ATA ENGINEERING, INC.

Webinar:
LiftShip - Simulating Ship Module Lifts and Turns with Femap

Vicki Harris, ATA Engineering

December 16, 2021

13290 Evening Creek Drive S, San Diego CA 92128

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www.ata-e.com

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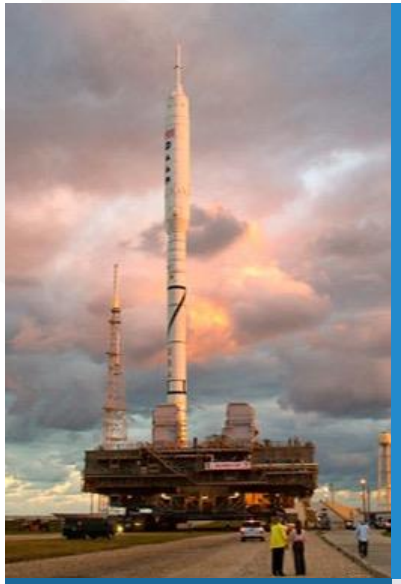

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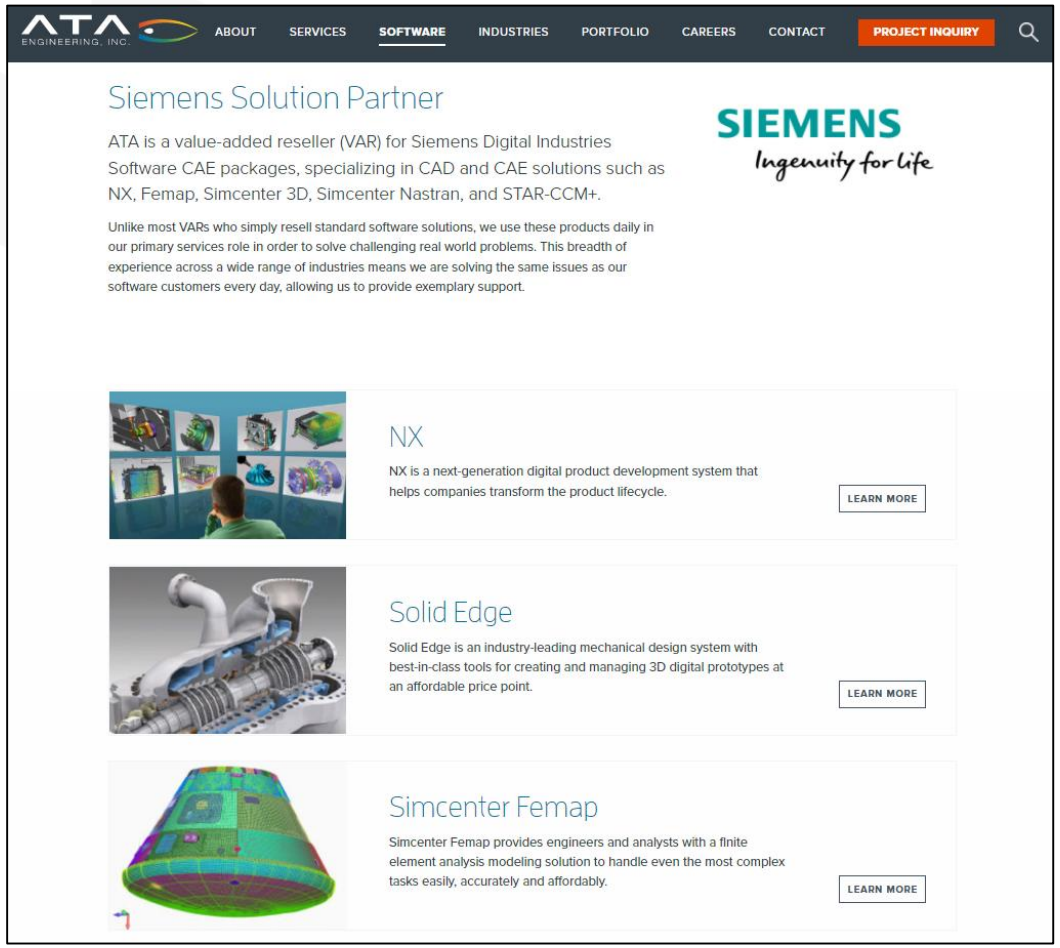

