

MBSE at the heart of Airbus Digital Transformation

Model Based Space Systems and Software Engineering World
Congress

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(France)



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AIRBUS

Airbus mission

Pioneering aerospace for safe and sustainable world



Sustainability!

Airbus strong engagement to a **decarbonized future**: a new Airbus aircraft which will use hydrogen as a primary power source to be the world's first zero-emission commercial aircraft could enter into service by 2035.

Digitalization is key!

“The next generation of Airbus products will be **“digital natives”**, in terms of **data generation, connectivity, end-to-end digital backbone**, to enable the design of the product, its industrial system and the support in operation”

Airbus Digital Transformation program: DDMS

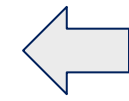
INCOSE

Vision 35
Aviation Engineering

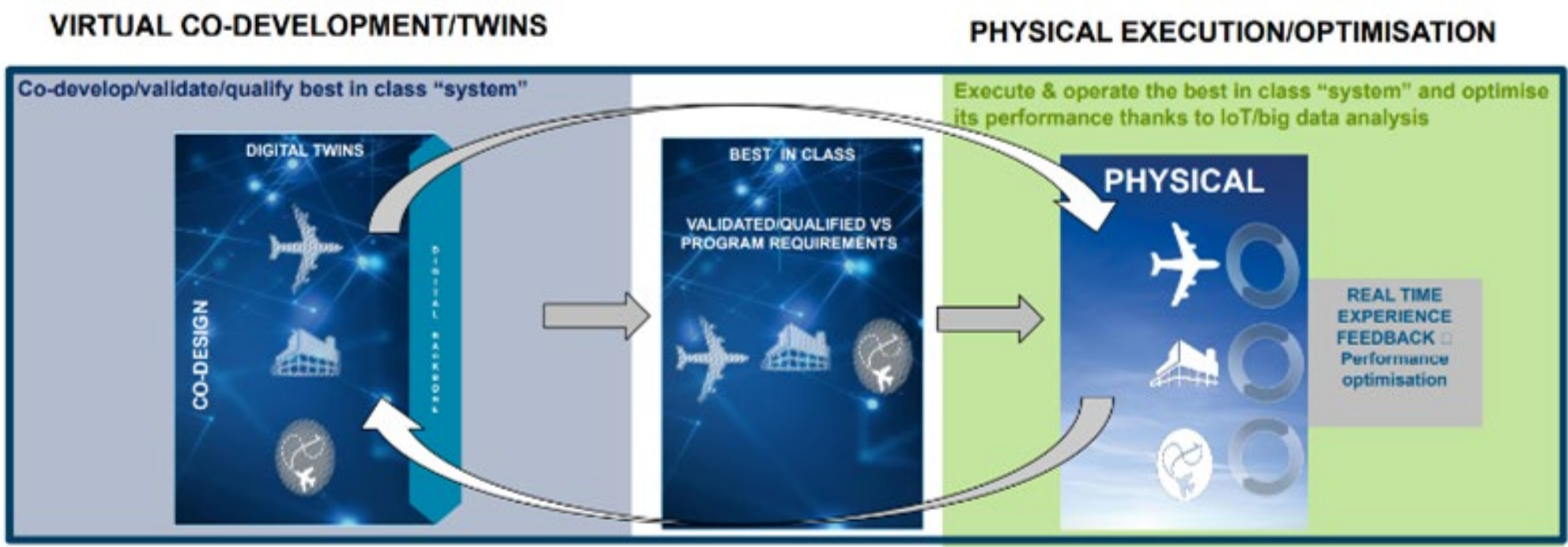


Digital Design
Manufacturing and Services

Rethinking the way we are designing and operating our products ensuring the co-development of the product/the industrial system/the ways to operate with customer satisfaction & services ambition at the heart of DDMS



- leverage advances in digital technologies
- modeling standards to enable rapid exploration
- provide seamless exchange of information with other disciplines and their tool environments
- Systems engineers partner with machines to combine creativity and automation in a robust and agile design process.



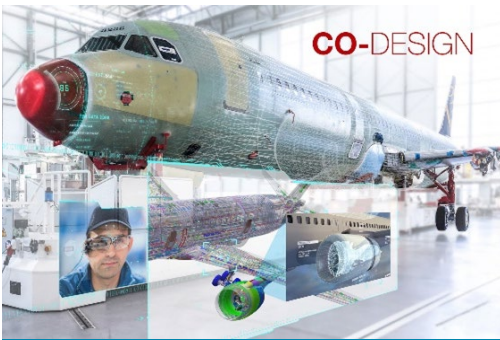
DDMS five pillars

Transformation & competences

Identify and develop key skills and competences to the business and existing programmes

Modelling and simulation

Allow to have a virtual world to be able to model and simulate the A/C, the industrial system and services



Co development & Integration

Make all the disciplines (engineering, manufacturing, customer services, supply chain of the partners) working together in a single process and single environment

Digital continuity

Every time you change a data everybody get access to this data and know what is the impact of the modification we have done on the complete tool chain



