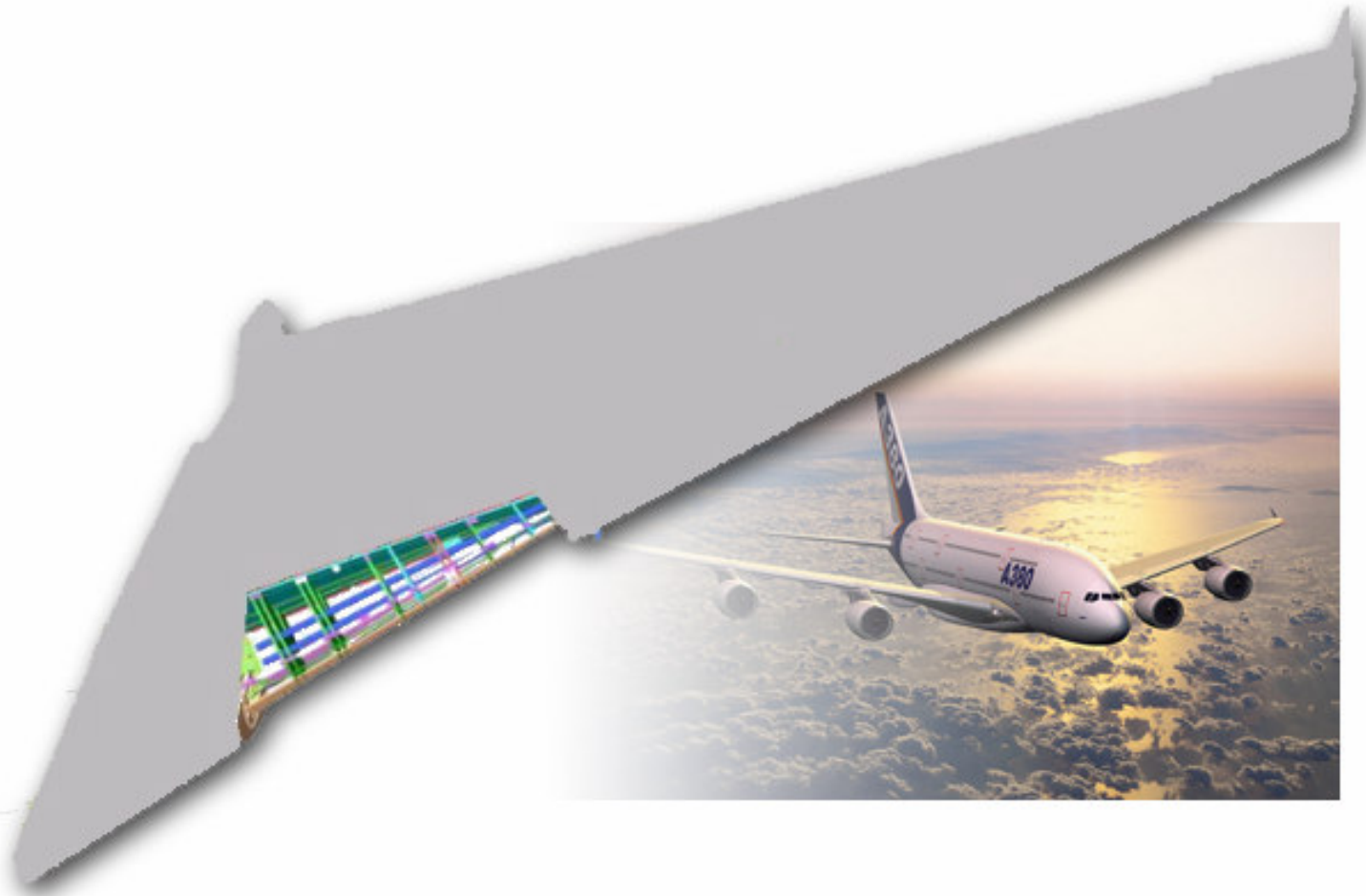


Altair Engineering

Accomplishments, Status, and Future Needs of CAE and Design Optimization

DAC 2006