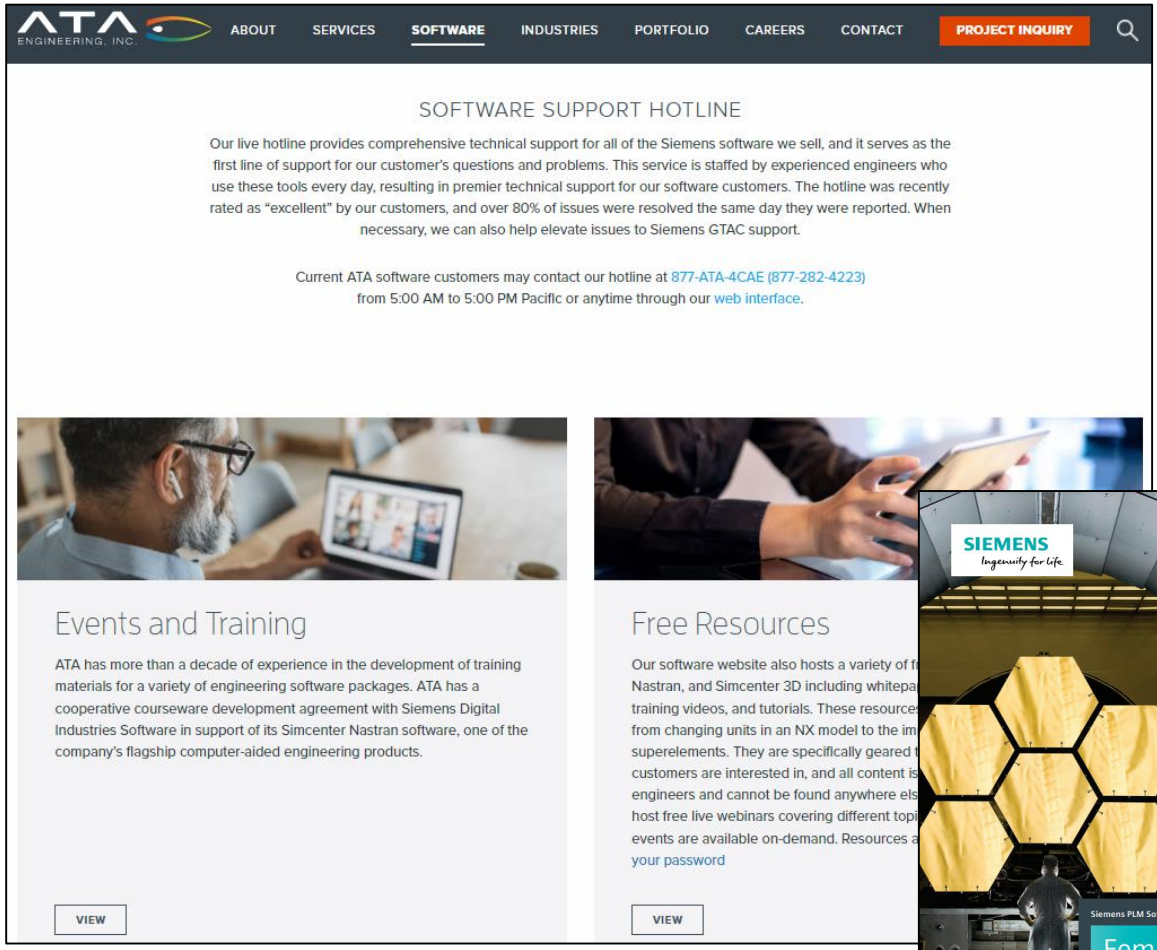

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LiftShip

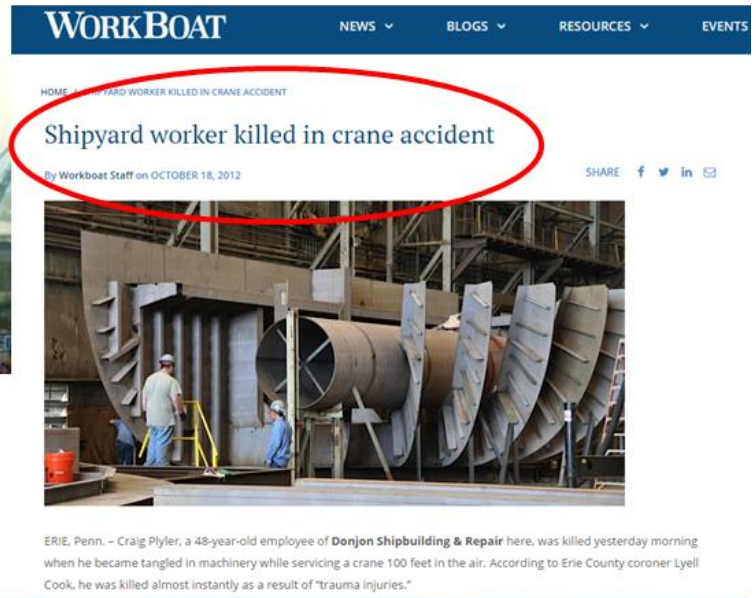
Simulating Ship Module Lifts and Turns with Femap

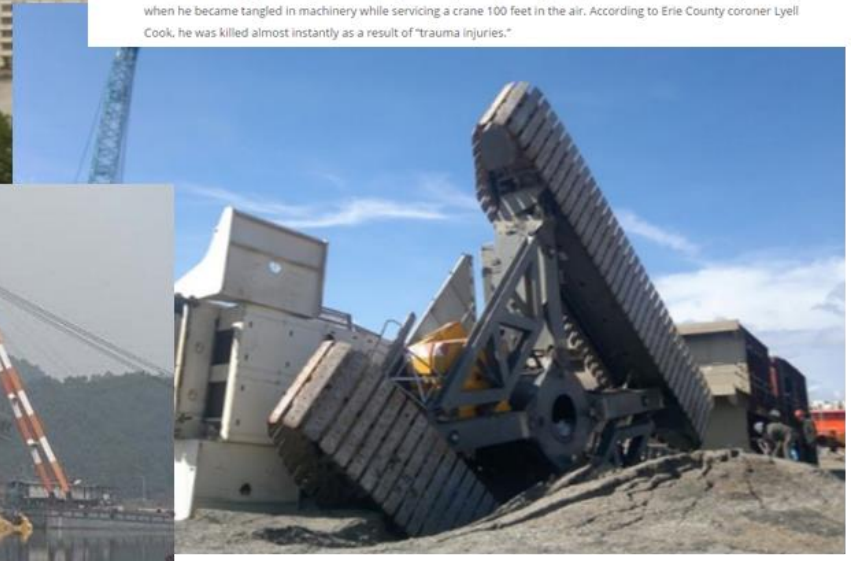
Thursday 16 December 2021

Outline

- The NSRP LiftShip Program
- ATA's Femap Tools for LiftShip
  - The Lift and Turn Workflow
  - The Femap API
  - Model Generator Tool
  - Lift and Turn Tool

LiftShip Overview





Why do we have these failures

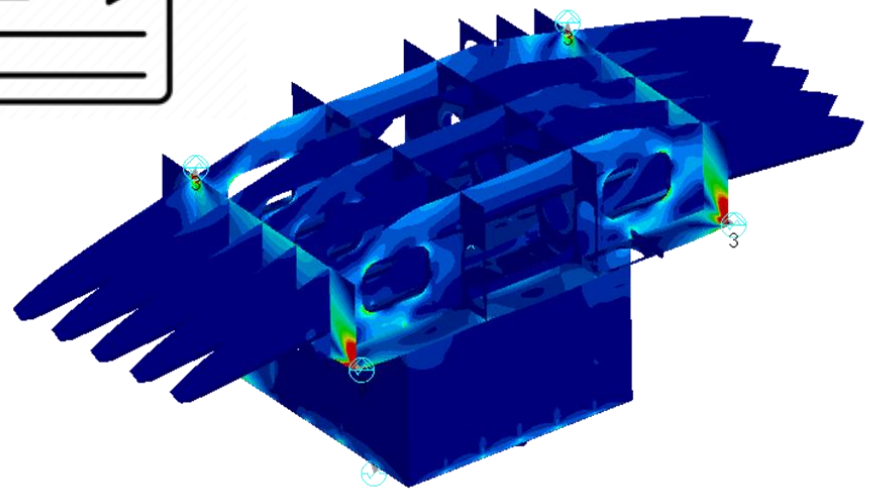
- Equipment:
  - Damaged
  - Overloaded
- Environmental:
  - Wind
  - Rain
  - Snow & Ice
- Calculation Issues:
  - Assumptions due to complexity and/or incomplete information
  - Using past project data which may be similar but not the same
  - Changes made after calculations performed

Lift Calculations

- Organizations define risk-based criteria for classifying ‘critical’ lifts
- Engineering calculations mitigate risk for each lift category

Many ways to perform lift calculations:

- pencil, paper, and a calculator
- spreadsheets
- finite element analysis software (FEA)



Finite Element Analysis Software

- FEA offers highly-detailed insights into structural integrity

So - Why isn't FEA used?

- FEA software requires a high level of expertise to efficiently develop models that yield accurate results. Even with expertise, development of models is tedious requiring significant labor.

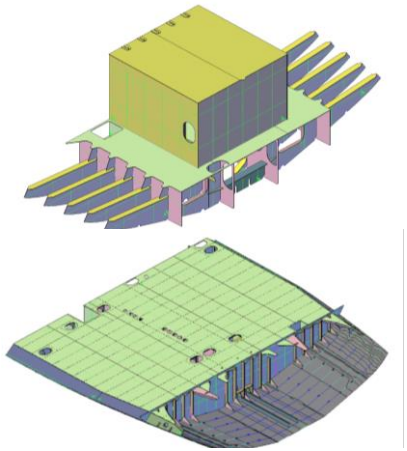
- Legacy hand calculations are much faster and can often mitigate risk of large-scale failure with sufficient conservatism (*assumptions adding factors for additional margin*)

- The benefits of speed (schedule & budget) and simplicity outweigh the potential to identify local yielding, distortion, and need for support structure (which you could get by using FEA)

