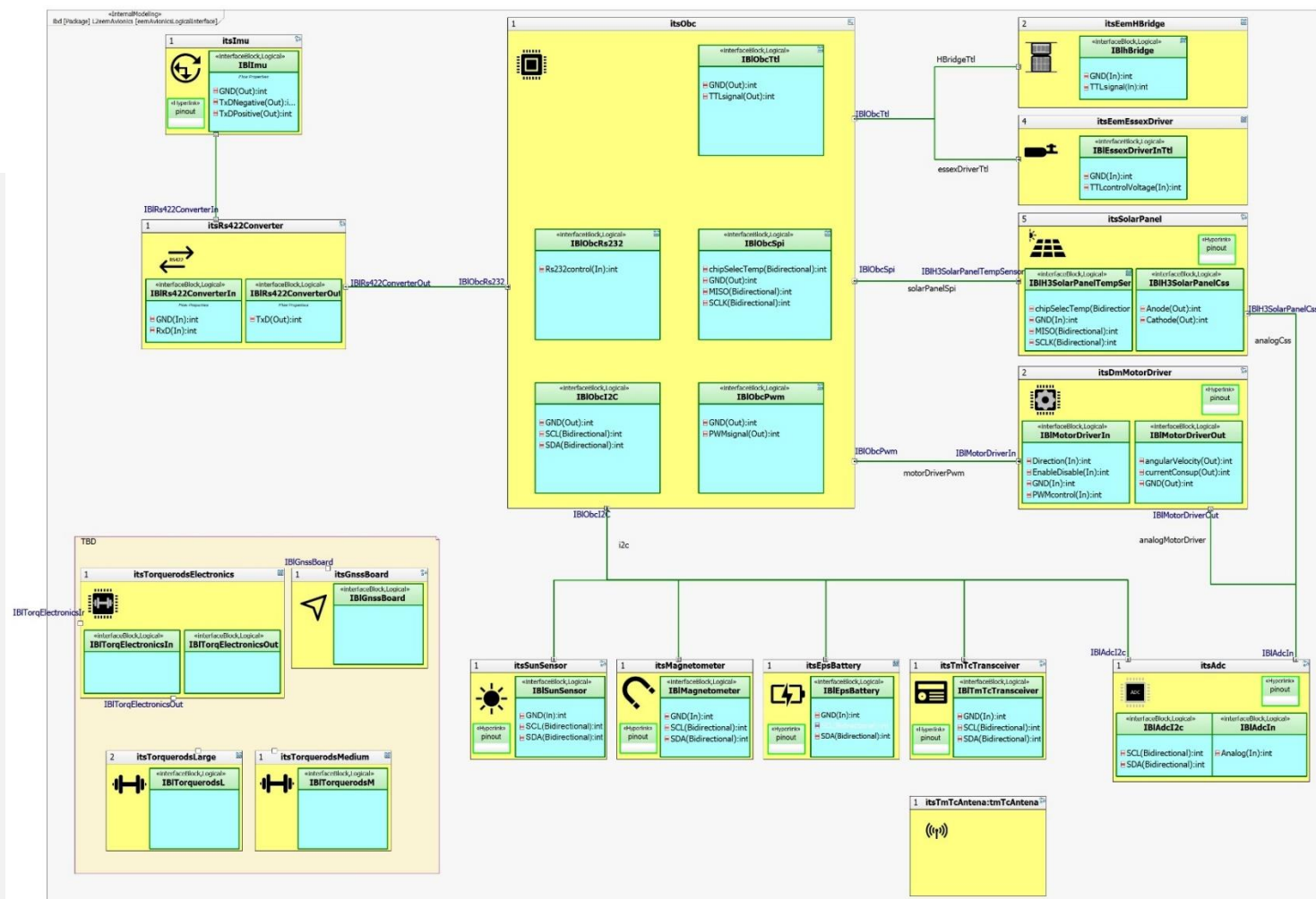