Product line

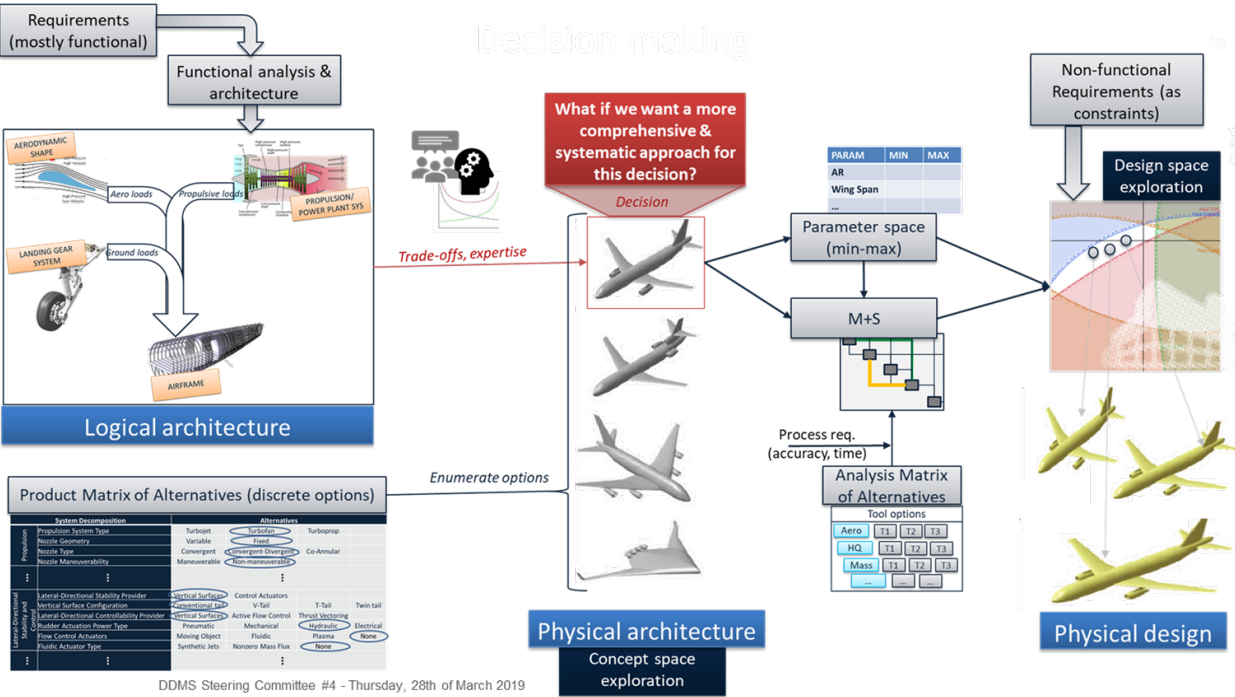
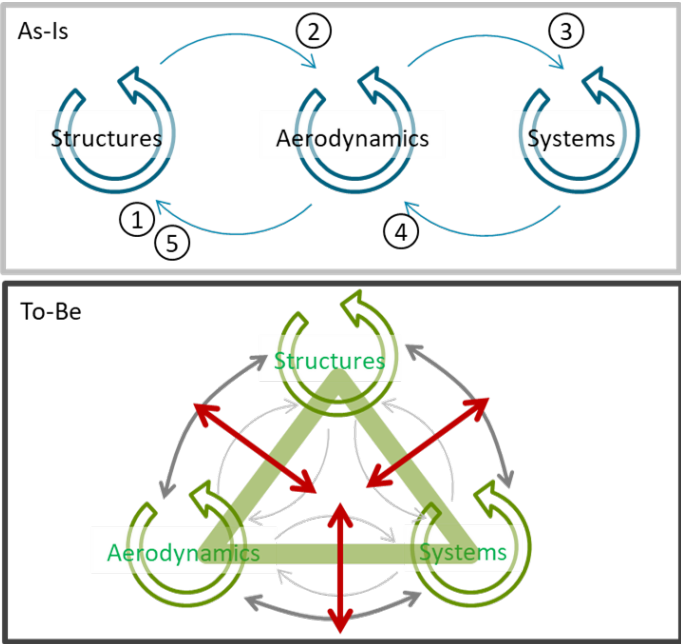
Find a way to produce the A/C in order to reuse parts



 5 pillars provide capabilities to the business to create value

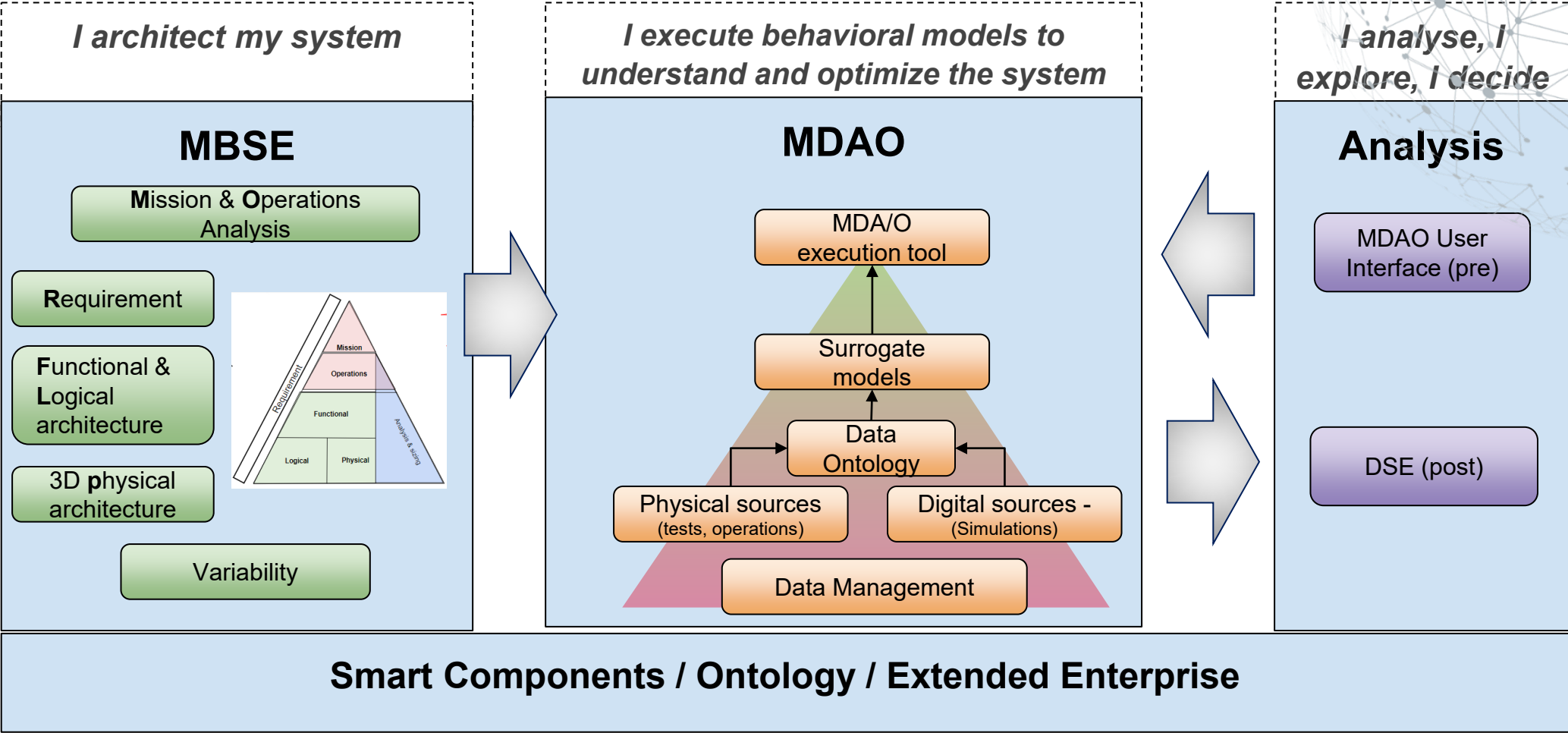
Complex MDA-MDO powered by MBSE

in Airbus MBSE play a more critical role than what it has been its first main goal to provide a modelling approach for mission/operation/functional and logical architectures. The fundamental concept for a model-based approach to enable an overall multi Sol optimization



