



**Software**  
"Design, Build & Maintain"

**ShipConstructor**  
Software Inc.



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## ShipLift

NSRP All Panel Meeting  
Philadelphia, PA  
September 15<sup>TH</sup>, 2009

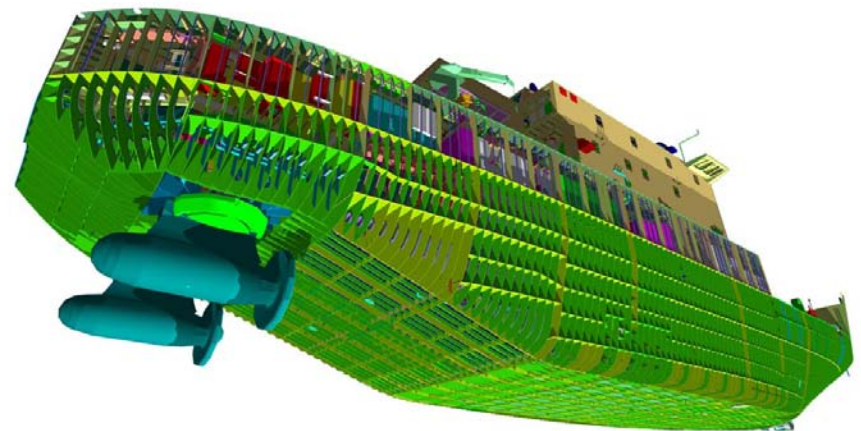
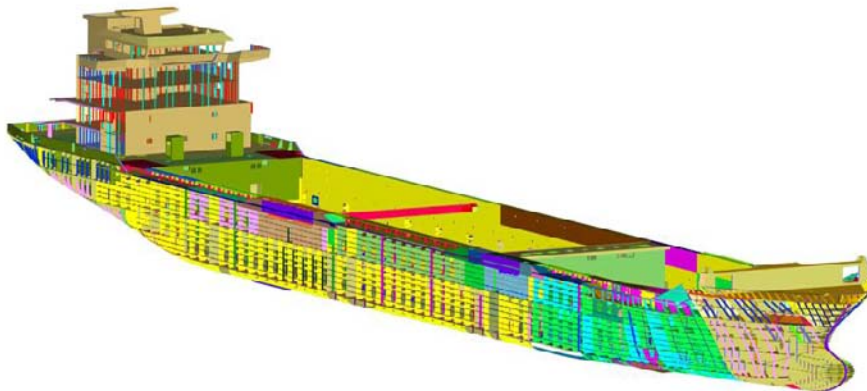
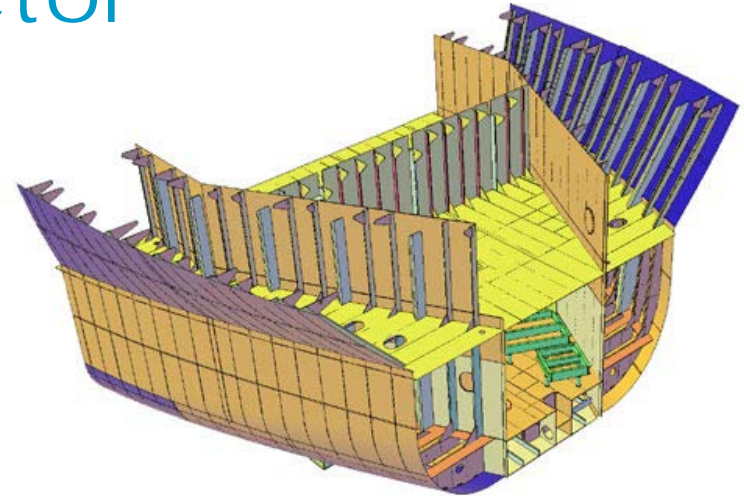
PRESENTATION BY: BART MCPHEETERS  
SENIOR APPLICATION ENGINEER, NEI SOFTWARE

# Project Overview Outline

- Project Team Member Representatives
- Overall Concept
- Goals & Objectives
- Lifting & Handling Knowledge Base & Examples
- Demonstration
- Questions

