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ESA Virtual Spacecraft Design

Demonstration of Feasibility of MBSE approach for European Space Programs

Harald Eisenmann Astrium Satellites
Joachim Fuchs, Don de Wilde ESA-ESTEC
Valter Basso TAS-I

25-27.09.2012

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The Tools Experts

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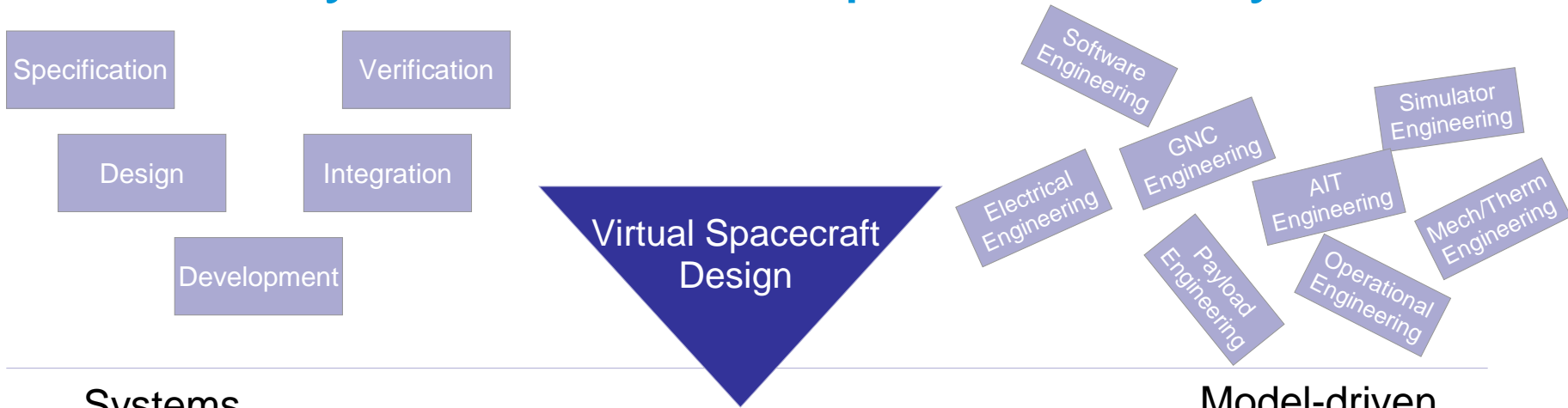
gmv **ThalesAlenia**
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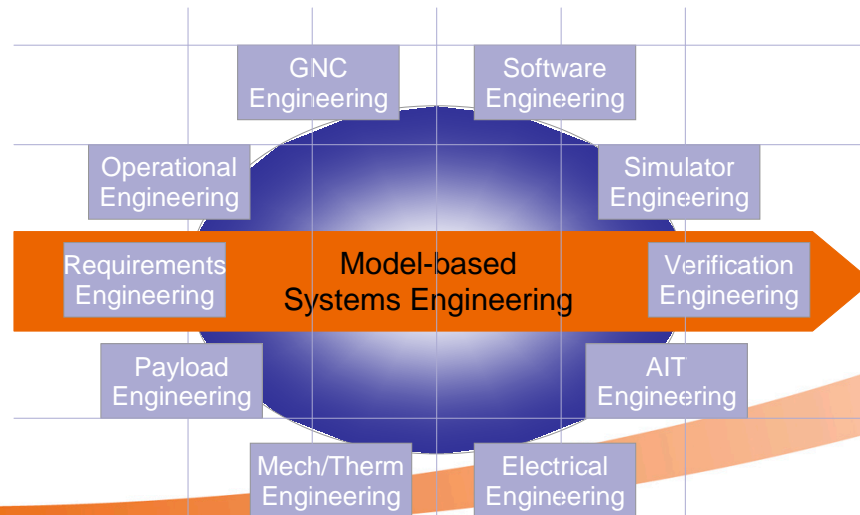
- **ESTEC:**
 - Joachim Fuchs, Don de Wilde, Hans-Peter de Koning
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 - Harald Eisenmann, Tobias Steinle
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- **ScopeSET**
 - Armin Müller, Björn Beyreuther, Frank Grimm, Kalin Nakov
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- **Novabase**
 - Ricardo Marvao, Andre de Brito

