

# Product line engineering methods to support model reuse

JL Marty, A Cortier : Airbus Defence & Space J Ly : IPSA 22/11/2022

**AIRBUS** 

### DEFENCE AND SPACE

This document and its content is the property of Airbus Defence and Space. It shall not be communicated to any third party without the owner's written consent Airbus Defence and Space SAS – All rights reserved.

See Page 2 for Export Control Information concerning this document's content

# **Export Control Information**

### This document contains EU or / and Export Controlled technology (data) :

🗌 YES

🔽 NO

### If YES :

### 1/ European / French regulation controlled content

- Technology contained in this document is controlled by the European Union in accordance with dual-use regulation 428/2009 under Export Control Classification Number EU 9E001. (1)
- Technology contained in this document is controlled by Export Control regulations of French Munitions List under Export Control Classification Number [AMA3]. (1)

### 2/ US regulation controlled content

- Technology contained in this document is controlled under Export Control Classification Number 9E515.a by the U.S. Department of Commerce
  Export Administration Regulations (EAR). (1)
- Technology contained in this document is controlled by the U.S. Department of State Directorate of Defense Trade Controls International Traffic in Arms Regulations (ITAR). (1)

Document shared under STA OneWe-UK-2019-083.

(1) See applicable export control license/authorization/exception in Delivery Dispatch Note. Dissemination is only allowed to legal or natural persons with right to know who are covered by an appropriate export license/authorization/exception.

This document and its content is the property of Airbus Defence and Space. It shall not be communicated to any third party without the owner's written consent





DEFENCE AND SPACE

# Summary



**AIRBUS** 

# Request from projects

### MBSE yes but shall support our way of working

- 1. Don't want to start from blank page
- 2. Support change on previous design to satisfy the need .
- 3. Need to reuse previous programs material and make change
- 4. Need to ensure answer to the need
- 5. Discipline architects collaboration around THE solution defined is key

### **MBSE** added value in reuse

- 1. Formalize knowledge and offer a mean to reuse formal definition
- 2. Use a formal description with capability to select elements and make changes
- 3. Formalize the variability accessible in solutions with coherency in the description
- 4. Support functional approach to be agnostic to technical solution
- 5. Only one truth : the definition model to support collaboration

This document and its content is the property of Airbus Defence and Space. It shall not be communicated to any third party without the owner's written consent 4 Airbus Defence and Space SAS – All rights reserved.



# Reuse model starting project : key elements

### **Technical proposition**

- 1. Propose a « generic functional model » definition with all available functions implementation agnostic
- 2. Propose definition of all generic logical components embedding generic functions with logical architecture proposition.
- 3. Propose definition of Technical components library based on generic Asset with a technical architecture\*

### **Constraints associated to variability**

- 1. Need to be capable to select only what is compliant with project need
- 2. Need to be capable to tune model from project selection
- 3. Need to be capable to select equipment from product line catalog answering to the need\*

### Constraints associated to long time usage

- 1. Need to define a process to enrich generic definition with project RETEX
- 2. Need to define a governance for models management
- 3. Need to define a model organization to support model governance





5 Airbus Defence and Space SAS – All rights reserved.

\* (future : not covered for the moment. Shall be align with DDMS@space architecture)





# Chosen approach : MOFLT<sub>®</sub> +PLE technics

### > MOFLT © {Airbus framework}

- ✓ Mission and Operation not considered for the moment
- ✓ Define functions to identify what system shall do
- ✓ Define logical component embedding function and component exchanges
- ✓ Possible extension by defining technical component part of the product line\*

### Product Line Engineering Technics

- ✓ Define variability on system definition
- ✓ When necessary define a configuration answering to a need
- ✓ Use the defined variant to support a project

This document and its content is the property of Airbus Defence and Space. It shall not be communicated to any third party without the owner's written consent Airbus Defence and Space SAS – All rights reserved.

\* (not covered for the moment Shall be align with DDMS@space architecture)







# Way of working chosen

### Define part of a generic platform functional chain by functional chain



### DEFENCE AND SPACE

Classical approach

Added for reuse

# **Functional definition**

- Define functions independently to implementation
  - -What my system shall do
  - Identification of all functional exchanges
  - Provide mean to allocate function in different way depending on architecture
- Hierarchical approach
  - -Manage complexity
- -Stop when function could be allocated to logical component
- Consider all functions used on our design
  - -Functional description shall have the right level to be generic
  - -Functional description shall take into account all possible usages
- Functional description shall cover all common needs

# Bit Planton (Generate decirical power (Generate electrical power from photons ) IN\_Planton IN\_Planton IN\_planta IN\_plan



# Logical definition

- Define components with main target "end user" interests
  - Component host functions and have Logical interface to support functional exchanges.
  - -Logical Interface definition is limited to function exchanges
- Logical architecture describes end to end exchanges and shall be agnostic to the communication means
- Consider all components and variability used on our design
  - Alternative between logical components hosting same function with different implementation
  - -All necessary logical components for our system design



AIRBUS

This document and its content is the property of Airbus Defence and Space. It shall not be communicated to any third party without the owner's written consent

Added for reuse

# Technical definition\*

- Define components part of the PBS & system configuration with components configuration
- Technical components implement logical components
- Technical path used to define how a logical connection is performed using technical connections
- "Interface end" definition is limited to function exchanges (coming from logical definition) supported and the interface end type (ANF, ANA, 1553, ...)
- Consider all components and variability used on our design based on catalog\*



# Technical path usage with моFLT®



11 Airbus Defence and Space SAS – All rights reserved.

### DEFENCE AND SPACE

# How to manage variability\*

- Use Product Line Engineering concepts : feature model & Variation point
  - Feature model to define Feature status
    - Options : possible to use or not
    - Mandatory : required structure usage based on multiple composite choices
    - Exclusive : required but only one in front of N
    - OR : required but at least one in front of N
    - Parameter : associate a value to a parameter
  - Variation point
    - Define a relation between a model object and a feature
  - Feature selection = define a configuration
    - configuration used to get only requested elements based on Variation point



\* (deep dive in variability management not supported in this presentation it is just an over view)

This document and its content is the property of Airbus Defence and Space. It shall not be communicated to any third party without the owner's written consent Airbus Defence and Space SAS – All rights reserved.



# Generate variant for usage with CAMEO MBPLE plug



Based on

## Define Configuration table



# **Conclusion & Usages**





Tested with success on Project Ariel model for



# Way forward

- Identification and modeling other generic functions to reach a model for generic platform (part of) based on 1rst level of platform generic FBS
- Use new generic functions on project for use case validation
- Define and develop validation rules for variant analysis
- Extend variability usage for trade off activity and usage for other engineering data

– **Application** : Generic power for SAVOIR



# Thank you, any questions ?

