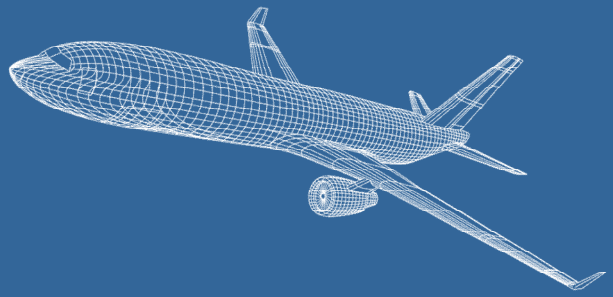
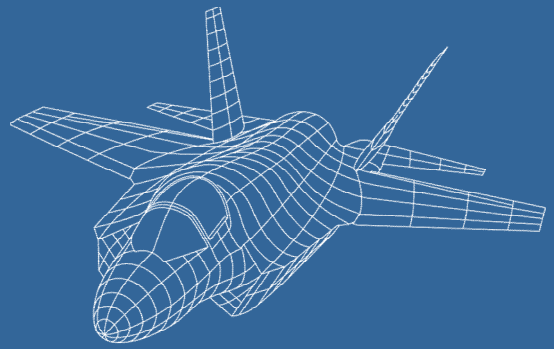
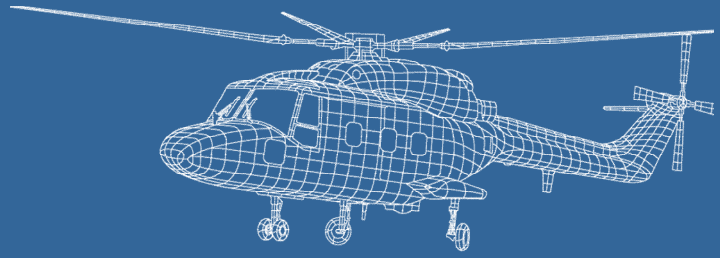

The VIrtual TUrbine Module demonstrator - VITUM

P. Johansson, O. Isaksson, C. Levandowski, J. Müller, A. Bertoni, D. Wiklund and A. Mann.

Presented by Peter Johansson peter.bv.johansson@gknaerospace.com

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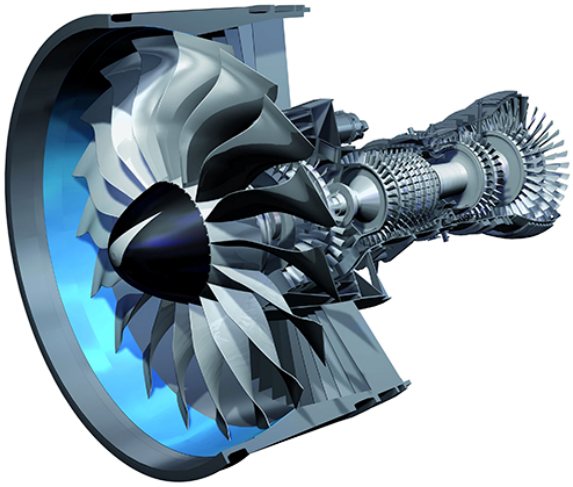
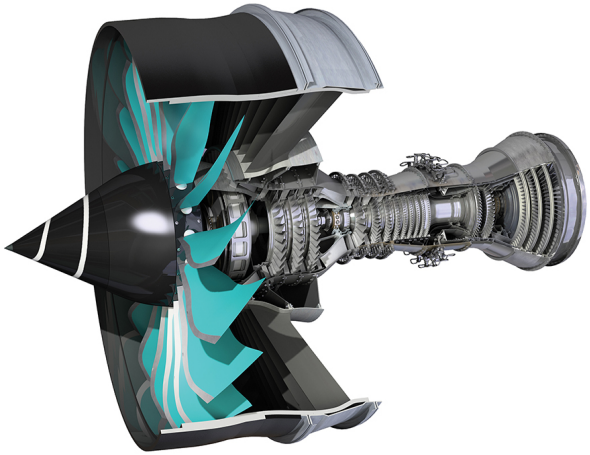
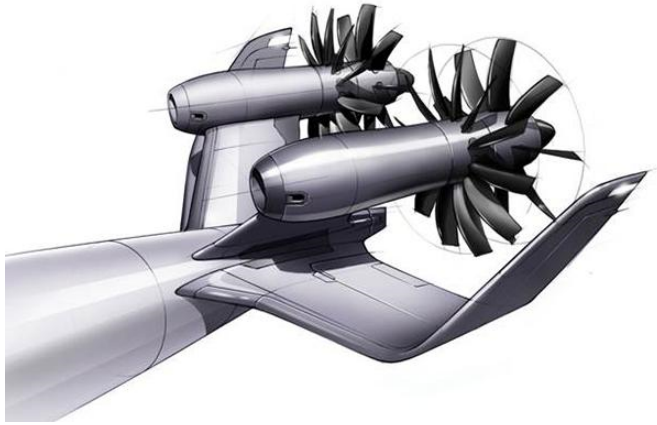
GKN TECHNOLOGY: MAKING THINGS FLY

Next generation aero engines...







