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Protecting people and planet



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Can generative systems design solve the flaws of MBSE?



*«Real Stupidity beats Artificial
Intelligence every time»*
- Terry Pratchett

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Agenda

- What do I mean by Generative Systems Design (GSD)?
- What is Model-Based Systems Engineering (MBSE) what is its purpose?
- How do the flaws of MBSE prevent it from fully reaching its potential? And what can be done about it?
- Conclusive remarks

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Bio

- Oluf Tønning (38)
- Master of Technology from NTNU class of 2012
- KDA Missiles' Line Manager for Systems Analysts and Systems Architects
- 14 years of experience working with or studying Model-Based Systems Engineering. Experience mainly from a managerial perspective
- Has applied or managed MBSE efforts to solve small, large and wicked problems in oil & gas, aerospace and defense



Model-Based Systems Engineering is best Systems Engineering



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Generative Systems Design (GSD)

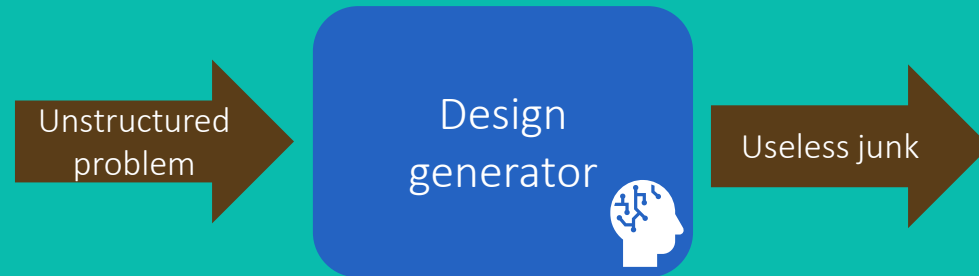
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Generative design



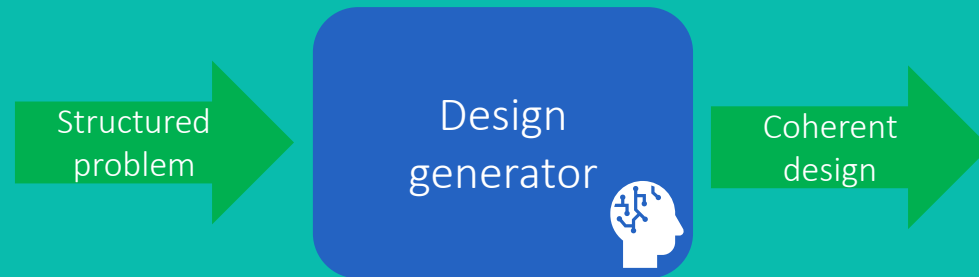
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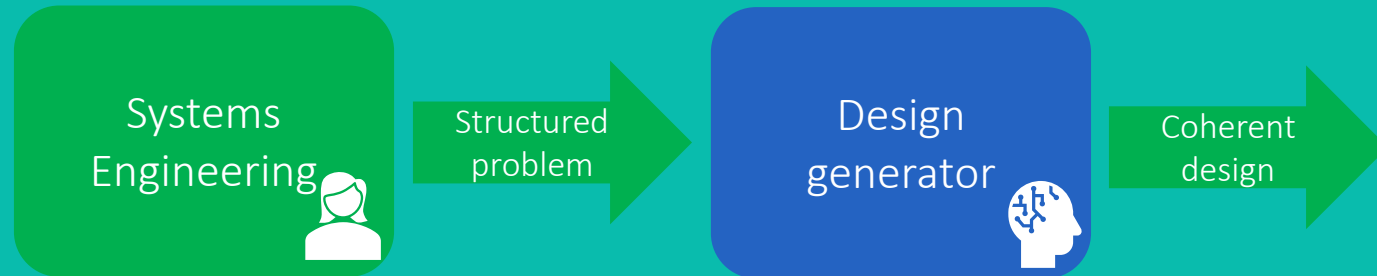
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Generative design



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Generative design



How can GSD best aid the Systems Engineering effort?

