Applying UAF and the Airbus MBSE Framework within Future Combat Air System Development

DEFENCE AND SPACE

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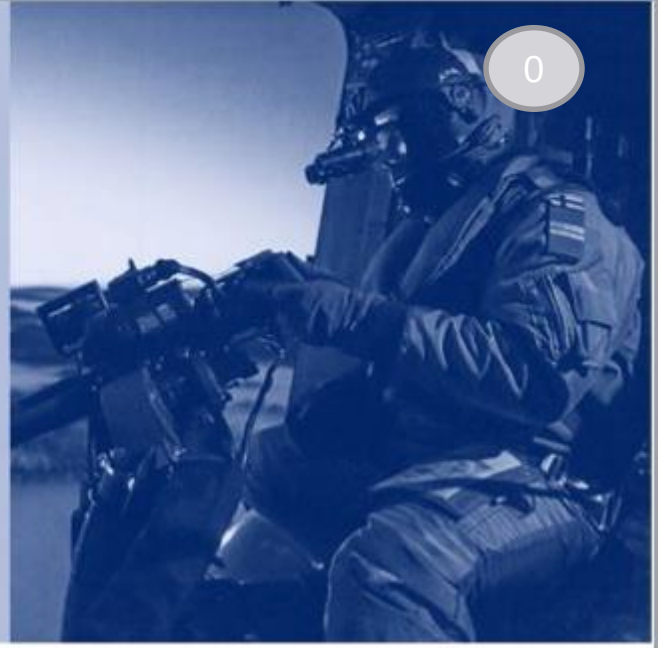
Applying UAF and the Airbus MBSE Framework within Future Combat Air System Development

1. Context
   a. Airbus Defence & Space & FCAS
   b. Digital Collaboration in FCAS
2. Rationale for using both frameworks
   a. According to the main frameworks objectives: SoS versus System levels
   b. Company SE guidelines versus customer requirements on deliverables(FR GE Spain MODs)
   c. UAF for Mission, Operational and Services architecture
   d. MOFLT for low-level systems details including simulation
3. Challenges & solution approach
   a. Several metamodels ==> how to mitigate the confusion of modelers, readers, reviewers?
   b. How to ensure the consistency btw models in different frameworks?
   c. Multiformat deliveries versus 1 source model: the need for interoperability standards

4. MBSE and extended enterprise : EUREcA

5 conclusions and outlook.



WHAT WE DO?

PIONEERING SUSTAINABLE AEROSPACE FOR A SAFE AND UNITED WORLD.

Airbus always has been at the forefront of innovating new technologies, with a pioneering spirit that has redefined the aerospace industry. Our products bring people closer together, helping them unite and progress. We strive to continually push the boundaries on what is possible to safeguard our world for future generations.

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1 FCAS: THE System of Systems Project

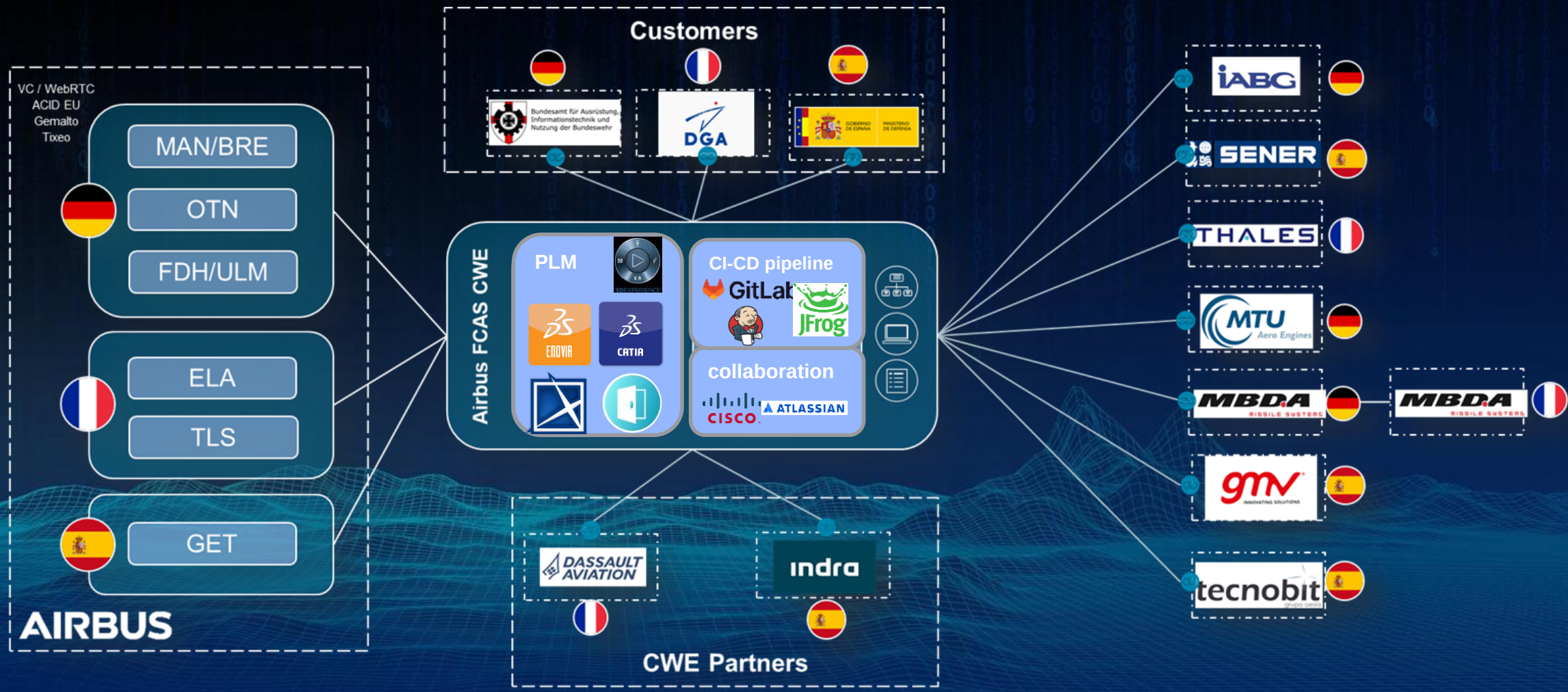
Beyond the capabilities and behaviors of each system (vehicle), the capabilities and behaviors of the **connected systems** define the performance of the mission.

