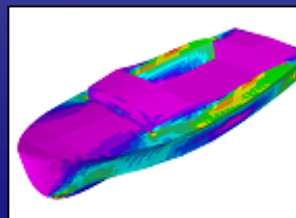
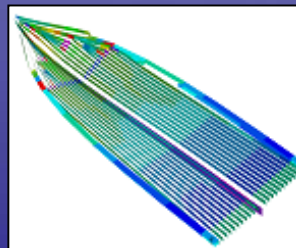
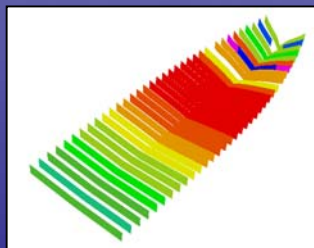
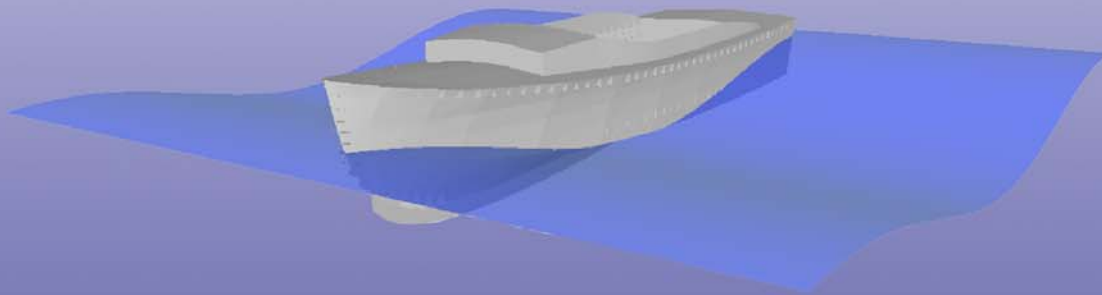


VIKING

S Y S T E M S

High Speed Craft Design



CONSULTING STRUCTURAL ENGINEERS

High Speed Craft Structural Criteria Assessment

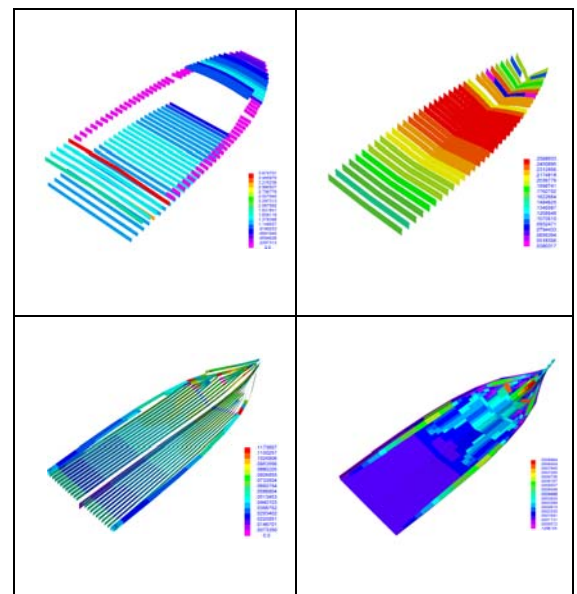
Viking Systems – a leading provider of structural design and analysis services - provides timely solutions using advanced analysis design tools and classification society requirements for high-speed craft marine structures. Viking Systems has implemented extensive knowledge of High Speed Craft structural design into SAGA, our in-house comprehensive structural engineering software.

Scantling Rule Verification:

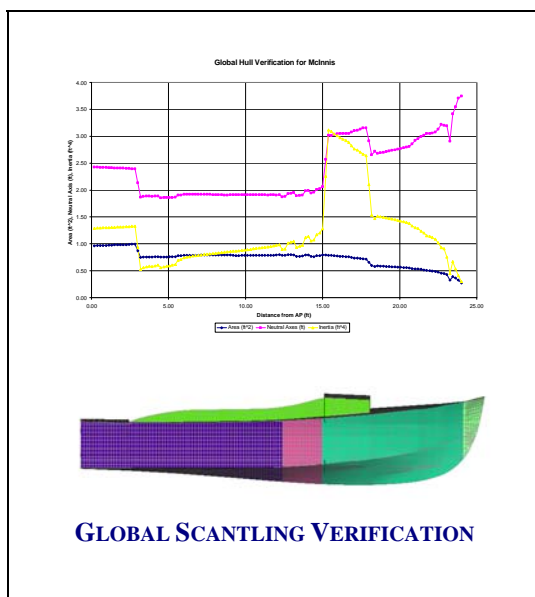
Viking Systems' in-house software SAGA performs 3D model beam scantling section modulus and plate thickness verification against any set of class society rules or client specific rules. Currently SAGA has First Principle, DNV and ABS High Speed Craft Rules built in to the program. SAGA also allows our clients to work interactively with us to create specific and unique assessment criteria for a project.