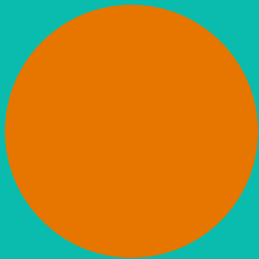
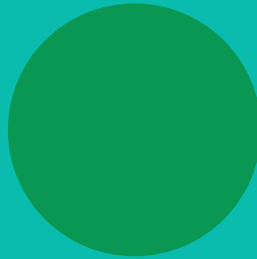


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Model-Based Systems Engineering

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Systems Engineering



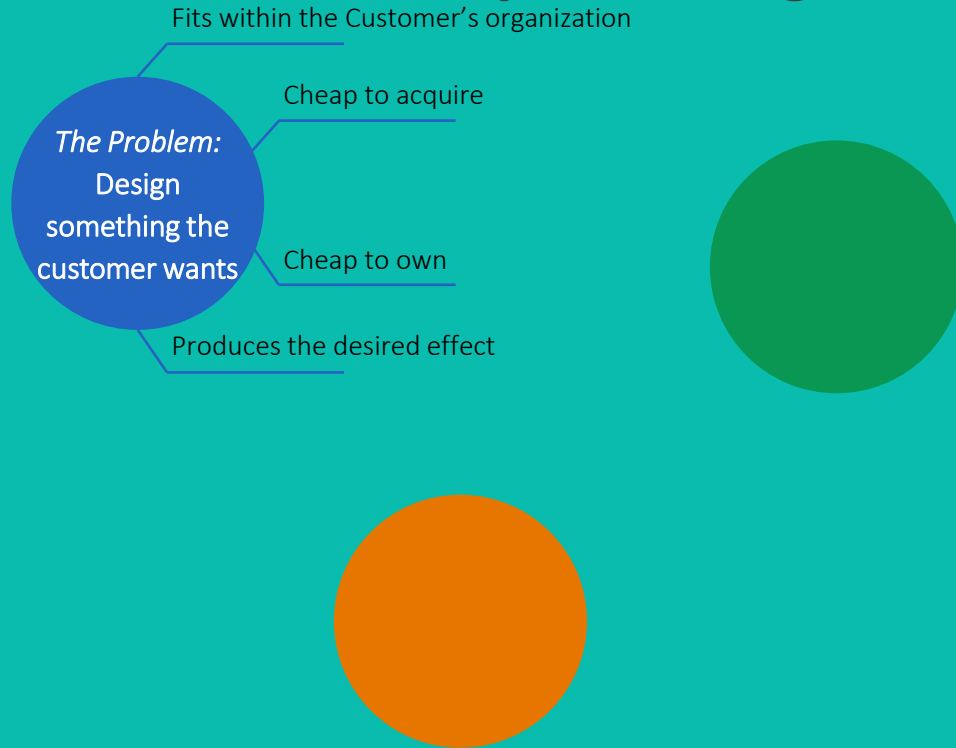
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Systems Engineering

The Problem:
Design
something the
customer wants

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Systems Engineering



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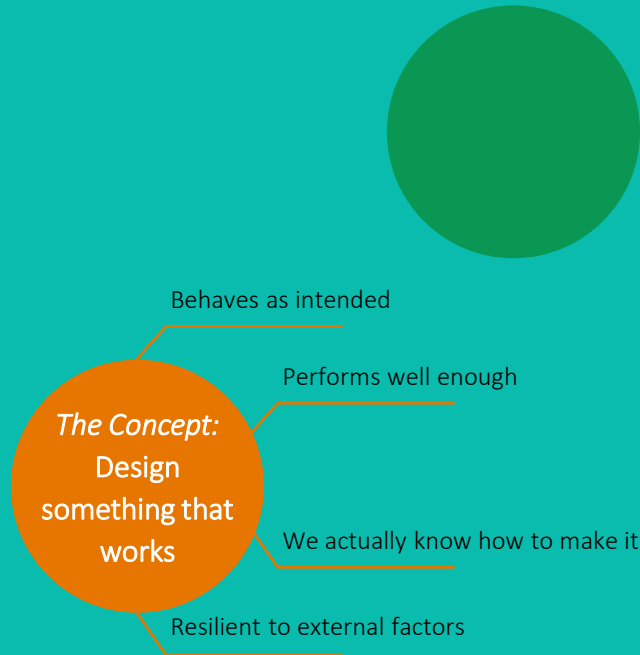
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Systems Engineering