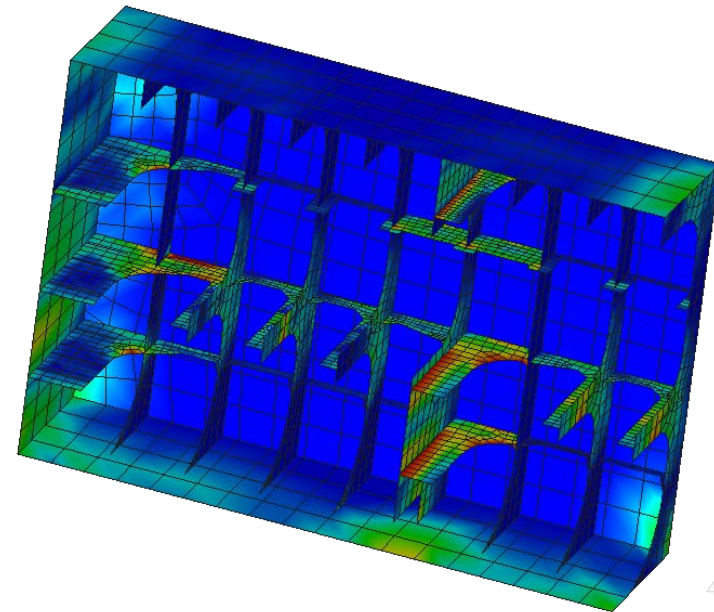
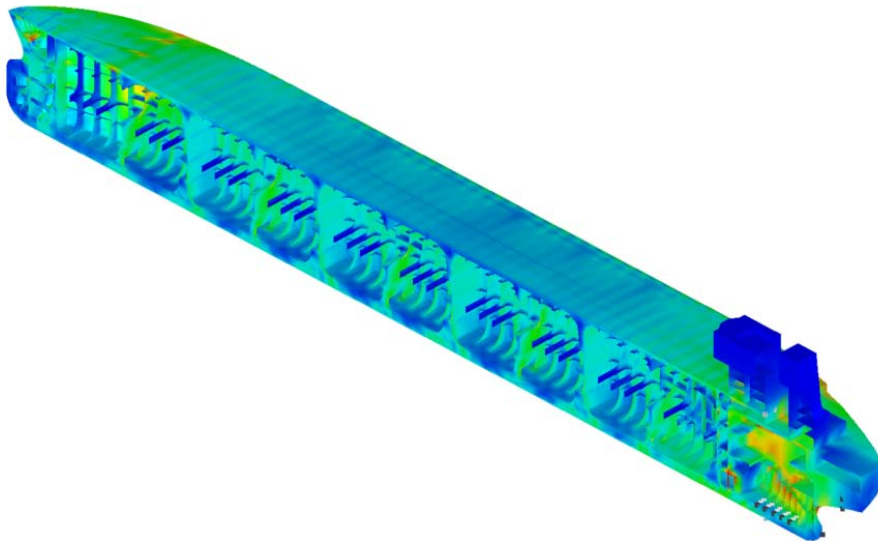
# SSI and ShipConstructor

- ShipConstructor is a shipbuilding software company based out of Victoria, BC, Canada
- U.S. Office located in Mobile, AL
- Patrick Roberts – Director of Operations
- 6+ engineers/developers working on ShipLift



# NEi Software and NEi Fusion

- NEi Software is a FEA software company based out of Westminster, CA
- Mitch Muncy – Principal Investigator
- 6 engineers/developers working on ShipLift



# Why do this project?

- Distortion of ship components and assemblies is a major contributor to unplanned labor and rework in shipbuilding.
- Past efforts to control distortion have focused primarily on the effects of the cutting and welding processes, resulting in a number of tools and methodologies
- Little or no effort has been placed on analyzing the effects of material handling on accuracy and distortion problems.

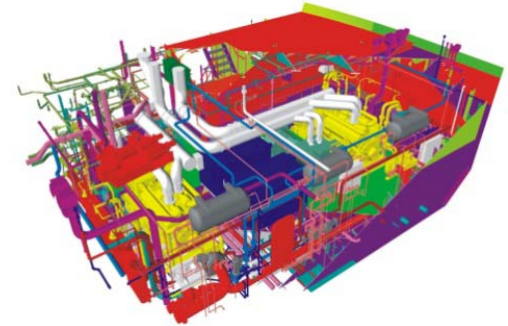


# Overall Concept



- To develop an analysis, design and simulation tool that will allow shipbuilders to mitigate distortion of components and assemblies that is caused during lifting, handling and interim storage evolutions.
- To decrease cycle time and man-hours associated with lifting and handling calculations.
- To directly interface with ship design software using automated finite element and other calculation methods to provide shipbuilders with calculated lift points, recommended rigging procedures, and analysis of the effects of various storage and transportation methods.

## Goals & Objectives



- Import/export of ShipConstructor geometry and product model data to/from NEiNastran.
- Development of a prototype lifting and handling knowledge base which can be customized for specific shipyard facilities and equipment.
- Identification of lifting points and methods from a lifting and handling knowledge base.
- Development of a rapid analysis model in NEiNastran.
- Analysis of distortion effects and identification of plastic deformation areas caused by material handling.
- Ability to modify lifting points and methods and re-analyze in a timely manner.

