Germanischer Lloyd

Naval Services – More Than Classification!

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Germanischer Lloyd

First Class Service Provider of Maritime Safety and Quality

André Grabow

Business Development Manager Navy

CONTENT

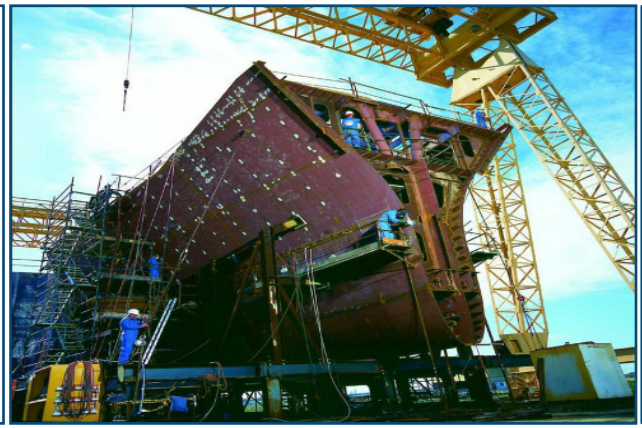
CONTENT

1. Classification / Non-Classification Services

GL supports navies and shipyards in

- Classification of Naval Ships → GL Rules / GL Naval Rules
- Fulfilling of requirements → National, Internat. or Military Standards
- Finding solutions for the naval vessel's platform in order to accomplish high safety standards – Navy SOLAS → Naval Ship Code (NSC)
- Complying with environmental standards (if applicable) → MARPOL
- Finding of designs at optimal cost by developing special regulations for naval vessels → Commercial Standards, if applicable

1. Classification



Non-statutory!

Design and construction phase:

- Consulting and engineering services
- Review of reference documentation acc. to class regulations

Building phase:

- Testing of materials and components; FAT, HAT, SAT
- Construction supervision within an agreed scope
- Issuance of certificates

Operating phase:

- Periodical inspections to guarantee safety
- Renewal of certificates

1. Classification

GL Regulations for Naval Vessels

III Naval Ship Technology

0 Classification and Surveys

1 Surface Ships

1	Hull Structures and Ship Equipment
2	Propulsion Plants
3a	Electrical Installations
3b	Automation
4	Ship Operation Installations and Auxiliary Systems