Global Scantling Verification:

Viking Systems software provides hull girder sectional property verification by plotting Cross Sectional Area, Neutral Axis, and Moment of Inertia values for comparison to the actual hull girder sectional properties craft.



ASSESSMENT OF STRUCTURAL MEMBERS



Structural Rules Comparison

SAGA allows for structural comparison of classification society rules in order to assess the rule criteria of:

- First Principle Rules
- ABS High Speed Naval Craft Rules
- DNV High Speed Craft Rules
- BV/GL/RINA High Speed Craft Rules

Systematic Craft Comparison Studies

SAGA allows for an accurate, verifiable, and visual comparison of craft structural designs:

- Comparison of multiple craft to same set of rules
- Level of compliance to a set of rules
- Structural Risk Assessment

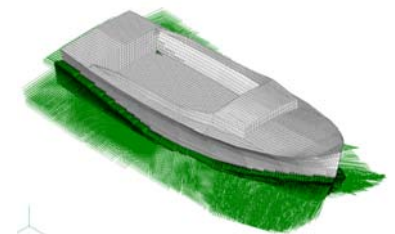
Advanced Analysis Assessment

SAGA Analysis System allows for both rules based verification and advanced analysis based on same underlying data model.

Loading Analysis:

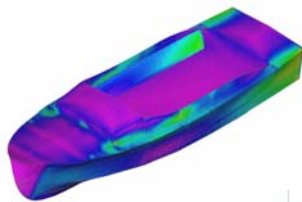
Viking Systems' SAGA software applies loads to the vessel with required load components including wave loading, dynamic pressures, vessel accelerations, and tank loading. SAGA has the ability to load pressure from other programs for application to the Finite Element Model.

- LAMP®
- SAGA NLS®
- PowerSea®
- Shipmo®

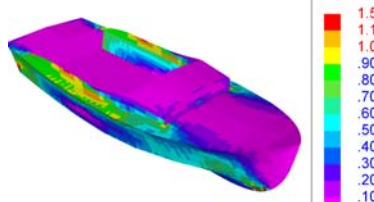


HULL SEA PRESSURE

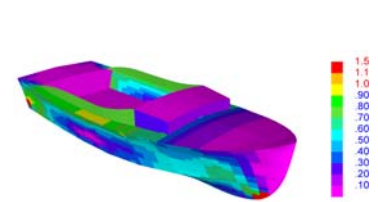
SAGA assesses FEA Solutions against buckling and yield evaluation to any structural rule system as well as fatigue damage ratio using simplified and spectral fatigue calculation methods.



FEA MODEL STRESS PLOT



YIELDING ASSESSMENT



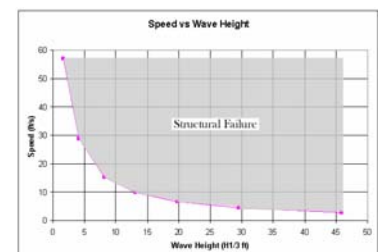
PANEL BUCKLING ASSESSMENT

SAGA rapidly creates, loads and evaluates structural finite element models, allowing for reliable comparison studies of rule-based calculations, finite element analysis results and measured field data. Examples include:

- First Principles Rules vs. Field Data
- First Principles Rules vs. finite element analysis using Hydro Loads and Accelerations
- Classification Rules vs. First Principles Rules

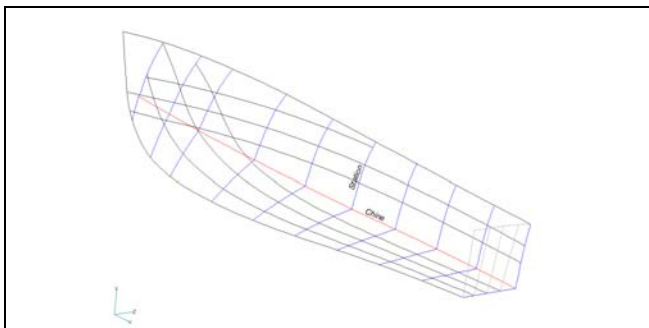
SAGA creates Sea State vs. Speed Envelope Plots:

