

DEFENCE AND SPACE

Beyond SysML models to describe Airbus Space missions in an extended MBSE environment for system architecting.

Stéphane Estable, Johannes Buerkle, Jacopo Aurigi, Falko Fahnauer, Christian Allweyer, Sebastian Bartsch, Alexandre Cortier, Marie de Roquemaurel

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Airbus Ambe

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- 2. Extended MBSE environment high level process
- 3. Extended MBSE environment high level architecture
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MBSE Goals

Describe a system from different perspectives and make them consistent in a single model.



Order and rigor

Order allows the design team to attack the problem in a coherent and consistent manner leading to a viable solution.

Power to demonstrate and persuade

The model allows the designer to demonstrate the system behavior.

Integrity and consistency

Eliminate ambiguity and inconsistency in the system design.

Insight

The model provides insight into the system problem facing the design team and design solutions.

David Long, Zane Scott (2007) A primer for Model-Based Systems Engineering, 2nd Edition, Vitech

System Engineering as an incremental layered process MBSE is a mean to manage the dependencies between domains and layers to support a controlled incremental system engineering.



Phase B

AIRBUS



Extended MBSE environment high level process

Build a solid foundation for a robust system design, while strongly reducing the CNQ in AIT phases.

Objective

Build the architectures for Mission, Operations, Functions, Logical Components and Technical Components that are consistent among each other and well aligned with the Requirements and the System Primary Design.



Extended MBSE environment high level process

Built-in Order & Rigor, Power to Demonstrate, Integrity & Consistency and Insight.



Extended MBSE environment high level architecture

System data shared in complementary system databases and managed in specific editors.



Airbus Amber

Extended MBSE environment high level architecture



Airbus Amber

The engineering digital continuity is given by the system database which allows the system data exchange with the main domains

- 1. Functional avionics
- 2. Electrical
- 3. Mechanical

and the management of product catalogues.

AIRBUS

Implementation status System Architecture model with MOFLT

Mission Architecture and Operations



Airbus Amber

In-Space Assembly and Manufacturing

ISAM

Mission architecture concept



Operational phases



AIRBUS

Functional behavior



Implementation status System Architecture model with MOFLT

Logical Architecture with functional allocation



Logical architecture with functional allocation



Implementation status System Architecture model with MOFLT

Containment

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Properties

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Allocation of the requirements to the architecture elements

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Implementation status System primary design model

Product tree with product catalogue

System Mode allocations to equipment states

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Implementation status System primary design model

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System Power budget

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Implementation status System data cockpit

System overview with mass distribution

System configurations with comparison btw config



Implementation status System data cockpit

Mass budget dashboard with evolutions

Power budget dashboard with phase distribution





Extended MBSE environment benefits

Improve the work efficiency and the system description quality.



Improve work efficiency in project

- Better quality system description with rich details
- Study implementation at lower cost with reuse of existing definitions and automated document generation
- Robust communication with stakeholders based on shared data
- Estimated 10% of cost savings for system engineering
- High cost savings expected in later phases due to CNQ reduction (60% estimated in studies)

Improve work effectiveness

 Definition of better suited solutions based on indepth interstanding of the needs and architectures

Lessons learned and Way forward

Lessons learned

- MBSE Learning curve is steep, also because different way of engineering thinking wrt encompassing problem description
- Higher effort in project during early usage
- Intensive coaching required
- Reuse from models and automation is often expected
- Analysis possibilities are expected as real benefit
- Therefore, proper mission and system description is the basis but the tools shall provide tangible benefits with automation and analysis
- Acceptance depends a lot on people background

Way Forward

- Finalize the development for the basic MBSE environment
- Complete the detailed process definition
- Complete the user manuals and trainings
- Continuous incremental development of the MBSE solution
- Exercise, exercise, exercise and be patient...



Thank you