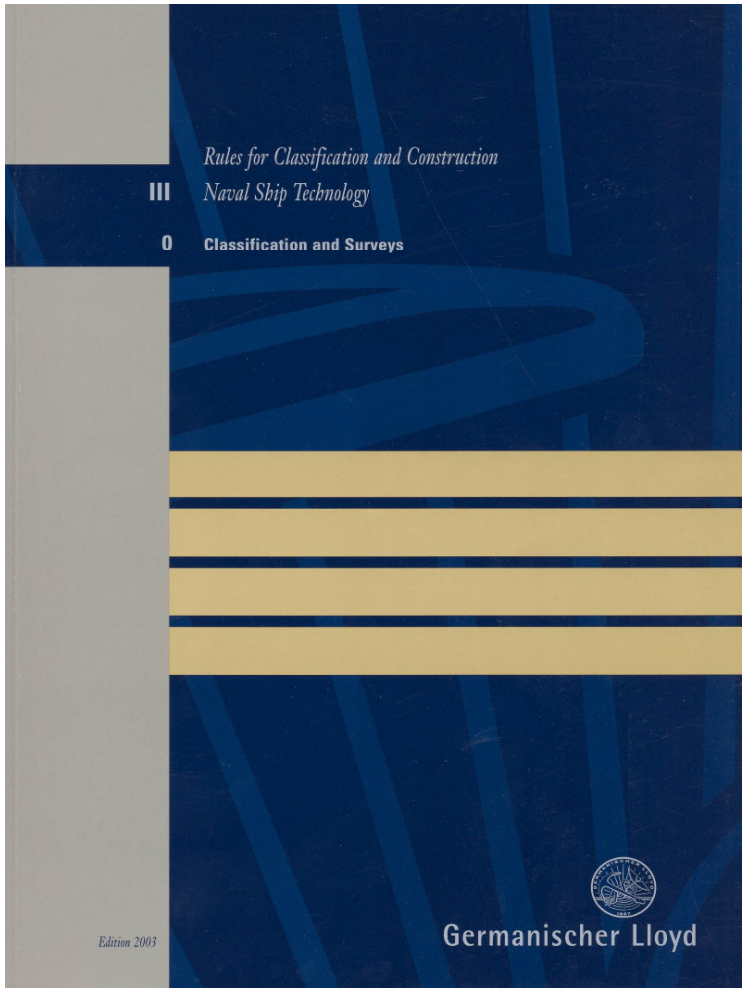
2 Sub-Surface Ships

1	Submarines
2	Remotely Operated Underwater Vehicles
3	Air Independent Power Systems for Underwater Use

II Materials and Welding

1 Metallic Materials

6	Special Materials for Naval Ships



1. Classification / Non-Classification Services

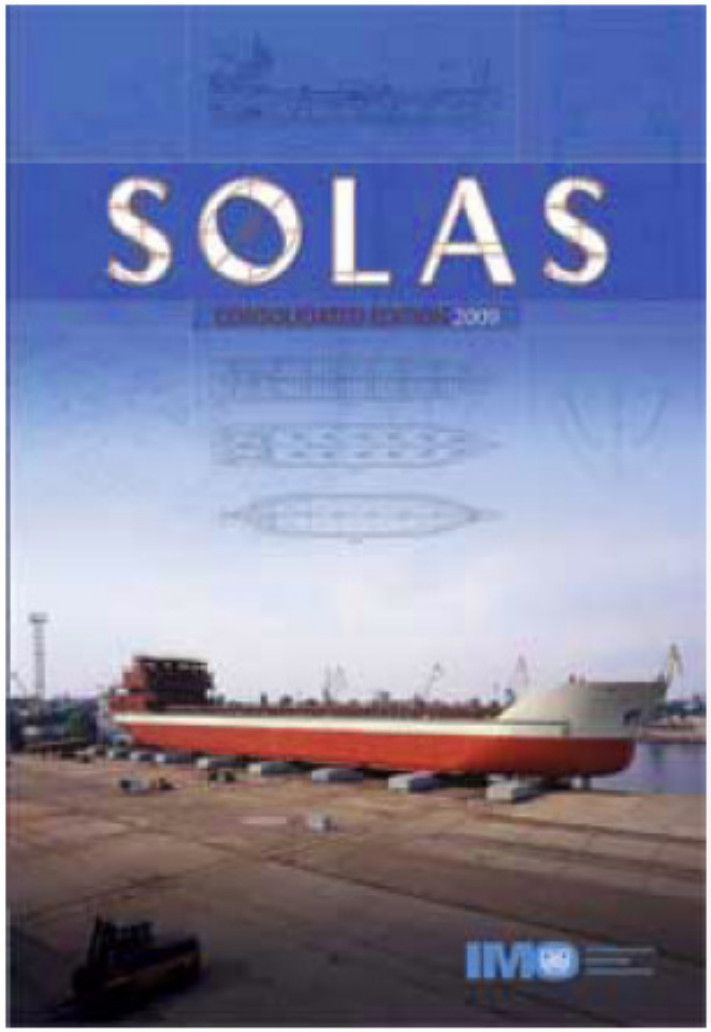
Naval Ship Safety and Classification

Application of SOLAS to Naval Ships – Safety Standards on Naval Ships

-> a challenge to designer, shipyards and navies

1. Classification / Non-Classification Services

Naval Ship Safety and Classification



- SOLAS Current Version (1st January 2011)
  - SOLAS 74
  - Protocol of 1988
  - Chapter I - General provisions
  - Chapter II-1 - Construction - Structure, subdivision and stability, machinery and electrical installations
  - Chapter II-2 - Construction - Fire protection, fire detection and fire extinction
  - Chapter III - Life-saving appliances and arrangements
  - Chapter IV - Radiocommunications
  - Chapter V - Safety of Navigation
  - Chapter VI - Carriage of cargoes and fuel oils
  - Chapter VII - Carriage of dangerous goods
  - Chapter VIII - Nuclear Ships
  - Chapter IX - Management for the safe operation of ships
  - Chapter X - Safety measures for high-speed craft
  - Chapter XI-1 - Special measures to enhance maritime safety
  - Chapter XI-2 - Special measures to enhance maritime security
  - Chapter XII - Additional safety measures for bulk carriers
  - Appendix - Certificates

