# Strategies for Deploying Expert and Casual CAE Tools

June 30th, 2010

# Agenda

## Strategies for Deploying Expert and Casual CAE Tools

June 30th, 2010

8:00am PDT (Seattle) / 11:00am EDT (New York) / 4:00pm BST (London)

- Welcome & Introduction (Overview of NAFEMS Activities)
  - Matthew Ladzinski, NAFEMS North America
- Strategies for Deploying Expert and Casual CAE Tools
  - Blake Courter, SpaceClaim
- Q&A Session
  - Panel
- Closing

Ladzinski

Courter

THE INTERNATIONAL ASSOCIATION
FOR THE ENGINEERING ANALYSIS
COMMUNITY

# An Overview of NAFEMS Activities

Matthew Ladzinski
NAFEMS North America

# Planned Activities

- Webinars
  - New topic each month!
    - Visualization Challenges in CAE - July 28th
    - Simulation of Variability in the Hybrid 3 Crash Test Dummy – August 25th
    - Practical Approach to Deformation Analysis – November 8th (NAFEMS Italy)
  - Recent webinars:
    - Strategies for Deploying Expert and Casual CAE Tools - TODAY
    - Fire Modelling in CFD
    - "Accepted Practices in FEA" (NAFEMS India Webinar)
    - Product Performance Simulation in the Year 2020
    - What is V&V
    - How to Ensure that CFD for Industrial Applications is Fit for Purpose
    - Practical CFD
    - Composite FE Analysis
    - 10 Ways to Increase Your Professional Value in the Engineering Industry
    - Dynamic FE Analysis
    - Modal Analysis in Virtual Prototyping and Product Validation
    - Pathways to Future CAE Technologies and their Role in Ambient Intelligent Environments
    - Computational Structural Acoustics: Technology, Trends and Challenges
    - CCOPPS: Power Generation: Engineering Challenges of a Low Carbon Future
    - Practical CFD Analysis
    - Complexity Management
    - CCOPPS: Creep Loading of Pressurized Components – Phenomena and Evaluation
    - Multiphysics Simulation using Implicit Sequential Coupling
    - CCOPPS: Fatigue of Welded Pressure Vessels
    - Applied Element Method as a Practical Tool for Progressive Collapse Analysis of Structures
    - A Common Sense Approach to Stress Analysis and Finite Element Modeling
    - The Interfacing of FEA with Pressure Vessel Design Codes (CCOPPS Project)
    - Multiphysics Simulation using Directly Coupled-Field Element Technology
    - Methods and Technology for the Analysis of Composite Materials
    - Simulation Process Management
    - Simulation-supported Decision Making (Stochastics)
    - Simulation Driven Design (SDD) Findings

**To register for upcoming webinars, or to view a past webinar, please visit: www.nafems.org/events/webinars**


- Established in 2009
- Next courses:
  - Non-Linear Analysis – July 13th, 2010 (*four-week course*)
  - Composite FE Analysis – August 24th, 2010 (*four-week course*)
  - Dynamic FE Analysis – TBA (*seven-week course*)
  - Simulation-Supported Engineering – TBA (*four-week course*)
- Proposed course offerings:
  - Optimization – TBA
- For more information, visit: www.nafems.org/e-learning

SEPTEMBER 8-9 2010

WWW 2010 NAFEMS VIRTUAL CONFERENCE
2020 VISION OF ENGINEERING ANALYSIS AND SIMULATION

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- Date: September 8-9, 2010
- Location: Online (virtual)
- Keynote Speakers: Prof. Jim Wood, University of Strathclyde, *plus three others TBA in the coming weeks*
- Conference Themes:
  - Business developments to increase the financial impact of CAE investments
  - Technical developments to improve speed, accuracy, reliability, accessibility, and applicability of results
  - Human issues (e.g. Teaching simulation as part of the basic engineering curricula, certification, etc.)
- For more information, visit: www.nafems.org/virtual

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OCT 12 13 2010 | PARIS FRANCE

FR 2010 NAFEMS CONFERENCE

SIMULATION NUMÉRIQUE : MOTEUR DE PERFORMANCE

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SIMULIA

- Date: October 12-13, 2010
- Location: Paris, France
- Keynote Speaker: TBA
- Conference Themes:
  - State of the art technologies and applications of digital simulation
  - Optimization, robust design and reliability of the products
  - Benchmarking, verification and validation
  - Economic impacts of simulation
- For more information, visit:
  www.nafems.org/events/nafems/2010/francecongres