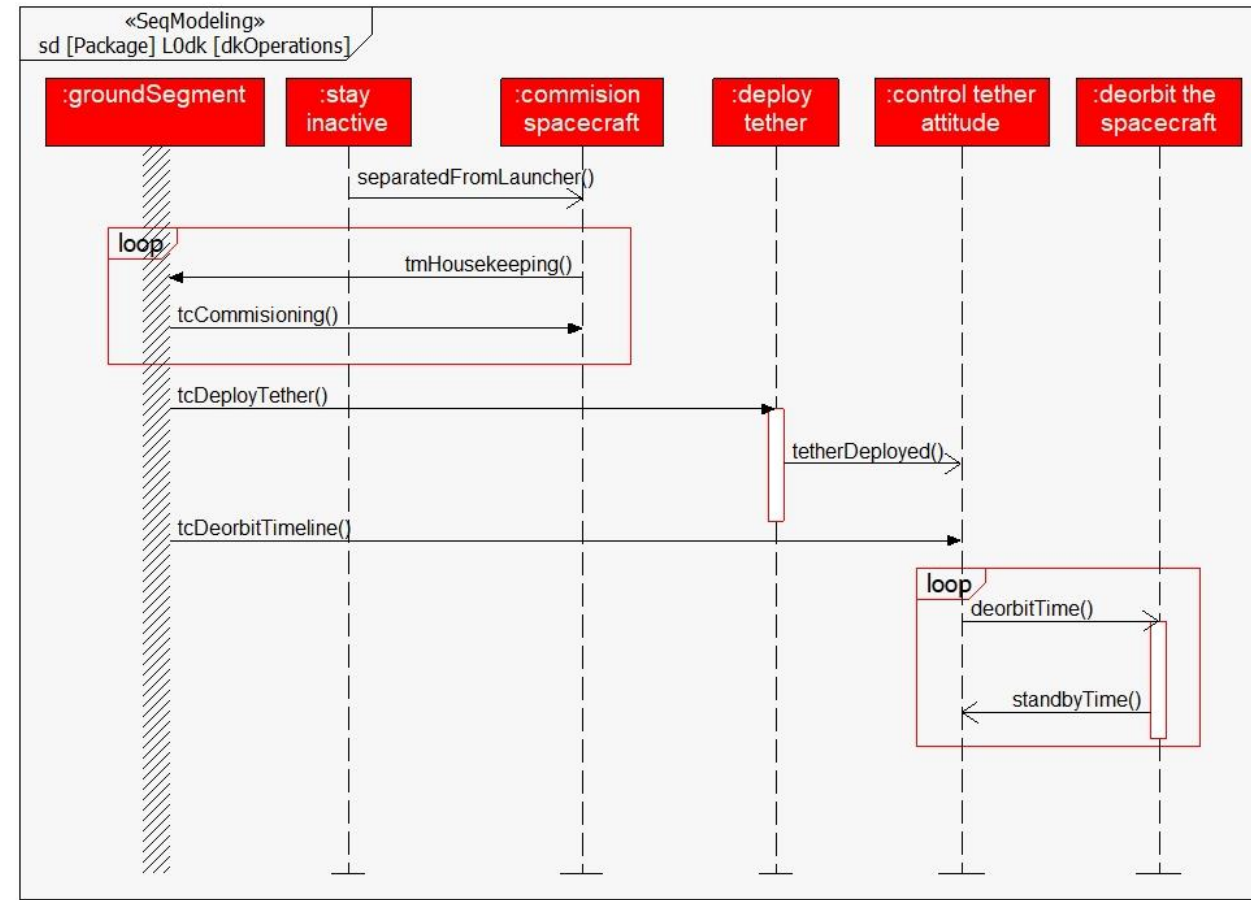
4. SysML Diagrams
Sequence Diagram