VSD should demonstrate the value & feasibility of MBSE for Space Industry



Systems Engineering

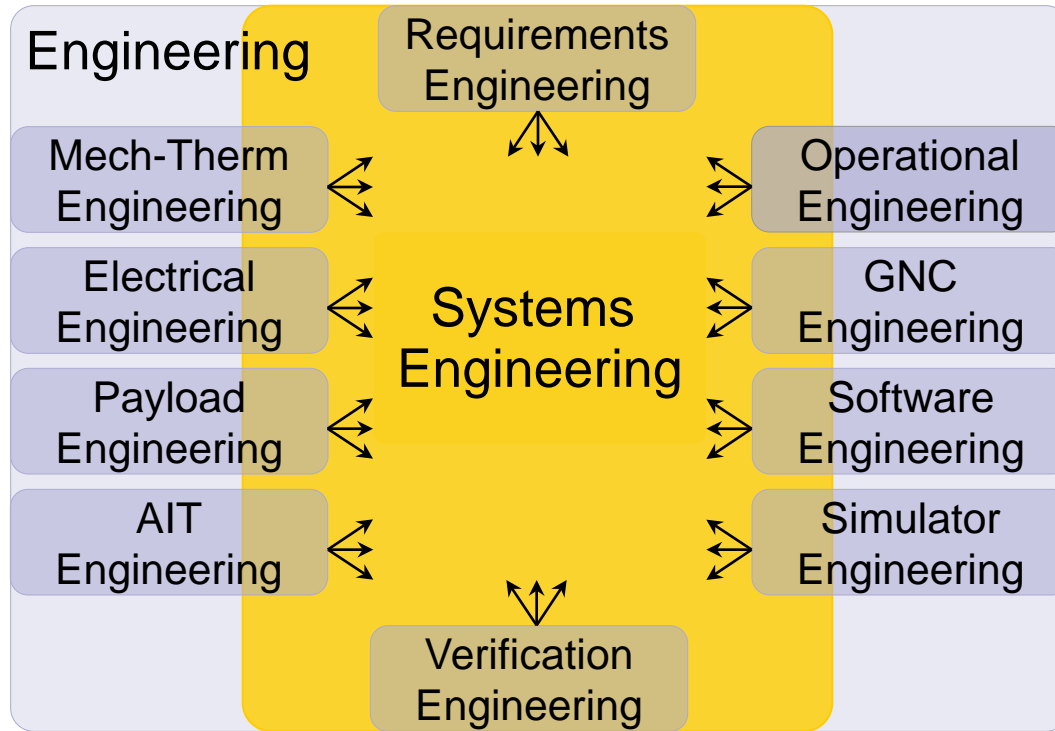
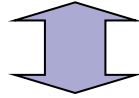
Model-driven Engineering



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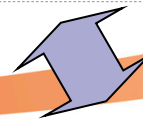
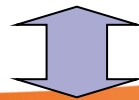
For the integrated “systems view” SE is to integrate data from different sources

Customer



- Data exchange along customer supplier chain (“extended enterprise”)
- Data sharing among disciplines
- Data ensuring design coherence (“traces”)
- Key design driver, performance & trade

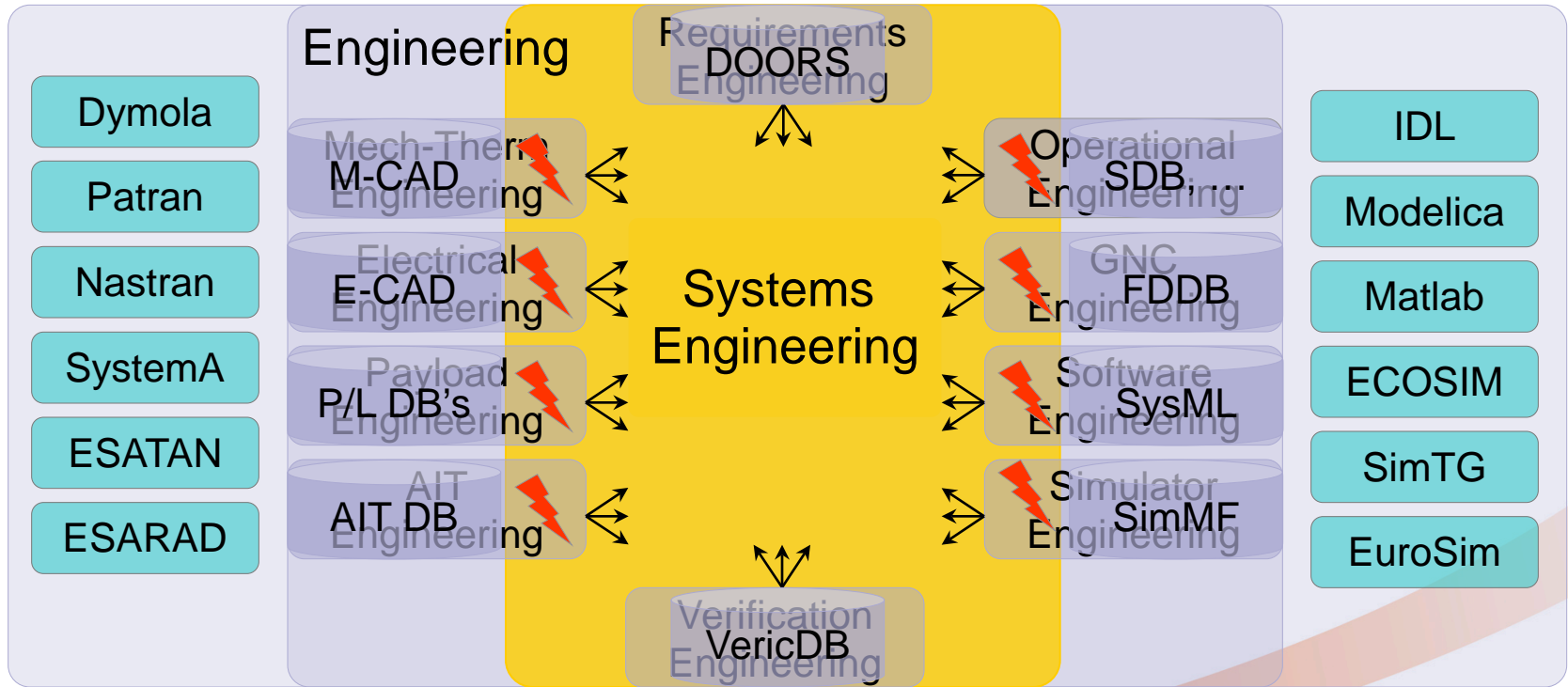
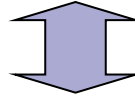
Supplier