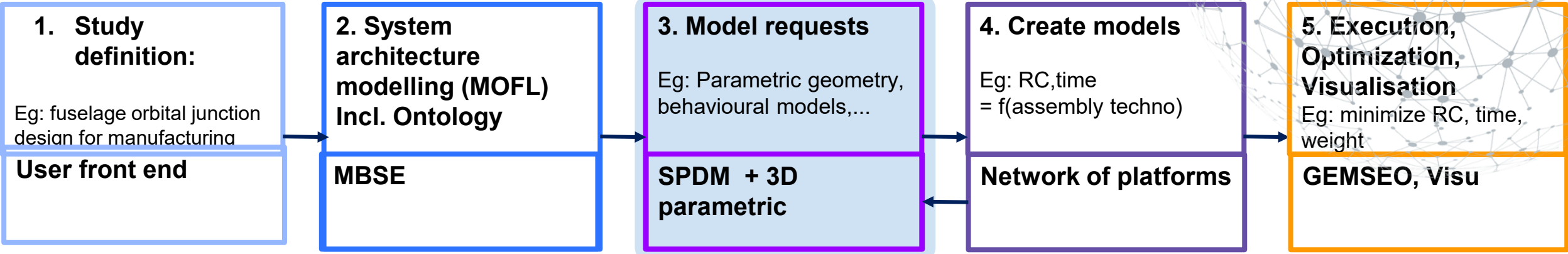
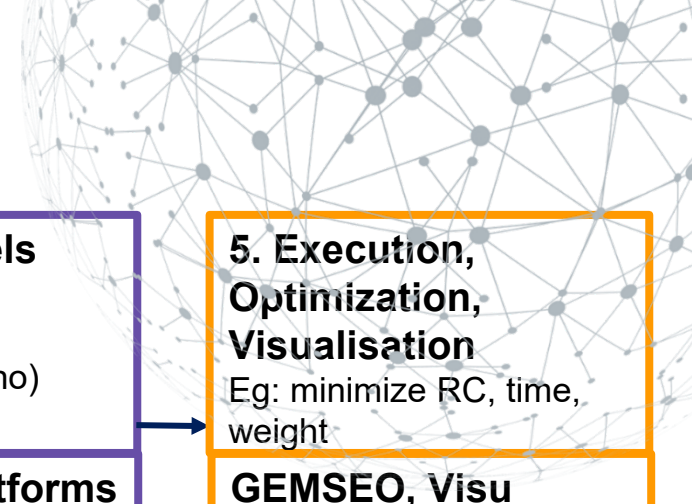
DDMS Steering Committee #4 - Thursday, 28th of March 2019

MBSE to enable Multi-disciplinary optimization



For a Globally optimised product

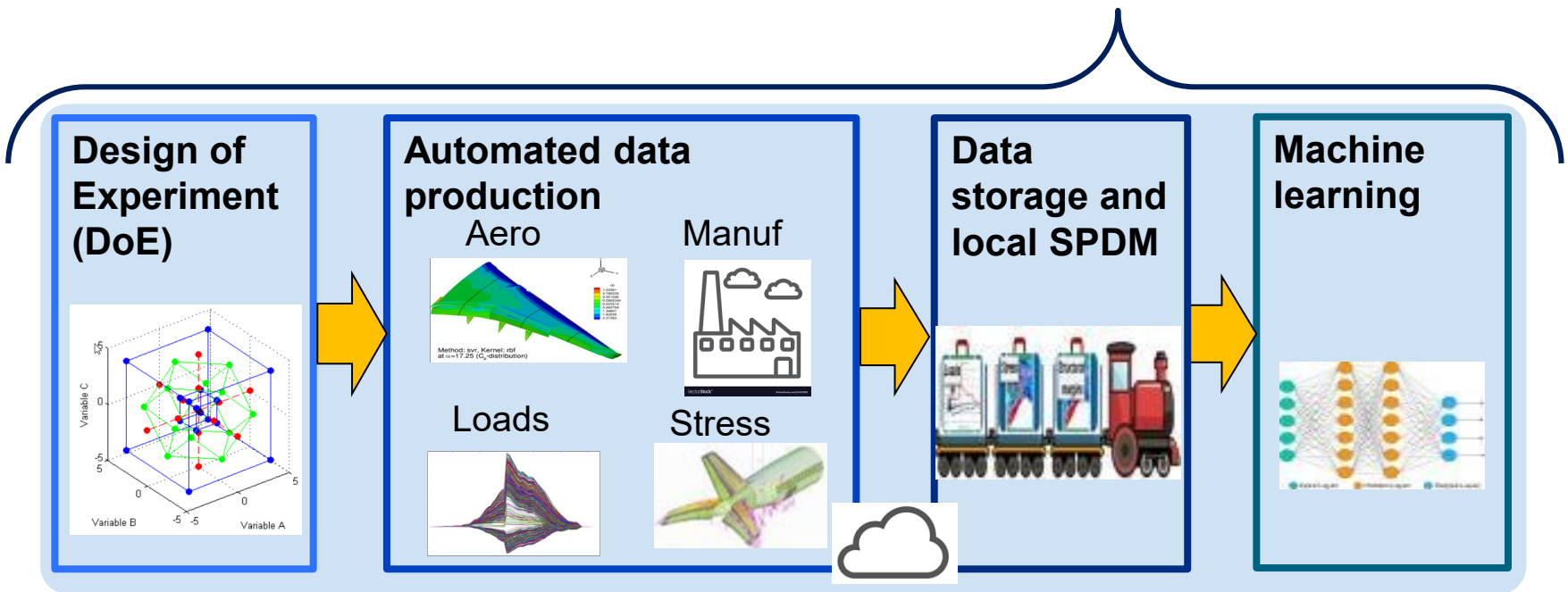
M&S Multi-disciplinary simulation workflow