FUTURE COMBAT AIR SYSTEM

Demonstrators	Industrial Partners Germany	France	Spain*
Next Generation Fighter	AIRBUS	Safran	AIRBUS
Remote Carrier	AIRBUS	MBDA	SENER / tecnobit / gmv
Combat Cloud	AIRBUS	THALES	AIRBUS / indra
Next Generation Engine	MTU	SAFRAN	ITP Aero
Sensors	FCMS	THALES	indra
ELO	AIRBUS	Safran	AIRBUS

FCAS: Future Combat Air System.

3 FCAS Common Working Environment (CWE)



FCAS collaboration between System Development partners based on a military restricted cloud.

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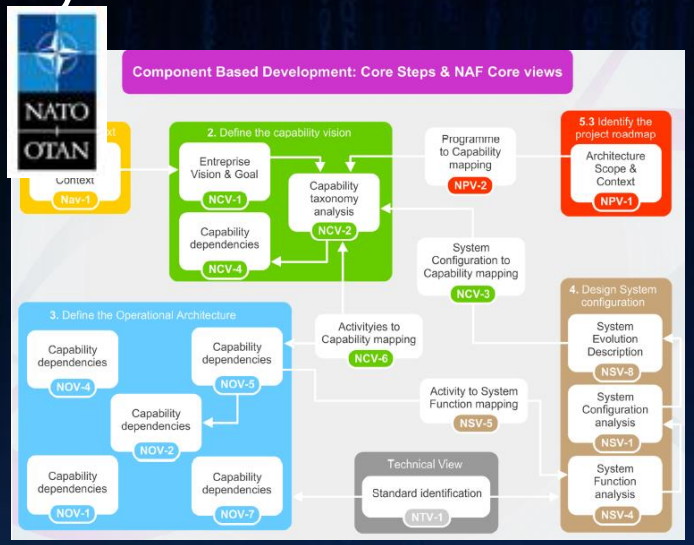
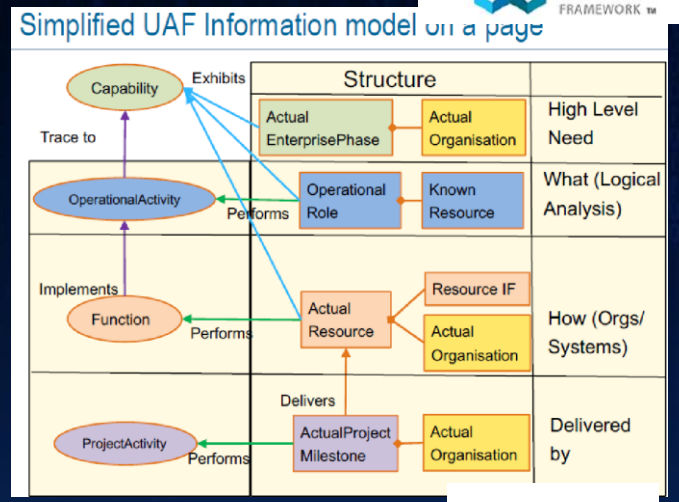
The Needs for Multiple Complementary Architecture Frameworks

- Typical architecture frameworks (AF‘s) as defined by ministries of defence (NAF, MODAF, DODAF and now UAF adopted by OMG) provide precise semantic constructs especially for **capability acquisition**.
- Being a **relevant concern** at the level of **system of systems** (SoS), the **needs** are **more oriented towards to physical aspects** as far as we dive into the system details.
- As a conclusion **Airbus DDMS decided to develop an autonomous but still complementary Systems Engineering Framework (MOFLT)** on the base of SysML taking best breed from other analyses AF.





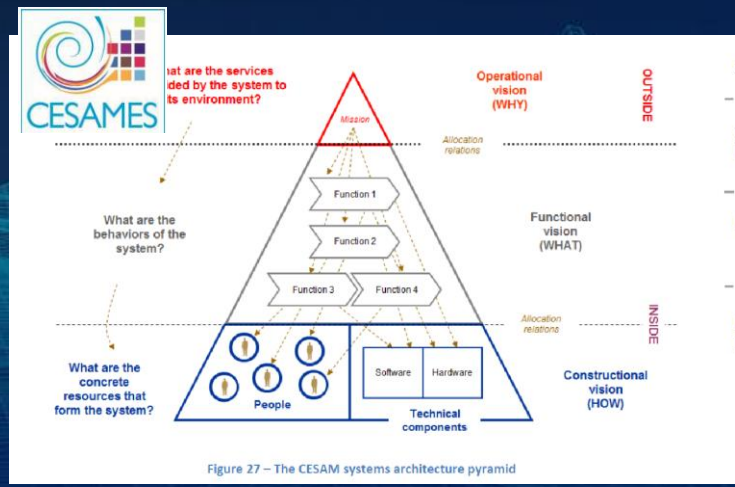
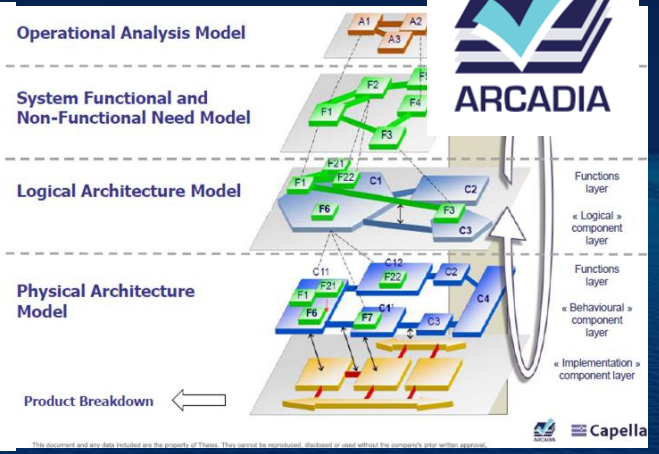