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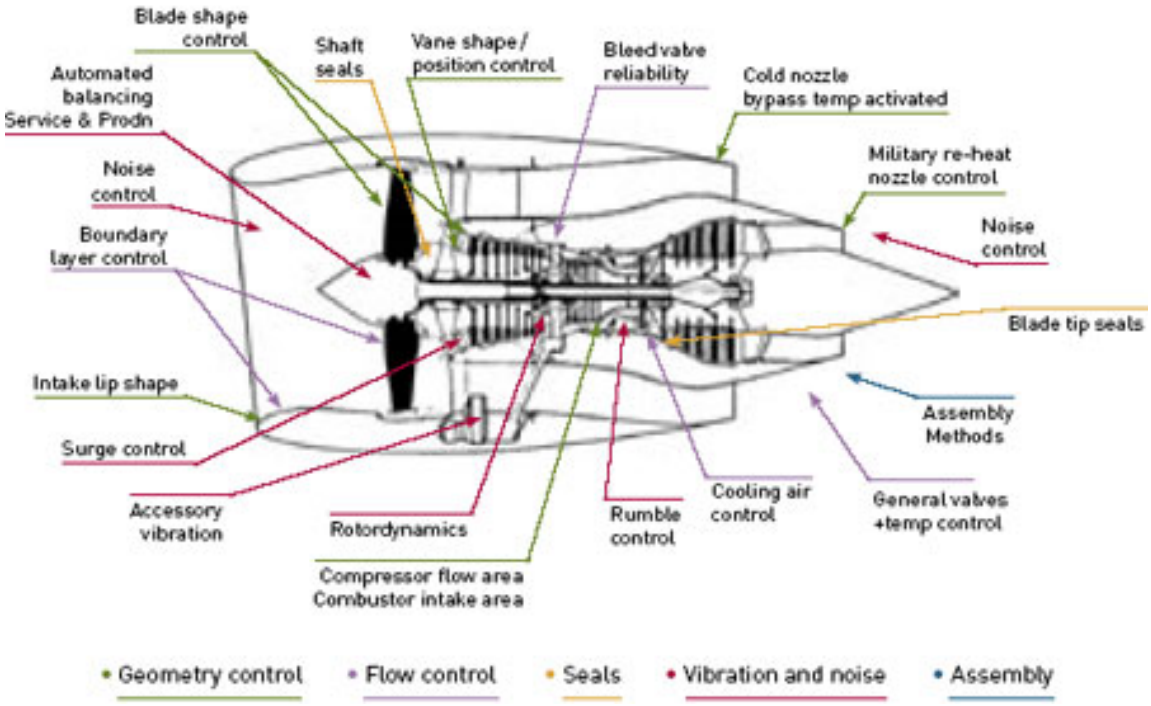
... Is based on many new technologies...

- New materials
- Blade shapes
- Noise control
- Cooling technologies
- Control technologies
- ....



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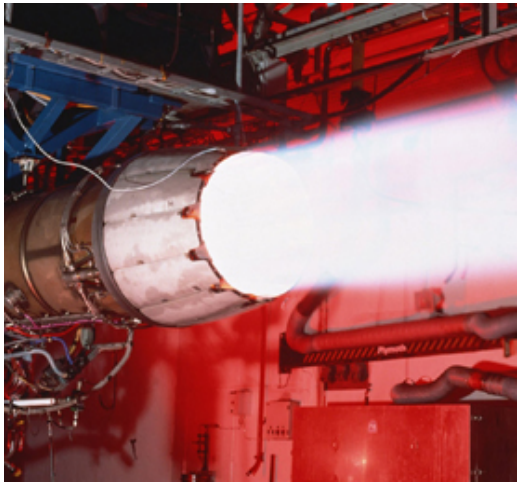
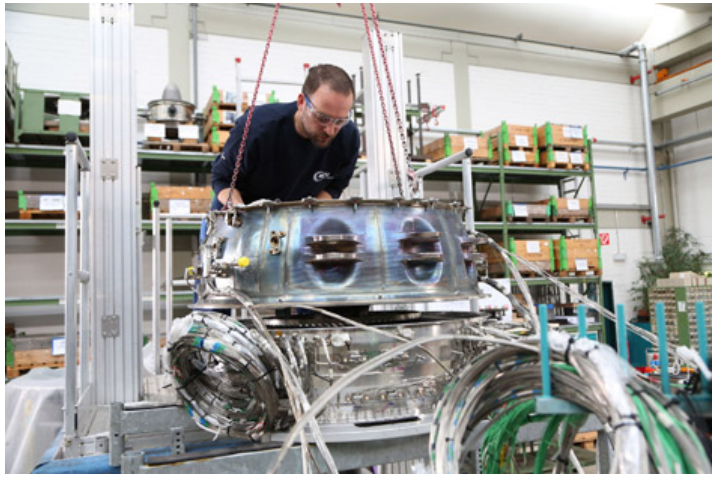
... Which requires testing