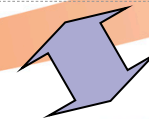
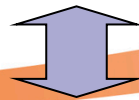
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MBSE requires integration of heterogeneous engineering tools

Customer

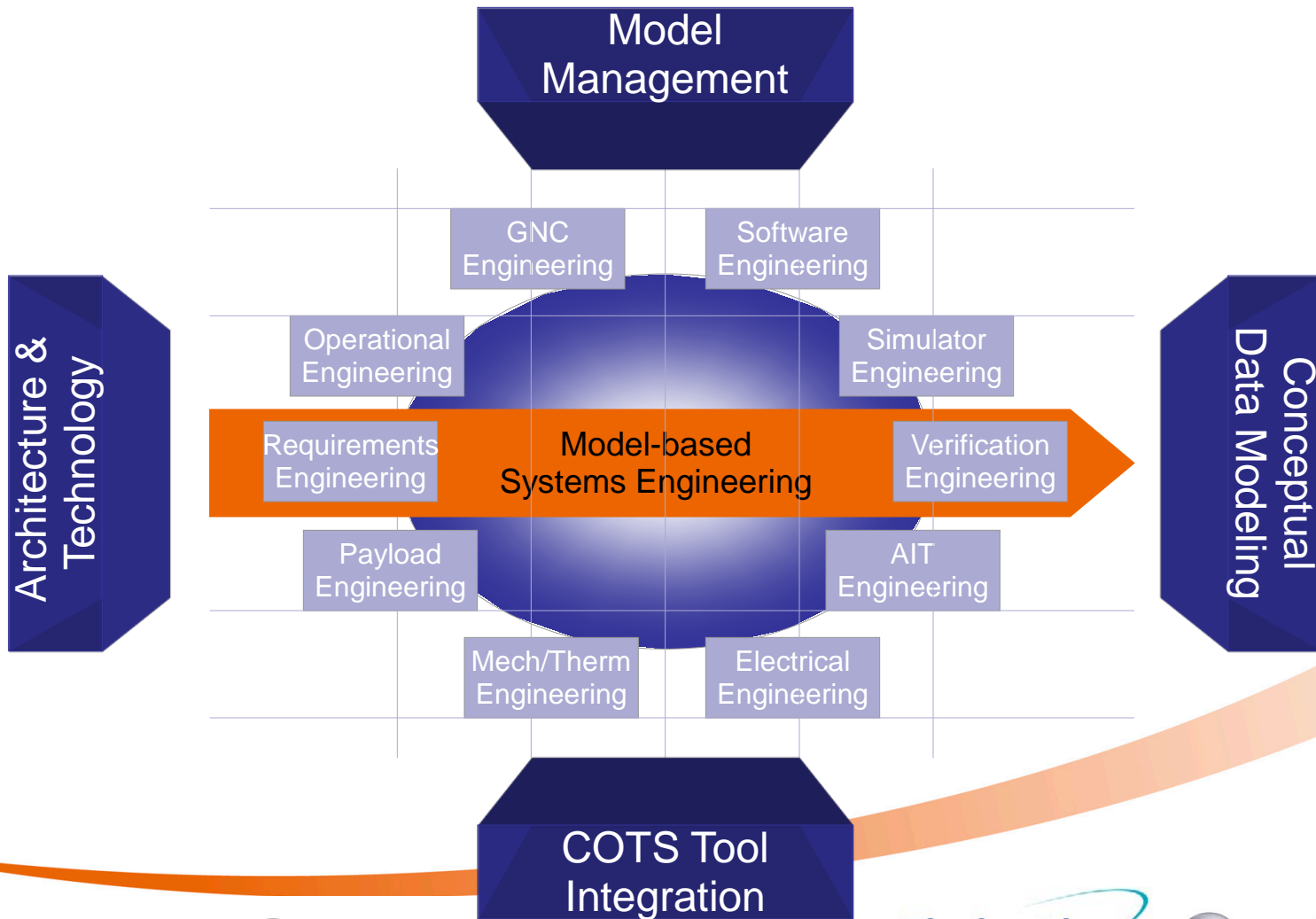


Supplier



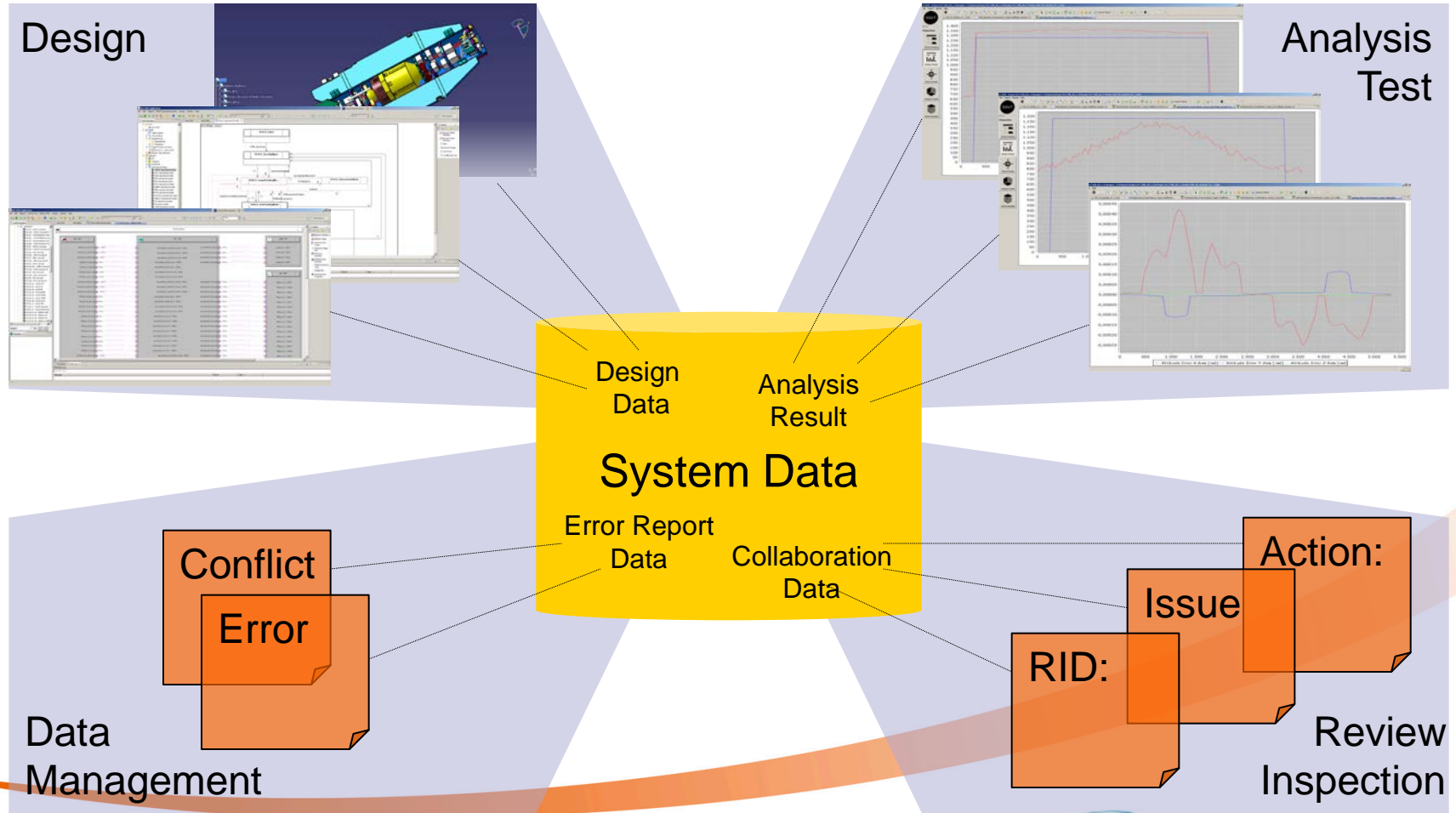
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VSD developed a solid technological basis to enable MBSE