Inputs:
- Design param
- Manuf methods

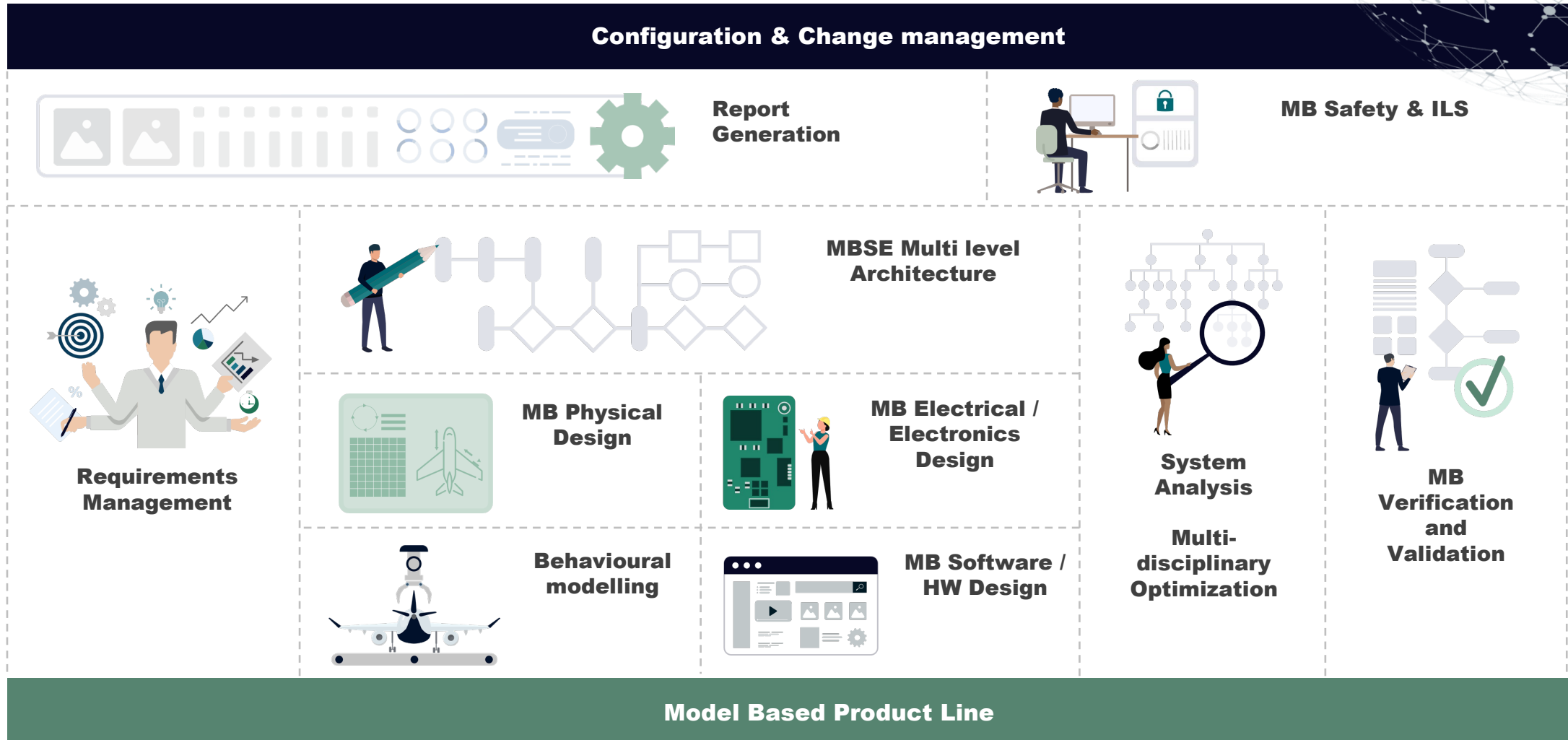
Study

Outputs:
- RC
- Lead time
- Weight

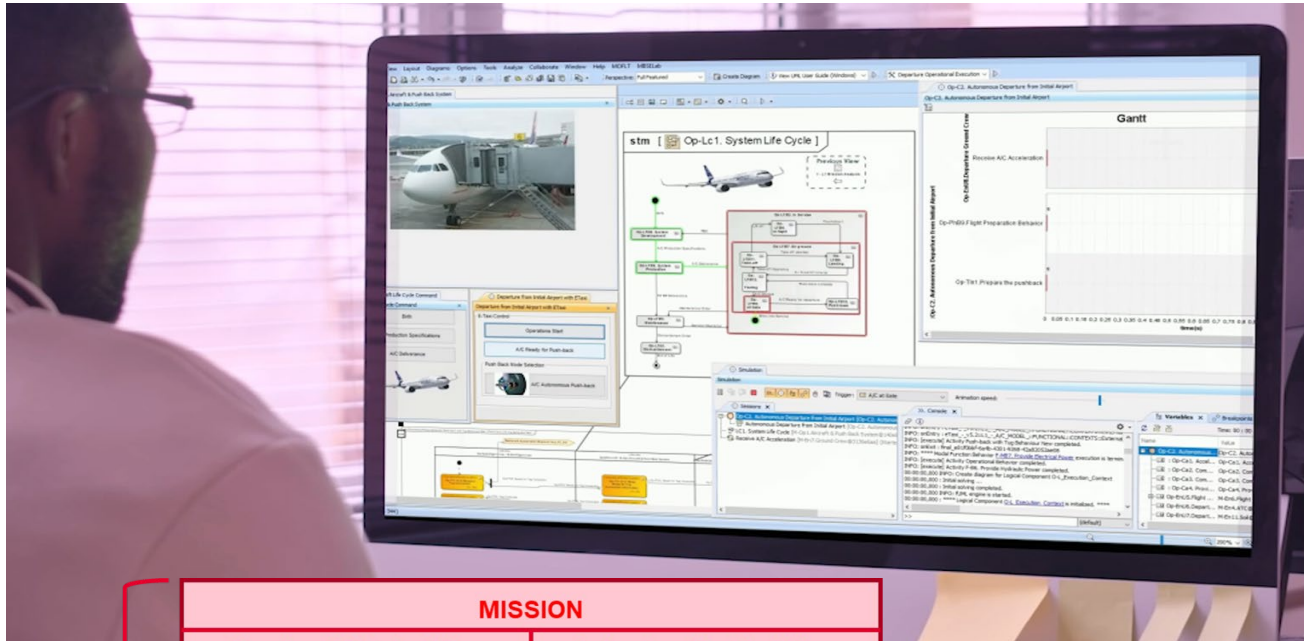
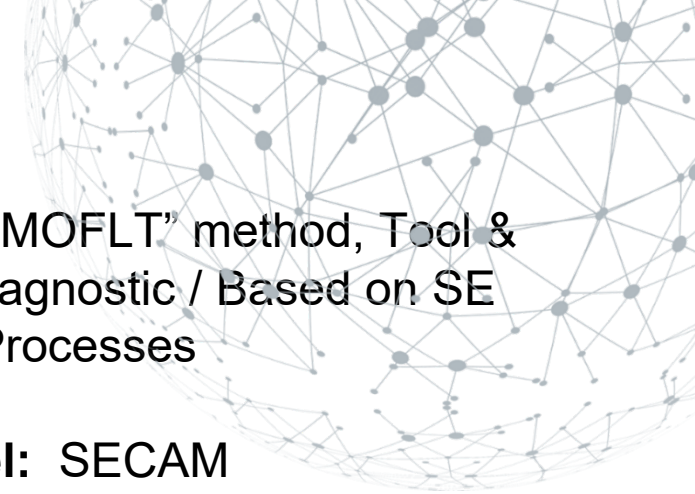