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Systems Engineering

The Problem:
Design
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The Product:
Design
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profitable

- Delivered on time and cost
- Manufacturing cost below breakeven cost
- Satisfies market regulations
- Attracts interest

The Concept:
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Systems Engineering

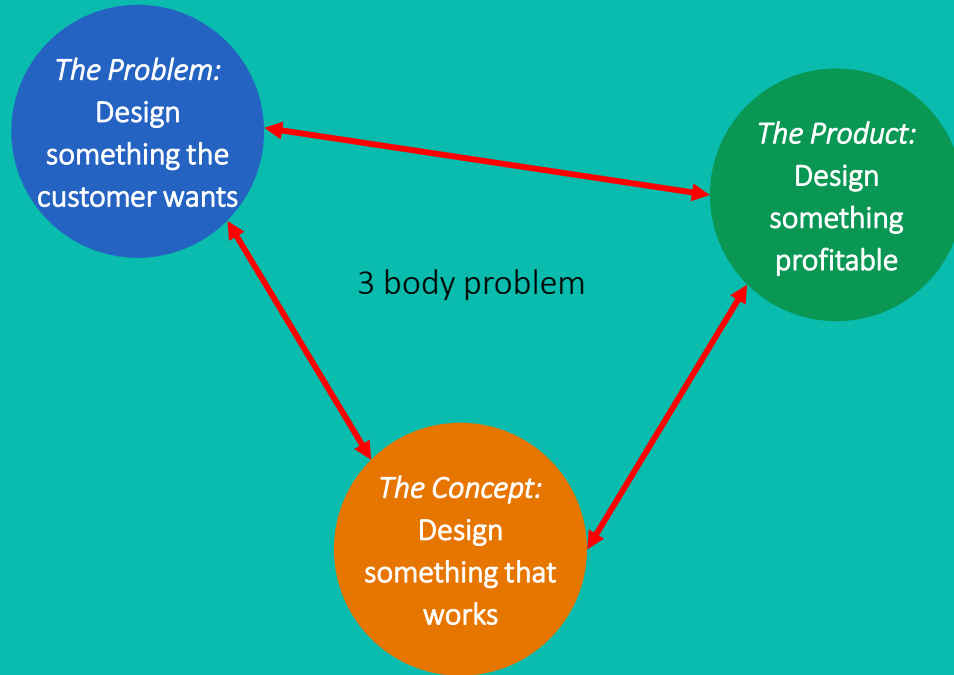
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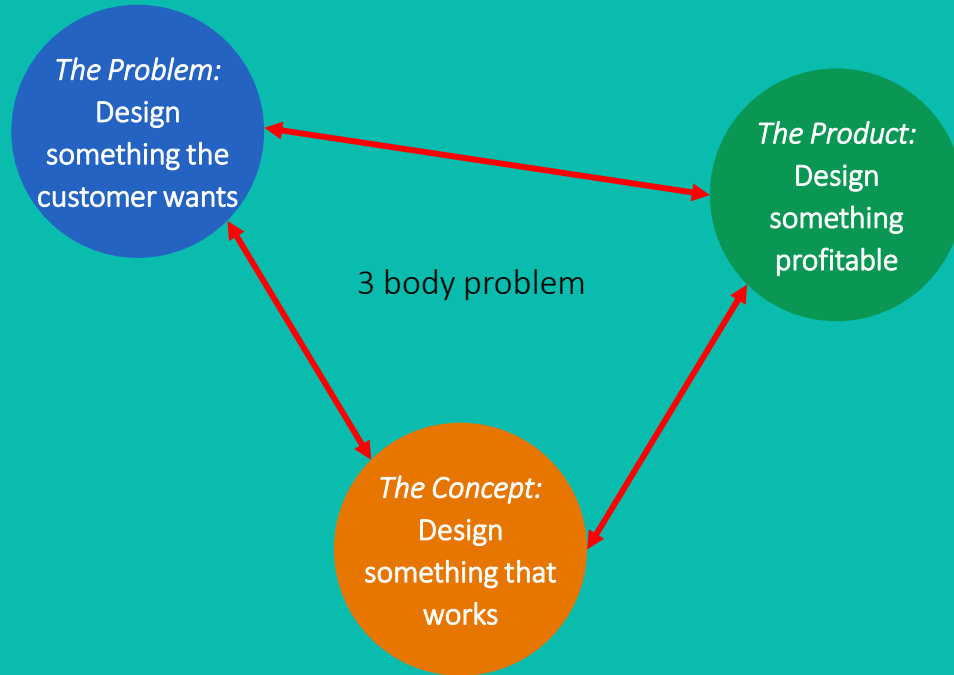
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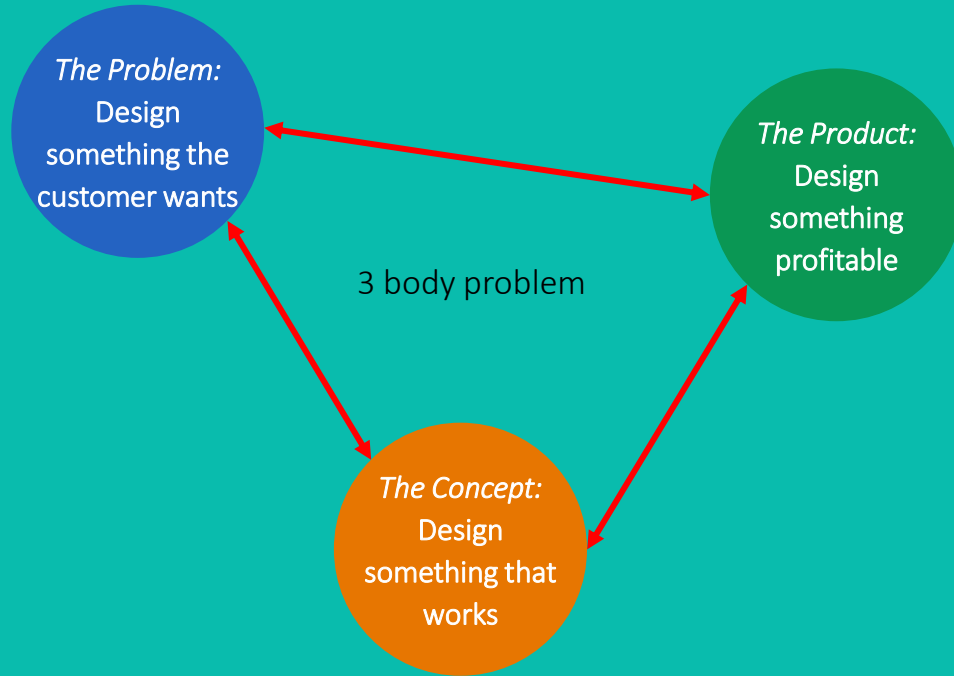
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Model-Based Systems Engineering