- Component testing
- Engine test on the ground
- Flying test bed





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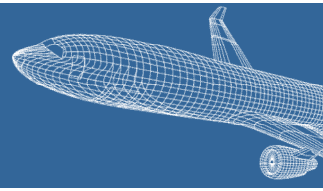
Development needs design space expansion

- Scalable architectures – a platform need to cover a large range of thrust classes
- Large number of parameters in the design space – impossible to physically test all
- Current design space is conservative – but the limit is unknown

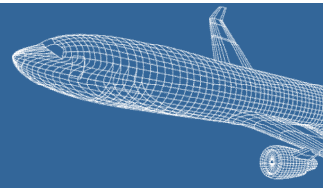
VIrtual TUrbine Module demonstrator – VITUM



- Objective
  - To define a virtual demonstrator to facilitate a (first) validation of technologies and design methods and capabilities in a context

- Expected benefits
  - A virtual testbed to
    - Prepare hardware tests
    - Prepare method implementation and change management initiatives
    - Represent sufficient realism to engage users and researchers

VITUM methods and technology

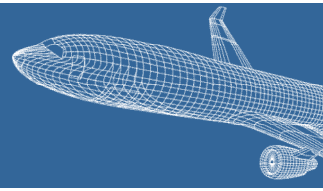


- New Development Process technologies (impact way of working)
  - Value Driven Design (BTH)
  - Functional modeling (Chalmers)
  - Link to analysis (Swerea)
  - Link to design criteria and product requirements (GKN)

- New product technologies (enable new engine component designs)
  - Ceramic Matrix Composites (Swerea)
  - Supplier involvement in early design phases (Swerea)