Uwe Schramm

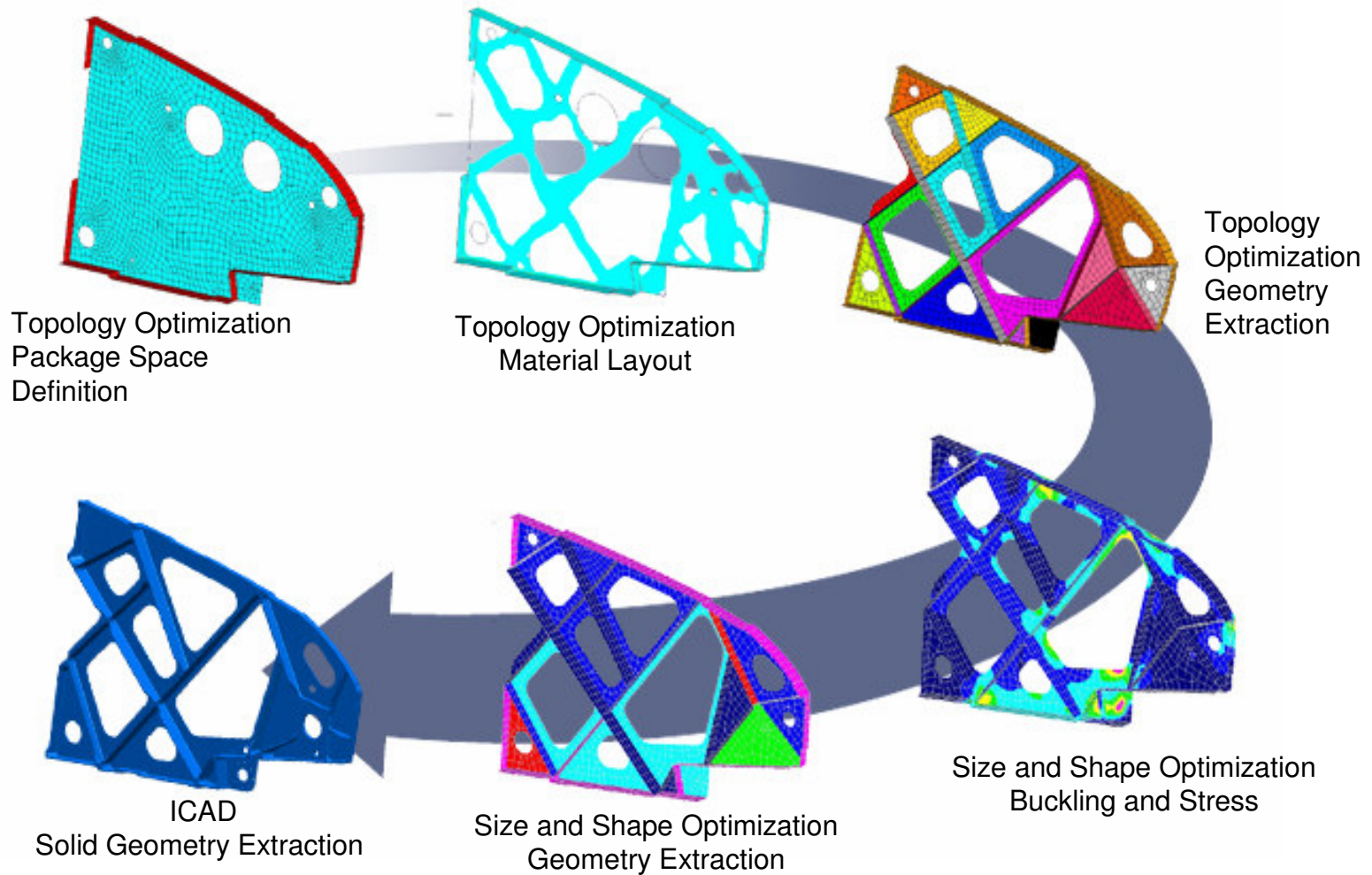
Airbus A380 Droop Nose Leading Edge



Courtesy of Airbus

Altair Engineering, Inc.