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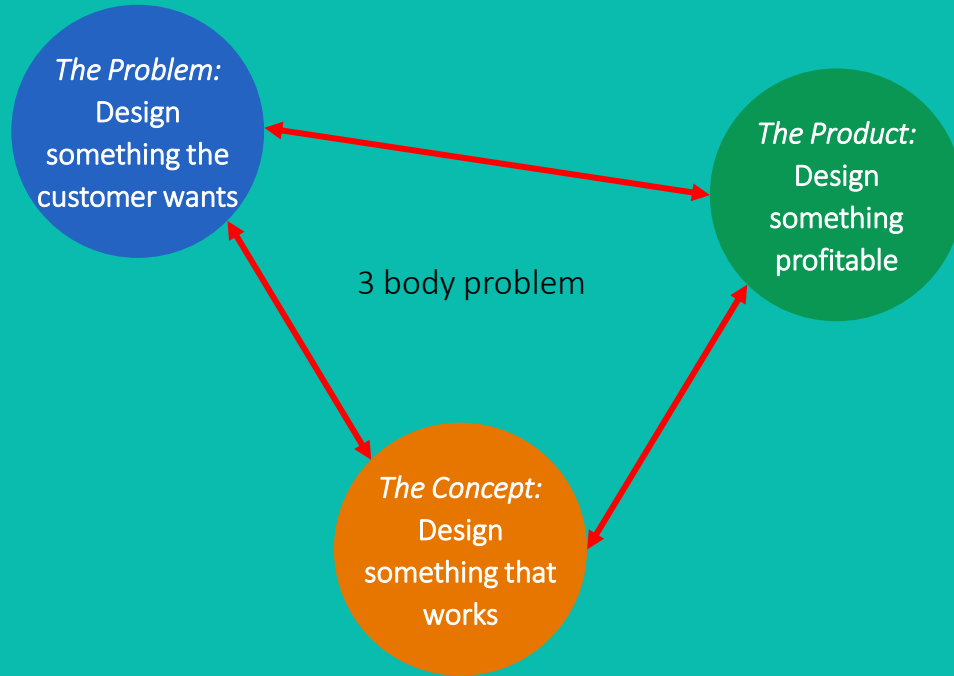


Primary purpose:

Visualize and connect systems engineering data

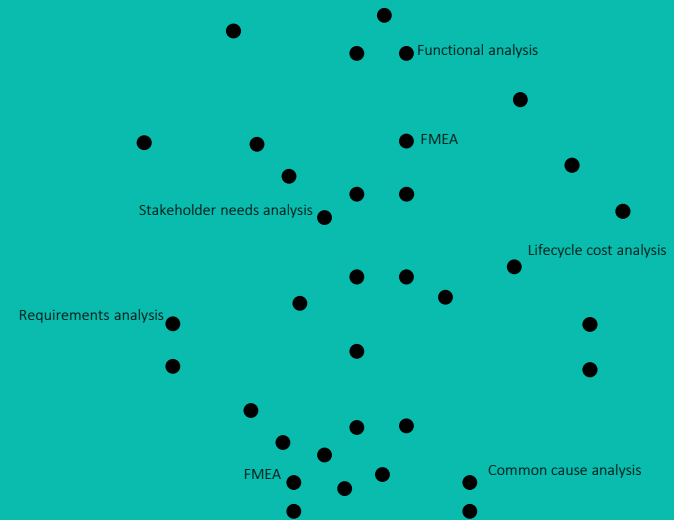
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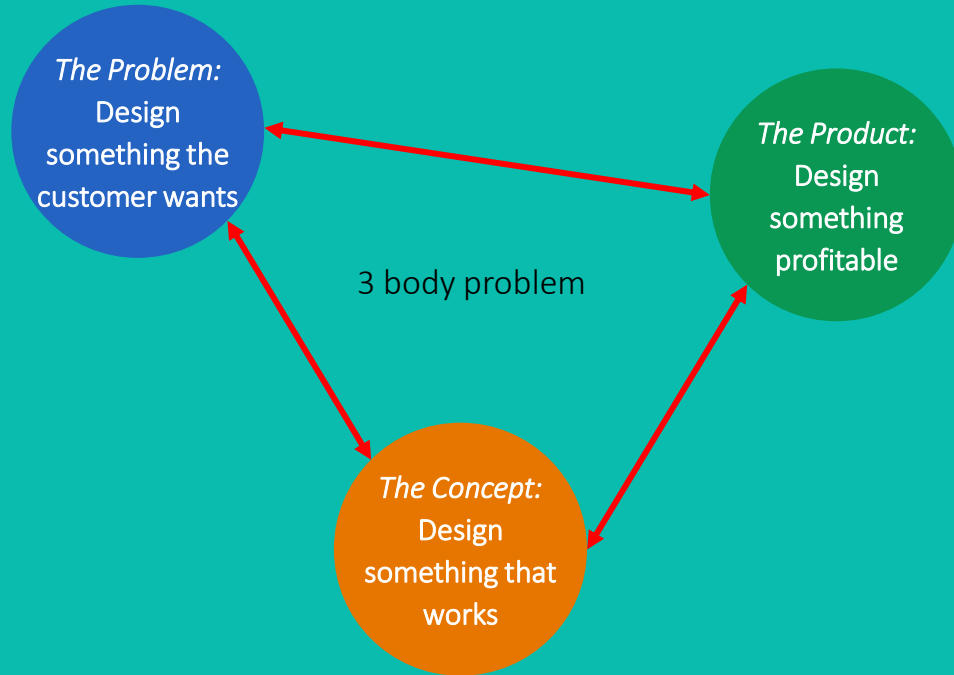
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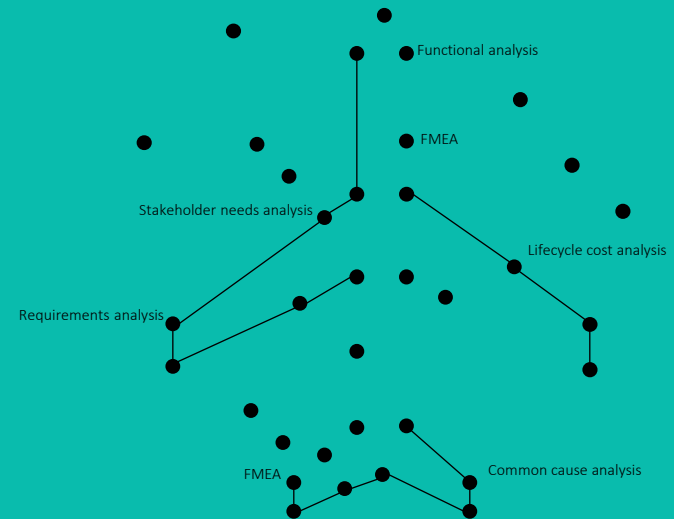
