Efficient virtual development at Saab Automobile using HyperWorks

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Saab Automobile AB
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Saab Automobile AB Quick Facts

- On 23 February, 2010, Spyker Cars N.V. took over the ownership of Saab Automobile AB
- Chairman: Victor Müller
- CEO: Victor Müller
- Headquarter: Trollhättan, Sweden
- No. of Employees - Saab Automobile AB including subsidiaries: >3 800
- Saab is distributed in over 50 countries. Main markets are the U.S., Sweden, UK, Germany, Italy, Australia, France, Netherlands and Norway.
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Saab Automobile AB – Recent News On products

Saab 9-3 Sn and Wn Griffin with 119g CO2 and 180 hp

New Saab 9-5 Wn

New Saab 9-4X

http://www.saabengineering.com/
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**Agenda**

- Quick Facts about Saab Automobile AB
- **CAE – a part of the company culture**
- People, Process and Technology, enabling pillars for a CAE Driven Development
- Decreasing development time by reaching effectiveness within simulation
CAE Driven Development at Saab Automobile

We believe in CAE!

- It’s a part of the company culture

We have learned that by using CAE in an efficient way we get:

- significant development time reductions
- product cost savings
- quality improvement (achieve consistent performance)
- increased product design innovation
- more balanced and optimized products
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New Saab 9-5 – a proof that we can rely on CAE
Developed without hardware prototype vehicles

Closing effort

Squeak & Rattles

Thermal – HVAC
- main defrost
- footwell duct
- front vent ducts
- rear vent duct

Low speed crash

Spotweld fatigue

FMH

Airbag deployment
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Enablers for virtually driven development

• Courage
• Skilled people / Organization
• Process
  • CAE Methods
  • Development process
  • Synchronized data
  • Vehicle Assessments
  • Requirements, defined load cases
• Technology
  • Software
  • Computer
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Hybrid Organisation – Combining Benefits

CAE groups report to two organisations:

- **Vehicle Simulation** – Central CAE Function that is more focused on CAE as a tool with related processes

- **Product Functional Organization** - a Vehicle Systems or Vehicle Integration area that handles the daily product related work

+ forming simulations at ME
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**Development process – Assessment loop**

**Generic development plan**

- Project Initiated and Started
- Ready for Production
- Vehicle Assessments
- Physical development
- Mule Vehicles
- Production Validation

**VA**
- VA-1
- VA-2
- VA-3
- VA-4
- VA-5

**Sync**
- Build FE models
- Analyze
- Solve issues / optimize
- Release
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**Technology: Tools**

- LS-Dyna
- MSC Nastran
- MSC Adams
- Abaqus
- **HyperWorks**
  - HyperMesh
  - HyperView/HyperGraph
  - HyperStudy
  - RADIOSS
  - MotionView/MotionSolve
- Fluent
- Star
- LMS Virtual Lab
- Matlab
HyperWorks applications at Saab and approximate numbers of users

- HyperMesh - 40
- HyperView - 40
- HyperGraph - 35
- RADIOSS (bulk) - 25
- HyperStudy - 1
- MotionView/MotionSolve - 1
- …
- Coming, HyperWorks Enterprise

Number of HyperWorks Units: 1200+
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By taking the development from the area of testing to the area of simulations we gain a lot of time.

How can we decrease the development time even more?
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Decreasing development time

Generic development plan

Project Initiated and Started

Ready for Production

VA-1

VA-2

VA-3

VA-4

VA-5

Mule Vehicles

Production Validation

Vehicle Assessments

Physical development

Sync

Build FE models

Analyze

Solve issues / optimize

Release

Move your mind
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Sync to Vehicle Assessment in critical line for project
Lead time at project start: 6-8 weeks
Target: 3-4 weeks

VINNOVA sponsored project in cooperation with Altair, Epsilon and Saab (ended in Feb-2011)
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Reduce lead time Sync to Vehicle Assessment

- **Harmonise** the softwares used throughout the whole simulation department
- **Standarize** mesh specifications (size and quality), connectors, filenaming, material naming, part numbering etc
- **Automate** the CAD export
- **Automate** the modeling of simulation models by utilizing and developing batch meshing techniques
- **Automate** the assembling of full vehicle simulation models e.g. Crash & NVH-models
- **Automate** the set up and submitting of several similar loadcases e.g. Pedestrian Protection & Free Moving Head
- **Automate** result generation and post-processing
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**Building Body FE-models – Level of Automation**

- CAD-export
- Meshing
- Mesh quality check
- Part and component naming and numbering
- Assigning property and material
- Assemble FE-models with specific content and mixed mesh densities (i.e. LHD, wsr, side impact loadcase specific)
- Generating spotwelds
- Generating adhesives
- Generating seam welds
- Generating rigid bolt connectors
Building Body FE-models  
- Output within one week from sync

• 1 RADIOSS (bulk) model for use in static/dynamics, spotweld fatigue, NVH simulations etc
• 1 MSC Nastran model for use in slam, maxload etc.
• 1 LS-Dyna front impact model used in front impact high and low speed simulations
• 1 LS-Dyna rear end impact model used in rear end high and low speed simulations
• 1 LS-Dyna side impact model used in side impact simulations, door intrusion simulations etc
• 1 LS-Dyna FMH model used in FMH simulations and roof crush

• Built by a team of 4 people
• When the first model is completed, next model takes about one person one day to build.
Winnings with the semi-automated model building process at Saab using Altair products

- **Quality** – less manual work and administration
- **Time** – less manual work and administration
- **Variants** – builds up to 8 complete Body in White mesh variants in much shorter time than one model was built earlier
- **Cost** – we are able to do the modelling in-house, with minimal resources
- …
Summary

• Saab is aggressively utilizing CAE – it is a part of the company culture
• CAE is key to “revolutionizing” the Vehicle Dev. Plan
  – Time
  – Cost
  – Quality
  – Innovation
• People, Process and Technology are enabling pillars for a CAE Driven Development
• Shorten the Sync to Assessment lead time by
  – Harmonize
  – Standardize
  – Automate

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Questions?