1. Classification / Non-Classification Services

Naval Ship Safety and Classification

Application of SOLAS to Naval Ships – Safety Standards on Naval Ships

-> a challenge to designer, shipyards and navies

Cooperation of

- Naval Ship Classification Association (NSCA) and

- NATO Naval Group 6

to translate SOLAS for application to naval ships: ANEP – 77

-> NAVAL SHIP CODE

1. Classification / Non-Classification Services

Naval Ship Safety and Classification

Application of SOLAS to Naval Ships – Safety Standards on Naval Ships

-> a challenge to designer, shipyards and navies

-> NAVAL SUBMARINE CODE

The development of a SOLAS related code applicable for submarines started in February 2012

1. Non-Classification Services

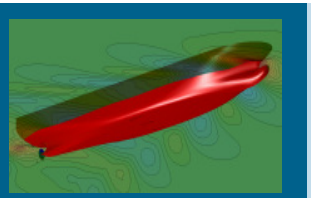
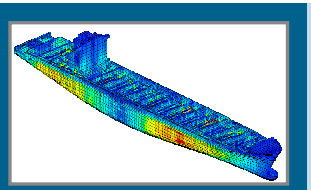
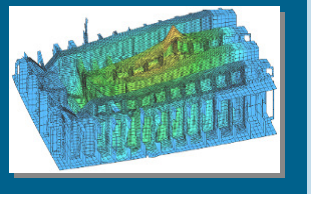
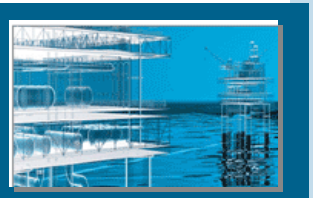
Building Supervision on behalf of the Navy (Shipyard) for

- New Building or Refit of Surface Ships or Submarines

  - acc. to technical specification
  - permanent presence not related to classification
  - Quality Assurance Representative

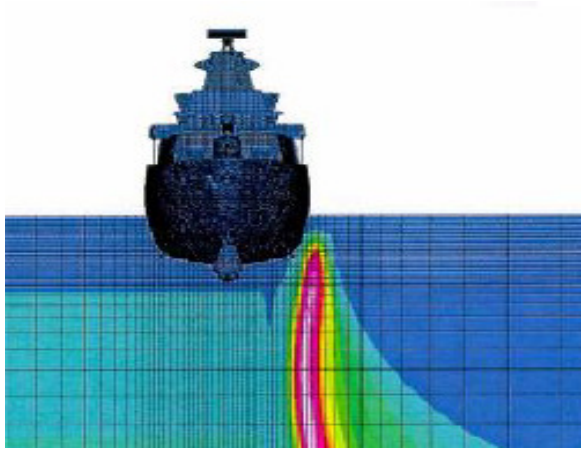
CONTENT

2. Naval Engineering Services – GL FutureShip

Fluid Dynamics & Engineering		• **CFD** analyses and solutions • Performance analysis, **hull shape and propulsion optimisation** • **Seakeeping** analysis, design loads incl. impact loads • Air flows, fire and **smoke propagation**
Structural Engineering		• Strength assessment & life time predictions • **Collision simulations**, fluid-structure interaction • Vibration and noise predictions • Underwater explosion and shock simulations
Mechanical Engineering		• Strength analyses of **equipment, fatigue** & fracture mechanics • Reliability & **life time** extension • Pipeline & **piping** analyses • **Energy efficiency** services, monitoring tool, EEDI technical files, ...
Risk Assessment		• **Risk** assessment and **analyses**, safety and reliability assessment • **Equivalence analyses** • **Safe return to port** assessment and evacuation analyses • **Navigational** risk analyses
Measurements		• Sea **trials** • **Speed & power** assessment • Noise & vibration **measurements** • **Trouble**-shooting