Figure 27 – The CESAM systems architecture pyramid

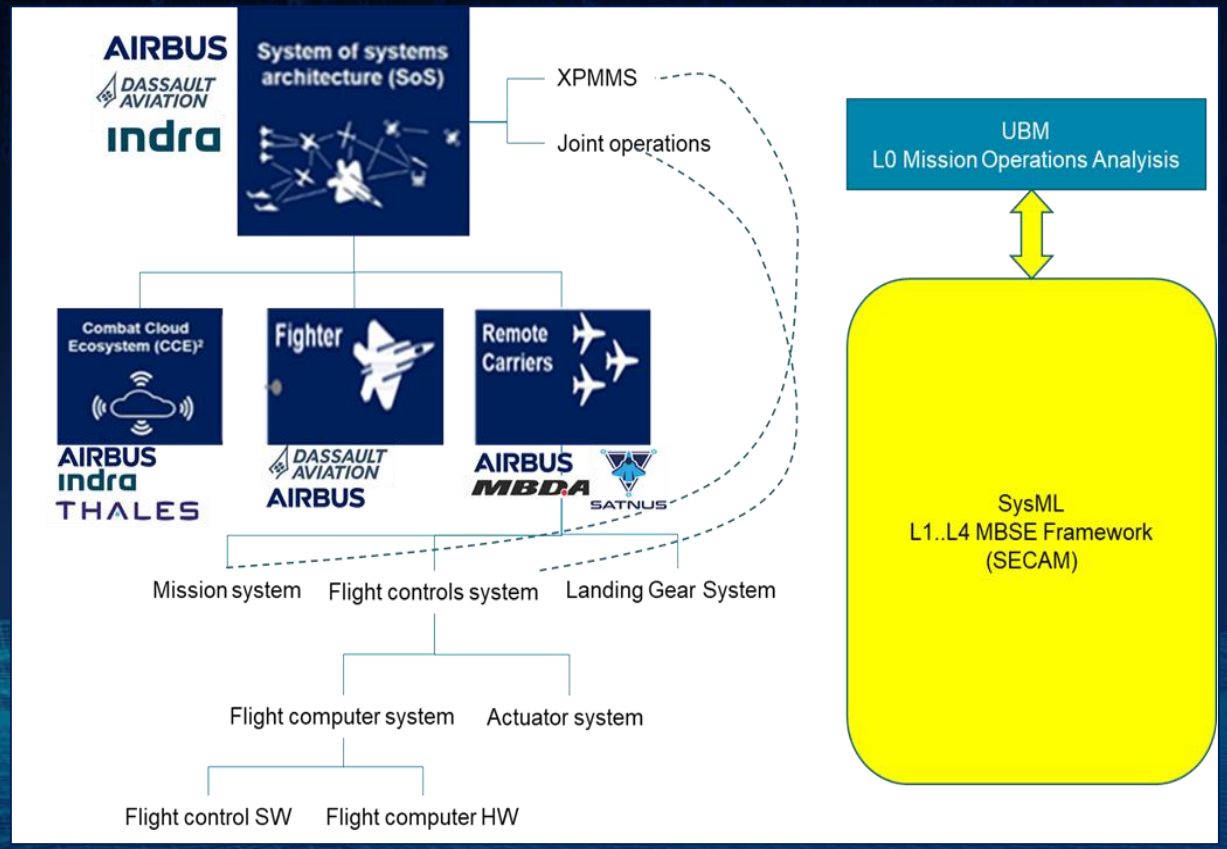


Combined usage Airbus MBSE Framework and UAF

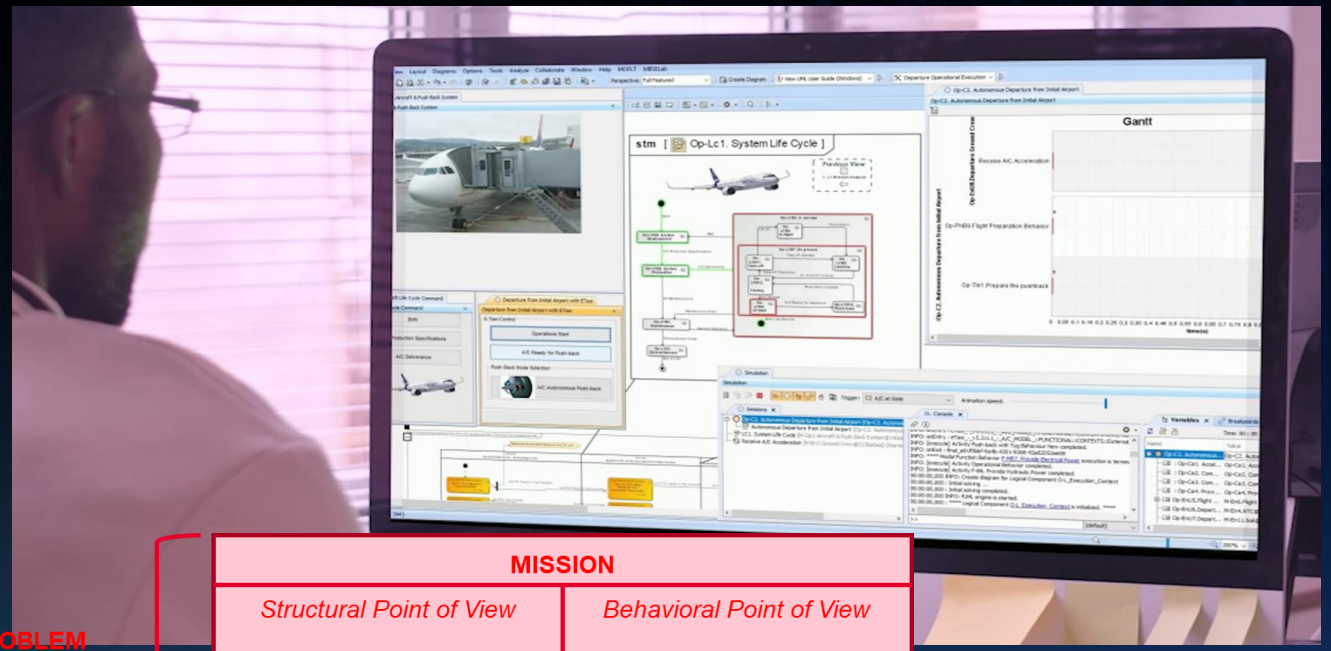
Since the customers expect the System of Systems Level (L0) of FCAS to be delivered as NAF models in different versions, it was decided to use the UAF profile.