MBSE/M&S integrated framework

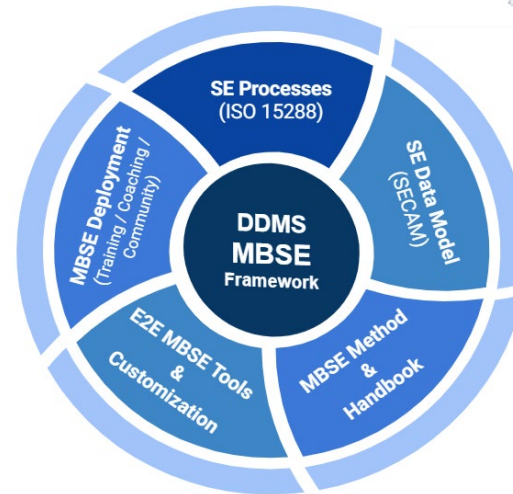
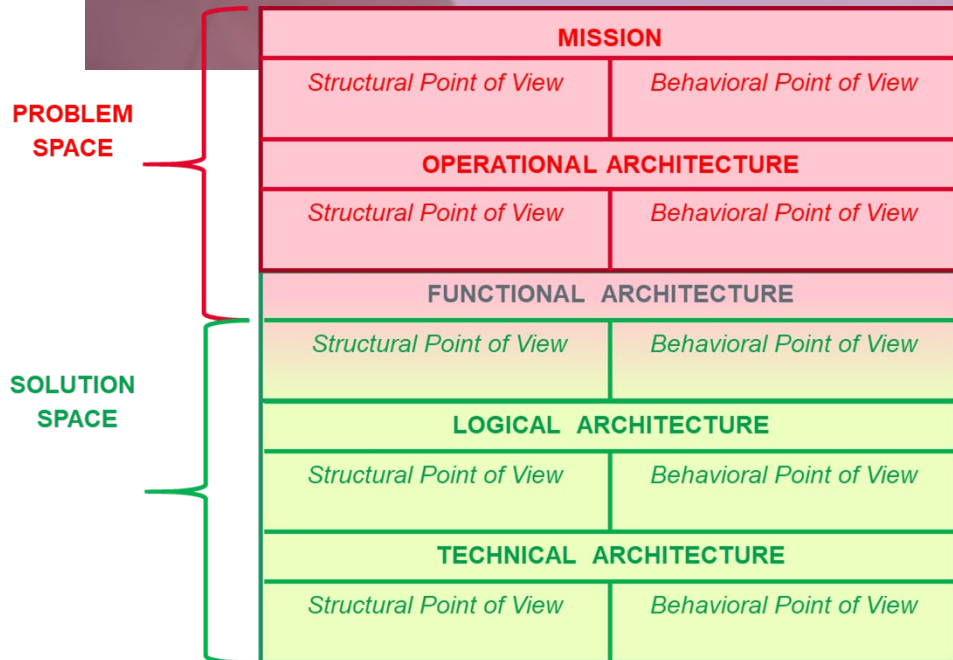
All the SE/MBSE/M&S capabilities have been architected and integrated into an holistic framework, through the Process, Methods, Tools and data by applying the enterprise architecture approach



The Airbus DDMS MBSE Framework

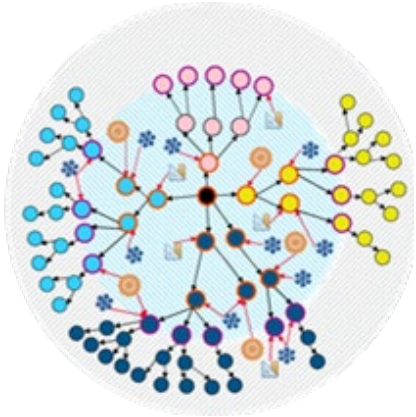


- **Method:** “MOFLT” method, Tool & Language agnostic / Based on SE technical Processes
- **Datamodel:** SECAM
- **Handbook:** Tool : CAMEO & Language : SysML / Based on Method
- **Plugin:** Tool customization aligned with Handbook & *SysML implementation of SECAM*
- **Example:** illustration of Method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