# ShipLift Project

- Project Process Issues
- Geometry conversion – CAD to FEA
  - Big issue!
    - Geometric simplification
    - Model simplification
    - Element types
    - Manual Inputs

# ShipLift Project

- Geometric Simplification
  - Does the Model need all the CAD detail?
    - Screw holes
    - Cutouts
    - Snipes
    - Rat Holes
  - Usually not
  - Can the model be automatically defeatured?
    - Difficult
    - We reviewed potential methods to evaluate the impact of defeaturing
  - Current software relies on manual defeaturing
    - Use has to take the original CAD part and remove some items that are not of interest
    - Some small features are automatically removed during the meshing process

# ShipLift Project

- Model Simplification
  - Do all parts need to be modeled?
    - Low mass items
    - Non-structural items
    - Stiff portions (equipment, for example)
  - Current implementation meshes everything that is in the CAD part
    - Future work may be able to simplify some things
    - Remove low-mass items and non structural items
    - Use concentrated masses and rigid elements for stiff portions
    - Would require more user intervention
  - We reviewed the effect of various model and geometric simplifications and attempted to quantify the effect of various simplifications
    - Removing bolt holes, for instance

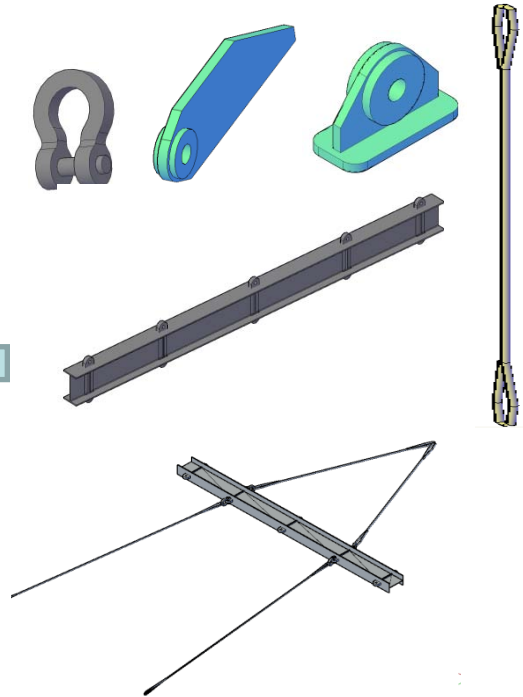
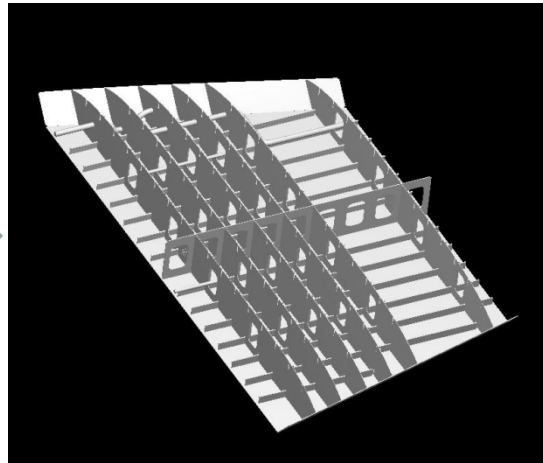
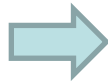
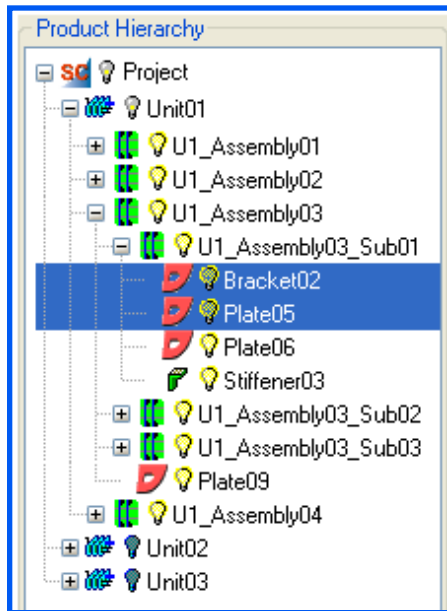
# ShipLift Project

- Element Types
  - We did a review of element types and their impact on an analysis and on the building of the FEA model
    - Solid elements make big models, but require little user intervention
    - Shell and beam elements require extensive user input
    - Attempted to numerically quantify whether a model was a candidate for shell, beam or solid elements
  - Current implementation automatically meshes parts with solid tet10 elements
    - Simple to implement automatically
    - Models can be big
    - Too much user intervention was needed for shell and beam representations