Sequence Diagram:

"Time ordered interactions and messages enchange between elements in the model"
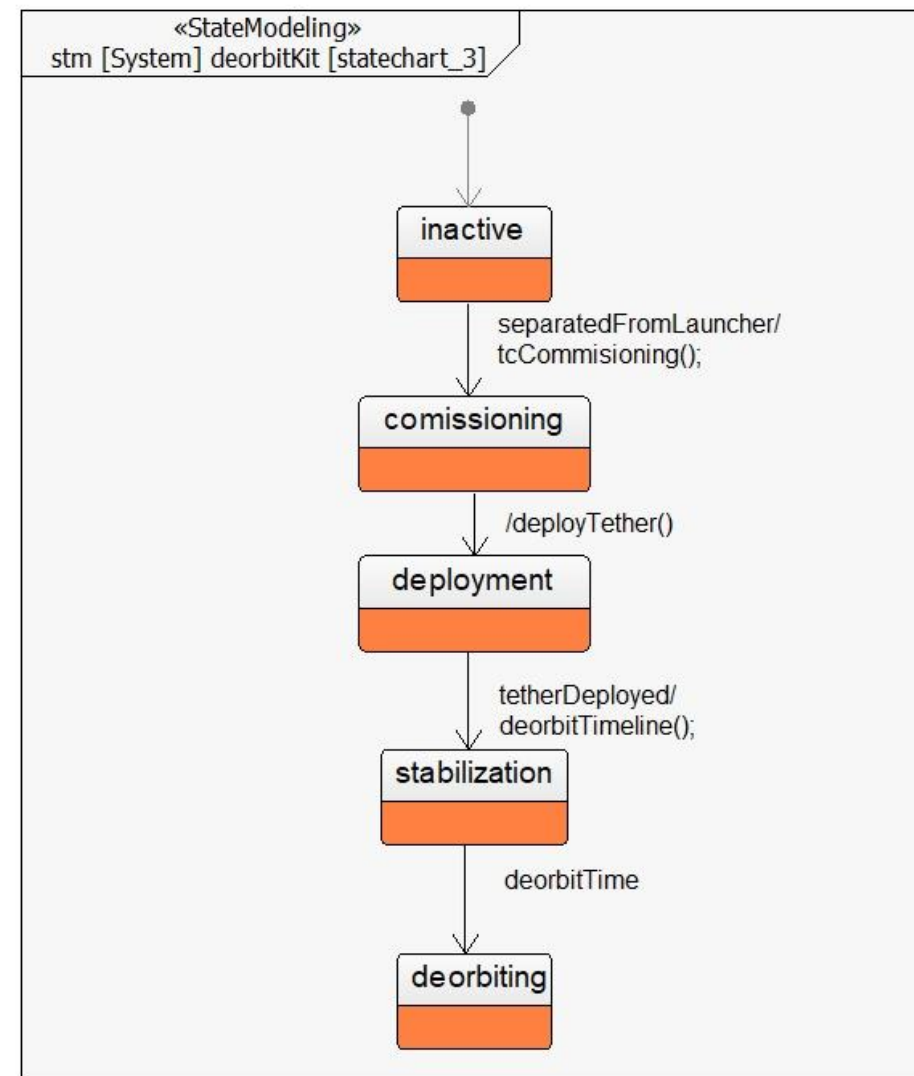
4. SysML Diagrams
Stachechart

Statechart:

"States of the system and transitions between states in response to event occurrences"
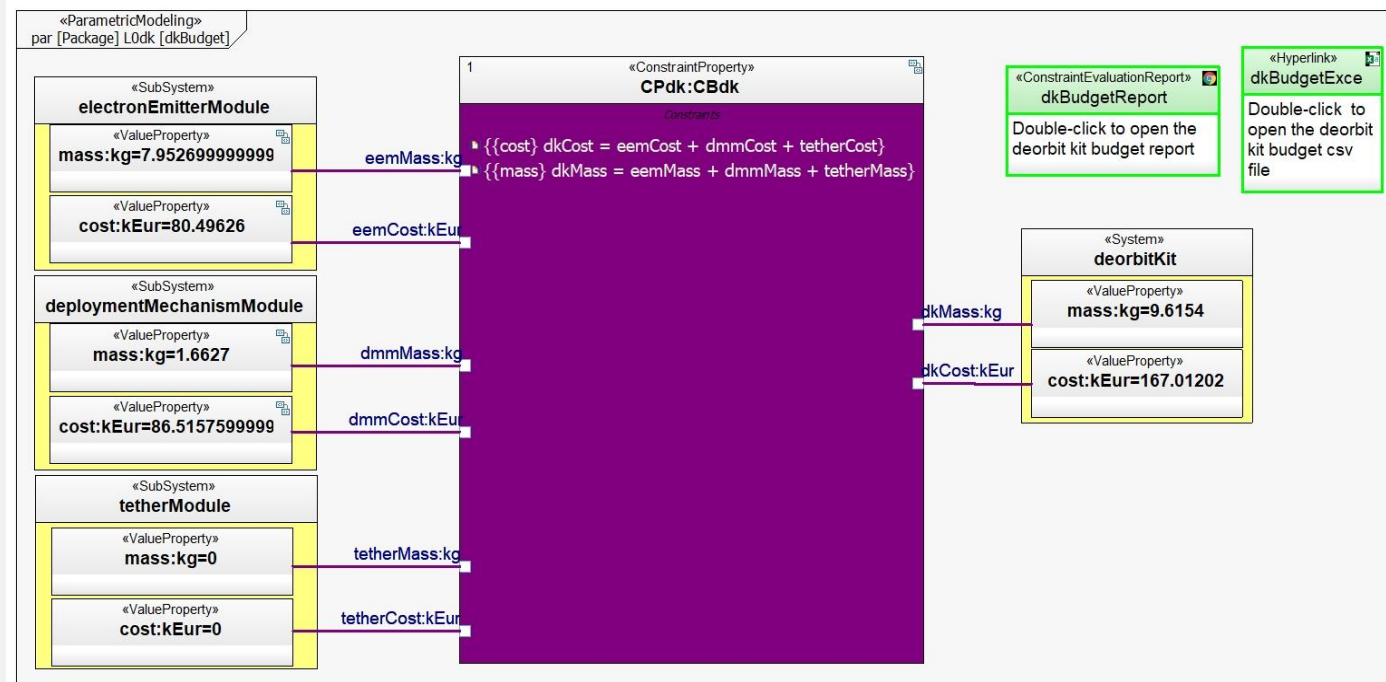
4. SysML Diagrams
Parametric Diagram