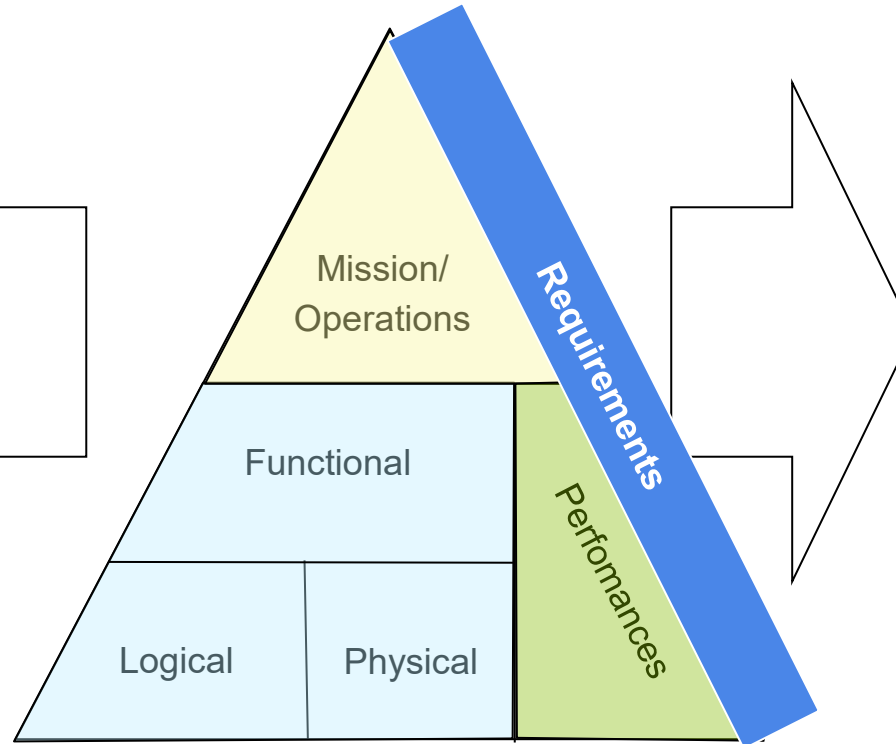


MBSE generic pattern based on SE decomposition

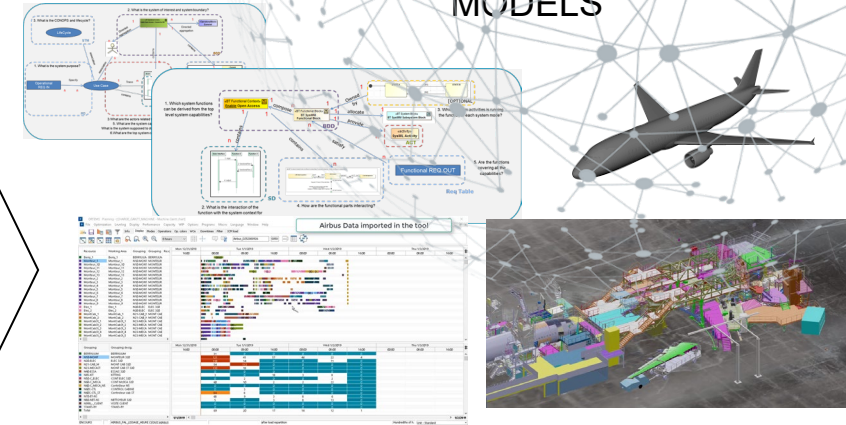
PARAMETRIC VIEW



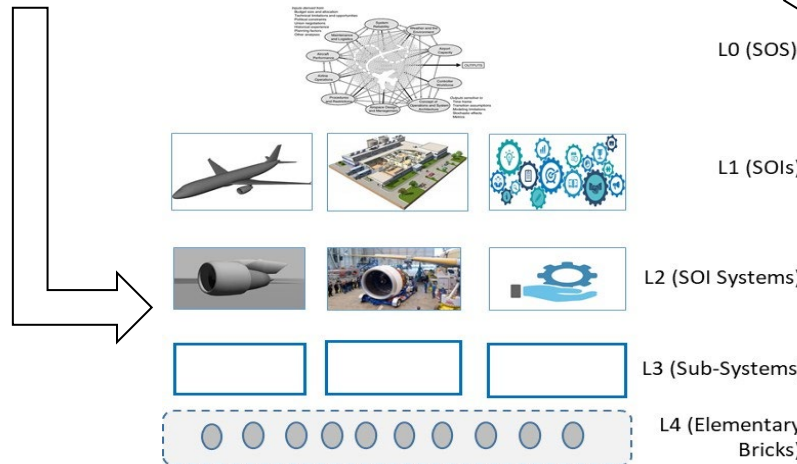
- Generic breakdown structure (per cluster)
- Key parameters
- Parameters interdependencies
 - Ontology (semantic model)



MODELS



- models (modelling approaches) for each cluster (purpose/scope)
- Which parameters are generated and consumed by each model
- toolchain architecture following the overall M&S framework



Same pattern applied to each logical item within the logical breakdown

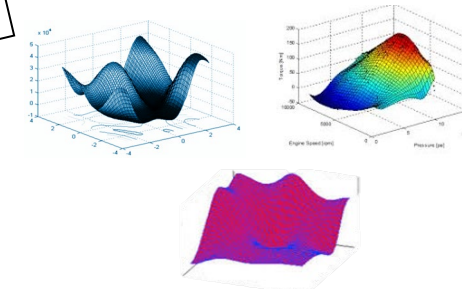
L0 (SOS)

L1 (SOIs)

L2 (SOI Systems)

L3 (Sub-Systems)

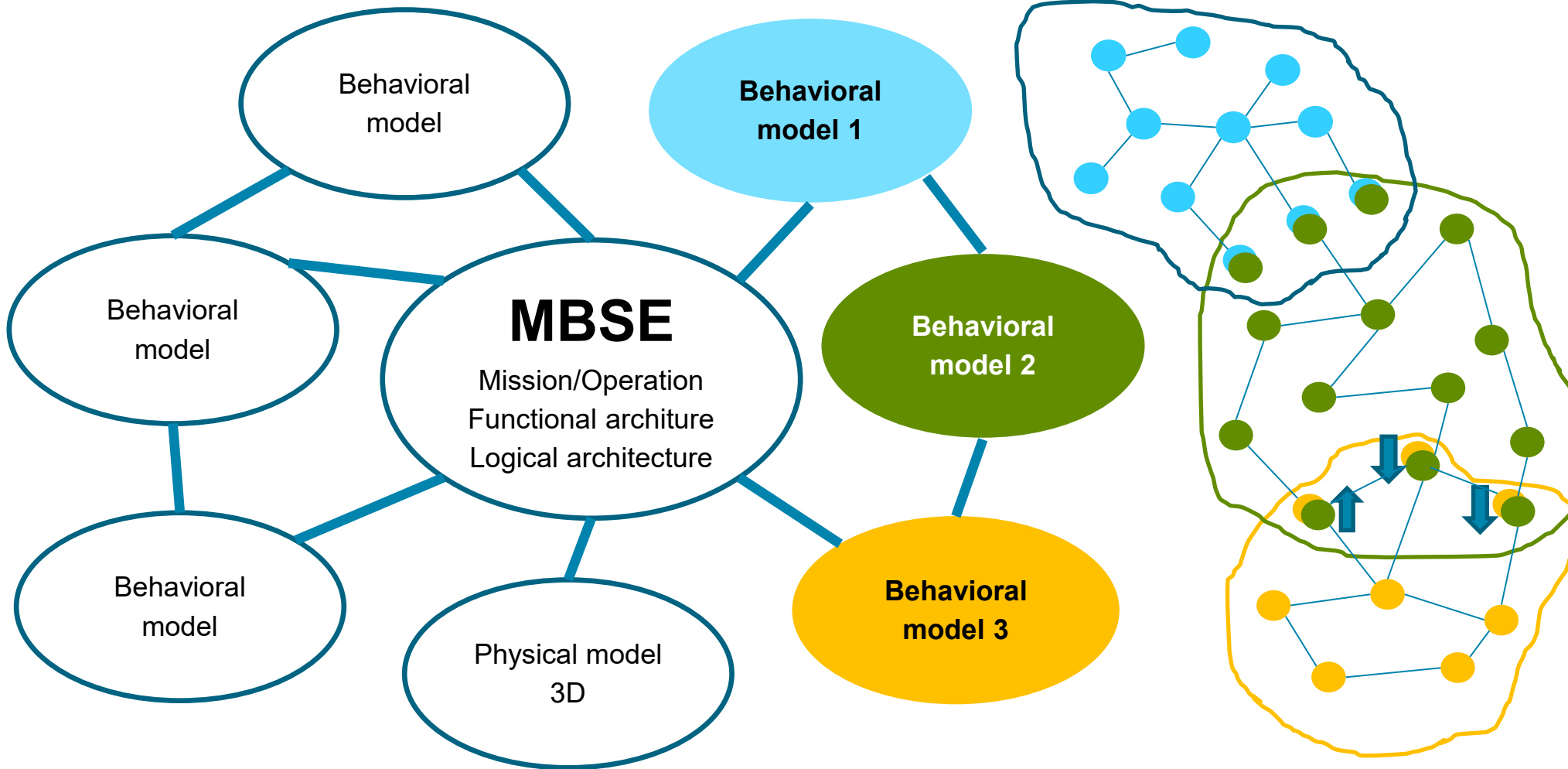
L4 (Elementary Bricks)



Surrogates models

Models architecture and architect

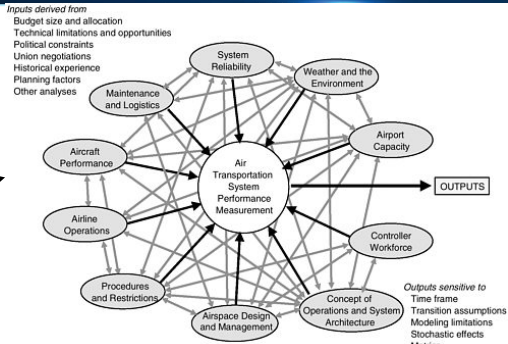
With DDMS in Airbus we are changing the paradigm with the concept of models architecture and M&S architect role