However on the System design levels (L1, L2…) the usage of the Airbus MBSE Framework (MOFLT) is preferred in order to take advantage of the advanced modelling capabilities on the F,L,T view and link into the 3D Experience platform and take advantage of the parametric modelization and link into simulation tools.

As a consequence the challenge comes up to ensure a model consistency between the UAF and MBSE Fmk model.



3 The Airbus MBSE Framework (MBSE Fmk)



PROBLEM SPACE

SOLUTION SPACE

MISSION	
Structural Point of View	*Behavioral Point of View*
OPERATIONAL ARCHITECTURE	
Structural Point of View	*Behavioral Point of View*
FUNCTIONAL ARCHITECTURE	
Structural Point of View	*Behavioral Point of View*
LOGICAL ARCHITECTURE	
Structural Point of View	*Behavioral Point of View*
TECHNICAL ARCHITECTURE	
Structural Point of View	*Behavioral Point of View*

- **Method:** Tool & Language agnostic / Based on SE technical Processes
- **Handbook:** Tool : CAMEO & Language : SysML / Based on Method
- **Plugin**: CAMEO customization aligned with Handbook & *SysML implementation of SECAM*
- **Example**: illustration of Method & Handbook application on a concrete example
- **Training** : Presentation & Application of the MOFLT framework on a case study