New Design Process Applied to Nose Ribs



Prototype of the Optimized Rib

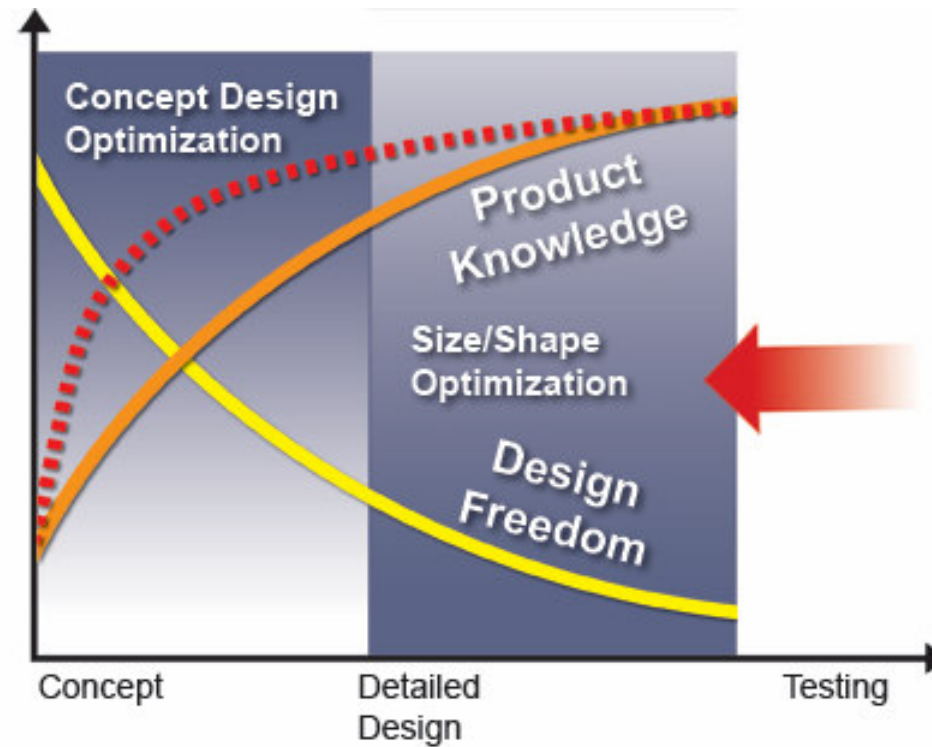


Challenges

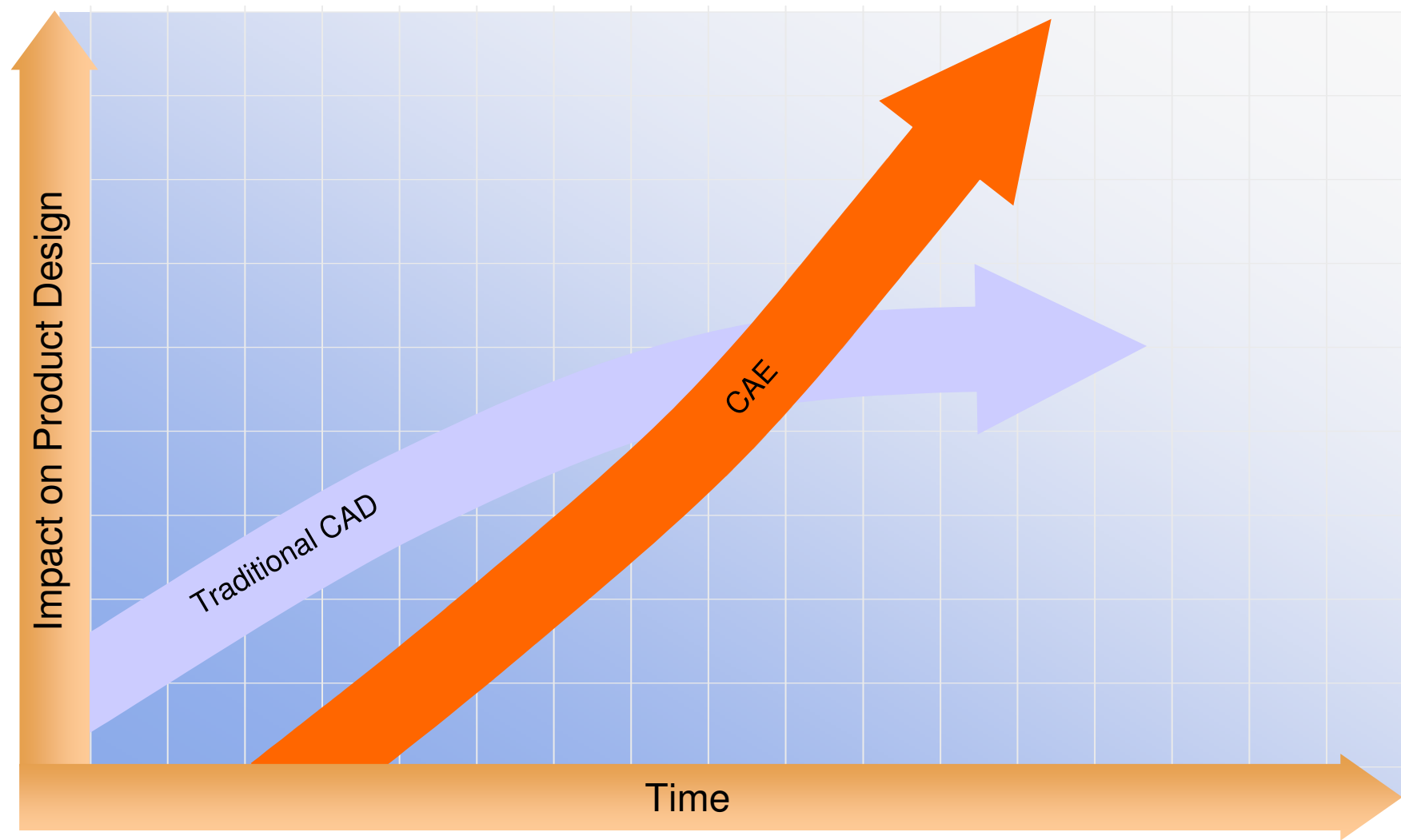
- Need for innovation, shorter time-to-market, best product performance, low manufacturing cost
- High cost of design iterations
- Even higher cost of changes to the design concept
- Multi-disciplinarity of the design problem
- Six-Sigma (Quality) requirements
 - Robustness and reliability of the product performance
 - Consistency of design decisions
 - Repeatability of the design process
- Amount of data involved
 - Data management
 - Best design practices
 - Knowledge management
 - Data availability
- Need for up-to-date performance and manufacturing validation
- Amount of uncreative engineering time involved in modeling



Design Process



Impact of CAE vs. CAD



Accomplishments and Status

- Computer Aided ENGINEERING
- CAE is largely replacing physical testing
- Design decisions are based on computational analysis
- CAE is driving the design process
- CAE (and CFD) is established in performance validation
- CAE is beginning in manufacturing validation
- CAE model is virtual prototype
- Designing is optimizing
- Design optimization is the true purpose of CAE
- Computational optimization is established for design improvement
- Concept techniques such as topology optimization have evolved