OCTOBER 26 - 27 2010
GOTHENBURG, SWEDEN

# NORDIC 2010 NAFEMS CONFERENCE

TRENDS AND FUTURE NEEDS IN ENGINEERING SIMULATION

call for papers

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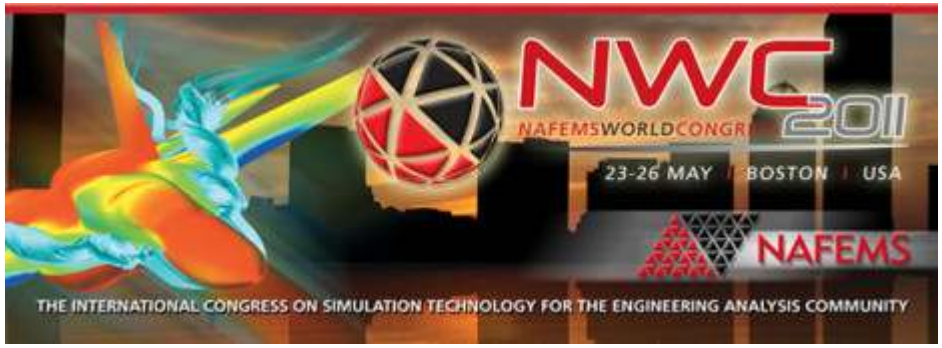
BETA CAE Systems SA

LMS ENGINEERING INNOVATION

- Date: October 26-27, 2010
- Location: Gothenburg, Sweden
- Keynote Speaker: TBA
- Conference Topics:
  - Trends and future needs in engineering simulation
  - Robustness and confidence of analysis results
  - Optimization / stochastics
  - Multiphysics / coupled analysis
  - Materials
  - Nonlinear Analysis
  - Plus much more...
- For more information, visit: www.nafems.org/events/nafems/2010/NORDIC2010/




- Date: May 23-26, 2010
- Location: Boston, MA
- Current Call for Papers (Deadline: October 18th, 2010)
- For more information, visit: www.nafems.org/congress

# NAFEMS Events

- Multiple opportunities to attend conferences, seminars/workshops and training courses

**Leveraging CAE for Greater Business Value Through Simulation**
17th Feb 2010
Webinar
Online,USA

**Delivering CAE for the Nuclear Energy Industry**
23rd Feb 2010
Seminar
Knutsford,UK

**Non-Linear Analysis**
2nd Mar 2010
Course
e-Learning,Online

**Practical Stress Analysis & Finite Element Methods**
9th Mar 2010
Course
Stratford Upon-Avon,UK

**Introduction au Calcul de Structures, aux Éléments Finis et à la Simulation Numérique**
16th Mar 2010
Course
Paris,France

**Coupling 1D and 3D CFD: The Challenges and Rewards of Co-Simulation**
17th Mar 2010
Seminar
Gaydon,UK

**FEM Basic 1 - Praxisorientierte Strukturmechanik / Festigkeitslehre**
24th Mar 2010
Course
Wiesbaden,Germany

**Composites FE Analysis**
13th Apr 2010
Course
e-Learning,Online

**Practical Stress Analysis and Finite Element Methods**
19th Apr 2010
Course
Madrid,Spain

**Verbindungstechnische Aspekte bei Finite-Elemente-Berechnungen**
28th Apr 2010
Seminar
Wiesbaden,Germany

**Finite Elements and Numerical Simulation of Forming Processes**
28th Apr 2010
Seminar
Aviero,Portugal

**Thermalmanagement mit CFD-Simulationen**
4th May 2010
Seminar
München - Ismaning,Germany

**FEM Basic 2 - Praxisorientierte Grundlagen für FEM-Analysen**
5th May 2010
Course
Wiesbaden,Germany

**Practical CFD Analysis**
11th May 2010
Course
Stratford-Upon-Avon,UK

**UK Conference 2010 - Engineering Simulation: Contributing to Business Success**
8th Jun 2010
Conference
Oxford,UK

**Introduction au Calcul de Structures, aux Éléments Finis et à la Simulation Numérique**
8th Jun 2010
Course
Paris,France

**Introduction au Calcul de Structures, aux Éléments Finis et à la Simulation Numérique**
5th Oct 2010
Course
Paris,France

**Congrès NAFEMS France 2010 - Simulation Numerique : Moteur de Performance**
12th Oct 2010
Conference
Paris,France

**Introduction au Calcul de Structures, aux Éléments Finis et à la Simulation Numérique**
23rd Nov 2010
Course
Paris,France