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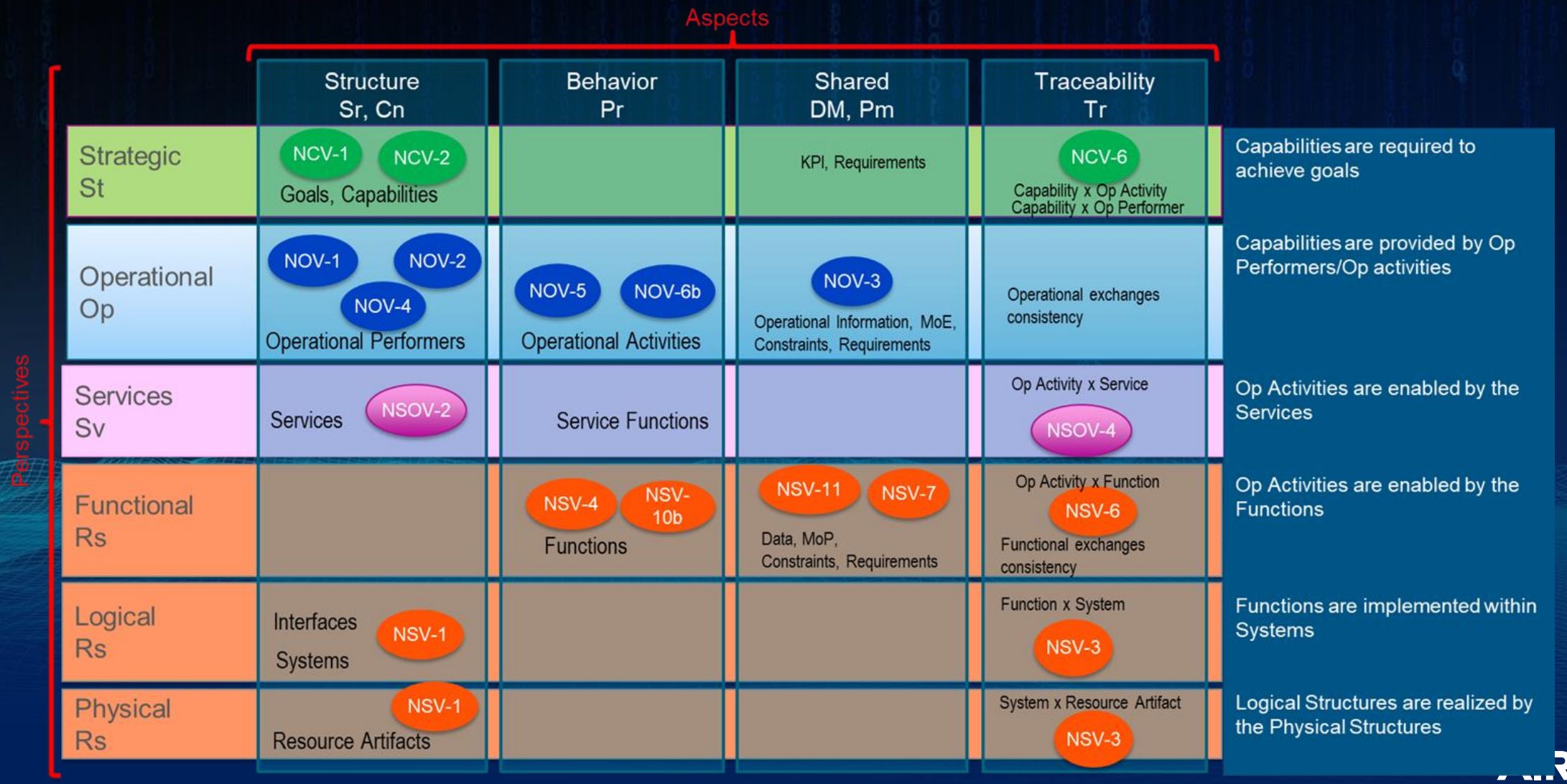
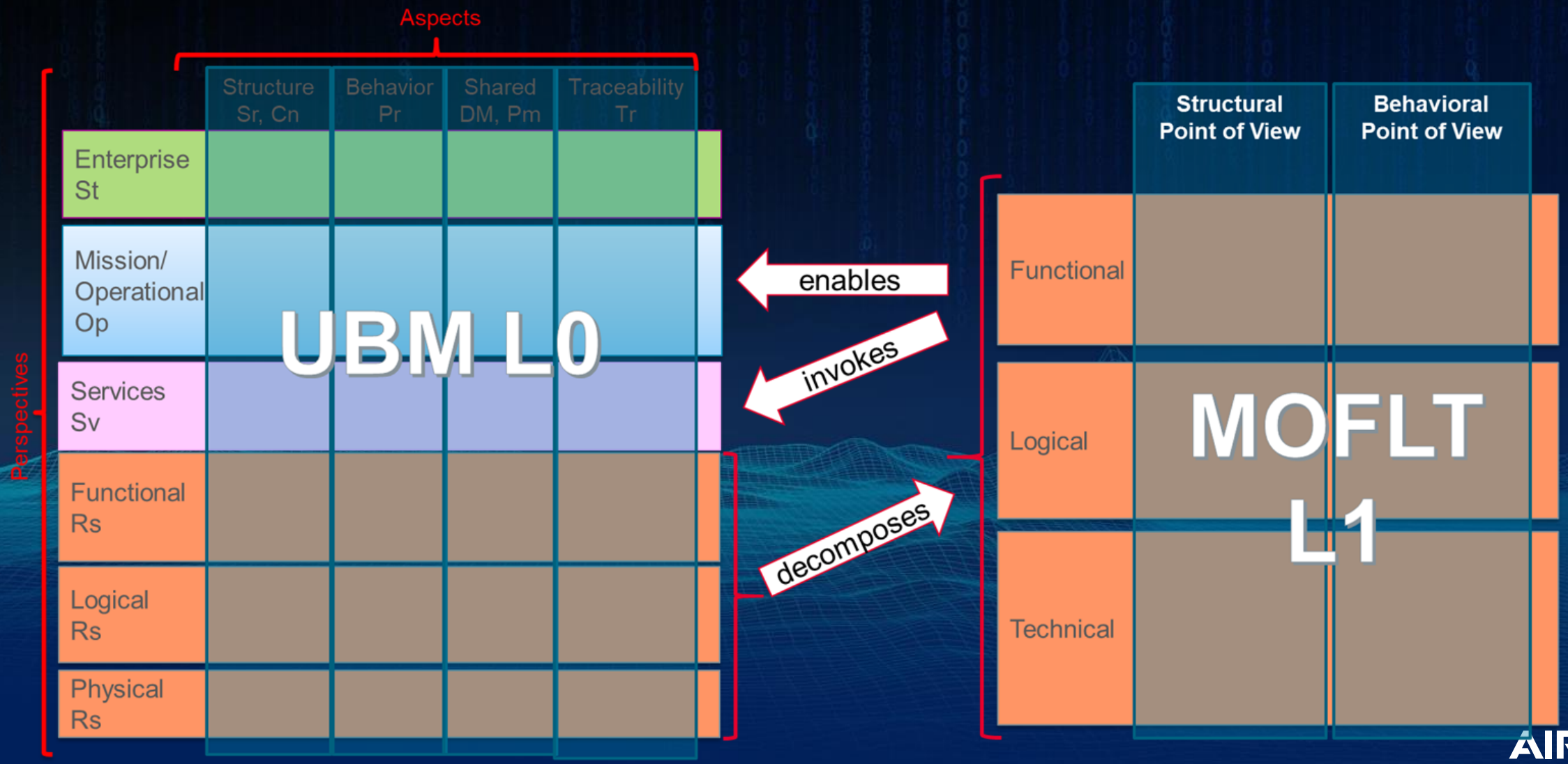
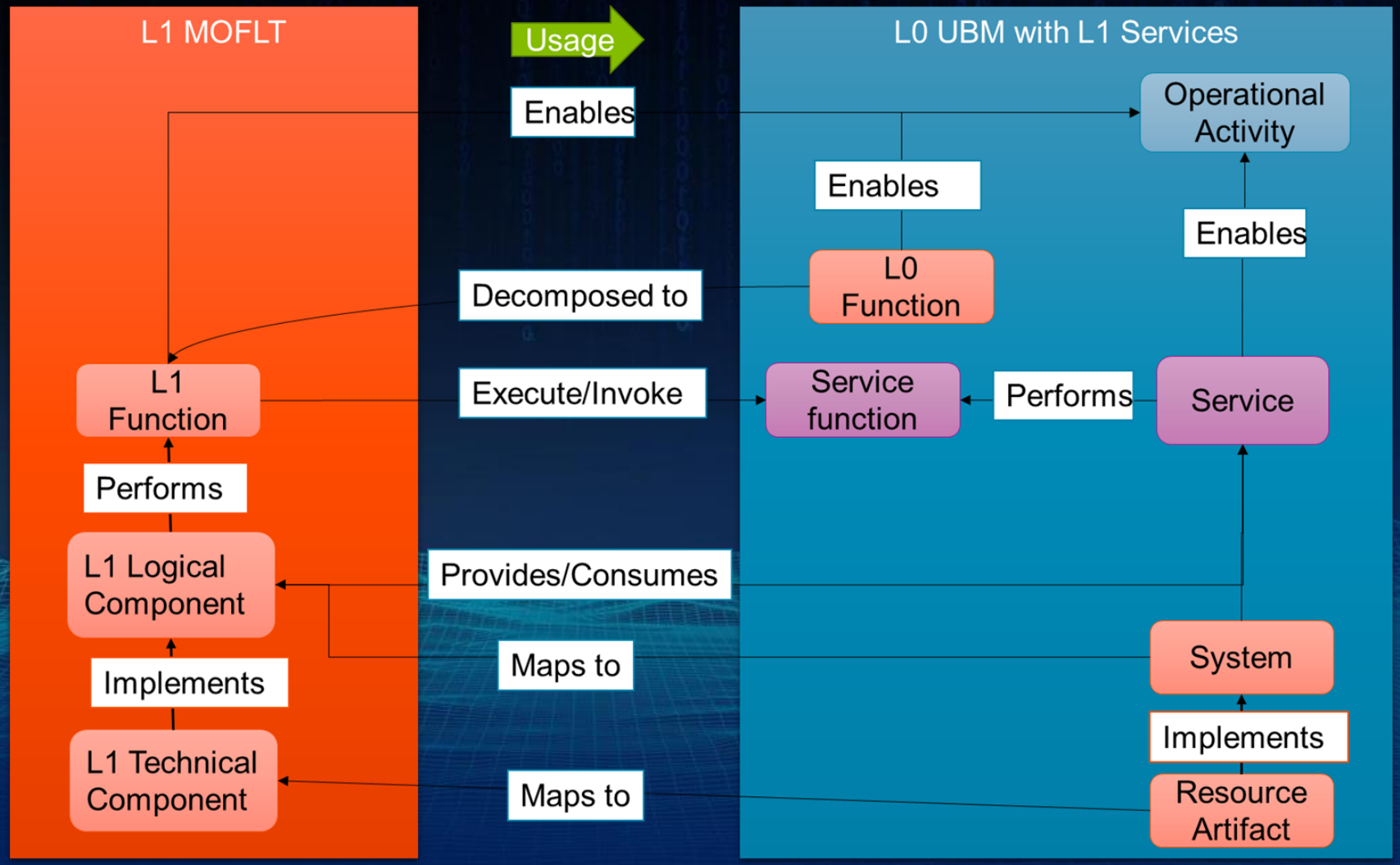
UBM Grid and related NAF 3.1 Views