2. Naval Engineering Services – GL FutureShip

Issues/topics	Disciplines/services
Signatures	➢ Water borne noise ➢ Infrared ➢ Wave pattern
Energy efficiency	➢ Hull form optimization ➢ Propulsion optimization ➢ Trim optimization ➢ Optimization of ship's operating systems
Survivability	➢ Damage stability (hydrostatics) ➢ Structural optimization (survivability and/or weight) ➢ Shock ➢ Fire safety
Availability	➢ Risk assessment / FMEA ➢ Hull structure fatigue
Lifecycle management / extension	➢ Condition monitoring (hull and machinery) ➢ Hull condition assessment and prediction of remaining lifetime ➢ Hydrostatics (weight of additional installations) ➢ Conversions: feasibility and impact (structures, hydrostatics, hydrodynamics, risk, ...)
Unconventional design	➢ Hydrodynamics: loads, seakeeping, operability index, propulsion, ... ➢ Aerodynamics: operational capabilities of helicopter, smoke propagation ➢ Structure: strength, vibration and noise ➢ Risk: materials, alternative fuels, ...
Troubleshooting	➢ Noise/vibration ➢ Strength & fatigue (hull and machinery)



2. Naval Engineering Services – GL FutureShip

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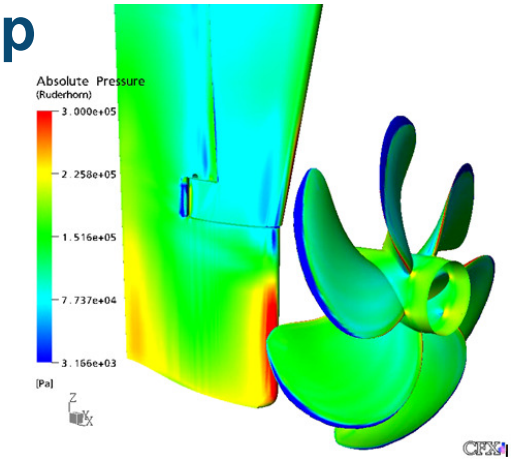
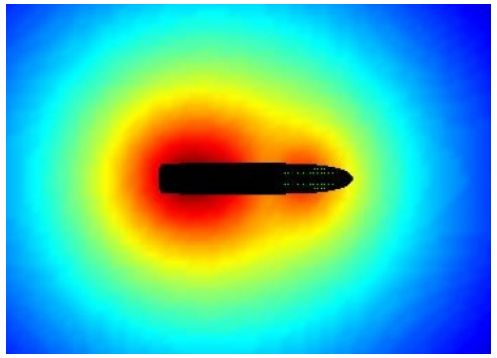
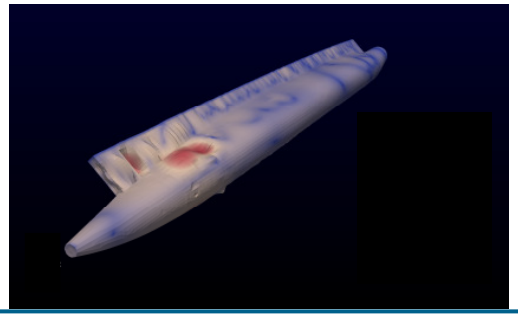
2. Naval Engineering Services – GL FutureShip

Water borne noise

- Work Scope
  - Computation of structure born noise and radiation into fluid
  - Taking into account: propeller, engines, thrusters, gears
  - Cavitation investigation of propeller & rudder
  - Acoustic signature of submarines (Noise FEM)
- Benefit of Calculation
  - Improved stealth characteristic
  - Avoid interference with own sonar
  - Optimized propeller & rudder design