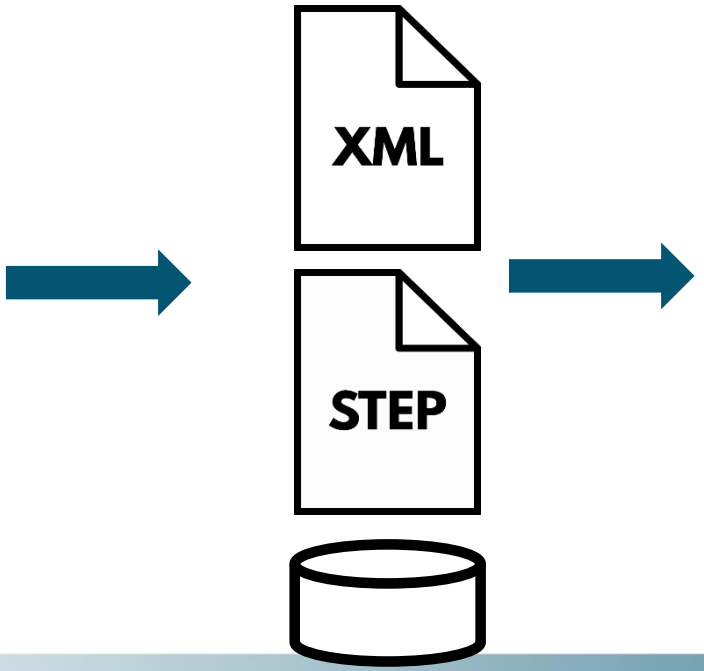
LiftShip

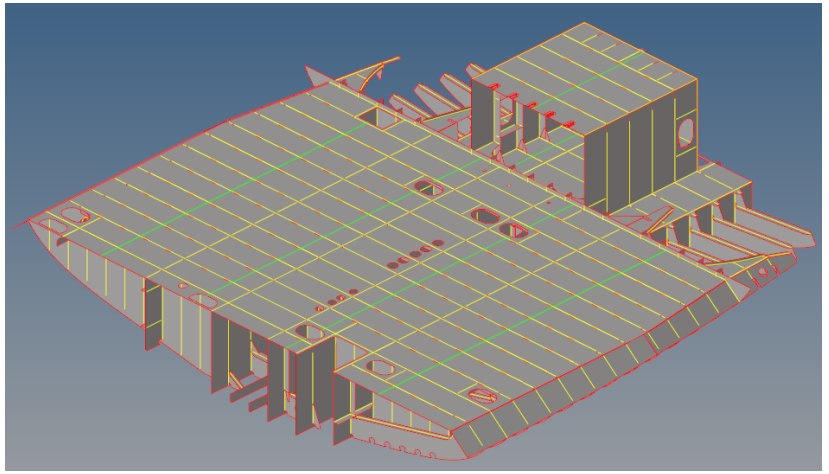
What if we can tip the balance and achieve the accuracy benefits of FEA in less time by automating the FEA process as much as possible?

LiftShip 1
Automation of geometry translation from ShipConstructor CAD software to Femap FEA software



CAD Model





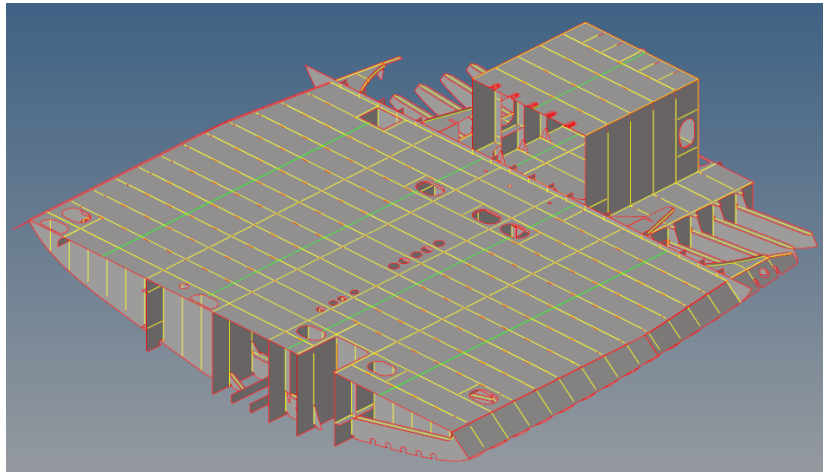
FE Model

LiftShip

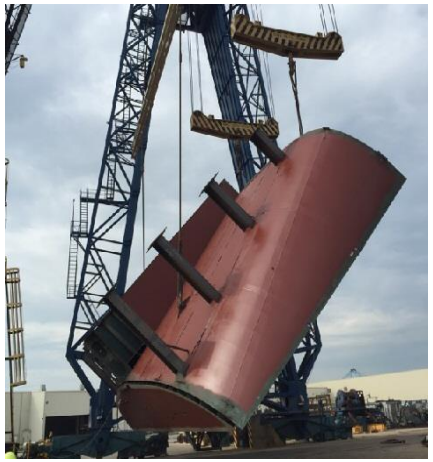
What if we can tip the balance and achieve the accuracy benefits of FEA in less time by automating the FEA process as much as possible?

LiftShip 2

- Lift & Turning (complex Lift Analysis)
- Level of Detail on geometry translation to the FE software
- Enhanced Visual Reporting