Transition from UBM L0 (SoS) to MBSE Fmk L1 (System)



Traceability between UBM model elements with MBSE Fmk elements



MOFLT
L1 Functions

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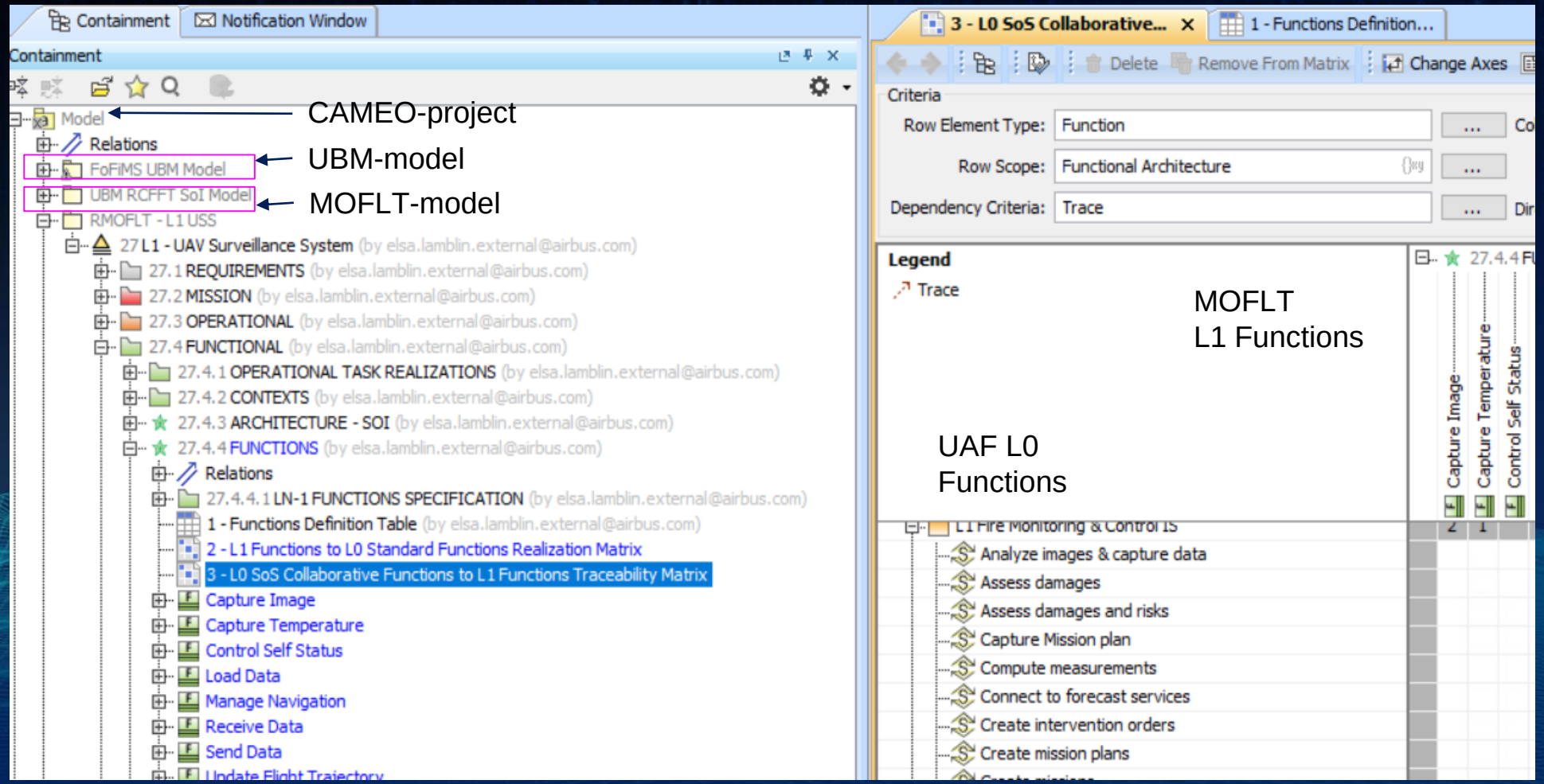
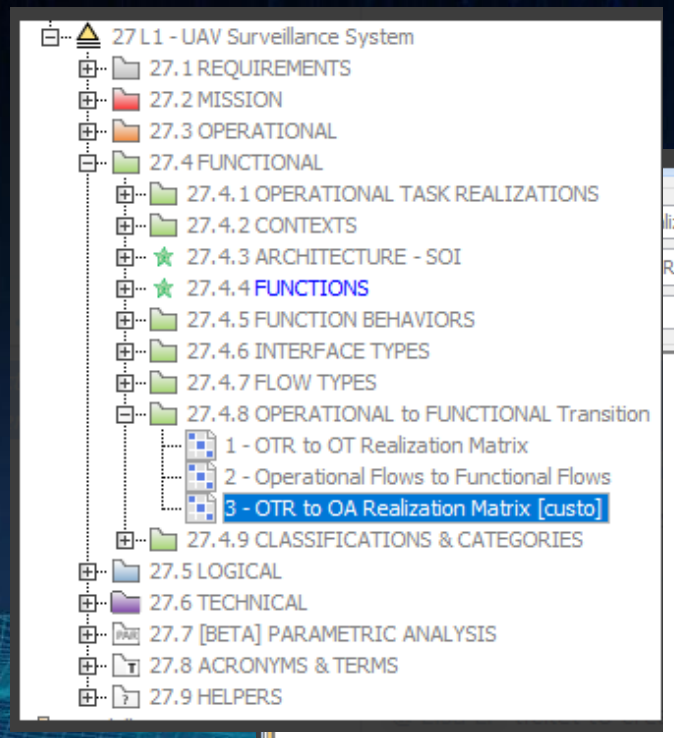
Traceability between UBM model elements with MBSE Fmk elements