**Practical CFD Analysis**
24th Nov 2010
Course
Wiesbaden,Germany

- Let us know if you would like to schedule an on-site training course

For more information, please visit: www.nafems.org

# Smart Strategies for Deploying Casual and Up-Front CAE

Blake Courter

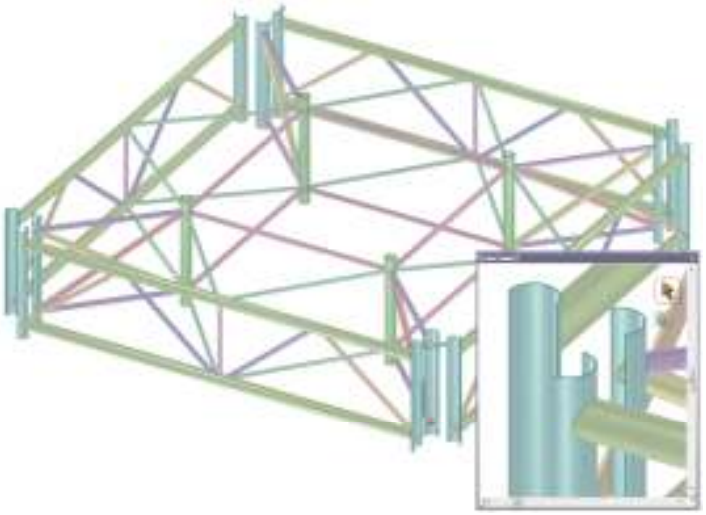
Co-Founder

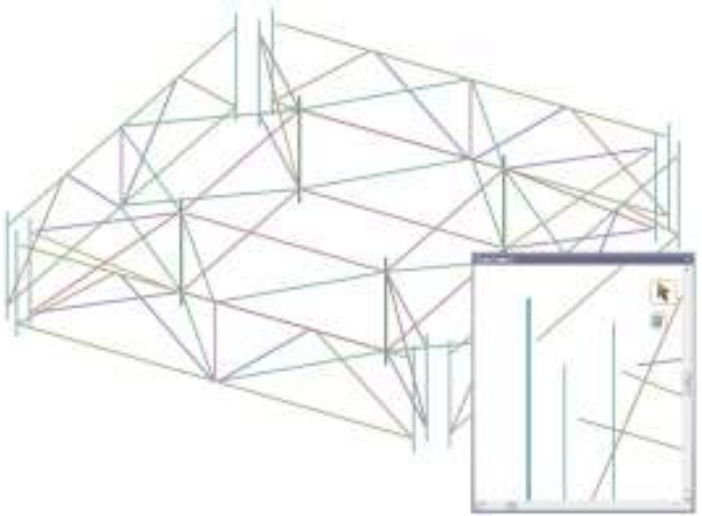
SpaceClaim Corporation

June 2010

# Agenda

- Define categories of CAE
- CAD vendors versus CAE vendors
- Up-front CAE versus QA CAE
- The right tool for the job
- Is casual CAE scary?
- A little about SpaceClaim
- Cultural considerations





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# Expert versus Casual CAE

- **Two classes of CAE users and tools**
- **Expert tools from CAE vendors**
  - Sophisticated, Accurate, Expensive
  - Designed for expert users
- **Simple tools from CAD vendors**
  - Simple add-on for CAD package
  - Make assumptions for casual users

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# Expert Users

- Highly specialized
- Masters or PhD
- Academic focus on precision and accuracy
- Enjoy hard problems
- Typically use tools from CAE vendors
- Wrestle with geometry

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# Casual Users

- Tend to be CAD experts
- Use CAD-hosted CAE
- Generalized degree
- Demand ease-of-use
- Less concerned about precision and accuracy
- Just want reasonable answers

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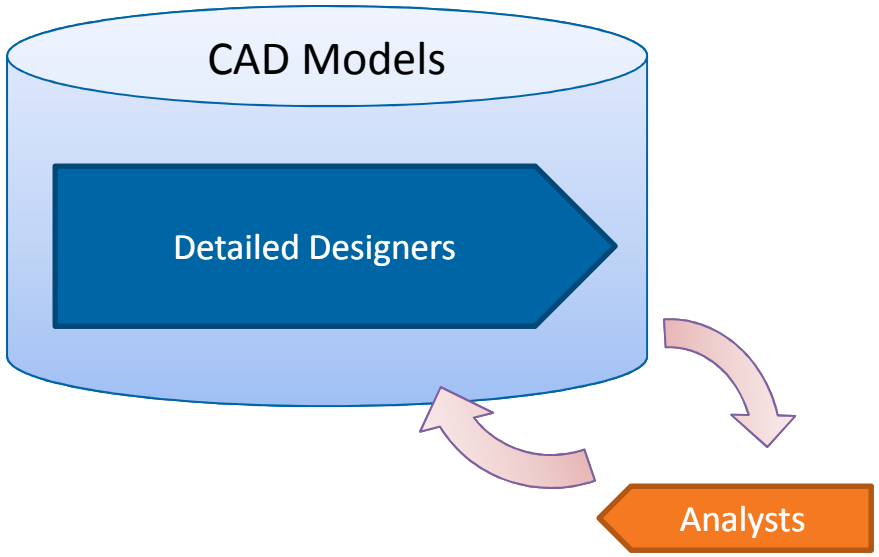
# CAD Vendors versus CAE Vendors

- **CAD vendors have been acquiring CAE companies.**
  - Strategy to sell more products to install base
  - Overwhelming majority of install base not experts in CAE
  - Tend not to invest in their CAE products as much as their CAD products
  - Management typically does not have a CAE background
- **CAE vendors tend to be dependent on CAD**
  - Core competency CAE
  - Can't run their products until CAD geometry exists
  - Create mini CAD products to complement CAE

# Traditional Implementation Challenges

- Historically, simulation was dependent on CAD geometry.
- Analysts struggled to de-feature, edit, and optimize CAD data.
- Late changes and unnecessary work burdened detailed design.