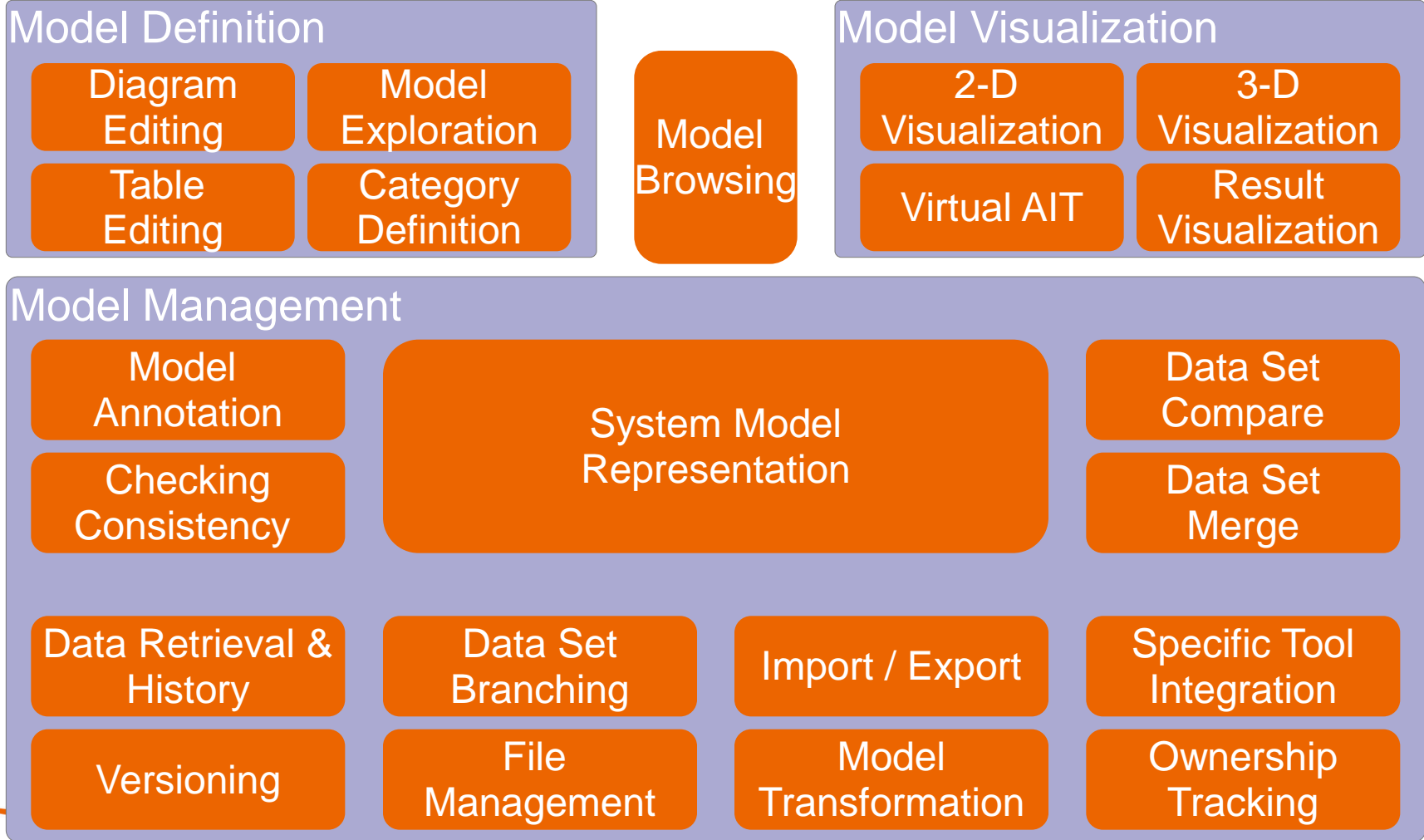
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Model management as a comprehensive approach to integrate various processes



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Overall decomposition of the functionality realized in the VSD project



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VSD demonstrates five key values for the stakeholders applying MBSE

Efficient systems engineering processes based on an underlying “integrated systems model”

Effective multi-disciplinary engineering



Open modular framework



Progress tracking



Full tracing of the design coherence



Early and continuous V&V

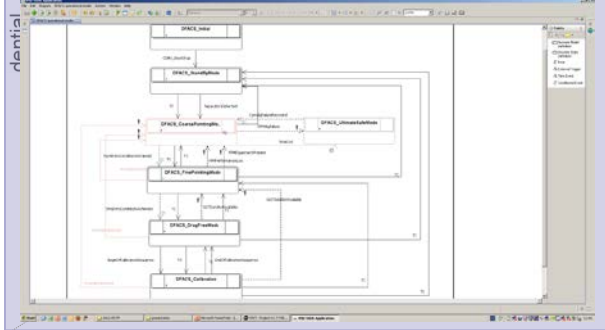


VSD Demonstrator

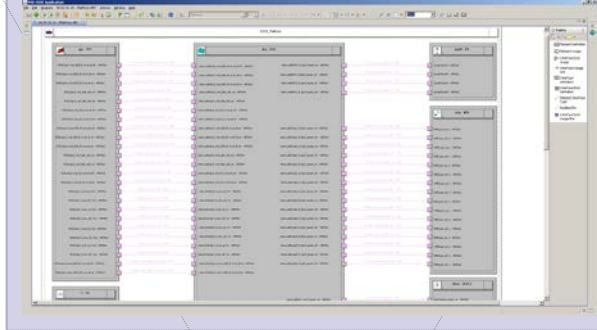
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Conceptual data model enables common representation and visualization of data