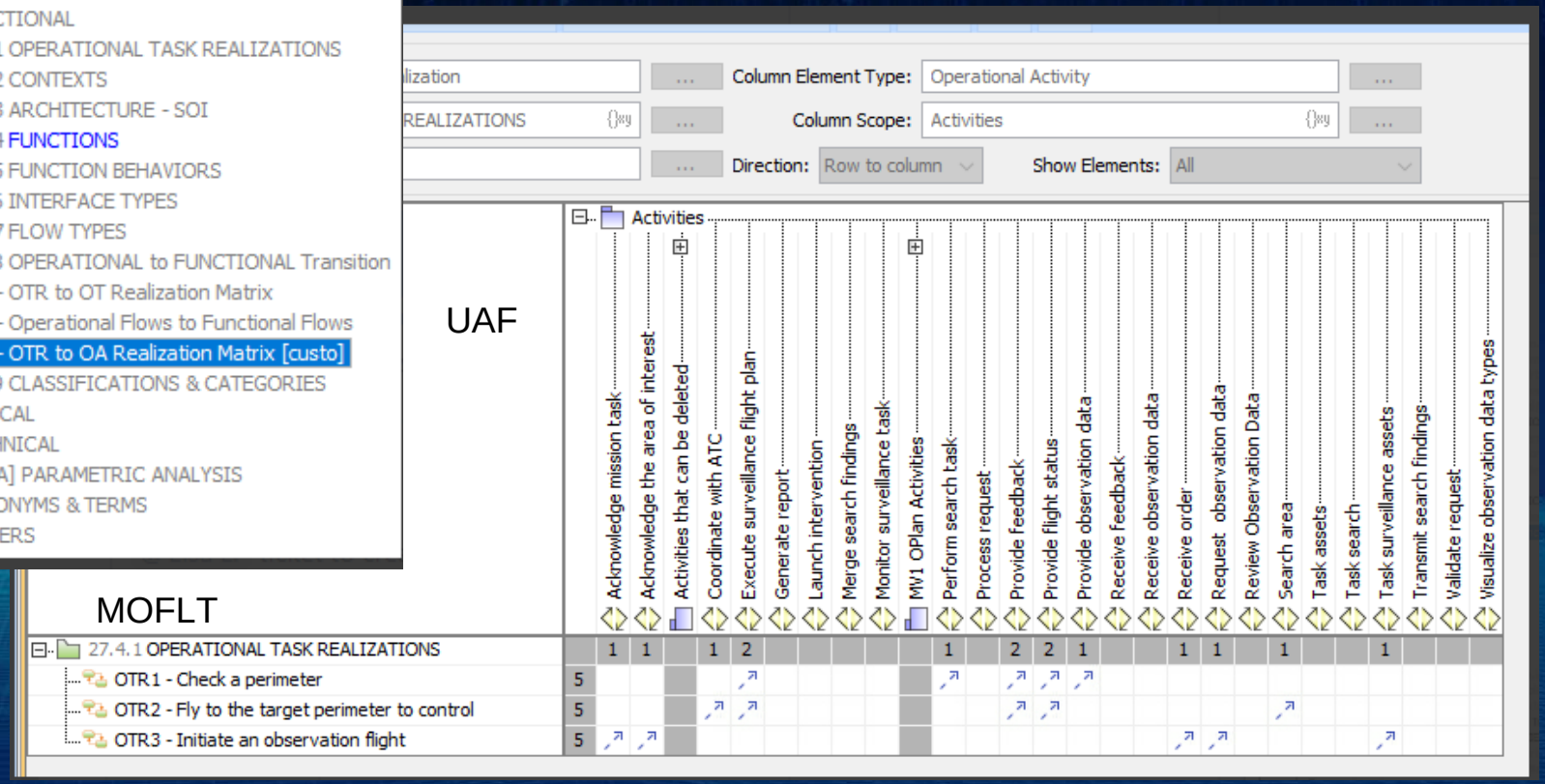
Example 1
MOFLT L1 Functions to the UBM L0 functions in L0 SoS