Parametric Diagram:

"Define mathematical expressions as constrains to perform evaluation with an external tool"
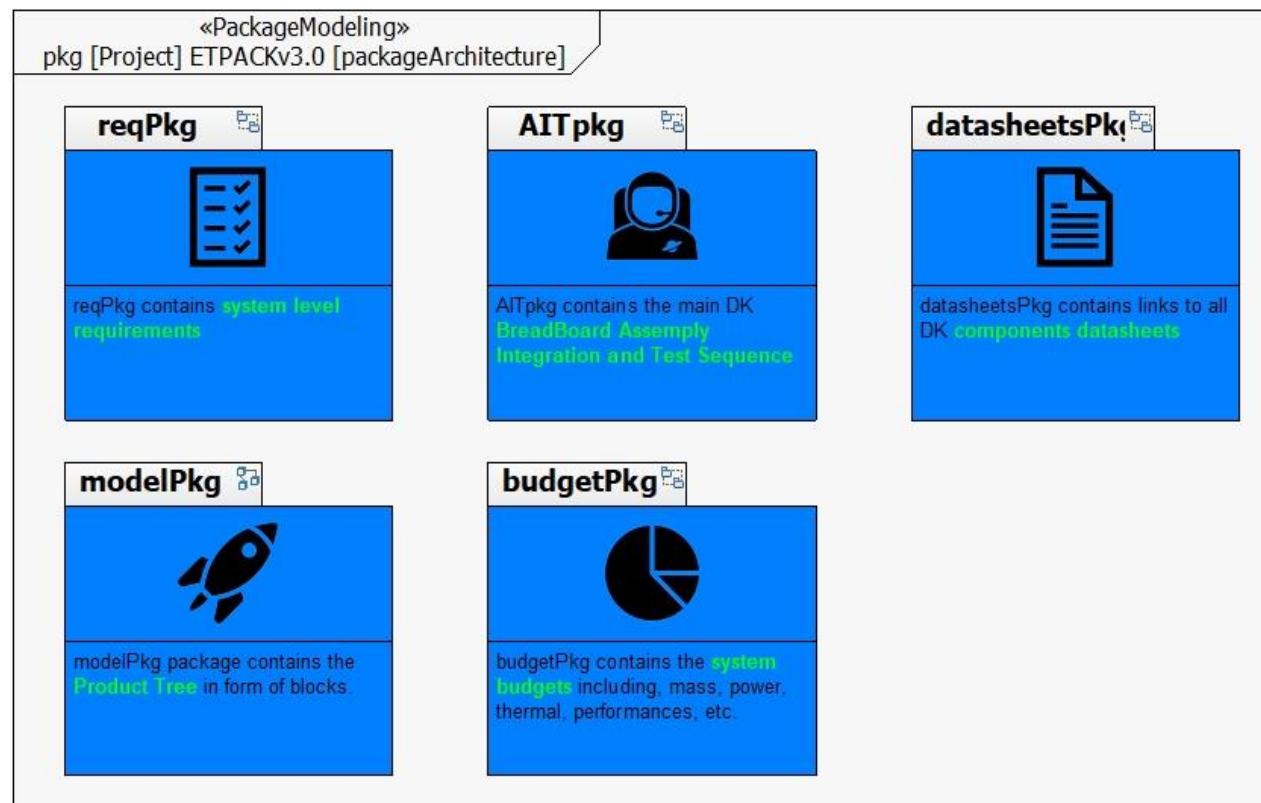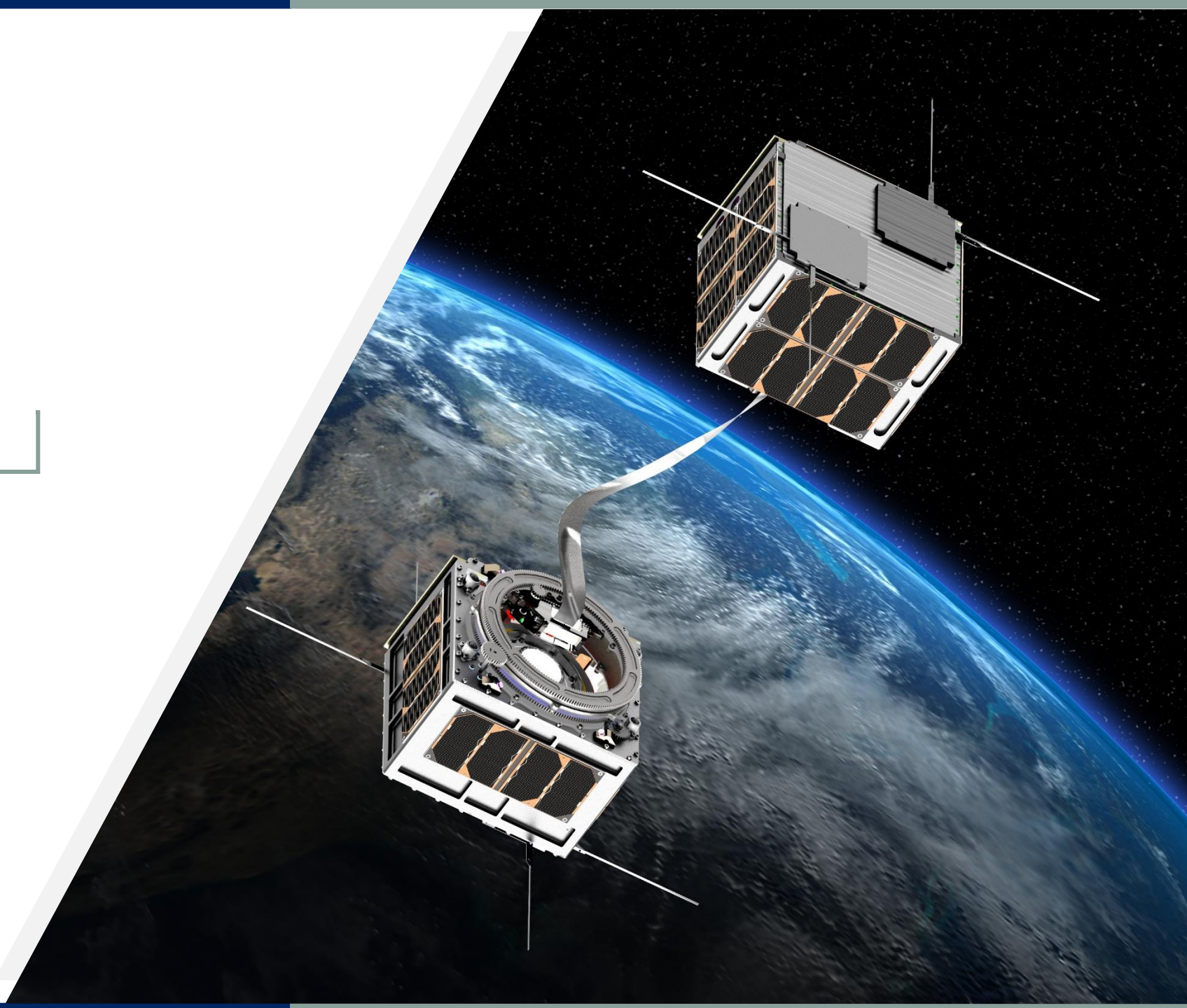
4. SysML Diagrams
Package Diagram

Package Diagram:

"Represent the model organization in cohesive groups"

«PackageModeling»
pkg [Project] ETPACKv3.0 [packageArchitecture]

reqPkg
reqPkg contains system level requirements

AITpkg
AITpkg contains the main DK BreadBoard Assembly Integration and Test Sequence

datasheetsPkg
datasheetsPkg contains links to all DK components datasheets

modelPkg
modelPkg package contains the Product Tree in form of blocks.

