



High Speed Craft Design

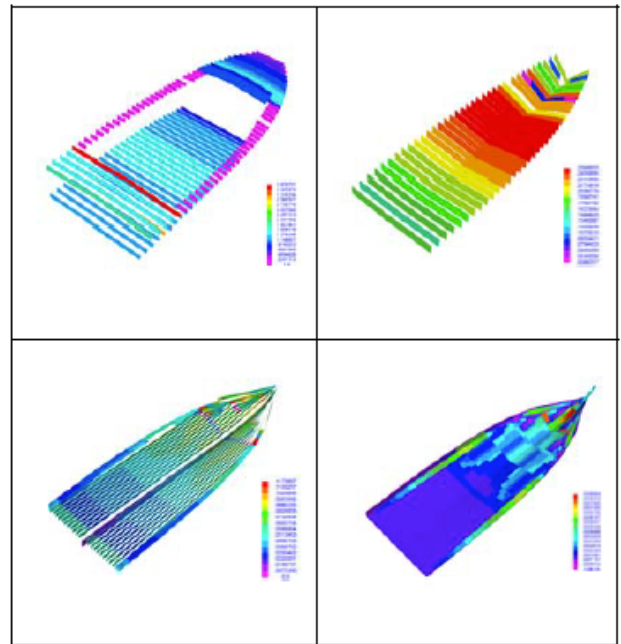
Viking Systems International, a leading provider of structural design and analysis services, provides timely solutions using advanced analysis design tools and classification society requirements for high-speed craft marine structures. Viking has implemented extensive knowledge of high speed craft structural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

Scantling Rule Verification

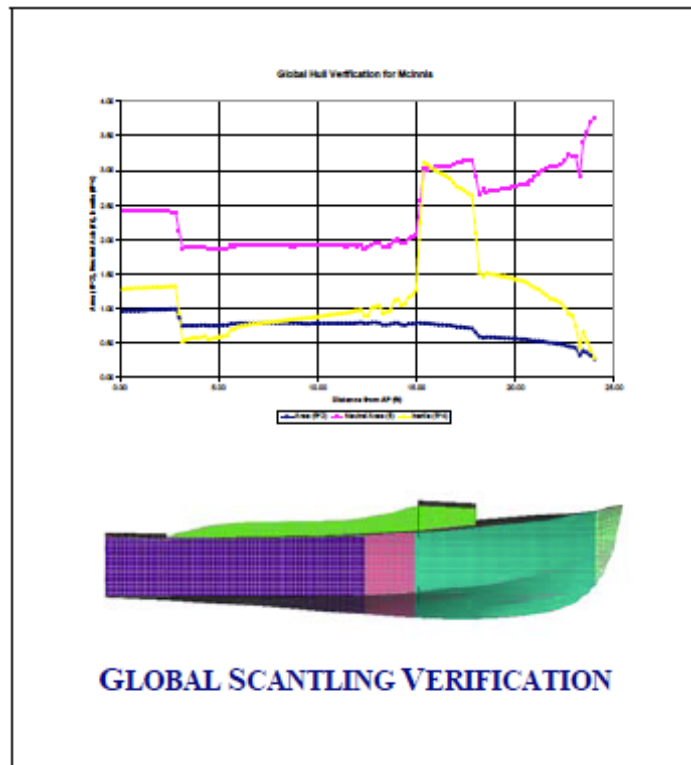
Viking's in-house software, SAGA, performs 3D model Beam scantling sections modulus and plate thickness verification against any set of class society rules or client specific rules. Currently, SAGA has First Principle, DNV and ABS High Speed Craft Rules built into the program. SAGA also allows our clients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

Global Scantling Verification

SAGA 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/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 the same underlying data model.

Loading Analysis

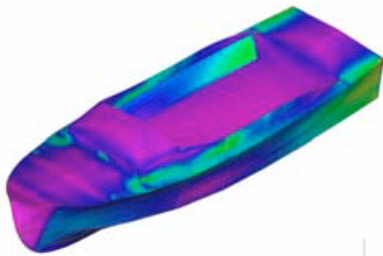
SAGA software applies loads to the vessel with required load components including wave loading, dynamic pressures, vessel accelerations, and tank loading. Also, SAGA has the ability to load pressure from other programs for application to the Finite Element Model.



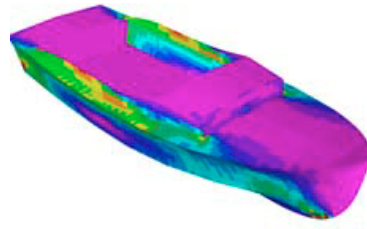
Hull Sea Pressure

- LAMP®
- SAGA NLS®
- PowerSea®
- Shimo®

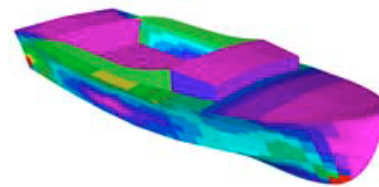
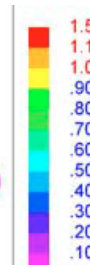
Through SAGA, Viking assesses FEA Solutions against Buckling and yield evaluation to any structural rule systems as well as fatigue damage ratio using simplified and spectral fatigue calculation methods.