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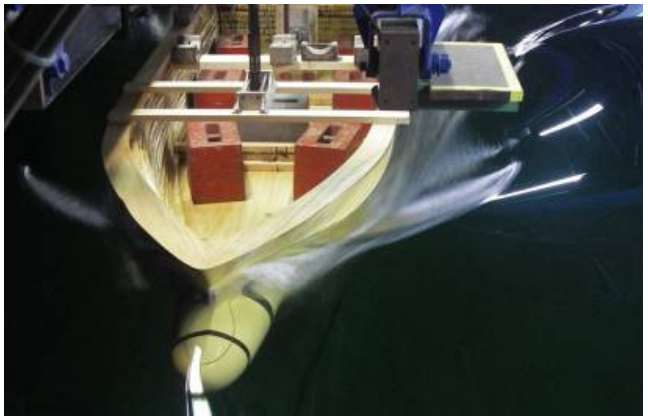
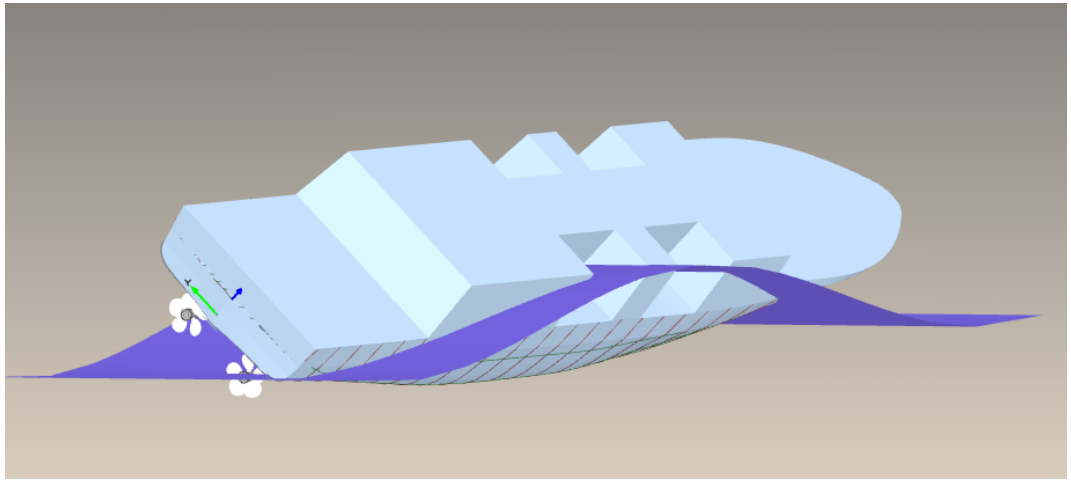
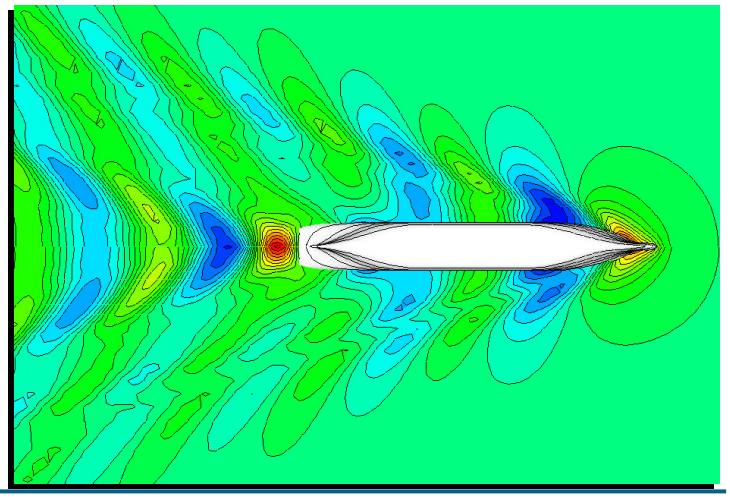
Hydrodynamic optimization of the frigate class F125

- Energy efficiency optimization
- Hull line development
- Systematic / formal optimization
    - CFD analysis
    - Exploration / Exploitation (>10.000 variants!)
    - former procedure... < 10 variants







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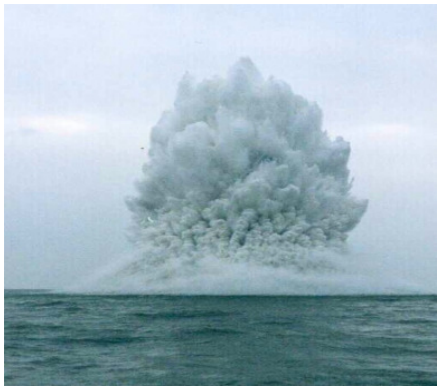
Underwater Shock – Shock Resistance Investigation / Optimization

Sinking of CHEONAN (ROK Naval Ship) caused by
non-contact torpedo detonation on 26th of March 2010

81st Shock and Vibration Symposium SAVIAC Newsletter 09-2010



Serious threat to all surface ships and submarines!!!