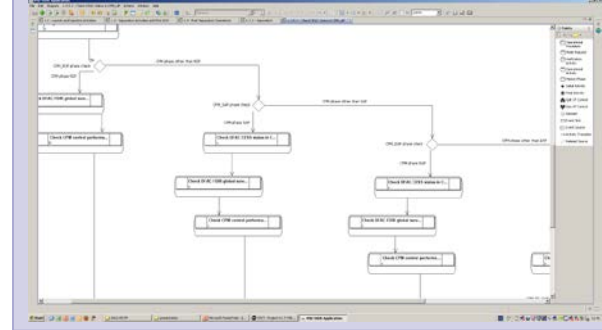
Operational Concept



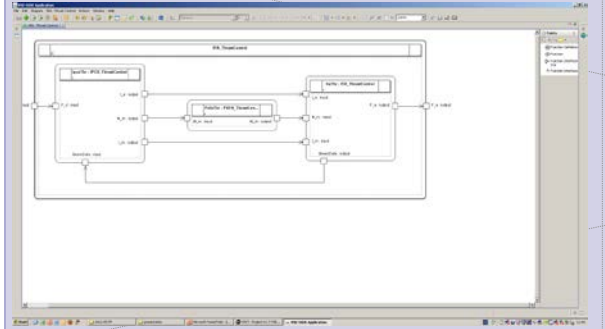
System Topology



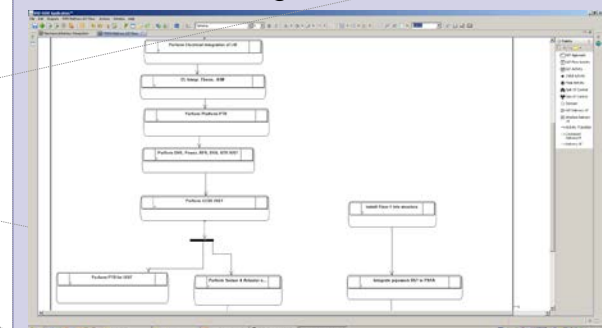
Operational Procedures



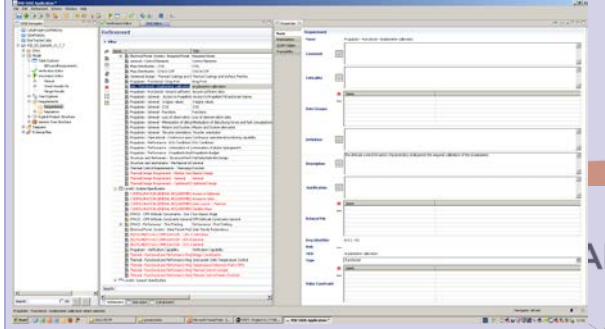
Functional Architecture



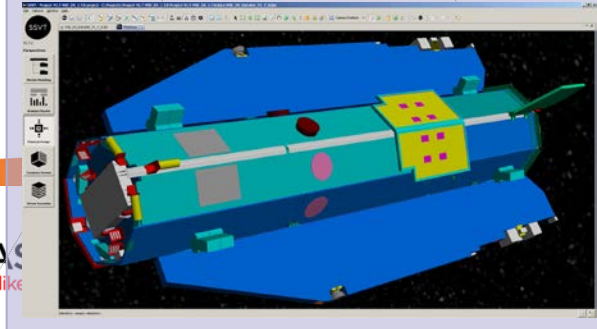
AIT Flow and Integration Procedures



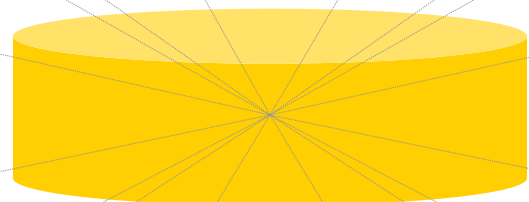
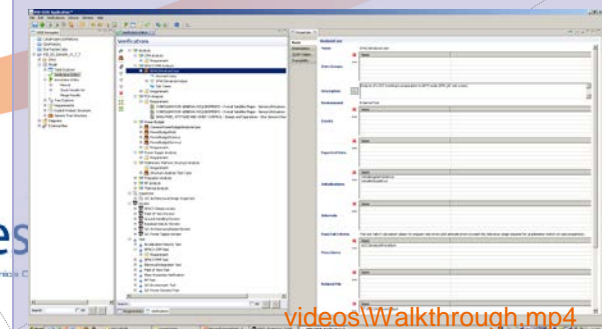
Requirements Engineering