ONTOLOGY of PARAMETERS

Overall framework and GLOBAL optimization strategy

System Of System



Sol

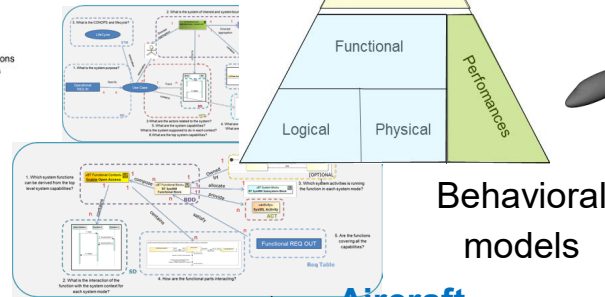
Product + Support & services
 (from Manufacturing to Decommissioning)



M-O-F-L
 (SysML)

P

3D models



Sol

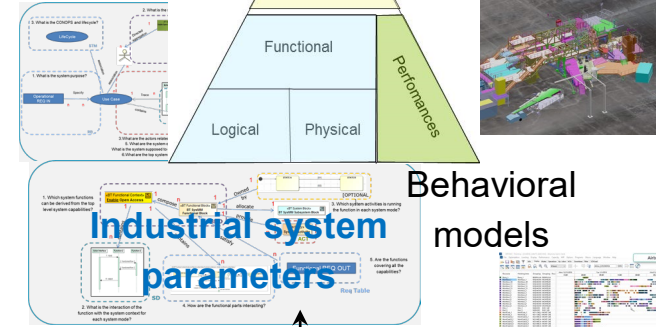
Manufacturing + Supply Chain
 (Enabling systems)



M-O-F-L
 (SysML)

P

3D models



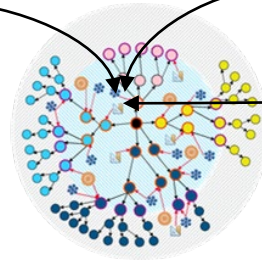
Sol = System of Interest

M: Mission
 O: Operations
 F: Functional
 L: Logical
 P: Physical

Top Program Objectives (TPOs)

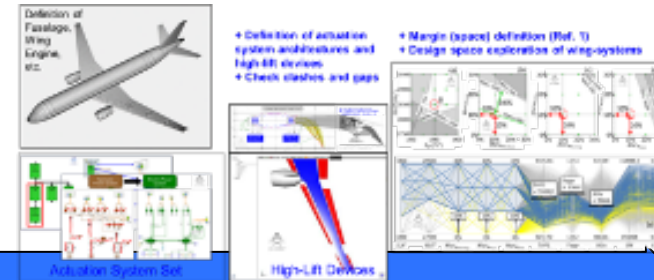
SoS parameters
 (including Services)

Global Meta Model (Ontology)



Multi-disciplinary/Multi-domains OPTIMIZATION*
 across Product/Industrial system/Service

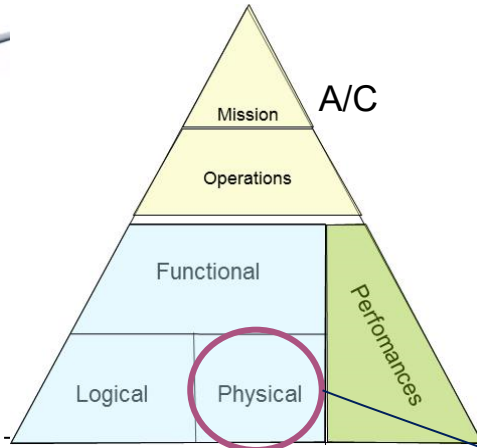
Reference Architecture



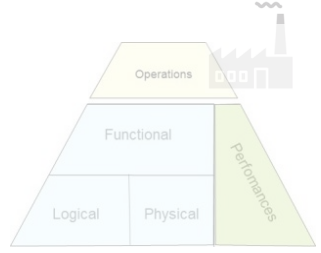
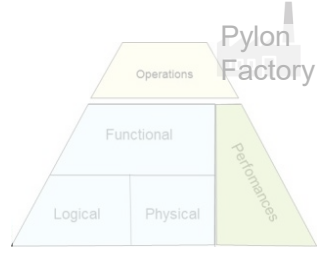
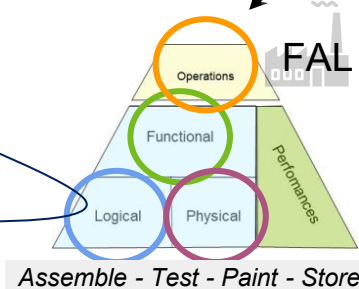
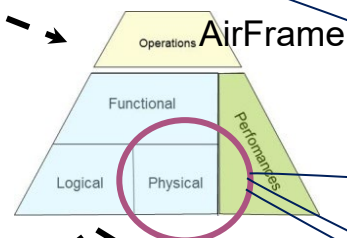
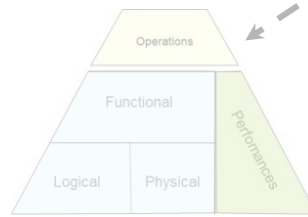
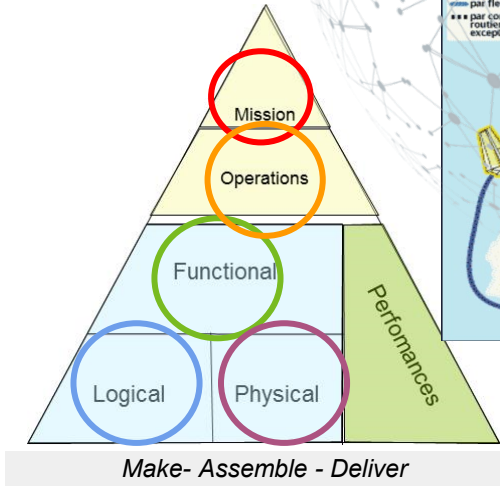
MBSE Product & MBSE industrial



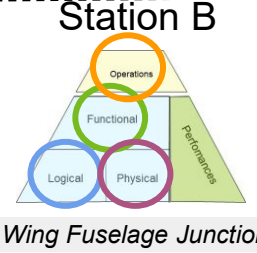
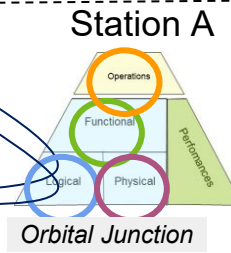
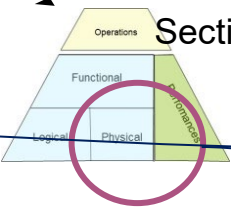
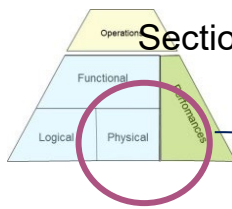
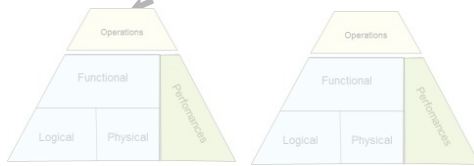
Aircraft Product