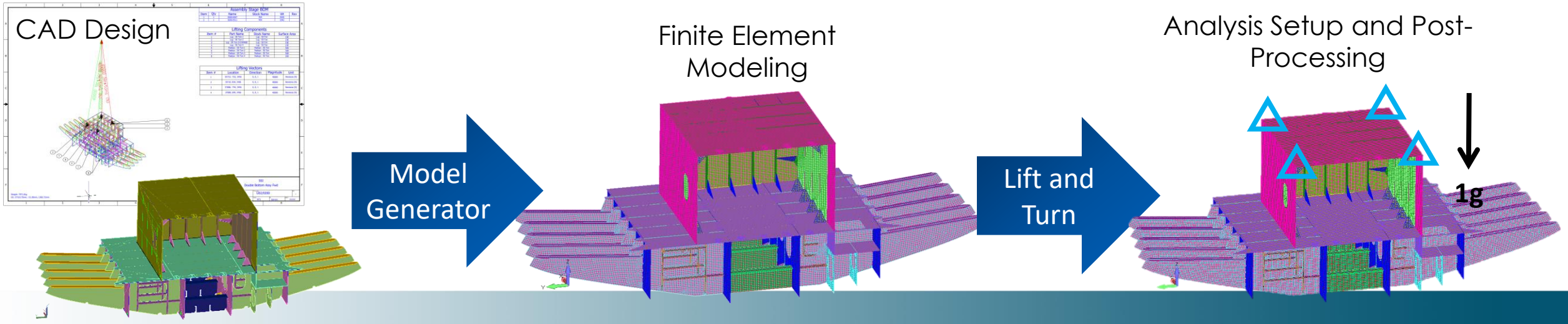
FE Model



Lift and Turn

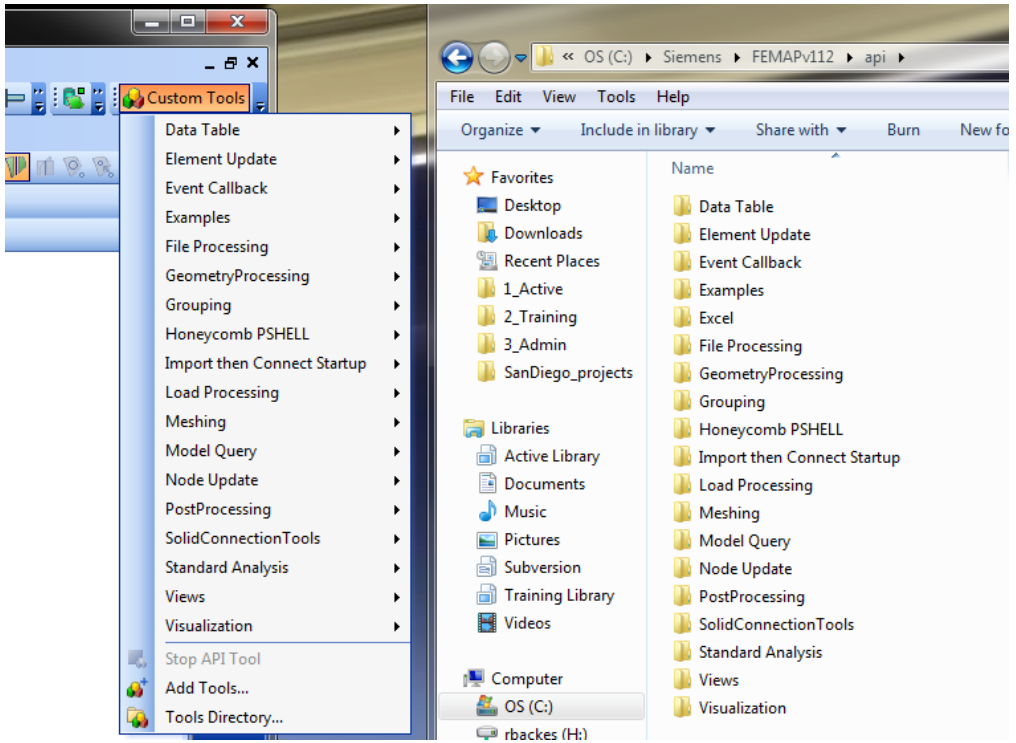
ATA's Lift/Turn Analysis Procedure

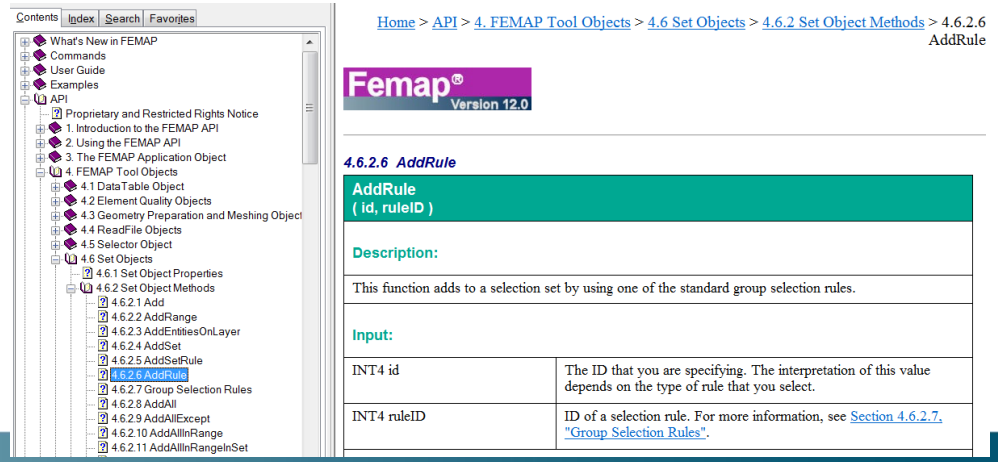
1. Translate geometry from ShipConstructor to Femap using Model Generator
2. Mesh ship module
3. Define lift steps using Lift and Turn
4. Analyze lift process
5. Review results
6. Add support structure (if necessary)
7. Analyze lifting solution again and check that support structure has resolved issues



The Femap API

- API (Application Program Interface)
  - The term API technically refers to the language and libraries that can control Femap
  - It's also used to refer to individual API programs
- Instead of opening Femap and clicking on tools or entering data manually, an API does the same tasks either inside Femap or from another program like Excel
  - Uses Microsoft's OLE/COM framework
  - Native language is Visual Basic (VB), but other languages can be used (Python, C#...)
  - Contains virtually every command in Femap
- FEMAP API enables the user to automate repetitive or tedious tasks via computer code by providing access to the objects in the model and FEMAP functionalities

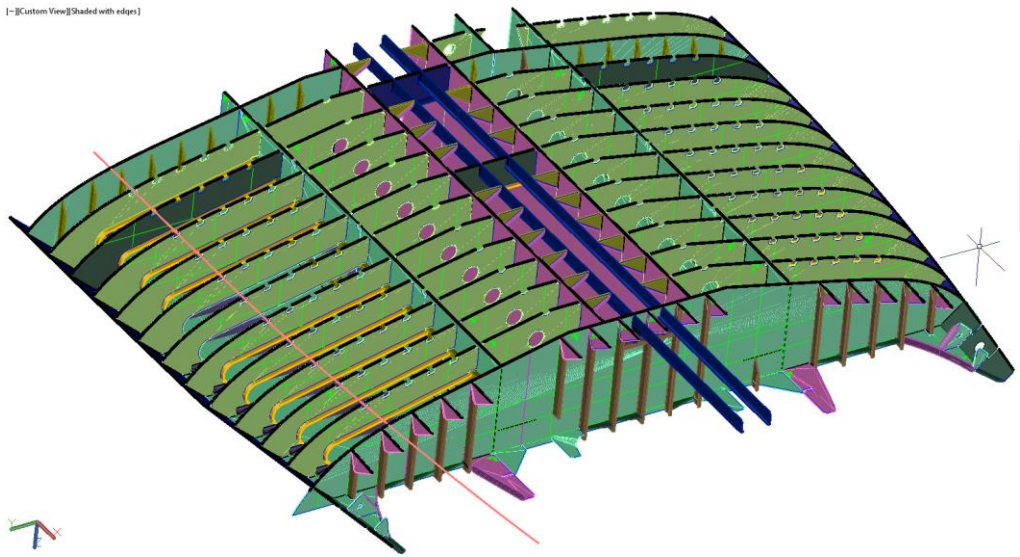




Femap Model Generator

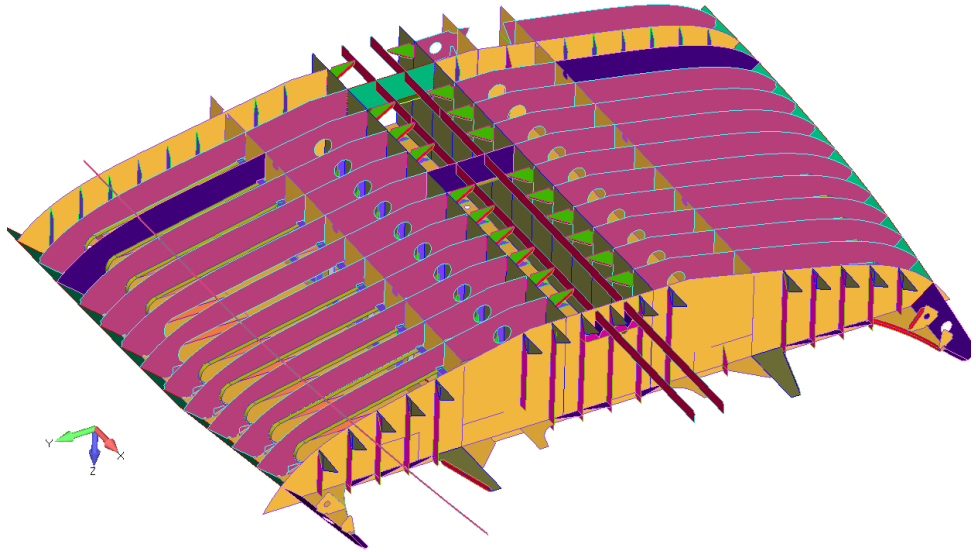
- Geometry information is extracted directly from ShipConstructor database and recreated in FEMAP, eliminating the time needed to export all part geometry from ShipConstructor
- Surface geometry is created in Femap with automatic assignment of entity names and physical and material properties, eliminating the time needed for manual property assignment and midsurfacing
- User selects of geometry level of detail
- All operations are executed by users through a graphical user interface (GUI)