Physical Configuration



Verification Definitions



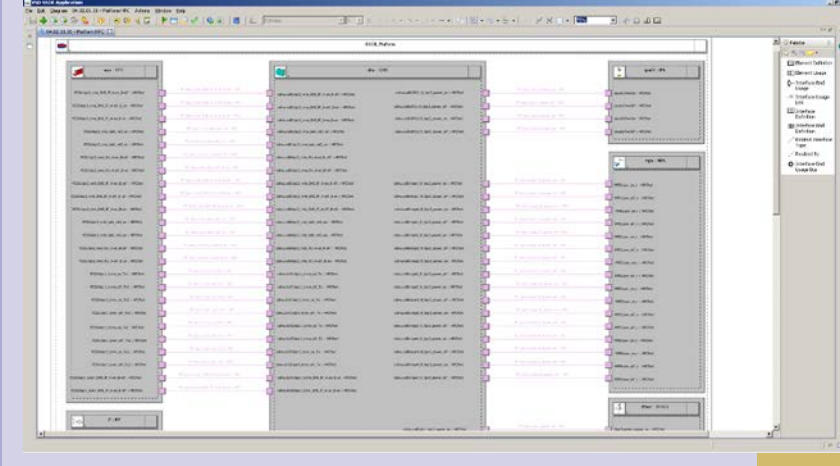
ABAS like

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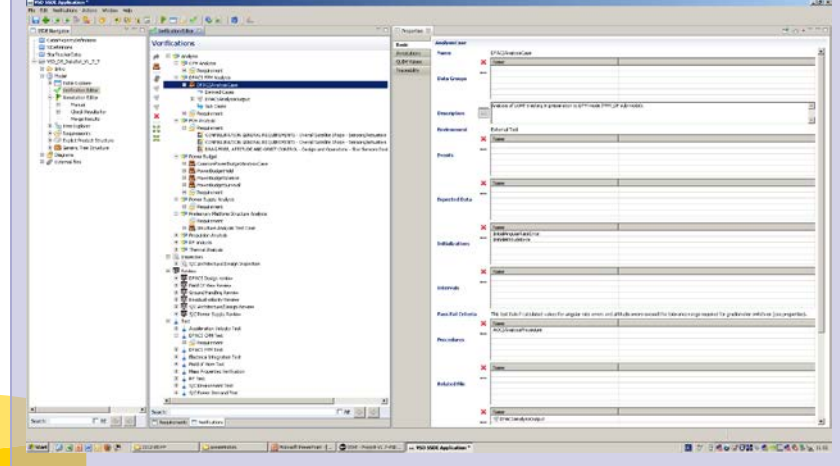
Editor allows definition of “system model” with powerful and flexible views

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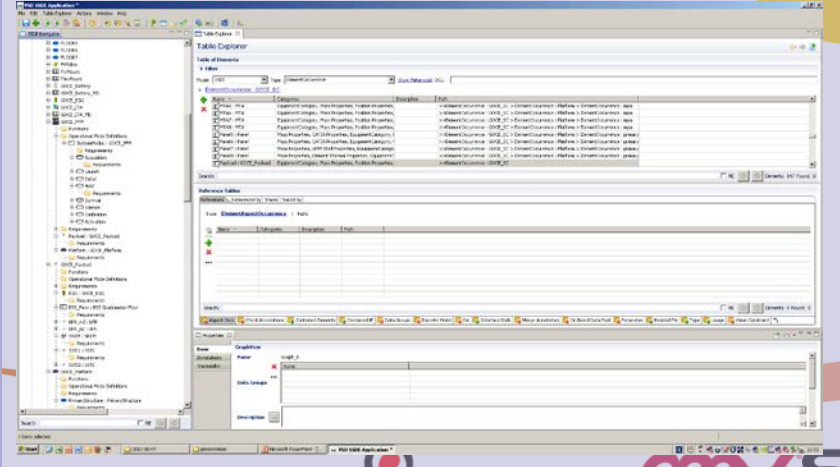
SE Diagrams