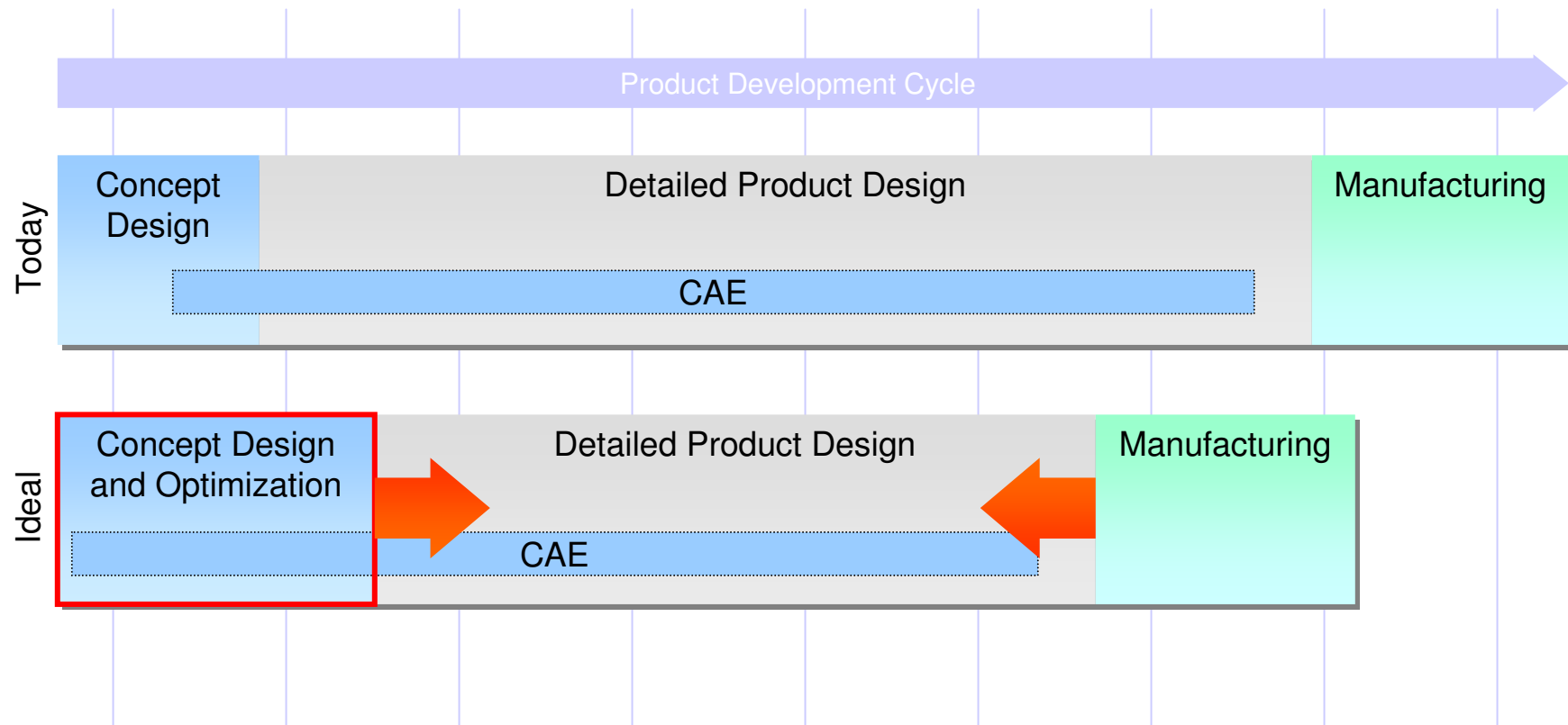
Future Needs

- Open, programmable CAE-centric design environment
- CAE automation
- Key CAE Modeling and Visualization Components:
Meshing, Morphing, Modeling, Visualization, Reporting, Collaboration
- Conceptual design technology
- Multi-disciplinary design, trade-off, decision making (design dashboard)
- Six-Sigma CAE
- Workload management
- Engineering data management
- Organizational challenges



Concept Design Technology

- Time-to-market
- Innovation



Case Study

Optimization Driven Design of an Aircraft Fuselage Tail Section

■ Situation

- New concept design for A350 rear section
- Reference model A330-200
- Investigate mass reduction potential
- 130 load cases

■ Methodology

- Multi-step optimization
- Combined topology & sizing optimization
- Minimize total compliance
- Constraint: mass



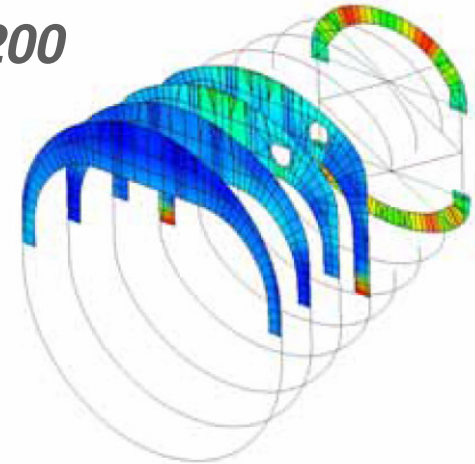
© 2006 The Authors
Journal compilation © 2006 Blackwell Publishing Ltd