ShipConstructor

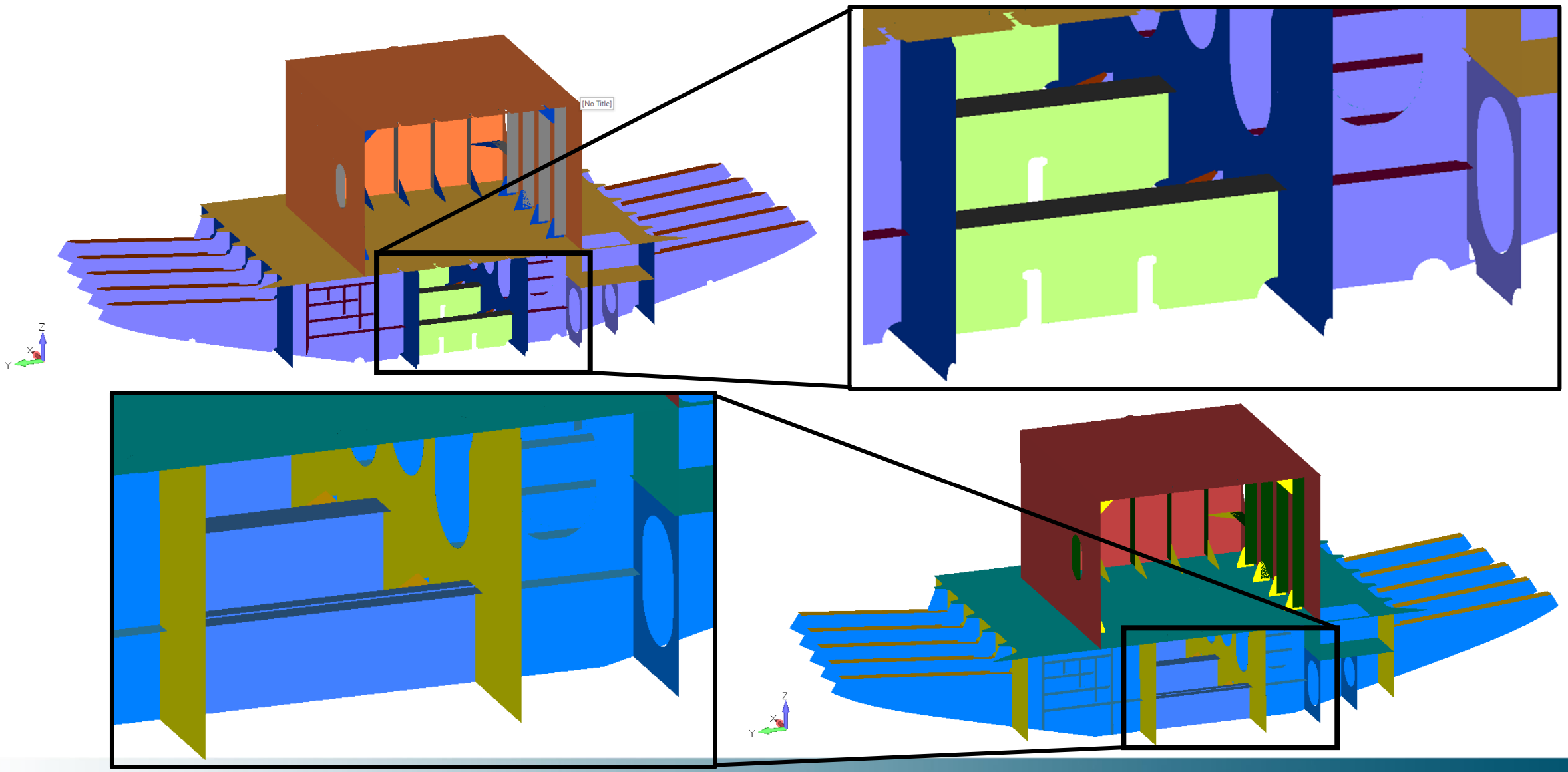


3 min 50 sec

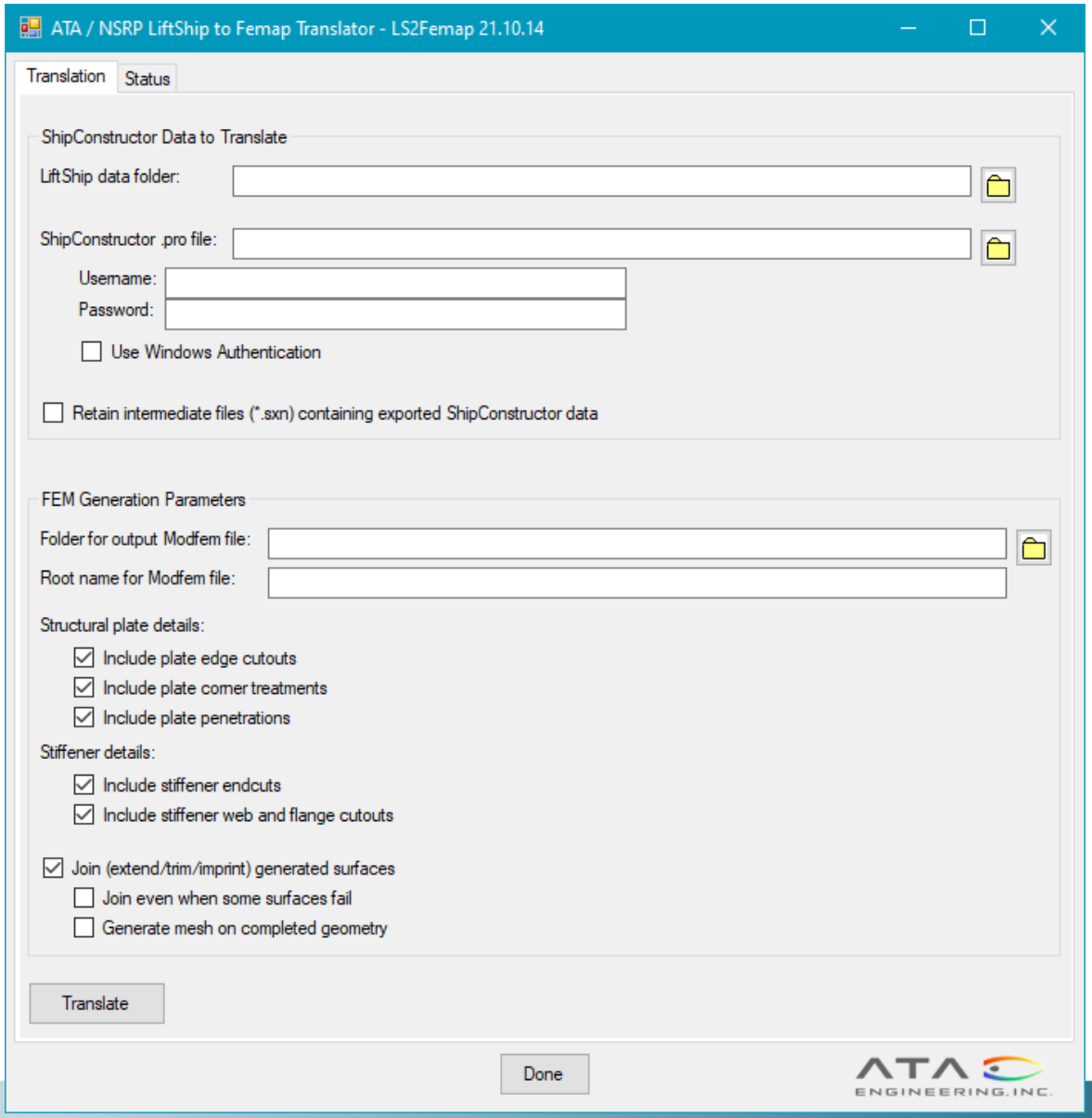
Femap



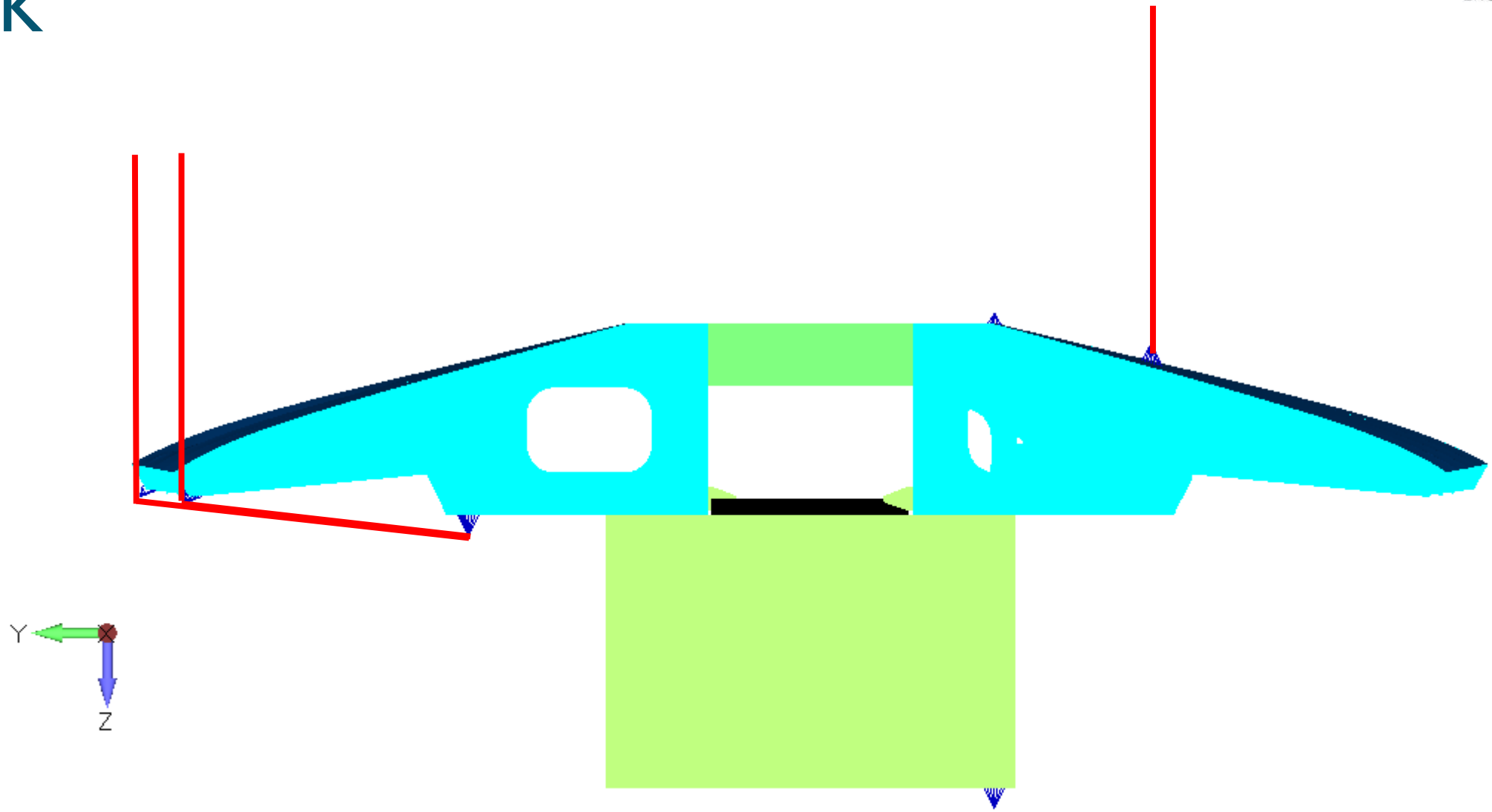
Level of Detail is Controlled By the User