- Virtual Validation in a Turbine Exit Structure environment at GKN Aerospace

The VITUM scenario – overview, one loop

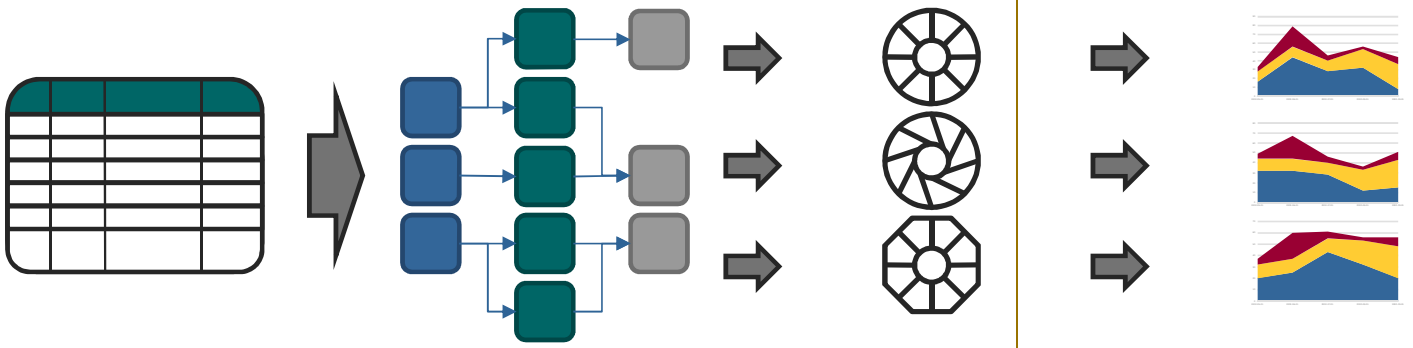


Functional description of requirements

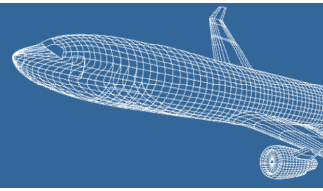
Functional alternatives

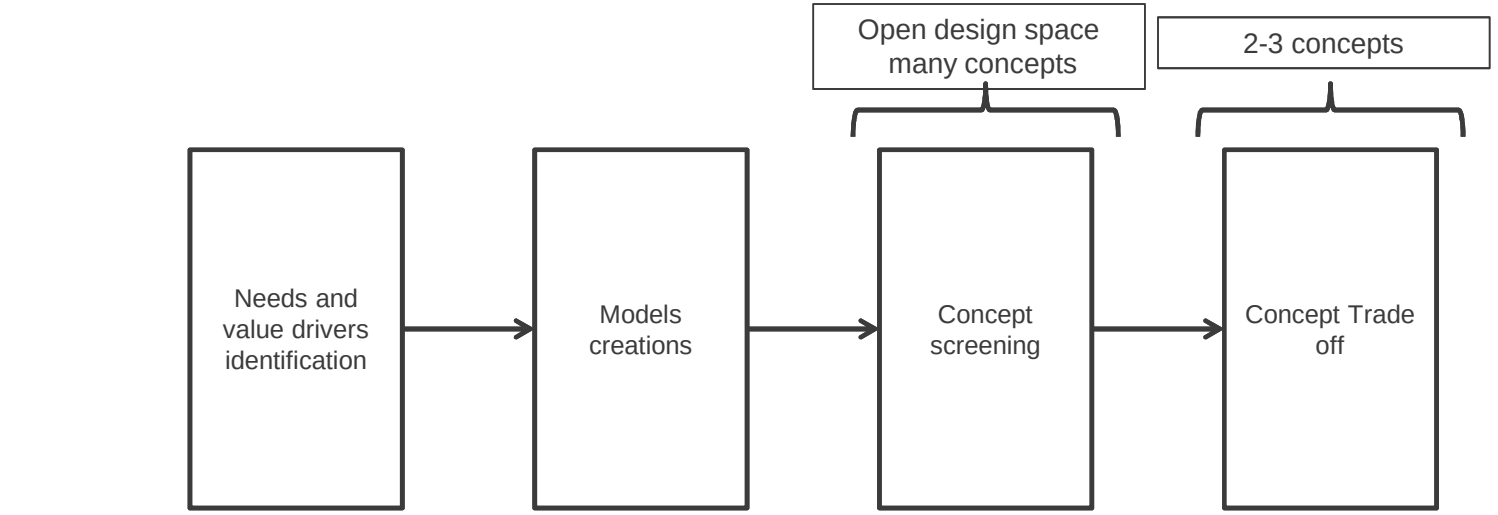
Geometric representations

Performance values



The VITUM product development scenario





ENABLERS

- Needs identification
- Value Drivers identification
- Value creation strategy definition
- Weighting matrix
  - Experts input
  - Suppliers input

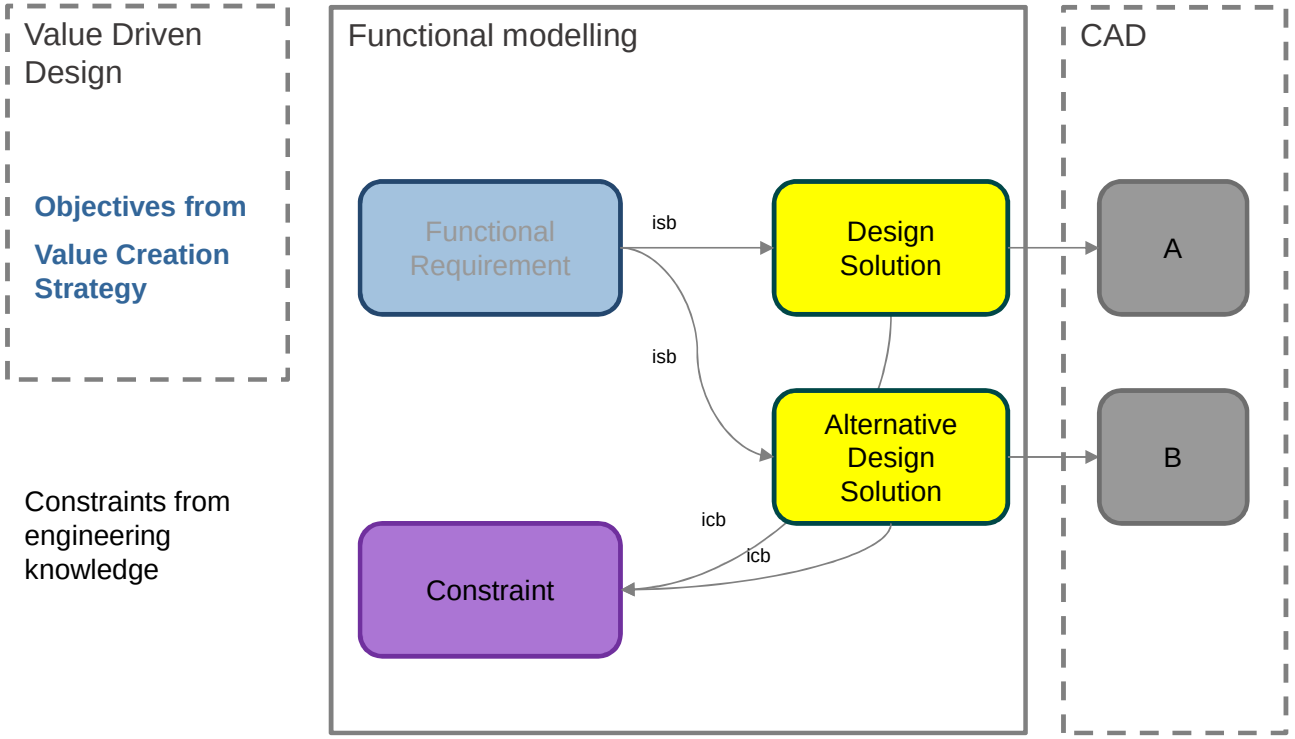
- CCM
- Weighting matrix
- Correlation matrix