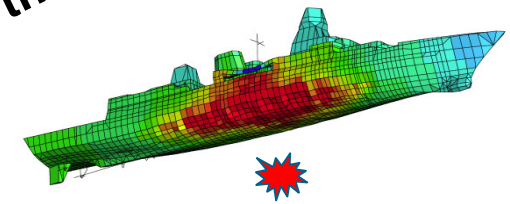
2. Naval Engineering Services – GL FutureShip

Shock Resistance Assessment

traditional approach

Shock Standard

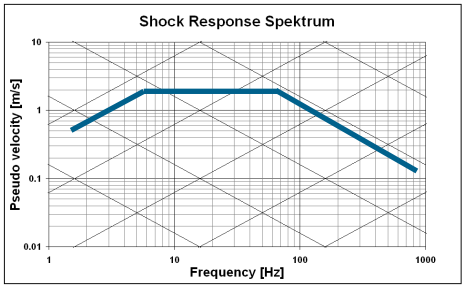
state of the art



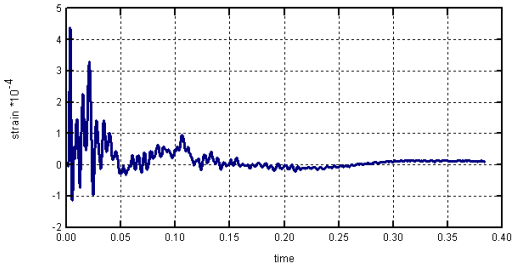
Global Shock Analysis

+

Shock Response Spectra



Shock Resistance Assessment of Equipment



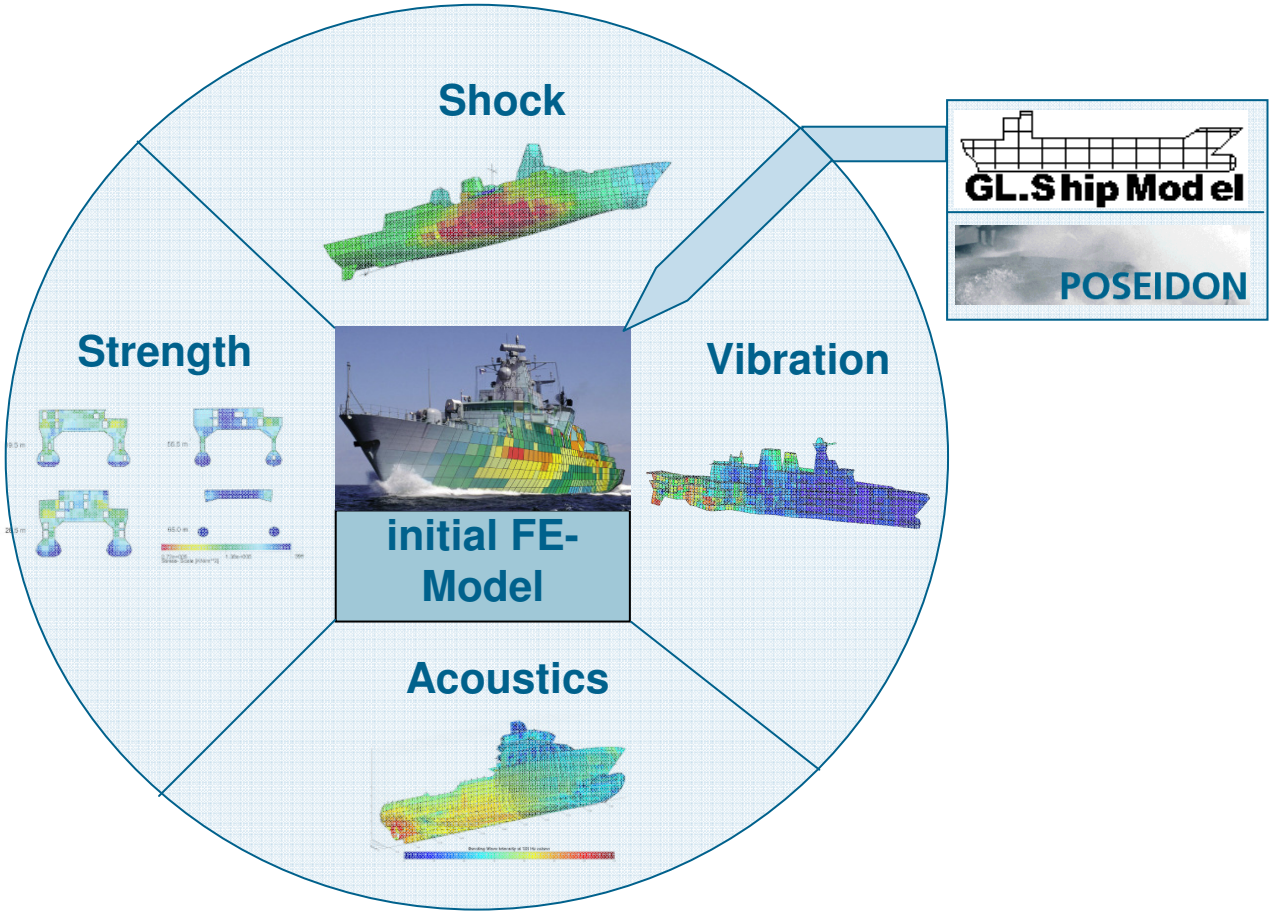
Shock Resistance Assessment of Ship-Structure