Traceability between UBM model elements with MBSE Fmk elements

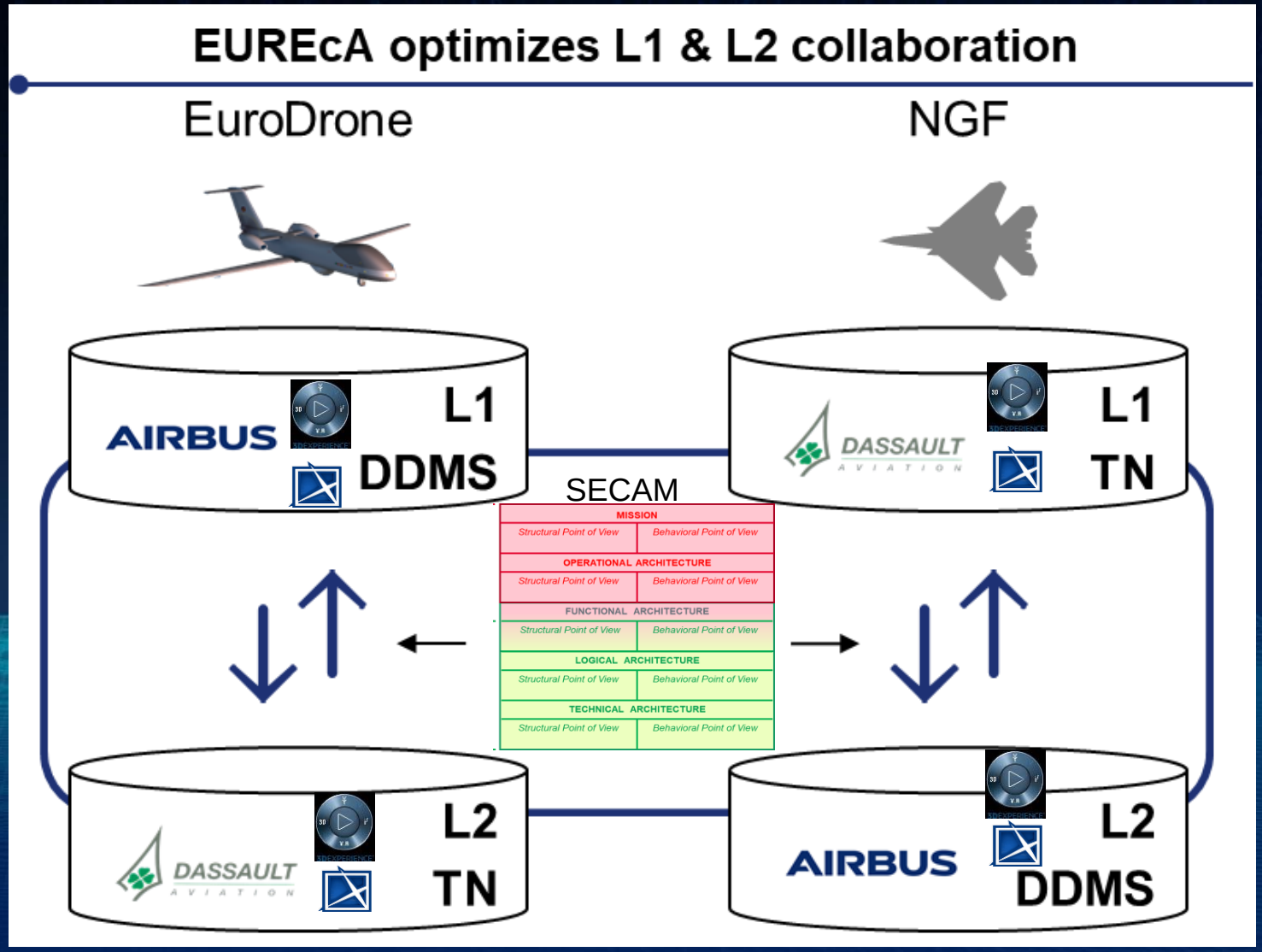
Example 2
MOFLT OTR to the UBM Operational activities in overall L0 SoS





3 the **EUREcA approach with Dassault aviation**

- ***EUR**opean **Ec**osystem for **A**erospace & Defence is a joint initiative between Dassault Aviation and Airbus with Dassault Systemes to provide 3D Experience PLM solutions*
- Agreed Data Model SECAM with Dassault Aviation for Eurodrone and FCAS Next Generation Fighter
- Aligned common collaboration principles and cross company collaboration architecture
- Application of the EUREcA aligned approaches in Eurodrone and FCAS programs



conclusions & way ahead

Huge systems of systems (SoS) projects involves **multiple contributors and customers** (e.g. MoDs).
Each partner comes with its own method, tool set, and **frameworks**.
The customers are often **imposing standard frameworks** (e.g. UAF).

Each **AF addresses dedicated concerns**: capability acquisition (UAF), system evaluation (MOFLT), …

Conclusion: There is a **need to use multiple frameworks**.
However, **global consistency is still to fulfill and** thus traceability mechanisms **shall traverse the different AFs**.

Combining multiple AFs is possible today.
The common **SysML foundations helps** that.

A **particular attention** shall be paid to the **notions overlapping the different AFs**.
The different vocabularies addressing common purposes **could confuse the users**.
Transparent **“translation”** mechanisms are **required**.