- Matrix of Speed vs. Sea State
- Curve is plotted at Structural Failure for a given speed and sea state
- Allows for comparisons of Vessel Operating Profiles

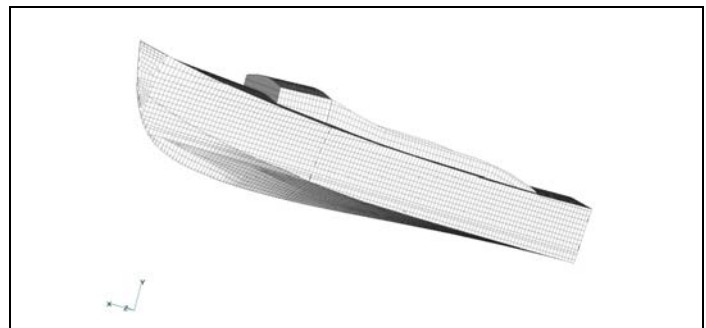


Craft Modeling Capabilities

Viking Systems is the developer of SAGA Ships, our in-house software system enabling us to rapidly and accurately create structural finite element models to support rule-based design and advanced finite element analysis.



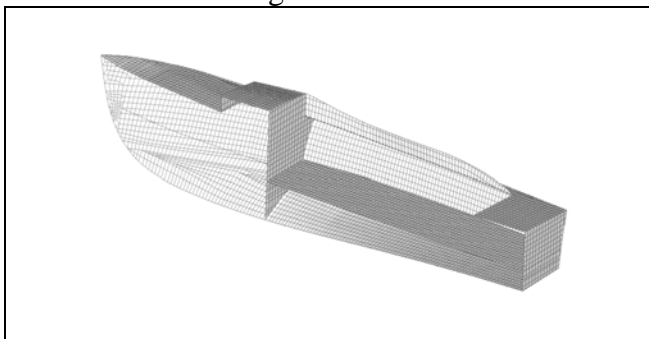
DXF FILE USED TO CREATE GLOBAL MESH



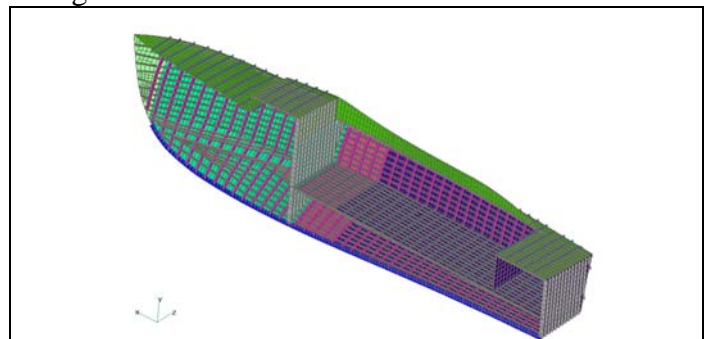
GLOBAL FINITE ELEMENT MODEL

- Automated shell mesh generation from DXF files, hull offset tables, structural drawings and general arrangement drawings.
- Corrosion deduction regions allow for rapid corrosion modeling.
- Geometry-based automated deck and bulkhead mesh generation.

- Field measured thickness values can be assigned to structural model allowing strength assessment of vessels in service.
- Automated updating of beam and stiffener strength properties to include attached plating.
- Mesh refinement capabilities for local model generation.



INTERIOR STRUCTURE MESHED FROM GEOMETRY



INTERIOR MEMBERS ADDED TO GEOMETRY

Viking Systems uses SAGA in combination with any of the major FEA programs including Patran®, FEMAP®, ANSYS®, MAESTRO®, SAFEHULL®, VeriStar® and Nauticus® to create global and local ship structure models. Model size and mesh density is customized to meet the needs of the client and the requirements of the project. SAGA allows us to work with a client-imposed system while allowing the advanced loading and evaluation features of SAGA.

1 Patran® is a trademark of MSC Software 4 MAESTRO® is a trademark of Anteon 7 Nauticus® is a trademark of DNV Software
 2 FEMAP® is a trademark of EDS 5 SAFEHULL® is a trademark of ABS
 3 ANSYS® is a trademark of ANSYS Inc. 6 VeriStar® is a trademark of BV