Model Based Systems Engineering
Best Practice From Space

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We Want to Do Model Based Systems Engineering – Now what...

Model based Systems Engineering is More Than Installing a Tool

Several times a year on the telephone:

„Hi Phil! We want to do MBSE in our Company and downloaded Virtual Satellite but we don’t understand how it works…“

• There is not one answer of MBSE to your questions

• And don’t start modelling for the sake of modelling!
  • Ask yourself what you want to do with it?
  • What is your envisaged return of investment?
Alright, so What is Model Based Systems Engineering (MBSE) in our Context is Some of the Following…

- For us there is no clear cut definition of MBSE:
  - Model Based Systems Engineering
  - Model Based Software Engineering
  - But also Process/Workflow Automation

- Anyway all of them target to …
  - … collect information
  - … improve consistency of information
  - … centralize information
  - … control information flow

- Altogether, the extra task of modelling should deliver a benefit in time, efficiency, money, etc. to you!
Early Spacecraft Design has an Intense Information Exchange
MBSE Helps to Organize, Structure and Analyze the Information

Scientists don't understand the engineers and the engineers don't understand the scientists.

Introducing MBSE with a textual model as a formal language to describe the execution of the scientific experiment.

The engineers’ code generator uses the model to generate on board software from the model.
MBSE for Improving the Simulation and Design Process of Aircraft Workflow Automation with one Parametric Data Model in the Back

MBSE Aims for Data Continuity Through the whole Life of a Spacecraft
Identifying Todays and Tomorrows Information to be Exchanged

System Model

Engineering Process A

Engineering Process B

Engineering Process C

Phase A
Phase ...
Phase F

*) P. M. Fischer, D. Lüdtke, C. Lange, F.-C. Roshani, F. Dannemann, A. Gerndt, (2017) Implementing model-based system engineering for the whole lifecycle of a spacecraft, CEAS Space Journal, DOI: 10.1007/s12567-017-0166-4 ISSN 1868-2502
Extending the Model When The Requirements of Tomorrow are Known
Our Latest Research to Extend our Data Base Models by Concepts

Phase A
CEF Concept

Phase B
Product Structure Concept

Phase C
Functional Electrical Architecture Concept

Phase D
TMTC Concept

Phase E

CEF Design
Func. IF Design

DB
DB

<< Evolves >>

Design
Development

Concept

DB
DB

Ports
Interfaces

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Successful MBSE for Satellites but What About Launchers?  
We Have the Tools but we don’t yet Fully Understand the Process!
MBSE is just a Part in the Big Picture of a Digitalization Platform
We can Handle Technical Aspects, but What About Commercial Ones?
A Use Case of How MBSE and Digitalization Will Interact
Real Time Supplier Involvement in Early Spacecraft Design

Design (CEF)

CEF
1. Designing Spacecraft
2. Need part following Specification.
3. Transmitting need to Platform
4. Launch windiow in 5 Month.

Supplier 1
- Can deliver but in 6 month

Zulieferer 2
- Can deliver in 2 month.

Zulieferer 3
- Can deliver with small deviations to the spec

GSOC
Wait!!! The equipment of supplier 2 has a high failure rate.

Operations (GSOC)
Researching the Emerging Trends in Digitalization Integrating Mixed Reality and Cyber Physical Systems
Back to the Question of What is MBSE?
It Remains a Question of What You Make Out of it!

• There is nothing such as the one MBSE that solves all your problems.

• Be precise when talking about MBSE !!!

• Even though you have some MBSE already running. Applying it to a new field can be tricky.

• MBSE is already a huge topic, but we have to see how it fits into the bigger picture of digitalization.

• If you have questions, give me a call: „Hi Phil! We want to improve MBSE in our Company and Virtual Satellite doesn’t help, but we have an idea of adjusting it…“ ;-}
End of Presentation

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