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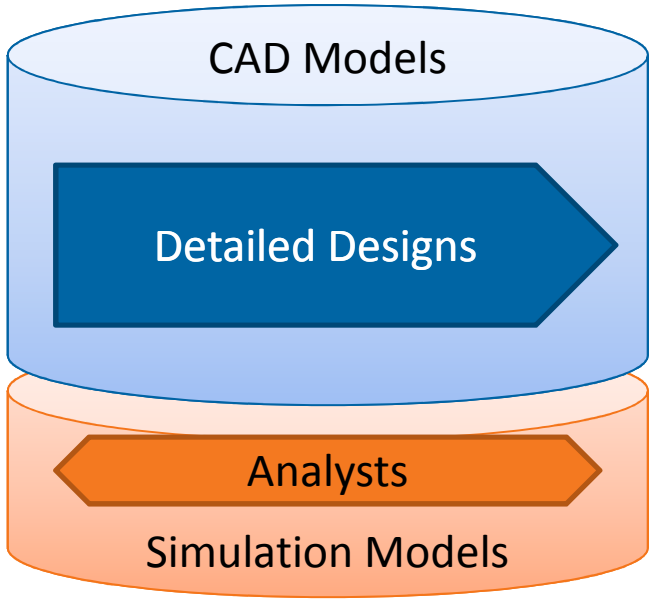
# Overcoming Implementation Challenges
# Phase 1: Creating a Parallel Model

- Simulation users have unique geometric and data management needs.
- CAE independence from CAD systems permits concurrent CAE.
- Simulation users act as advisors to the CAD team.
- CAD teams are freed from supporting analysts' geometry needs.

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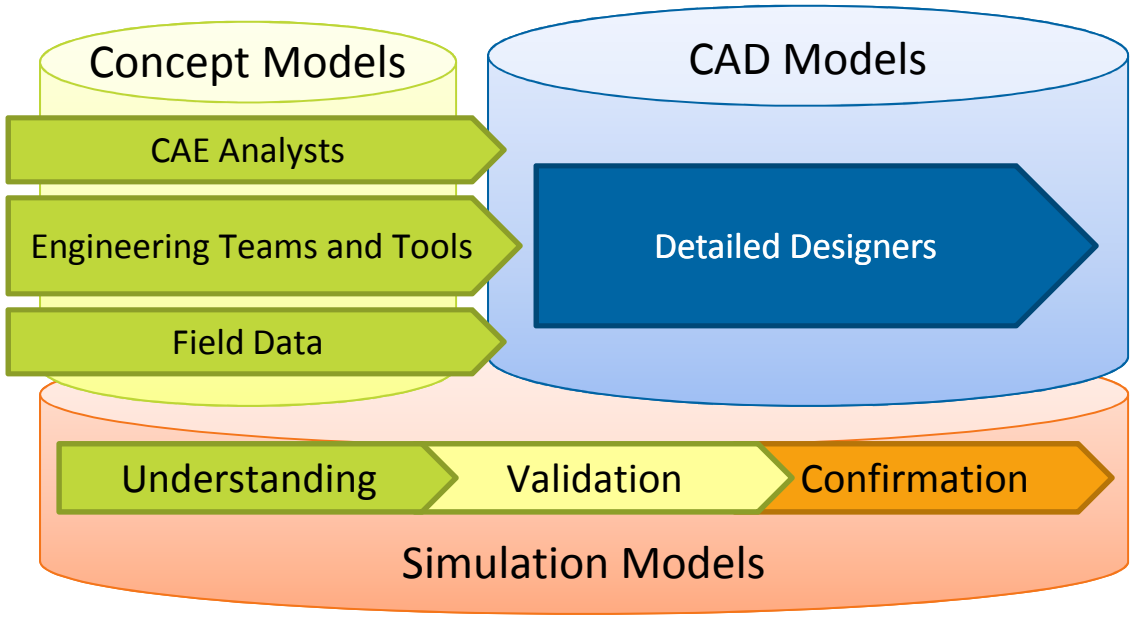
# Overcoming Implementation Challenges
# Phase 2: Simulation on Concept Models

- Simulation on simple concepts optimizes designs before CAD.
- The engineering model and CAD models enjoy clear separation.
- Innovation becomes repeatable; fidelity moves forward.
- Detailed design proceeds smoothly, without unpredictable delays.