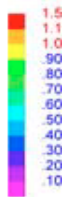
FEA Model Stress Plot



Yielding Assessment



Panel Buckling Assessment



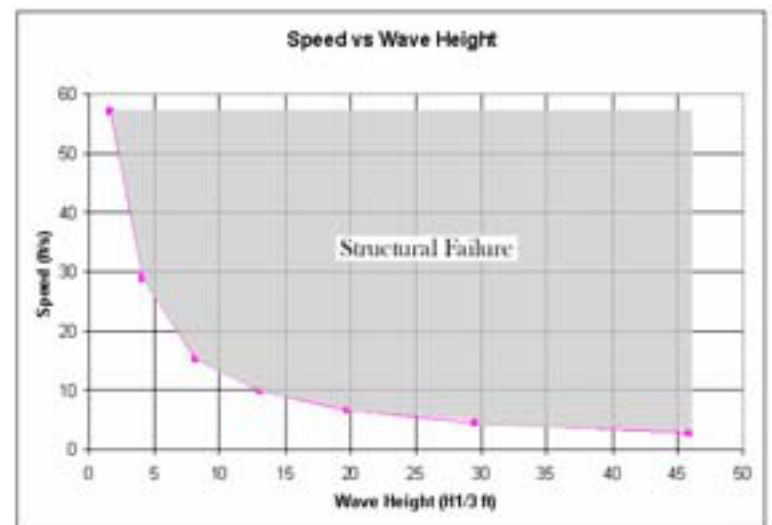
SAGA rapidly creates, loads and evaluates structural finite element models, allowing for reliable comparison studies of rule-based calculations, finite element analysis results and measured field data.

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

Sea State vs. Speed Envelope Plots are created by SAGA:

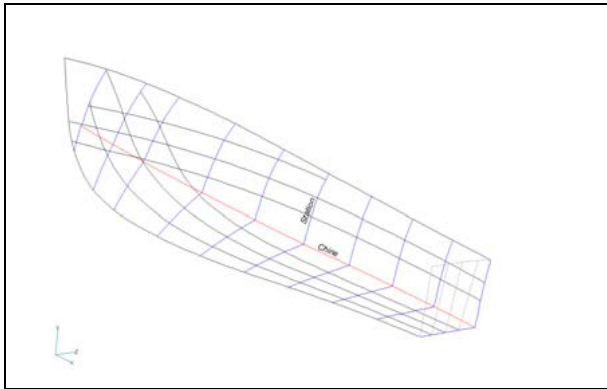
- Matrix of Speed vs. Sea State
- Curve is plotted at Structural Failure for a given speed and sea state
- Allows for comparisons of Vessel Operating Profiles





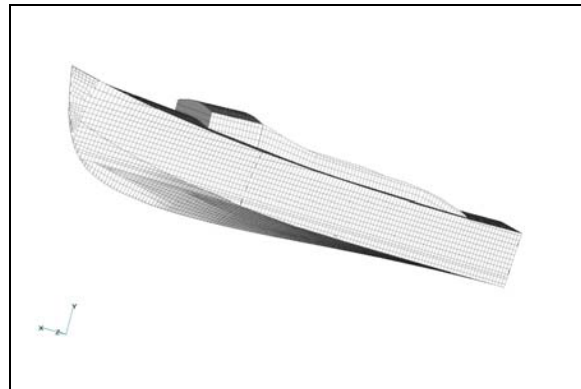
Craft Modeling Capabilities

Viking 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.



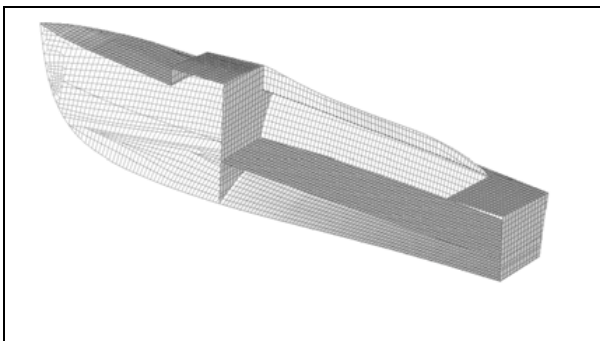
DXF File Used to Create Global Mesh

- 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.

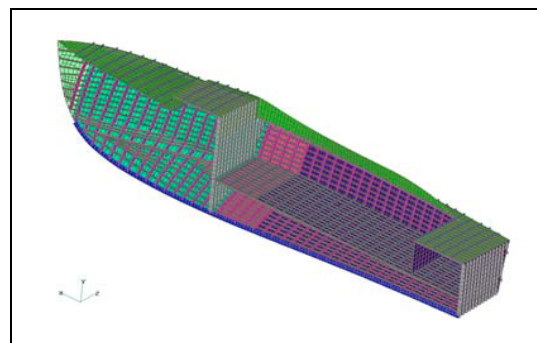


Global Finite Element Model

- 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 International 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 (2) FEMAP® is a trademark of EDS (3) ANSYS® is a trademark of ANSYS Inc (4) MAESTRO® is a trademark of Anteon (5) SAFEHULL® is a trademark of ABS (6) VeriStar® is a trademark of BV (7) Nauticus® is a trademark of DNV Software