budgetPkg
budgetPkg contains the system budgets including, mass, power, thermal, performances, etc.
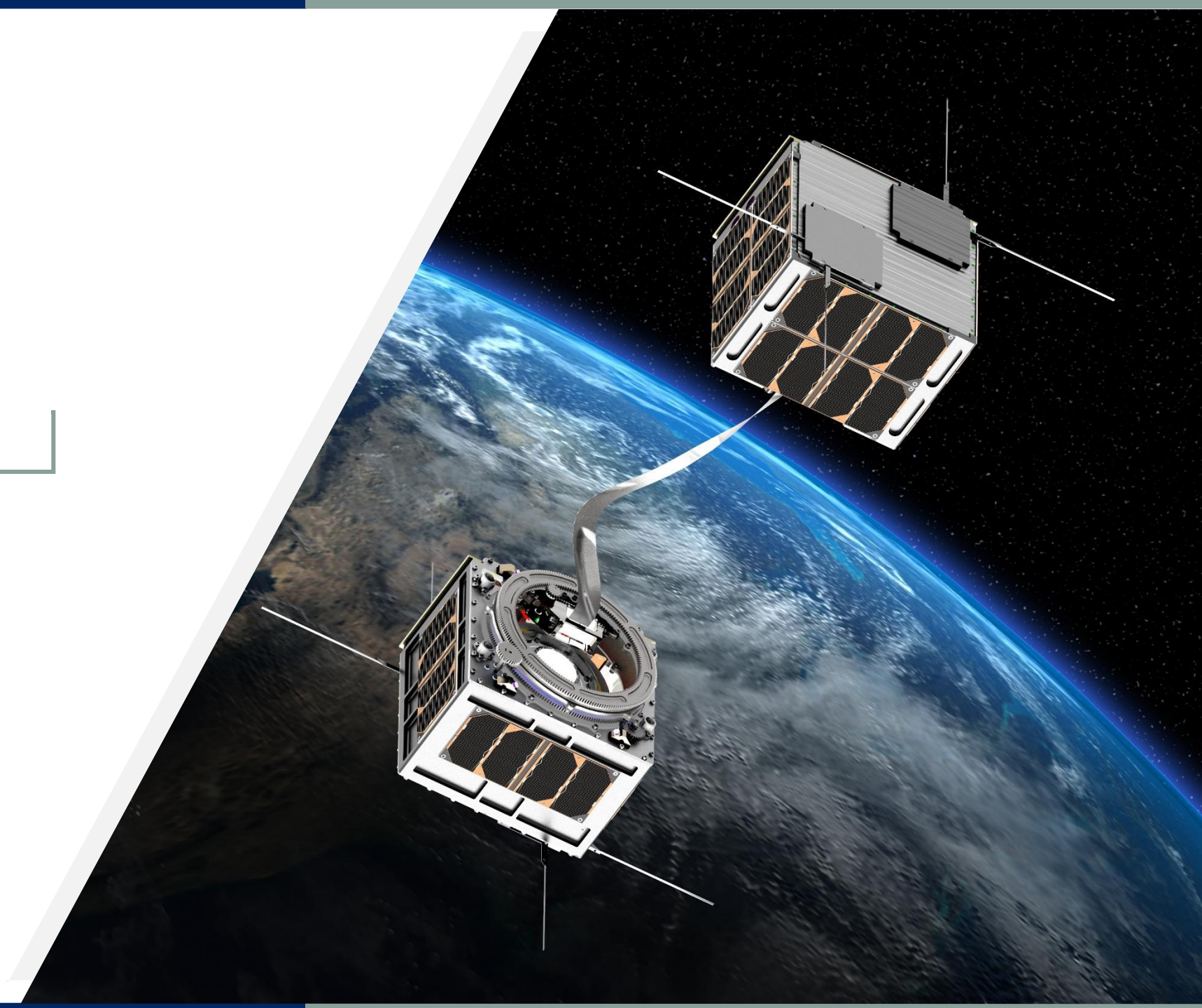
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5. Demo

5. Demo
Live Demonstration

3.2.1 entering the "Rhapsody" …

6. Conclusions

6. Conclusions
MBSE Approach

This presentation is focused on the SysML language and the IBM Rhapsody tool.

It provides a set of guidelines to start modeling following the MBSE approach

It goes through each of the 9 diagrams and their different elements and relationships among them. To do so, it describes the E.T.PACK project using IBM Rhapsody.

THANK YOU

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▶ www.youtube.com/user/senerengineering