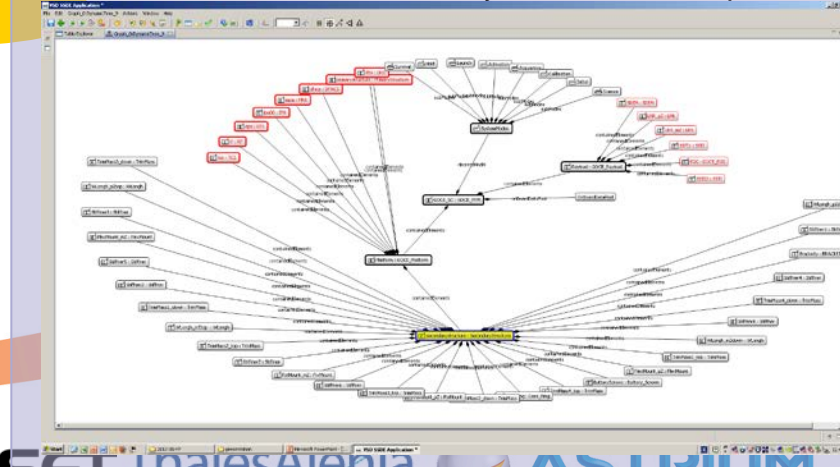
Tailored Property Editors



Generic Tree / Table Editor



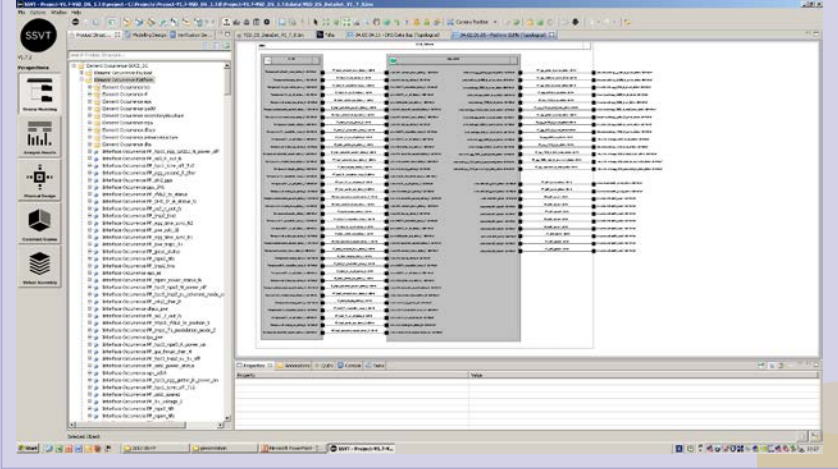
Dynamic Model Exploration



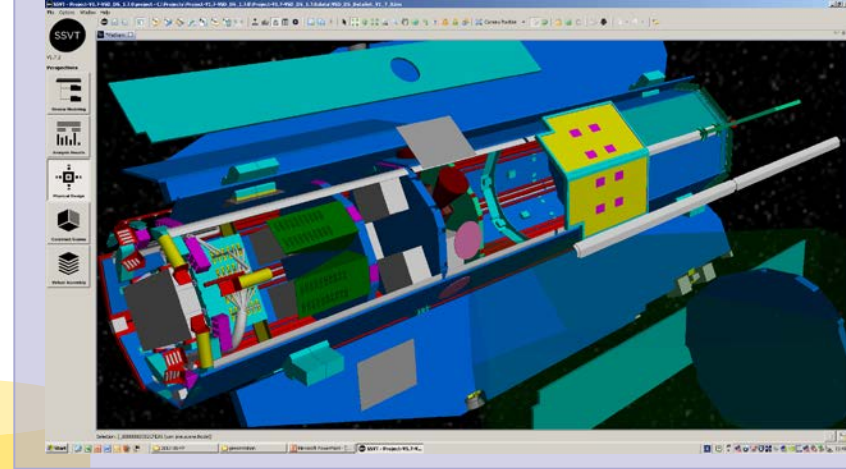
Integrated visualization allows integrated review of complete engineering activities

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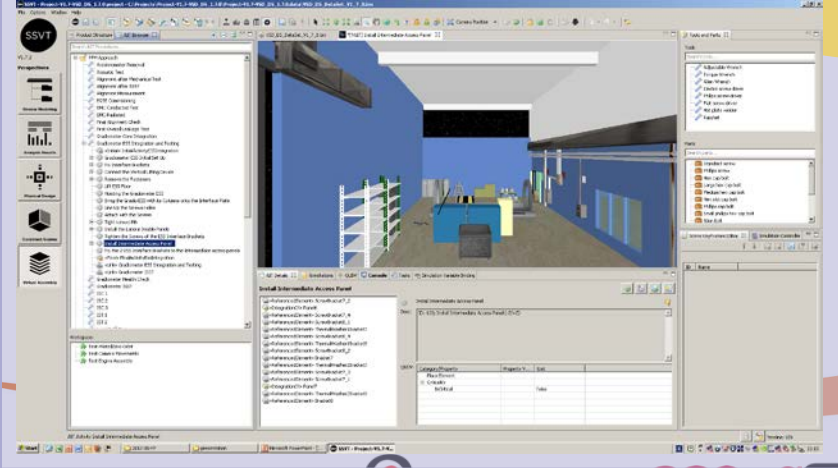
Visualization of all "functional" views and data



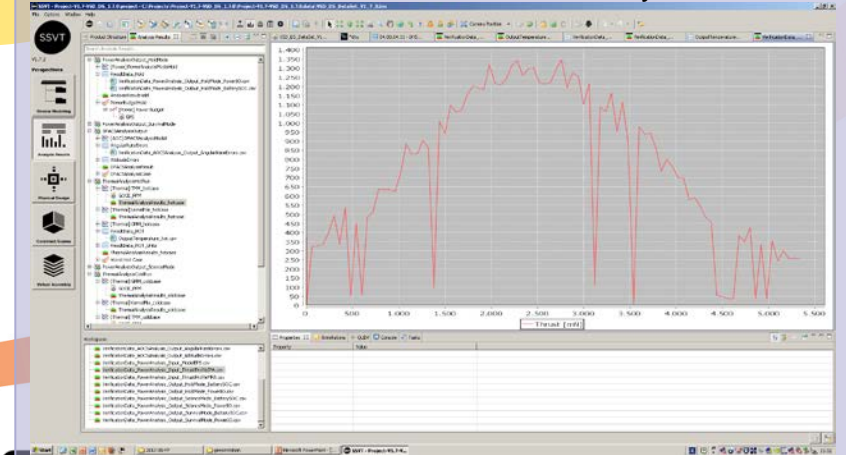
Visualization of all "physical" data



Definition and execution of animated AIT procedures



Visualization of analysis result data



VSD will provide benefits for space community based on demonstrated values



Key Values of MBSE

Based on VSD technologies key values of MBSE can be demonstrated

- VSD is "backbone" for efficient Multi-disciplinary engineering
- VSD provides an open & modular framework for MBSE
- With VSD we can manage engineering progress
- VSD allows a new dimension of traceability
- VSD enables early system verification/validation

To achieve benefits further steps are required

- Perform operational validation in pilot application
- Integrate VSD functions into operational environments
- Further research and development

Benefits to space community

- Higher efficiency through
- Better quality
- Risk reduction
- Optimizing design
- Cost as result
- Reduced dependency from tool supplier
- Higher Flexibility
- Better cost/performance ratio