Results: Comparison of Frame Stresses

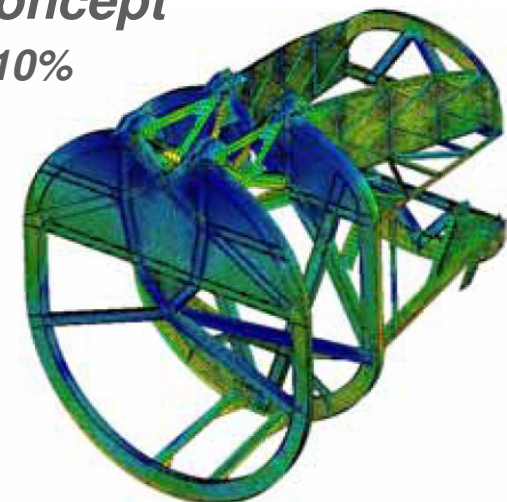
- Evaluation of multiple concepts with various mass targets: $m-0\%$... $m-20\%$
- Homogenized stresses, peaks reduced
- Similar results for skin stresses
- Reduced internal loads
- No displacement increase even with reduced mass
- Preliminary buckling analysis shows sufficient reserves
- **Predicted weight savings: 15-20% due to new layout**
- **Design concept validated for all load cases!**

A330-200

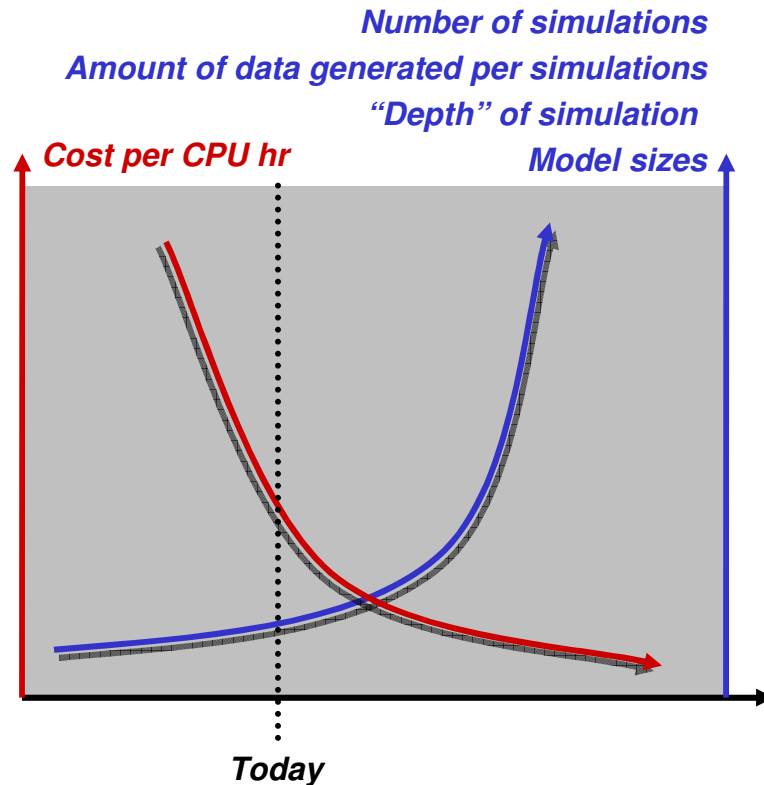


A350 Concept

m-10%



Engineering Data Management



- More data created faster
- More demand (competitive edge)
- More supply (hardware resources)

*As the amount of result data explodes,
the way you do CAE will and has to change dramatically*