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# Best-In-Class Tools for Specialized Users

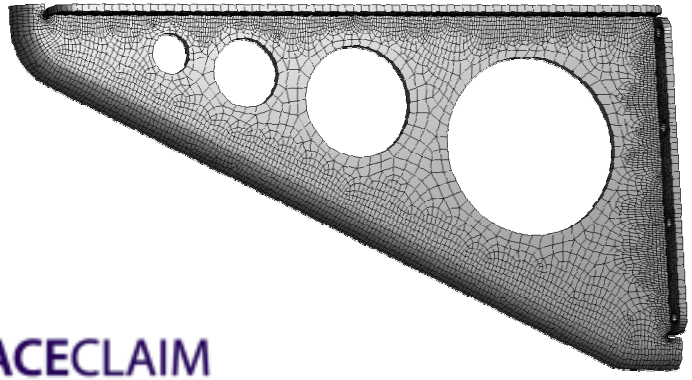
- **Simulation tools embedded in CAD systems force late-phase CAE.**
  - For the most sophisticated results, use the best possible CAE tools.
  - Is the vendor's expertise CAE or CAD?
- **Equip engineers with the best tools for their needs.**
  - How can you compete without the most competitive tools?

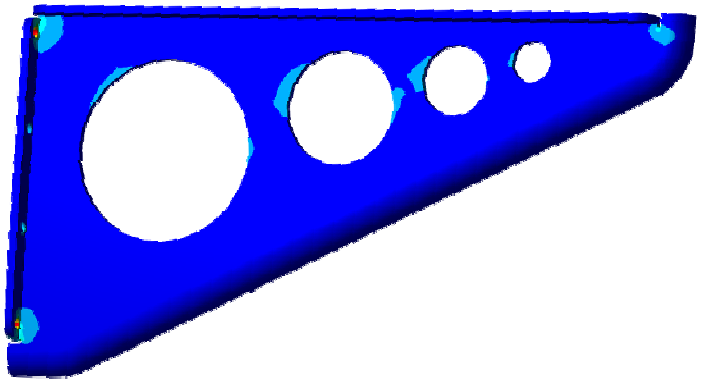
"The argument for streamlining by enforcing a single CAD platform is a thing of the past. The goal is to streamline the workflow while introducing the best tools for every job. Although a mix of tools comes at higher support costs, reducing wasted time in engineering and getting products to market faster is what gives us our competitive edge.

*- Hiroshi Mizuide, Hioki E.E. Corp., Japan*

# When Possible, Assemble the Right Team

- **Make sure the correct engineers are using CAE.**
  - Are they trained engineers in their field of simulation?
  - Could they approximate a solution by hand?
- **The challenge isn't using the software, it's describing the problem.**
  - Structural users should be domain experts in statics and dynamics.
  - Thermal users should be domain experts in thermodynamics.
  - CFD users should be domain experts in fluid dynamics.





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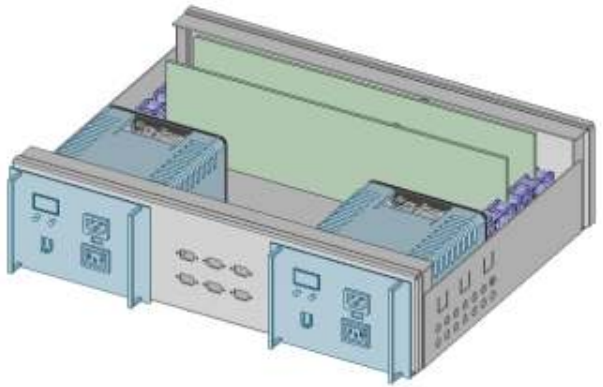
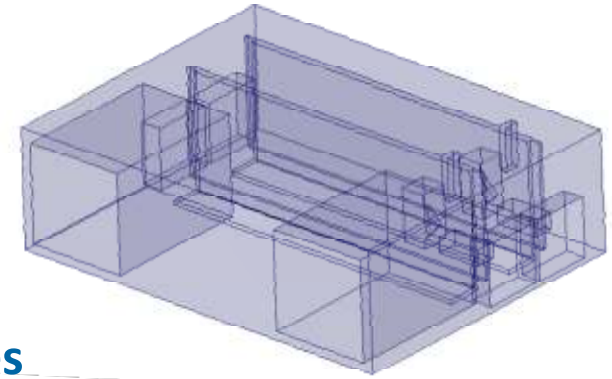
# A Little About SpaceClaim

- **Push-button tools dedicated to simulation**
  - Simplify rounds, small features, irrelevant features
  - Merge faces to simplify meshing
  - Extract mid-surfaces to create shell elements
  - Extract extrusions to create beam elements
  - Create volumes for CFD
  - Isolate relevant sections of large models, assemblies
  - Set up symmetry conditions





- **Dedicated tools to repair flawed CAD geometries**
- **Industry-leading direct modeling to edit and optimize the design**
  - Post-Facto Parametrics

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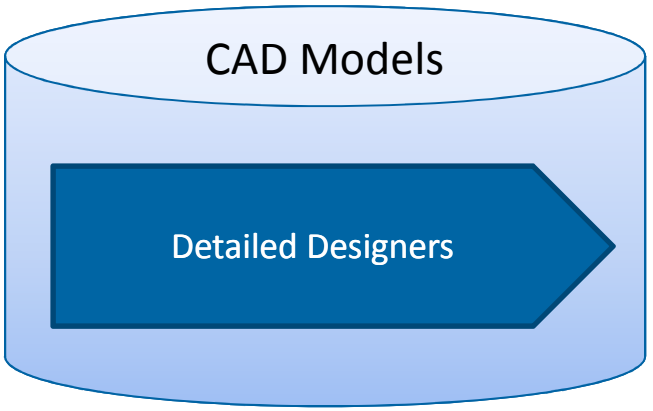
# Is Casual CAE Scary?