- Design solution from CCM
- Engineering characteristics of design solution
- Identification of baseline design
- CODA matrix

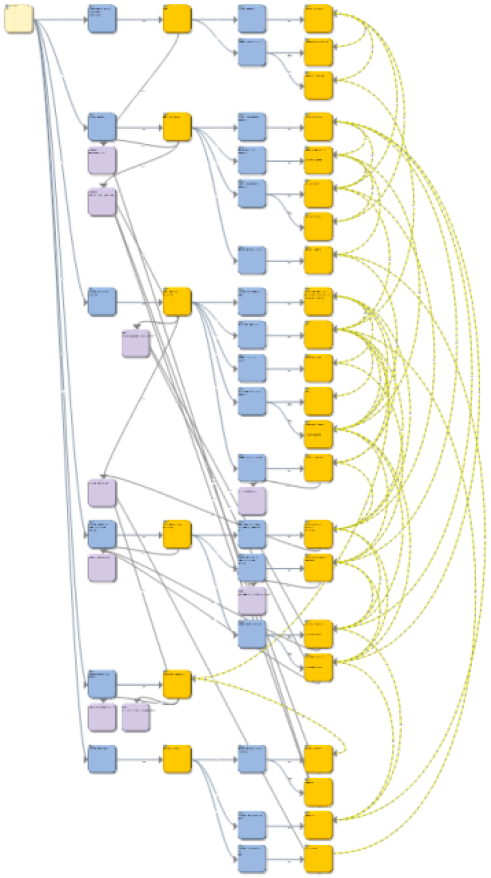
Models creation

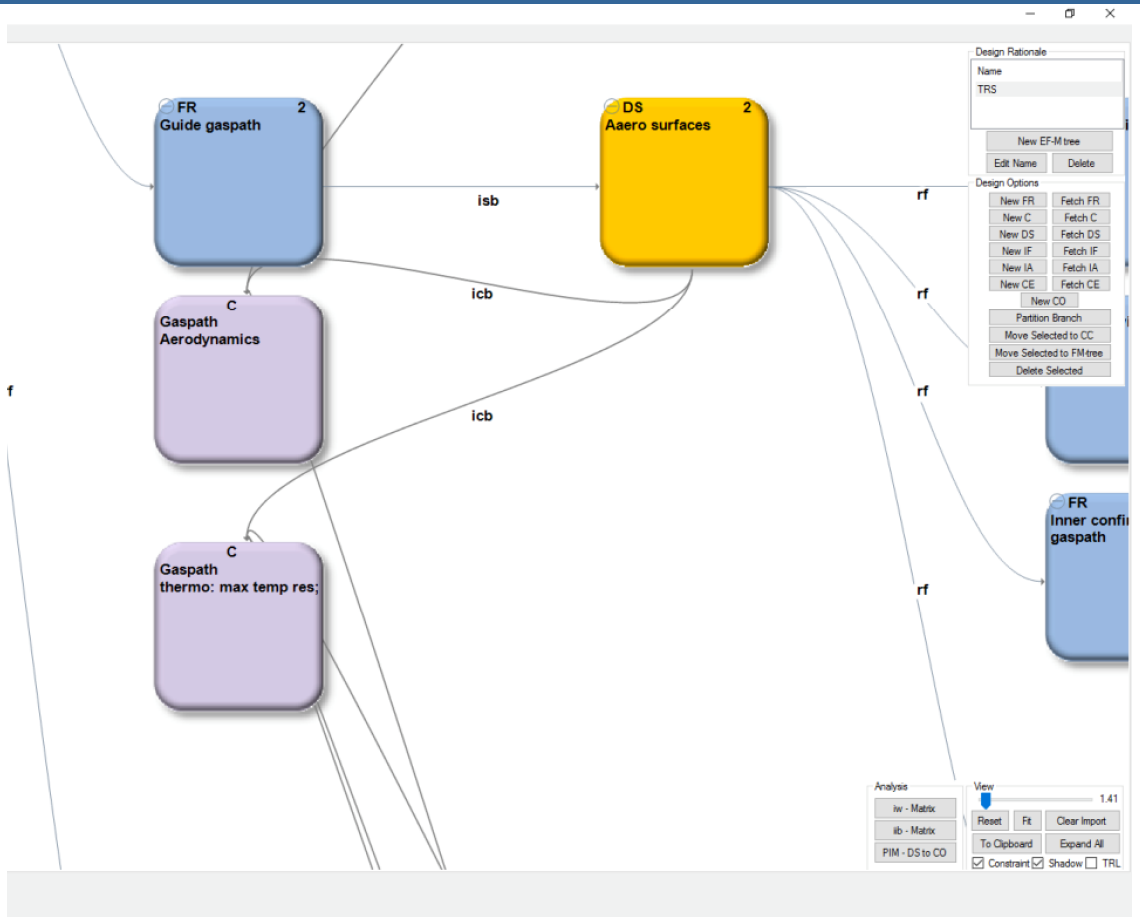
Enhanced functions-means modeling