Global Access to Data & Performance Metrics

- Multi-site Installation
 - Independent
 - With data replication



CASE STUDY – MAGNA STEYR Fahrzeugtechnik

Challenge

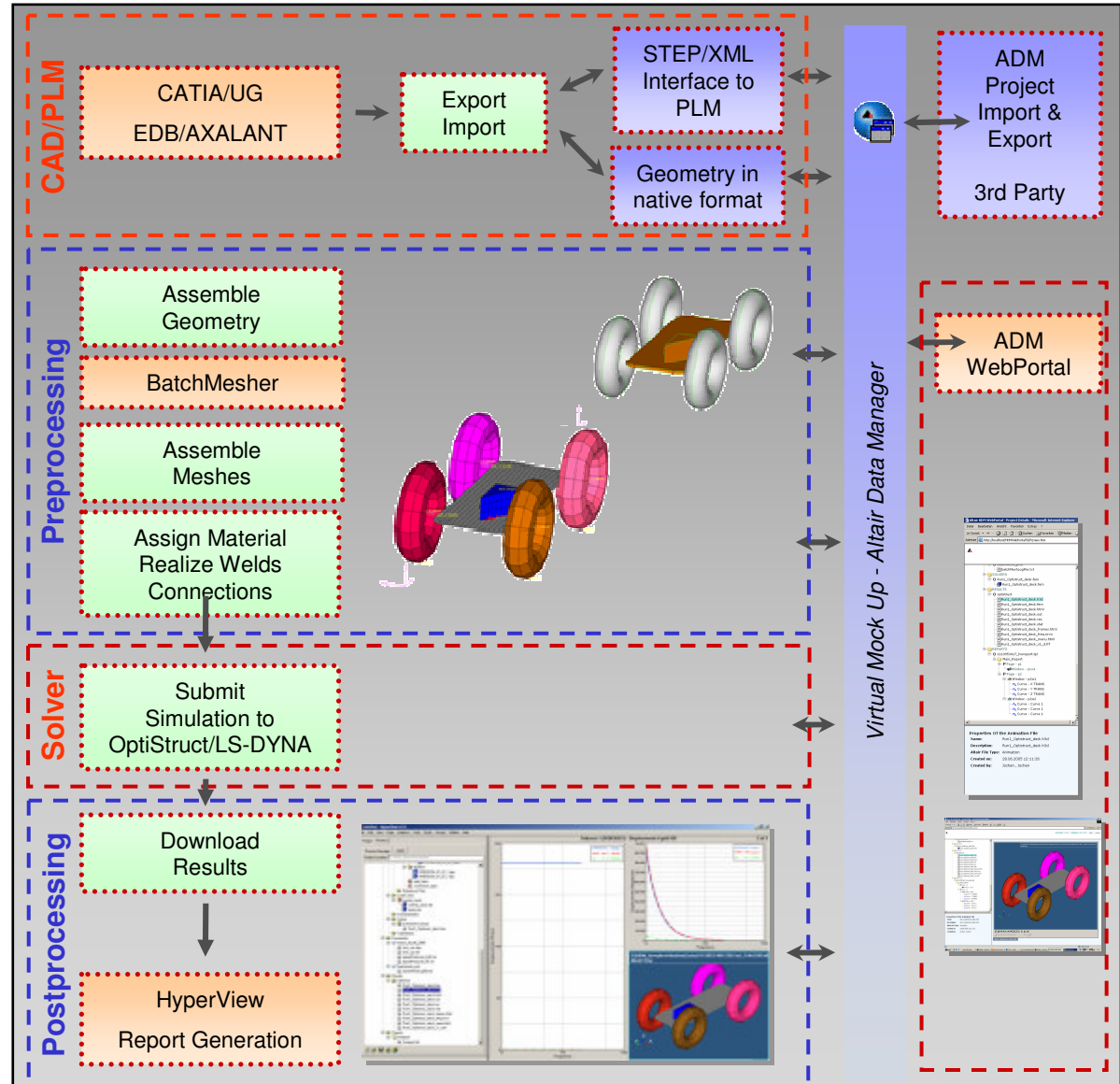
- Need an environment to manage and automate CAE process and data