2. Naval Engineering Services – GL FutureShip

Global Shock Analysis - GL's process approach

Advantages:

- different structural analysis conducted in parallel
- decreased design process duration
- one stop shopping



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Global Shock Analysis – Benchmark

Validation by comparison with full-scale shock trial:

On behalf of a German shipyard GL predicted in 2009/2010 a shock impact on a navy vessel. A good analogy could be achieved between simulation and measurements.

The results are confidential and can therefore not be presented here.

2. Naval Engineering Services – GL FutureShip

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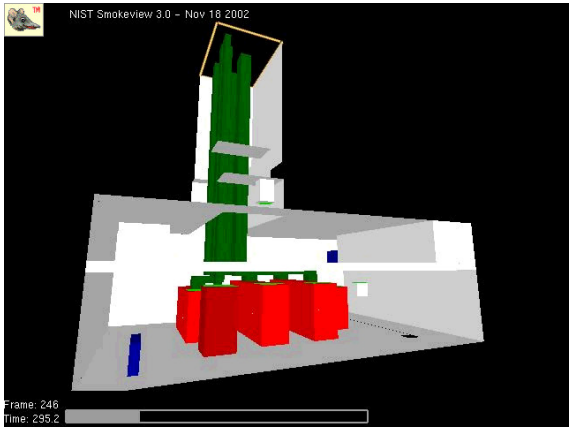
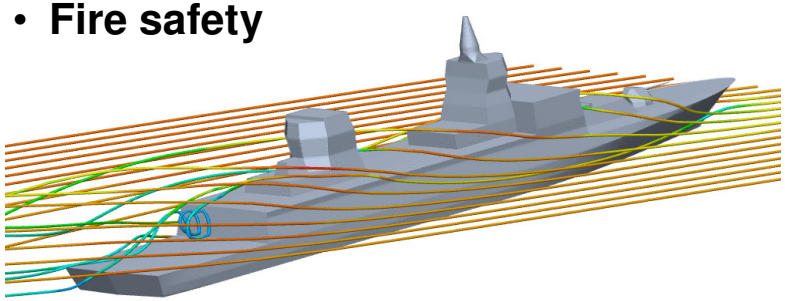
Troubleshooting	➢ Noise/vibration ➢ Strength & fatigue (hull and machinery)