- "Casual tools aren't sophisticated enough for accurate answers."
- "You can't solve the CAE problem unless you can solve the paper problem."
- "Casual users don't keep up with engineering skills."
- "You have to do this daily to know your precision."

- Perhaps, but are there ways to empower casual users?

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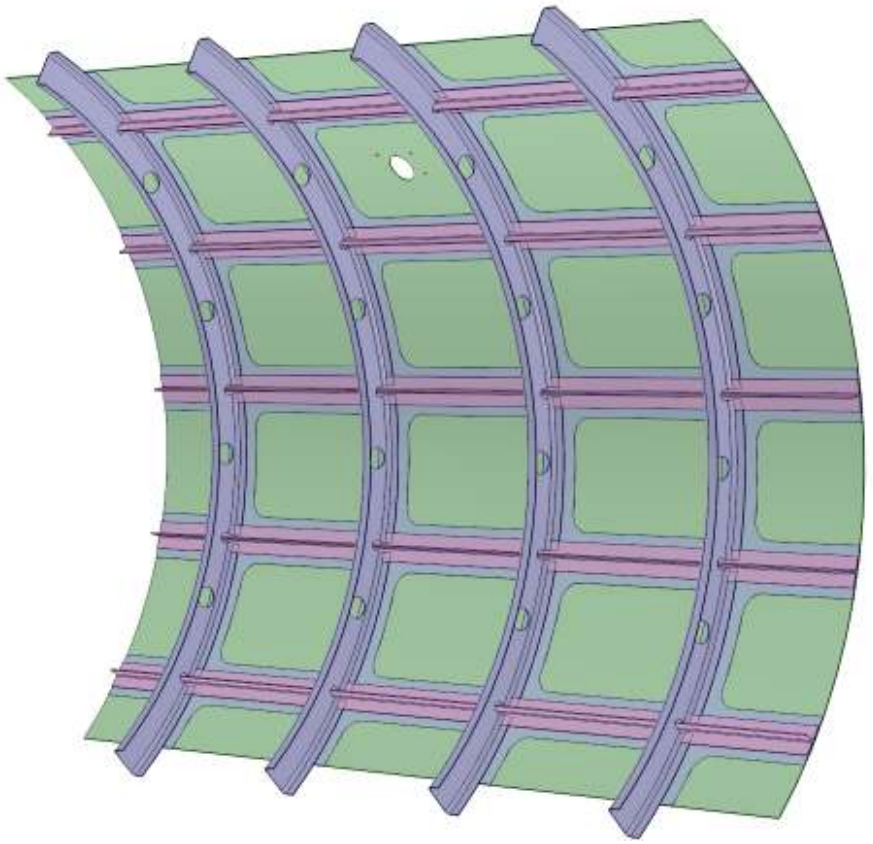
# Deploying CAE to Casual Users: Approach 1: Templates

- Templates work when solving a similar problem repeatedly
- Constant material, solution type, physics
- CAE expert in a box
- Time-consuming to deploy
- Limited reuse