# ShipLift Project

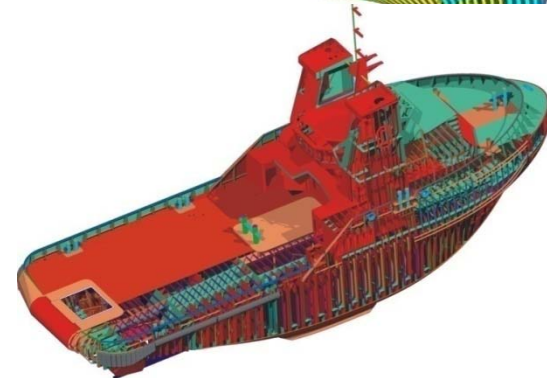
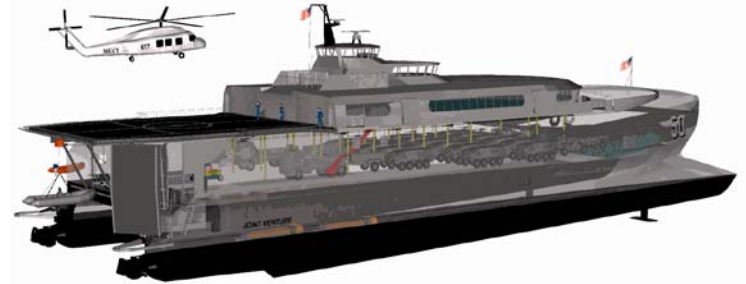
- Manual Inputs
  - We attempted to minimize the user input required to build FEA models from geometry.
    - Solid elements only for current implementation
    - Small features removed automatically
  - If specific simplifications are needed, the user needs to work it beforehand in ShipConstructor

# ShipConstructor ShipLift Development



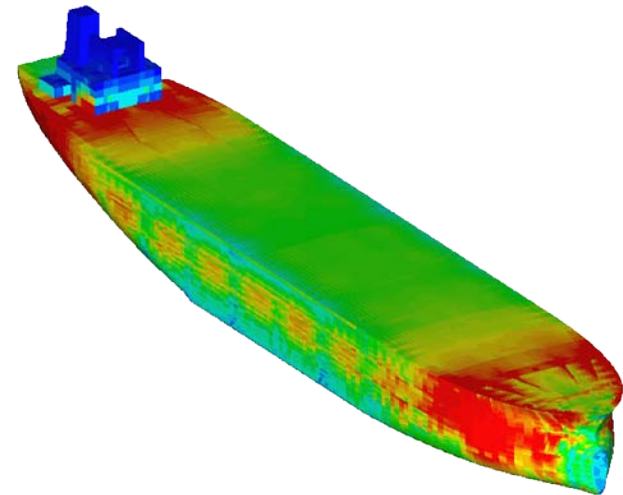
# ShipConstructor Development Status

- Lifting & Handling Knowledge Base
- Knowledge Base User Interface
- Participation from Major Shipyards



# NEi Fusion Development Status

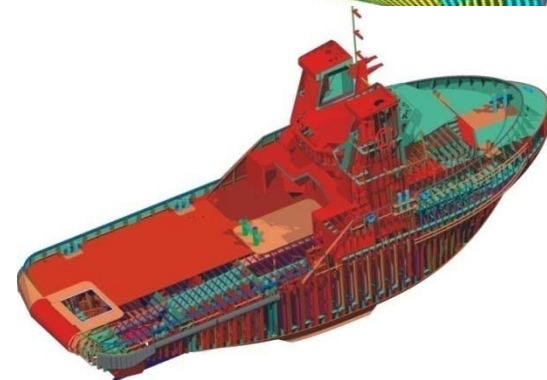
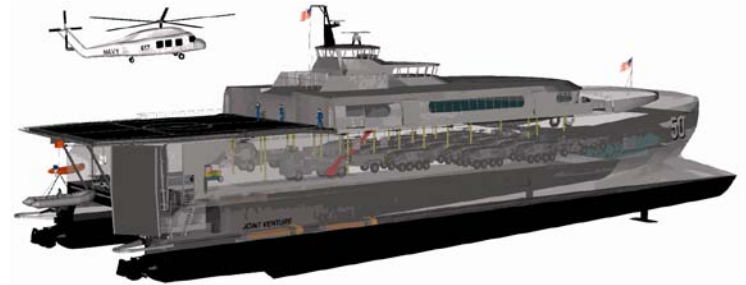
- Rapid Analysis Model
- Support for Solid Meshing
- Automated Contact Scenarios
- Automated Loading/Constraints





# Future Development

- Support for Additional Mesh Types
  - Shells, Beams
- Lifting/Handling Optimization
  - Locate lift points automatically
- Manual user intervention
  - Add components
  - Flag items for removal
  - Flag items for simplification







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Questions?