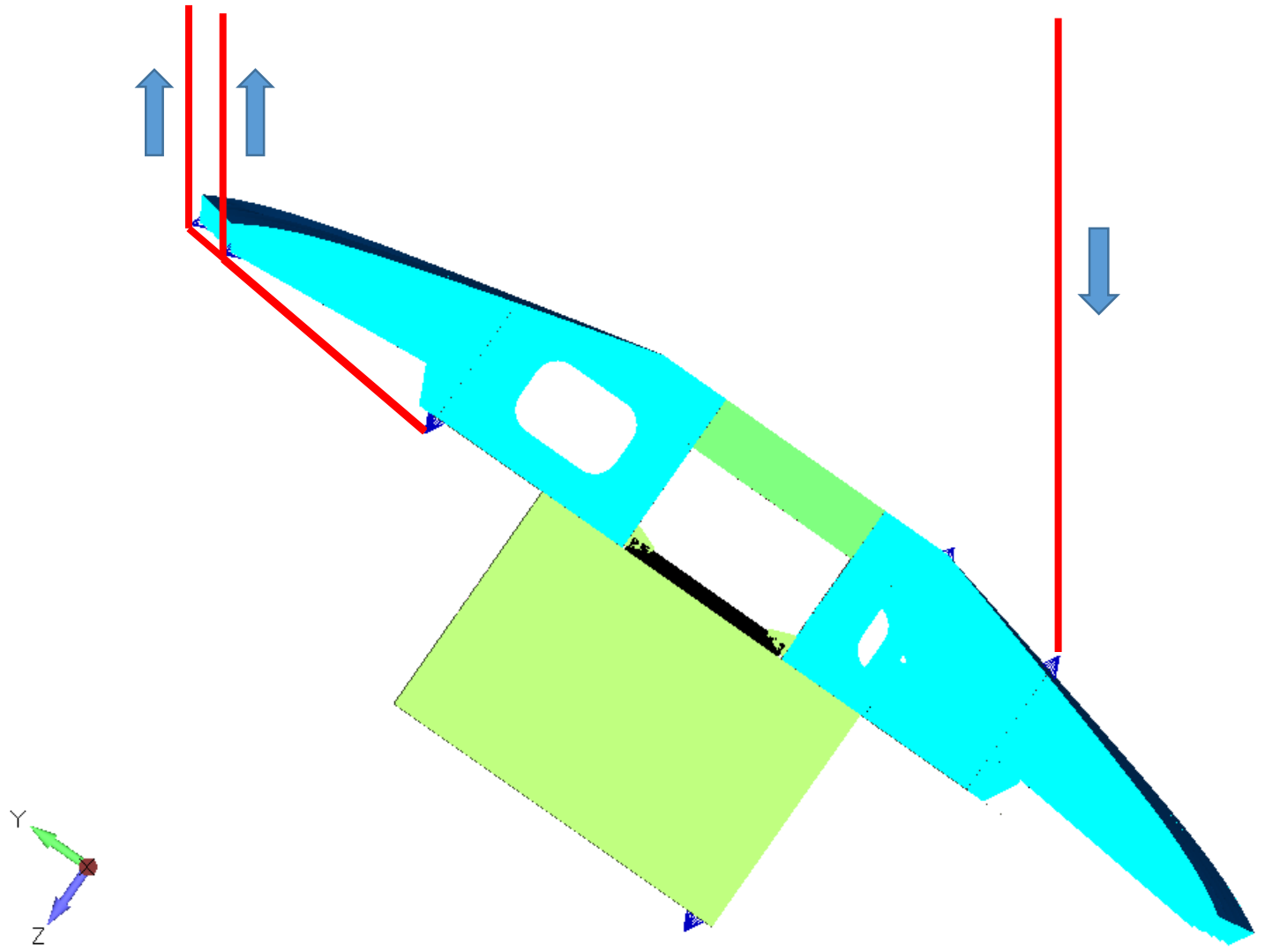
Model Generator Executes Through GUI



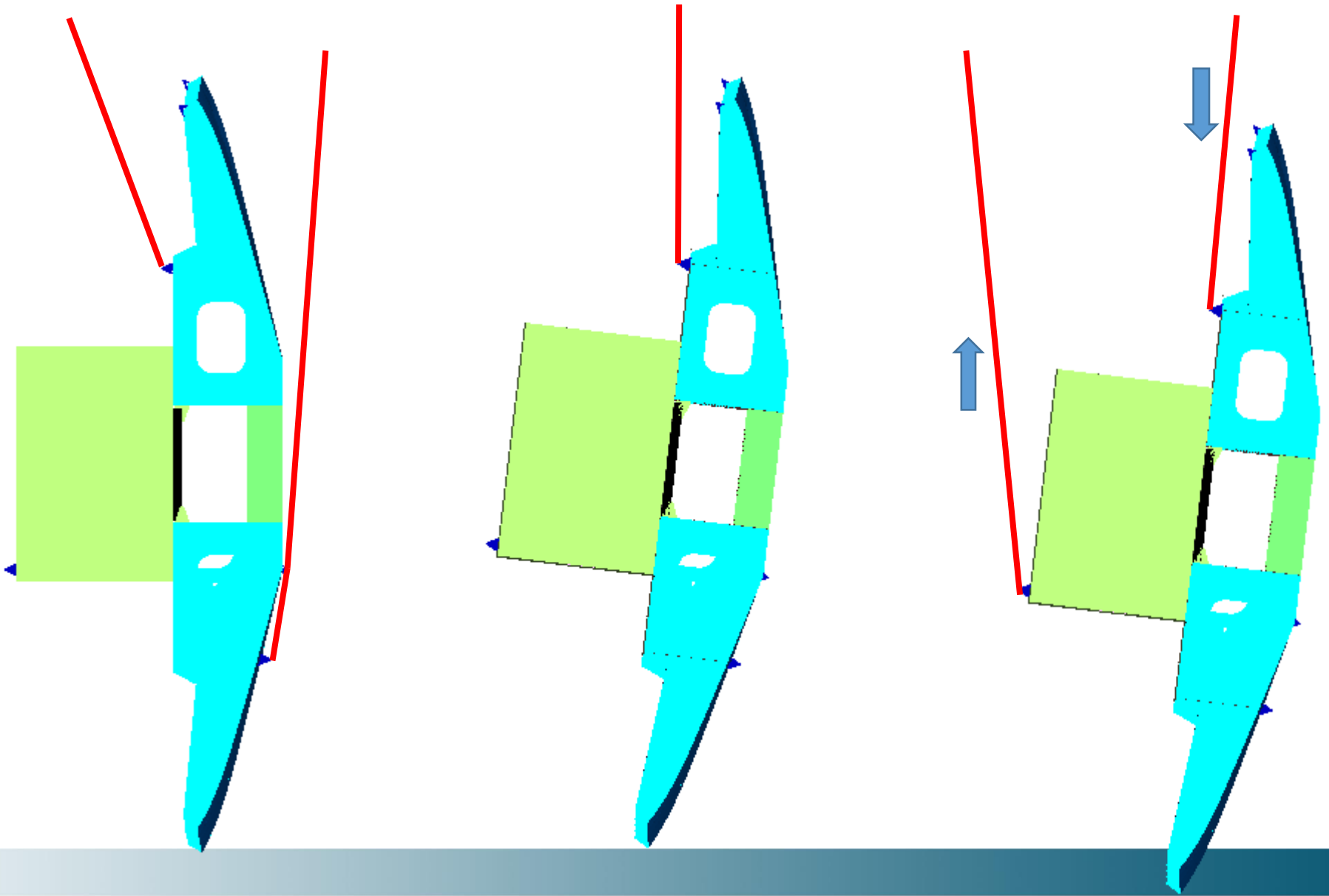
Pick



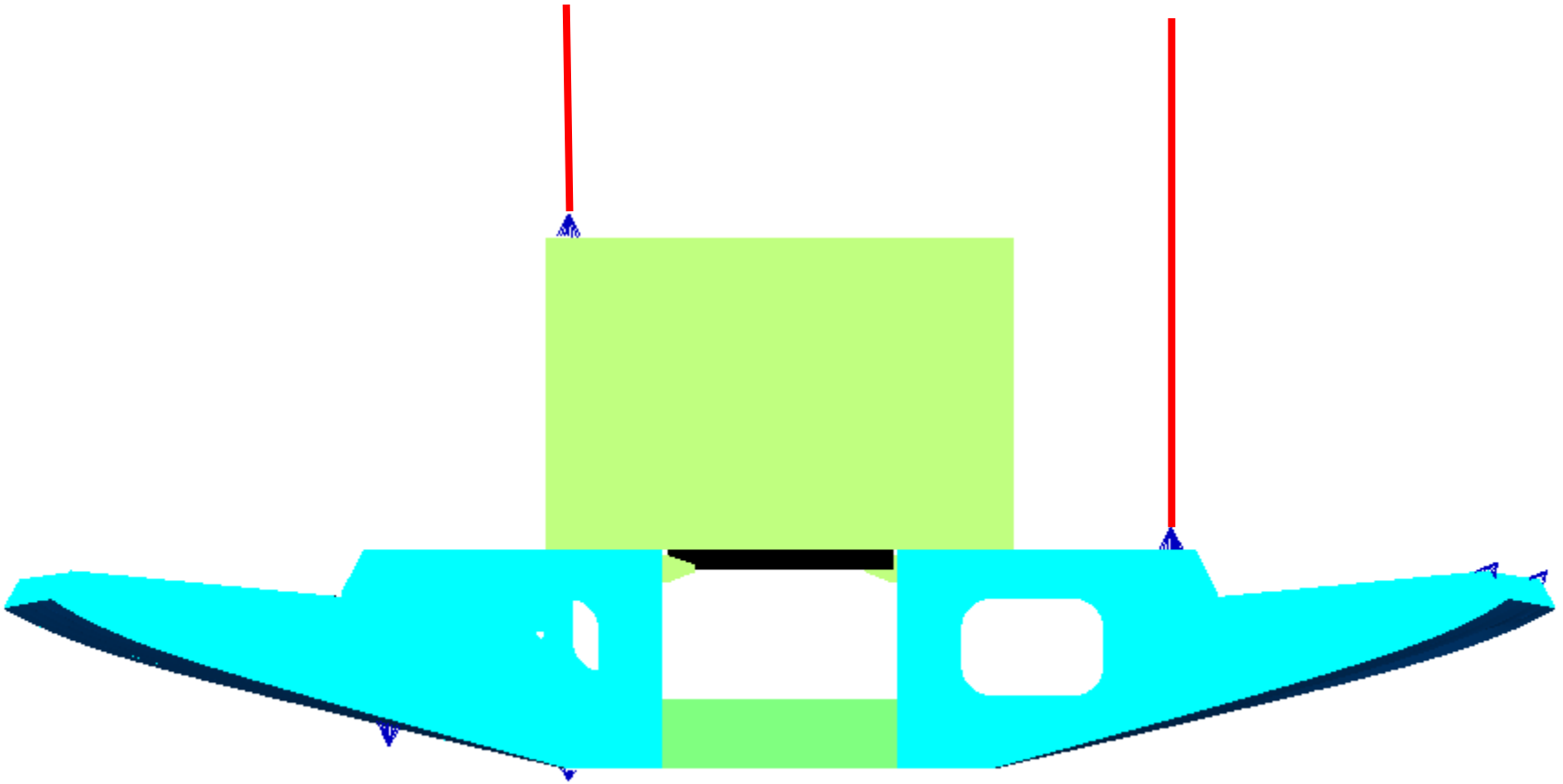
Turn



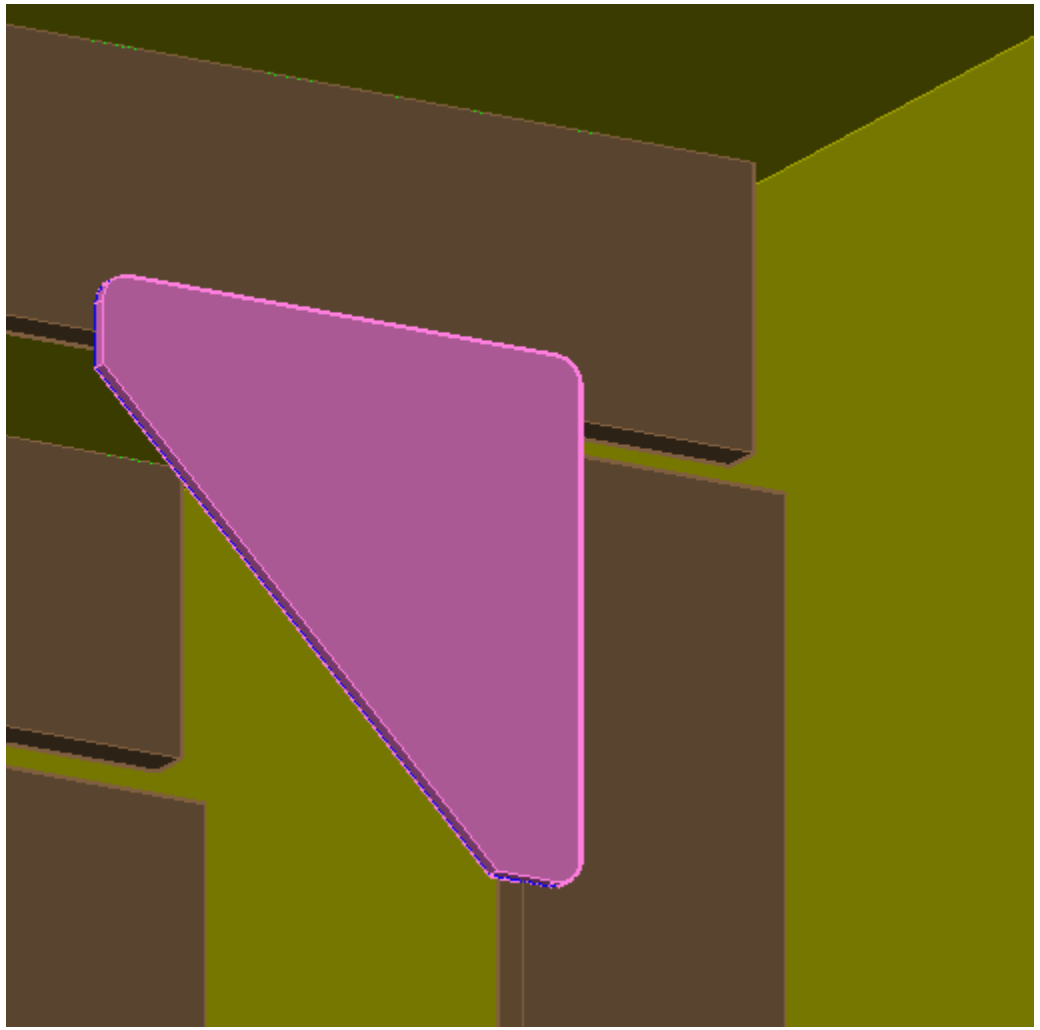
Free Hanging

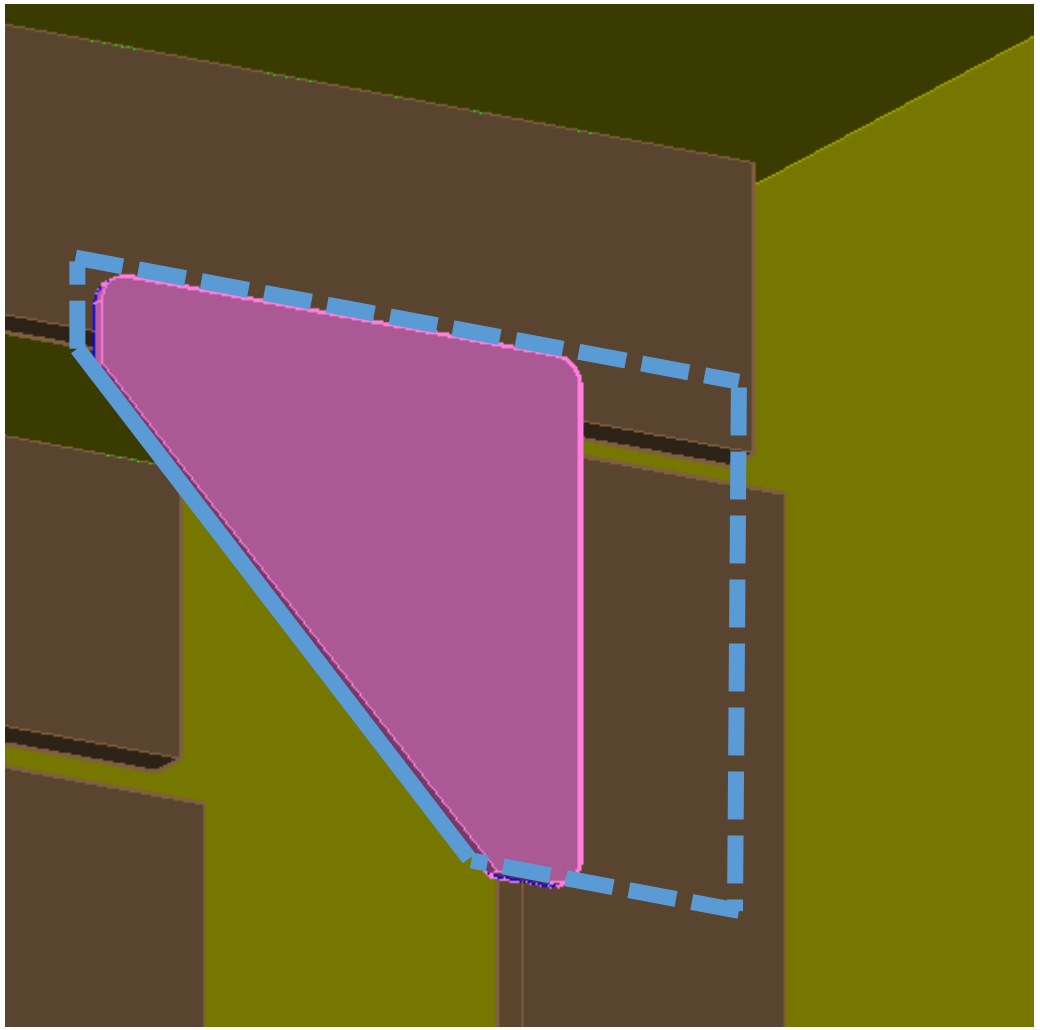


Upright



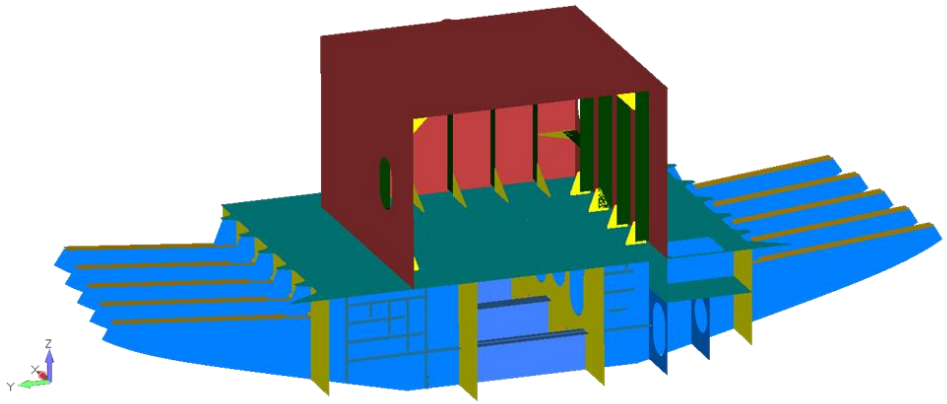
Stress Solution - Add A Reinforcing Plate





Quantitative Cost Analysis

- If our customer asked us to assess a lift of the demonstration module, we estimate it would be a 44-hour level of effort for ATA engineers.
- By leveraging the tools developed under this program, we estimate a 50% savings in effort.



Task	Standard Methods	With LiftShip Femap Tools
Geometry Preparation & Quality Checking	20 hrs.	4 hrs.
FE Meshing	8 hrs.	8 hrs.
Setup of Loads & Constraints	8 hrs.	1 hrs.
Results Post-Processing and Reporting	8 hrs.	8 hrs.
Total Labor Savings:		~ 50%

Summary

- LiftShip is an NSRP program for automating the simulation of ship module lifts and turns
- ATA Engineering is using the Femap API to produce a suite of LiftShip tools
  - Model Generator automates the ShipConstructor to Femap translation
  - Lift and Turn automates the setup of lift/turn analysis
- Combined use of tools should result in significant time savings

Questions?

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