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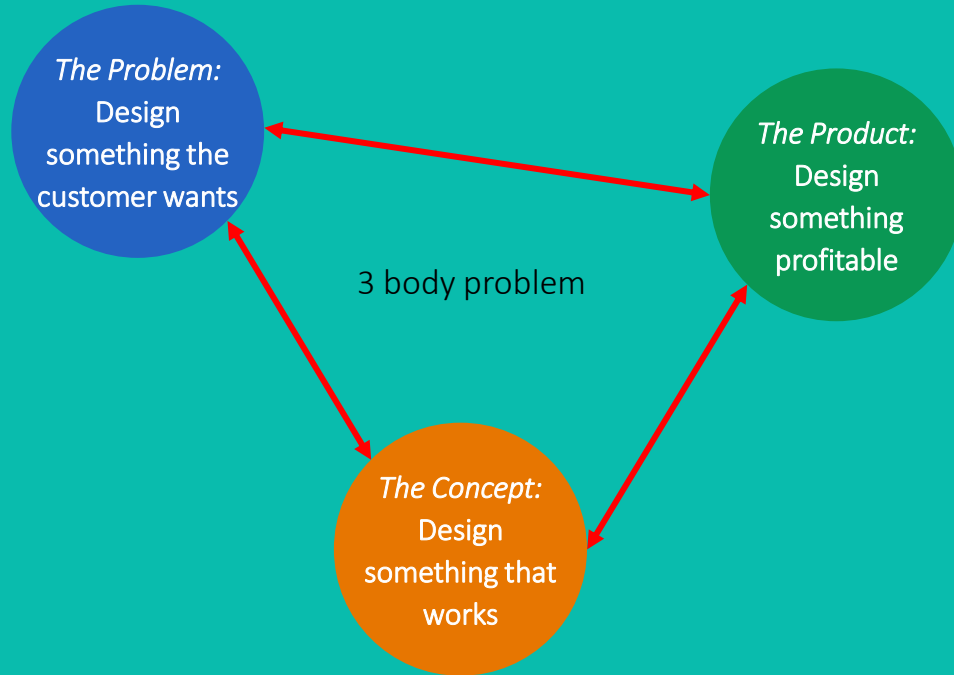
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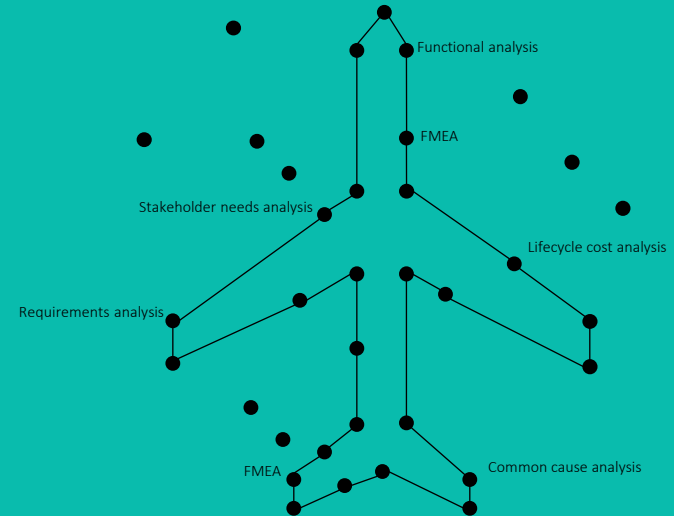
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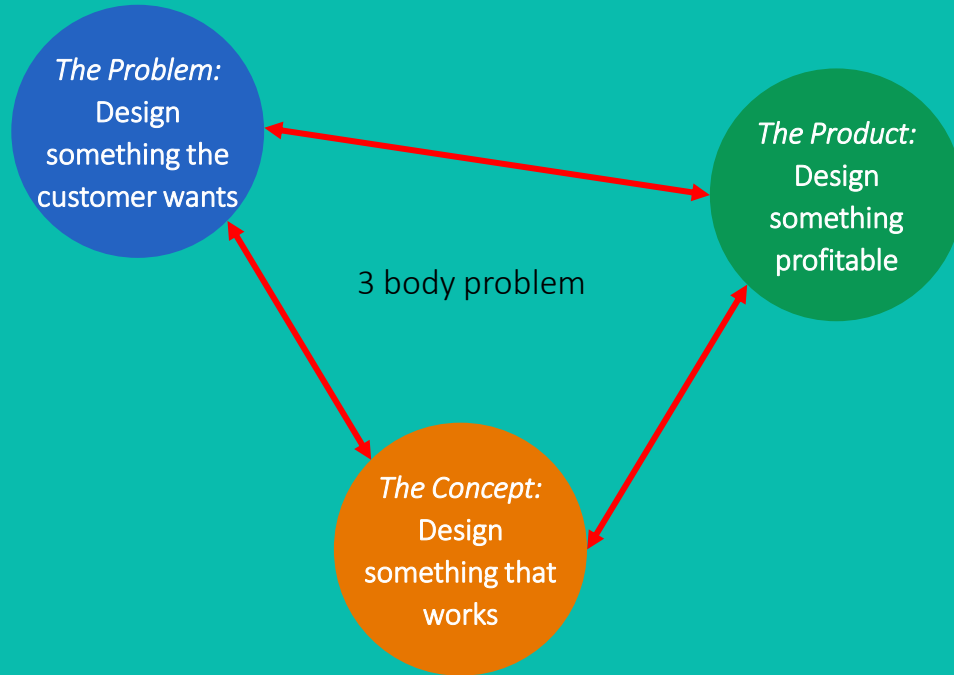
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Model-Based Systems Engineering