Value drivers work as a constraint in the functional modeling



Functional model, engine exit module





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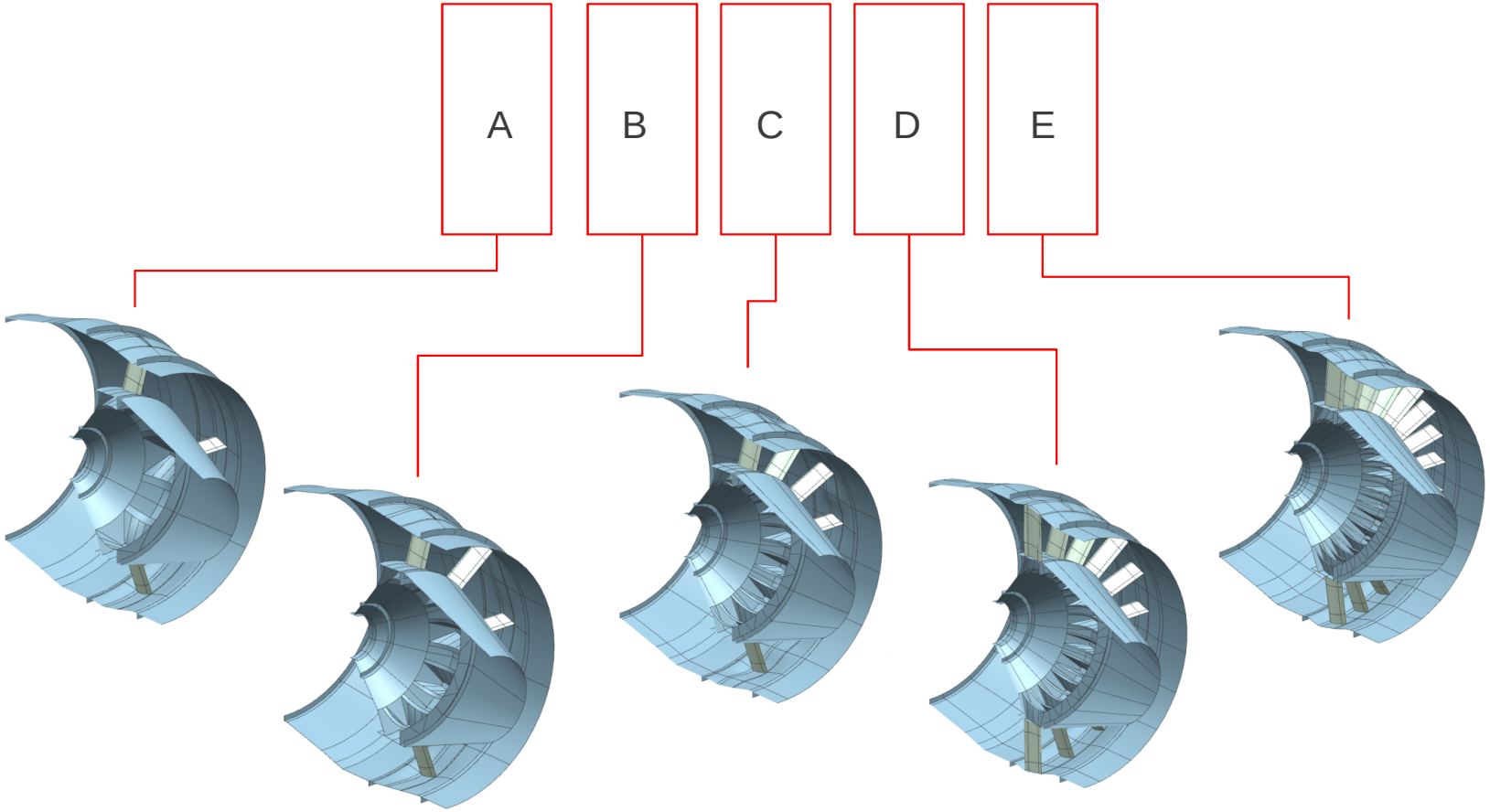
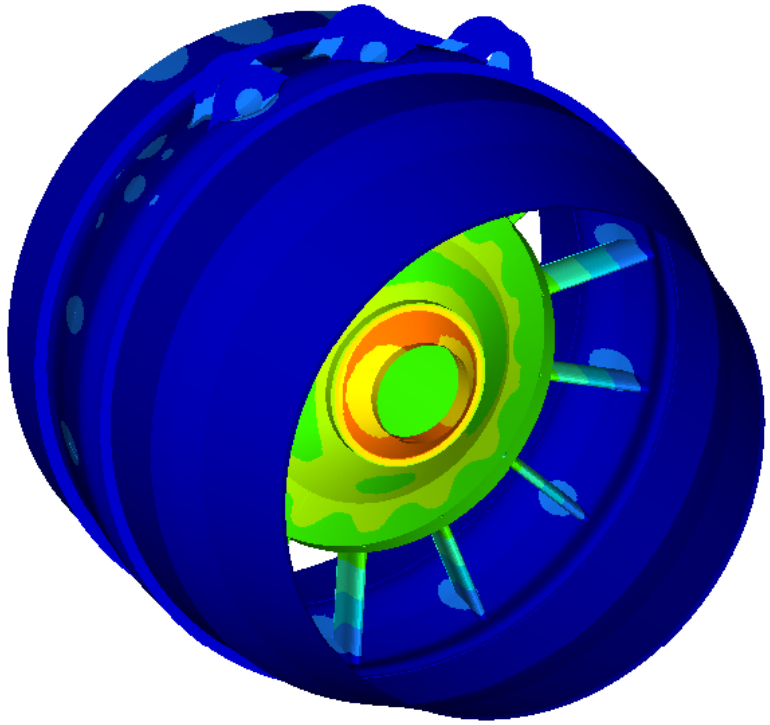
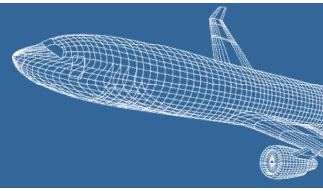
Design solution CAD model generation