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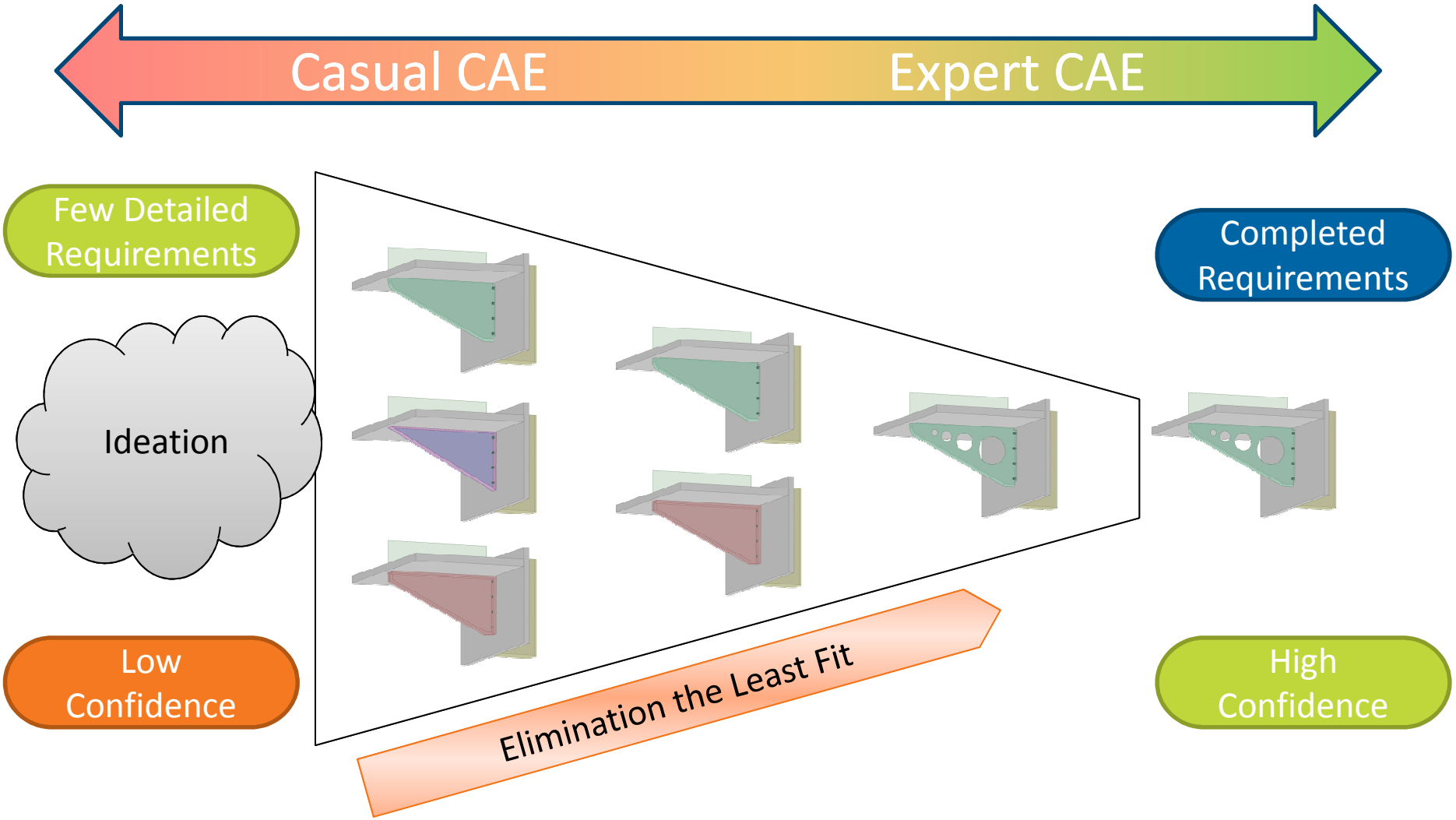
# Deploying CAE to Casual Users: Approach 2: Set-Based Concurrent Design

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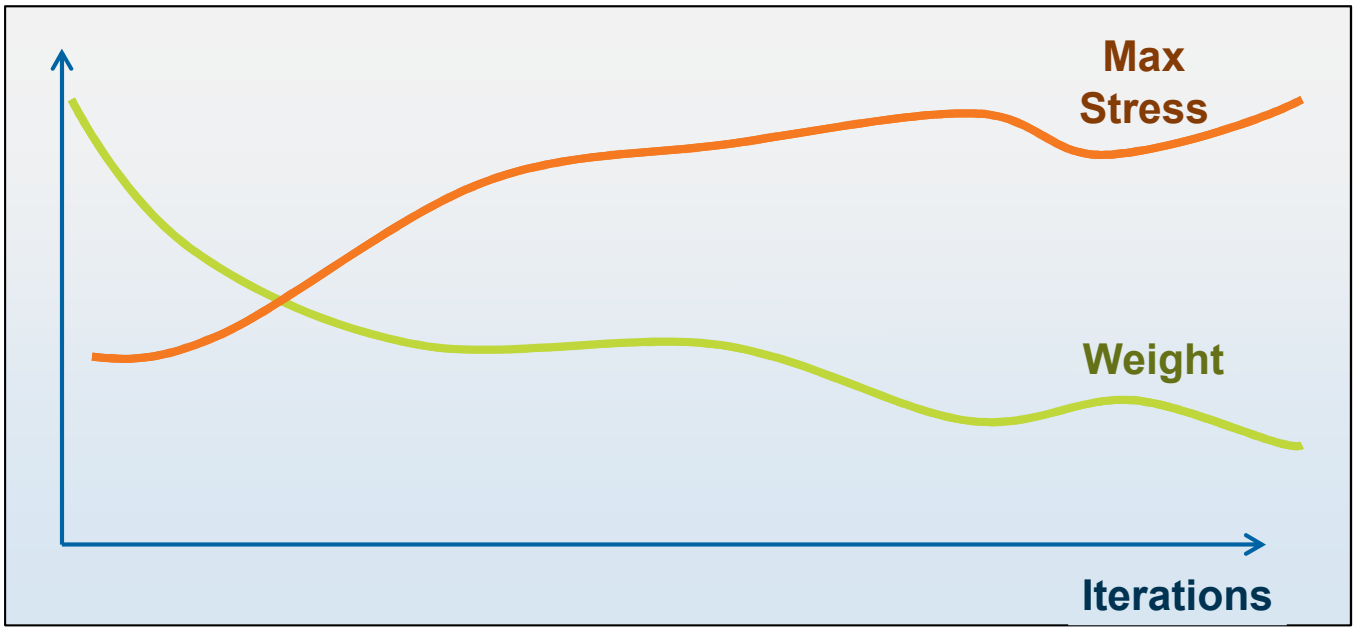
# Deploying CAE to Casual Users: Approach 3: Trend Analysis