Overall Industrial System



Assemble - Test - Paint - Store

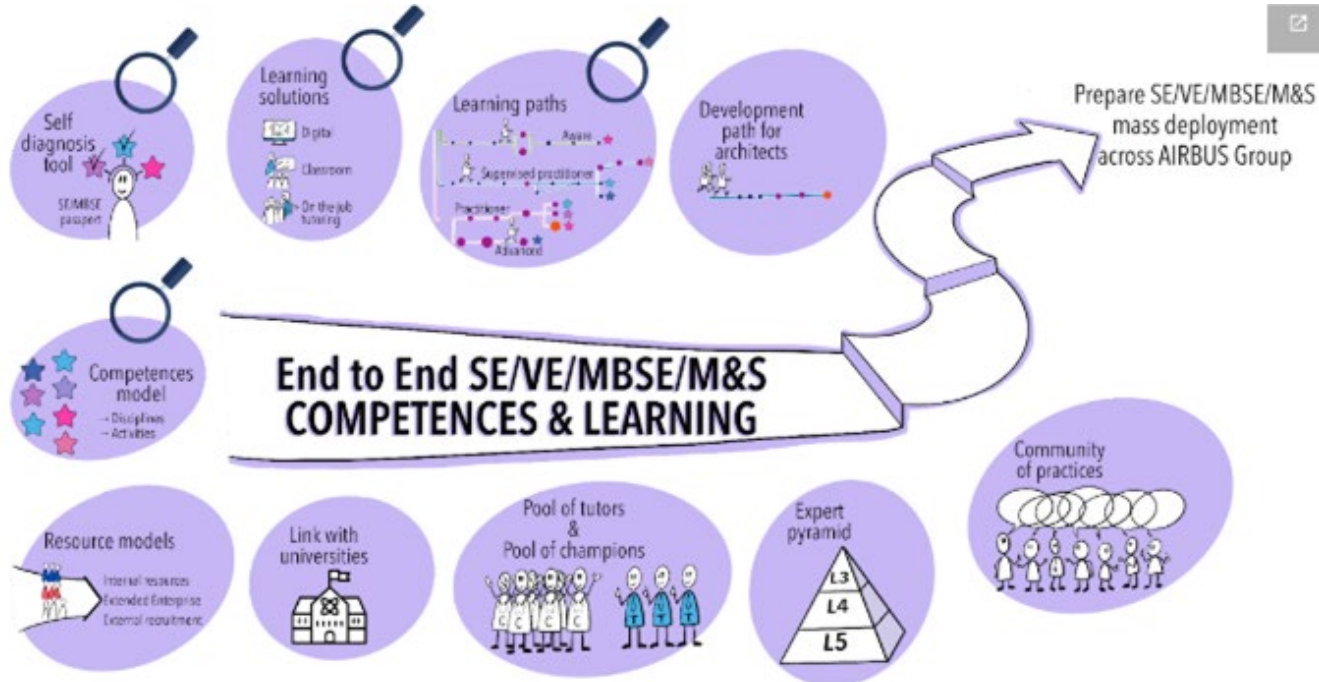


Orbital Junction

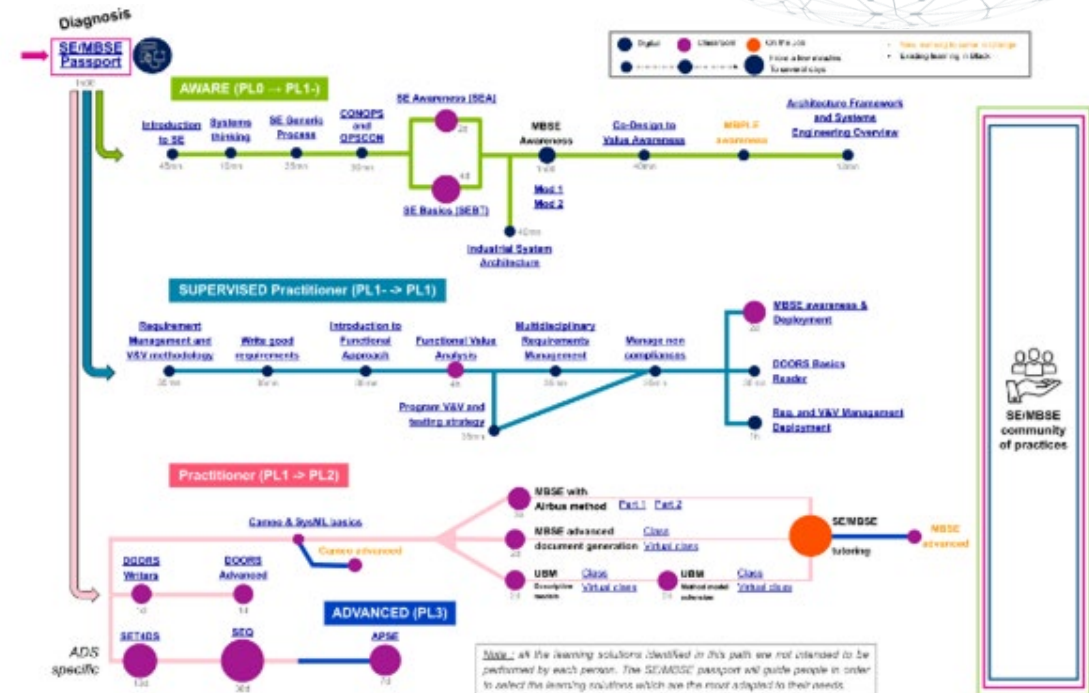
Wing Fuselage Junction

SE/MBSE skills and competencies: key enablers

An end to end view covering all aspects in an integrated approach



Customized learning path considering target proficiency levels



**Systems Engineering
Model Based Systems Engineering
Community Groupwide**

What are you looking for ?

Systems Engineering Fundamentals 	Model Based Systems Engineering 	Modelling & Simulation supporting SE
Systems Engineering Governance 	Direct access to All Referentials 	People Development

a strong SE/MBSE community with a common repository for any information

Conclusions - key take aways

- ▣ System engineering is highly recognized and sponsored in Airbus, a group community and governance is in place
- ▣ Modelling & Simulations is one of the five pillars of the Airbus Digital Transformation
- ▣ **MBSE in particular is at the heart of the new M&S approach** enabling consistent co-development across several system of interest and across disciplines
- ▣ In DDMS we are developing an overall M&S framework to permit end to end digital continuity across models but also real data permitting the implementation of digital twins
- ▣ The Airbus SE/MBSE vision and trajectory at group is in line with INCOSE 2035 vision



We Make It Fly

AIRBUS