Primary purpose:

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MBSE brings order to chaos

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Model-Based Systems Engineering

- Primary purpose: Visualize and connect systems engineering data

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Model-Based Systems Engineering

- Primary purpose: Visualize and connect systems engineering data



- Secondary purpose: Enhance the Systems Engineering practice

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Model-Based Systems Engineering

- Primary purpose: Visualize and connect systems engineering data
- Secondary purpose: Enhance the Systems Engineering practice
 - Make it faster; ensure Systems Engineering stays ahead of the curve



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Model-Based Systems Engineering

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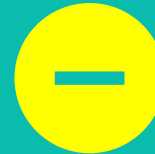
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The flaws of MBSE

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MBSE Flaw #1: MBSE has not made SE quicker

Pros	Cons



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MBSE Flaw #1: MBSE has not made SE quicker

Pros	Cons
Greatly improved design control and design quality gained from traceability.	



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Make traceability semi-automatic



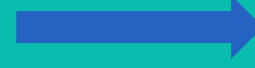
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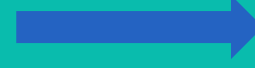
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Generate improvement proposals



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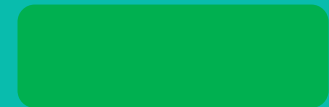


Assist the engineer in assessing when to stop

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MBSE Flaw #2: MBSE has not made SE more approachable

Pros	Cons



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Modeling frameworks enable consolidation and alignment of modeling practices within a company or industry	



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Continuous automatic
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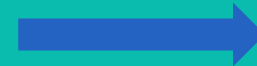
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Continuous automatic compliance assessment



Generate formal models from informal sketches



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Diagrams convey an unambiguous and structured representation of the design	Diagram is a peculiar dialect spoken by surprisingly few engineers



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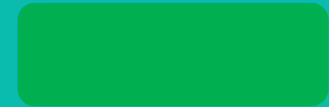


Generate informal sketches from a formal model

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MBSE Flaw #3: MBSE has not revolutionized SE

Pros	Cons



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Pros	Cons
Sequence and States & Modes diagrams can be directly added to Test Case descriptions	



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MBSE Flaw #3: MBSE has not revolutionized SE

Pros	Cons
Sequence and States & Modes diagrams can be directly added to Test Case descriptions	MBSE tools do not have built-in functionality for detecting emergent behavior or behavior design flaws.



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Validate the
functionality in the
background



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Modeling guides the engineer through the Systems Engineering process ensuring process compliance	It is still the same decades-old process; <ul style="list-style-type: none">• Requirements and Test Cases are not automatically generated by-products of the modeling process• Validation is still an activity that occurs <i>after</i> design, not during



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Let GSD do the
“boring” stuff

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Conclusive remarks

- So, can GSD solve the flaws of MBSE?
 - The answer was always «YES»

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Conclusive remarks

- So, can GSD solve the flaws of MBSE?
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- But how?
 - By acting as an assistant, co-pilot or navigator – not as an omnipotent Creator

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Conclusive remarks

- So, can GSD solve the flaws of MBSE?
 - The answer was always «YES»
- But how?
 - By acting as an assistant, co-pilot or navigator – not as an omnipotent Creator
- Why?
 - Because Systems Engineering is about structuring the Problem, proposing a set of Concepts and deciding what is the desirable Product – computers are far away from achieving that ability

The Problem:
Design
something the
customer wants

The Concept:
Design
something that
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The Product:
Design
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profitable



**Thank you for
listening!**

oluf.tonning@kongsberg.com