Solution

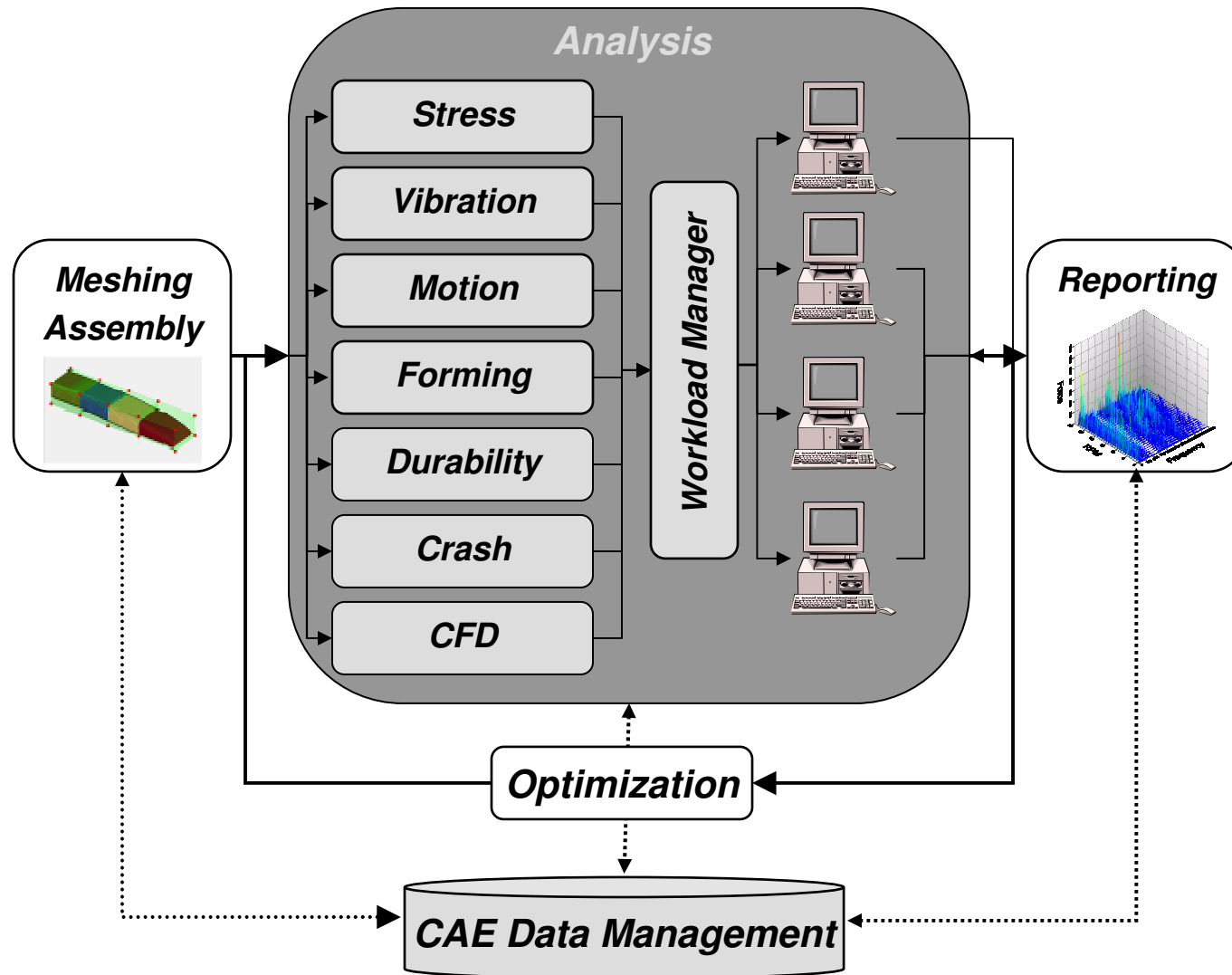
- Select Altair as a strategic development partner

Results

- Software available in less than 12 months
- Centralized CAE Data Management
- Improved Data Supply Speed
- Standardization and reproducibility of CAE processes



Consistent Data Model Driving Multi-Attribute Design



Future Needs

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