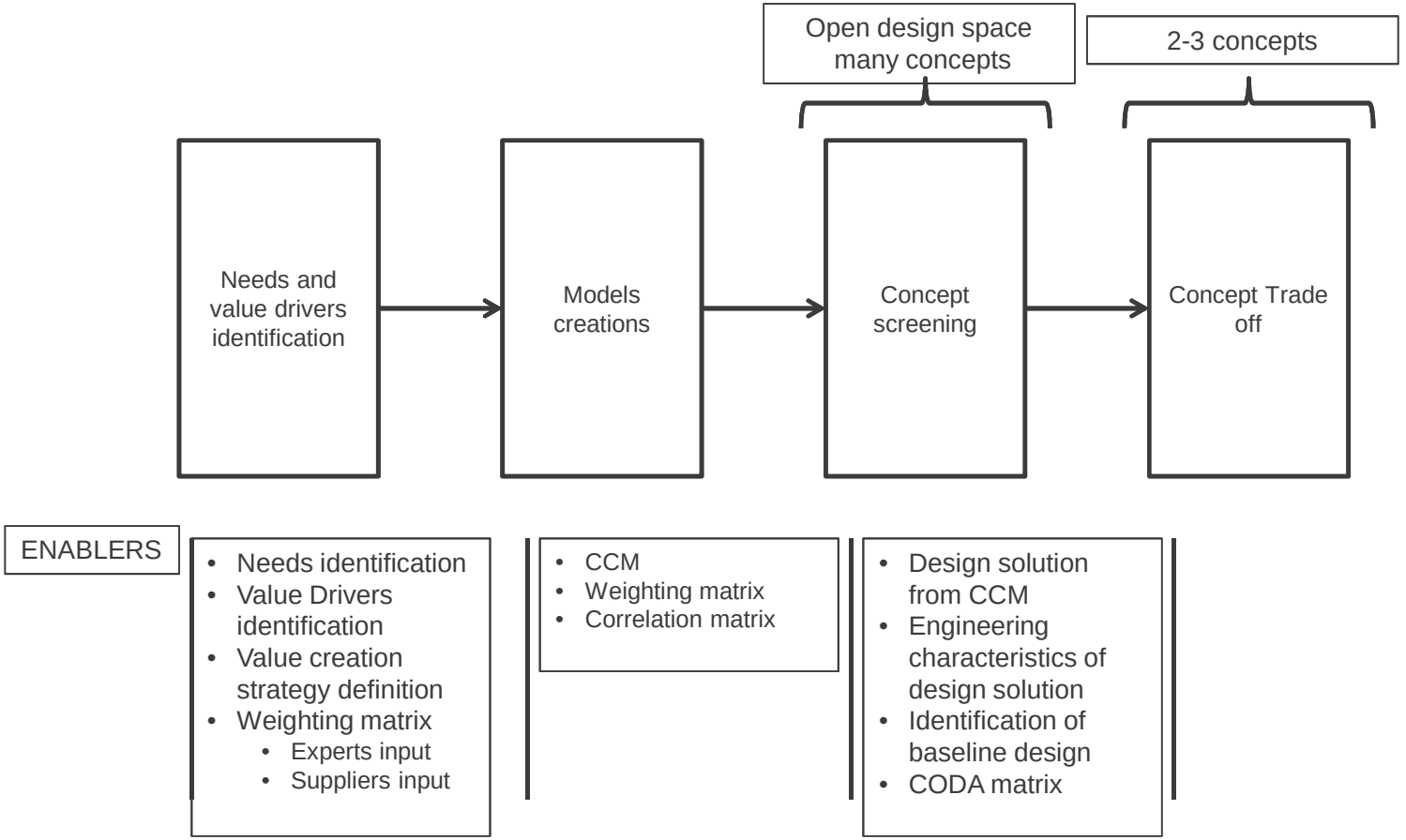


Link to analysis – in this case stiffness evaluation

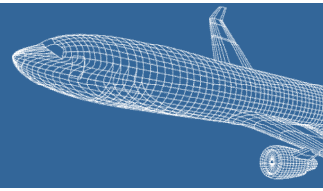


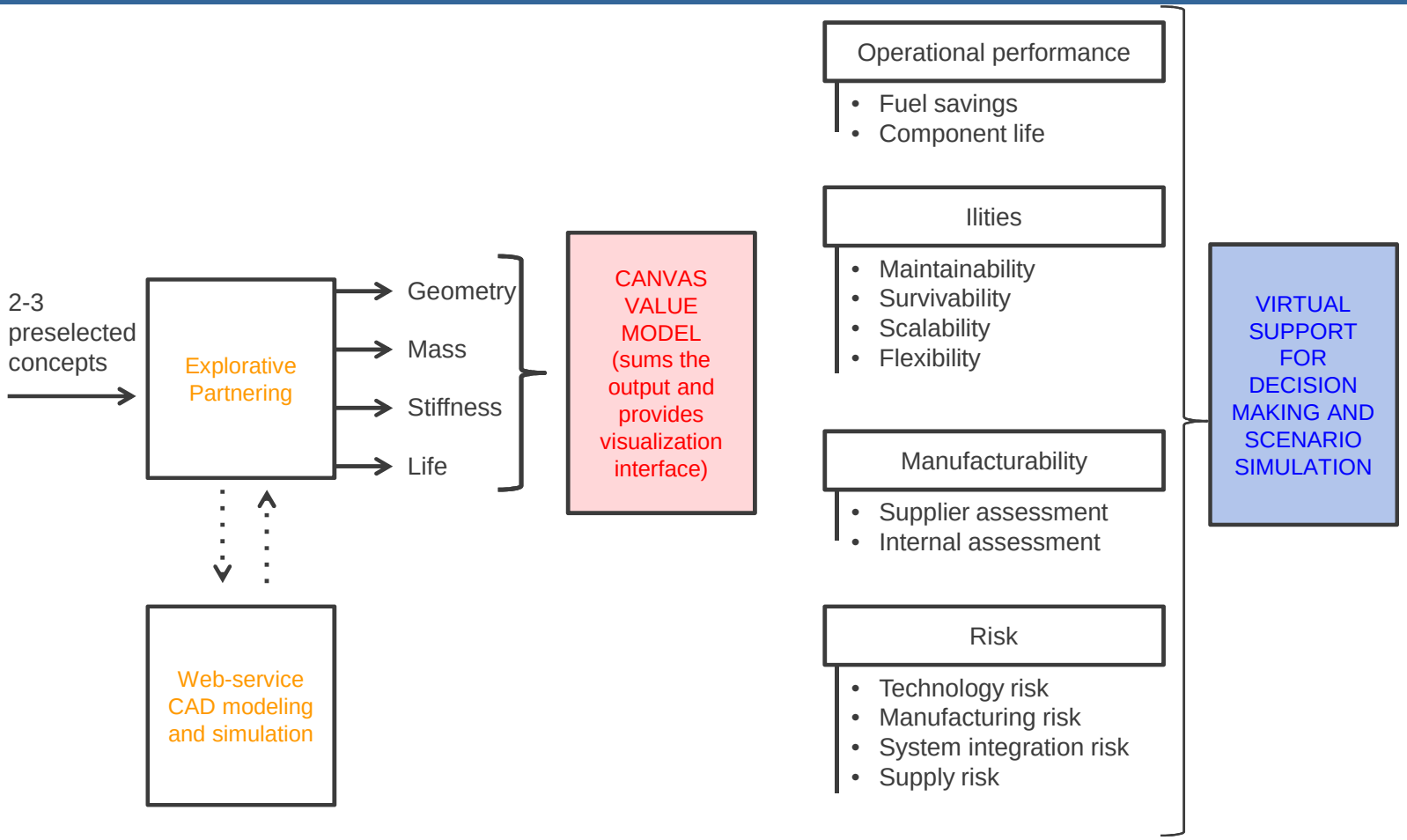
The VITUM product development scenario



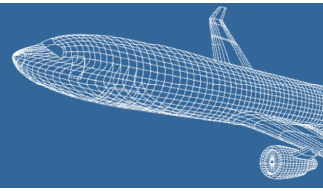


Concept evaluation phase





Summary



- New design methods has been combined with insertion of new technologies in a ”virtual demonstrator”
- Researchers from three research organizations team up to share and integrate new approaches together with an industrial design team
- Industrialist get a first hand experience with novel design methods – preparing hardware validation and implementation
- Academics can validate novel design capabilities in a realistic context

Acknowledgement
This work has been performed with support from Swedish Governmental Agency for Innovation Systems (VINNOVA) via the NFFP programme.

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