- Trend analysis: look at the deltas, not the absolutes
- First pass optimization
- Answers can be good enough to validate a concept

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# Cultural Considerations 1: Milestones

- **Expert users need a milestone when to finish**
  - Use your error bars
  - Only answer the question asked
- **Casual users need a milestone to start**
  - Tie to projects
  - Can't make a prototype until rudimentary CAE

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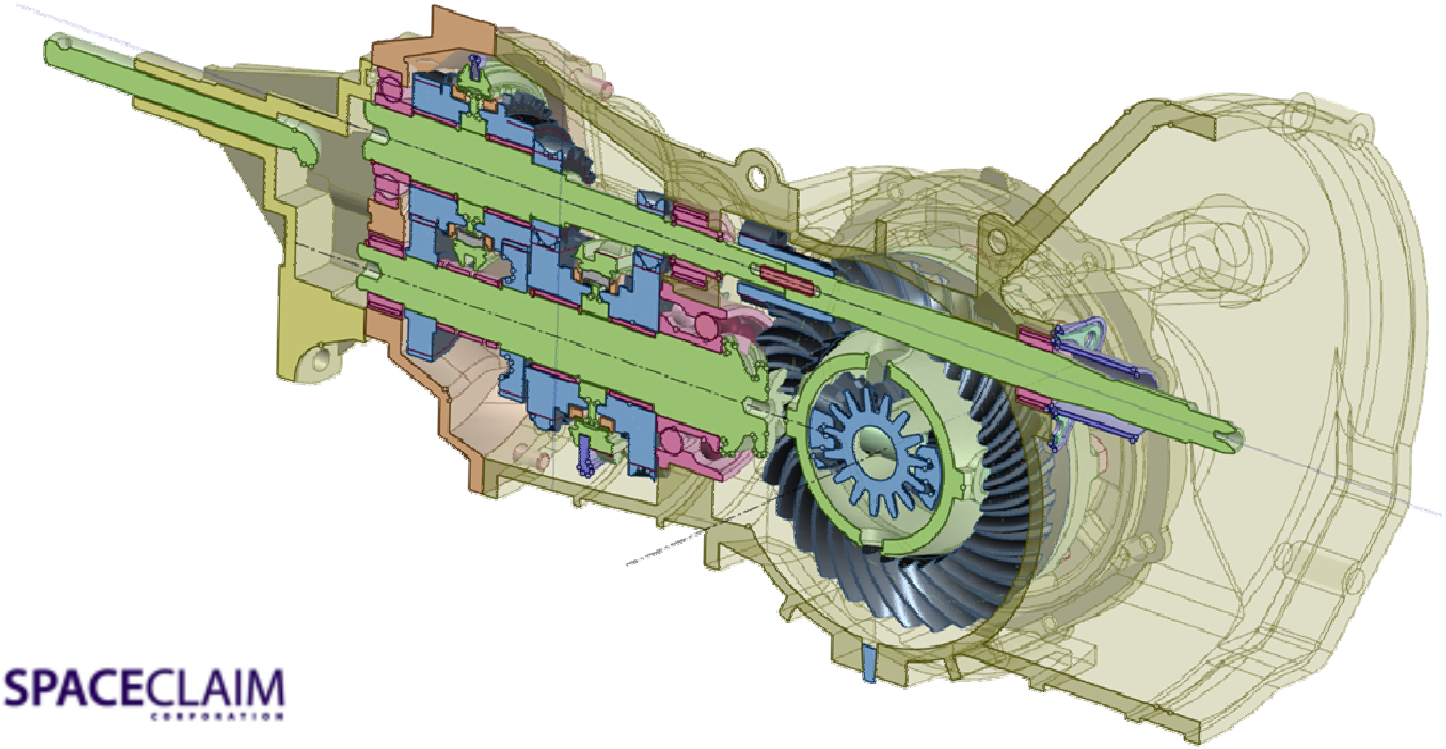
# Cultural Considerations 2: Too Much?

- **For what problems can you skip CAE?**
  - Do you collect empirical data and capture knowledge?
  - Can you create your own tools to assess real-world performance and lifecycle costs?



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# Cultural Considerations 3: Business Impact

- Is CAE an active voice?
- Do you measure the ROI of CAE time investments?
- Have you created a value stream map of your CAE process?
- Do you measure the waste of last-minute ECOs?
- Do you use CAE to out-bid your competitors?

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# Thank You

Blake Courter
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# Questions

**Website:** www.nafems.org


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# Thank you!