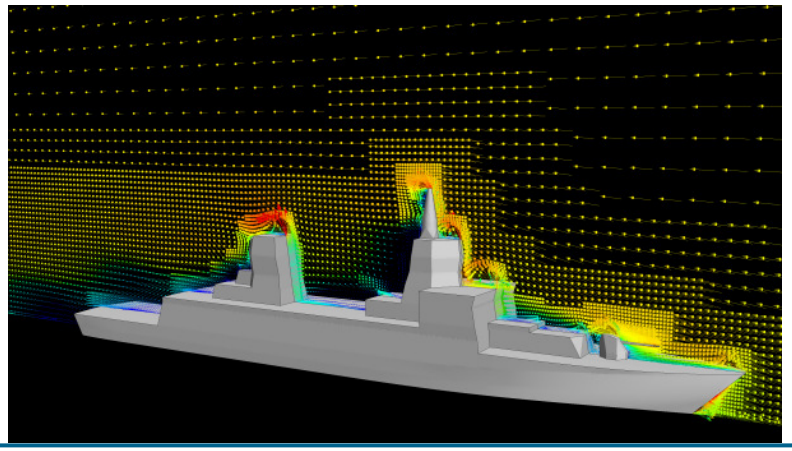
2. Naval Engineering Services – GL FutureShip

Aerodynamics - Reference Case F125

- **Scope of work**
  - Investigation of aerodynamics
  - Smoke propagation
  - Fire simulation
- **Benefit of Calculation**
  - Improved operational capabilities on heli-deck
  - Reduced obstruction of sensors
  - Improved signature
  - Fire safety







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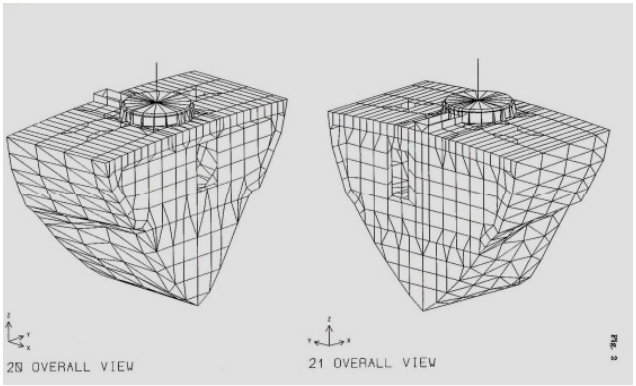
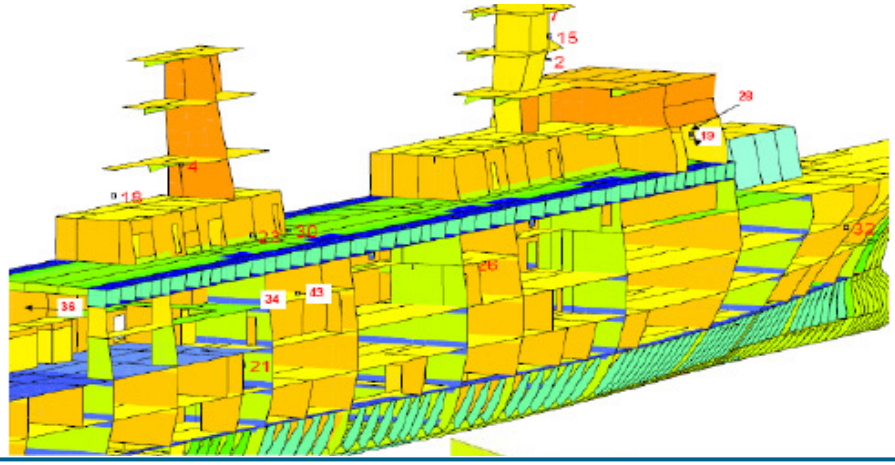
2. Naval Engineering Services – GL FutureShip

Deflection Analysis Weapons & Sensors - Reference Case F125

- Scope of work
  - **Computation of relative deflections between weapons and corresponding sensors in defined sea way**
- Benefit of Calculation
  - **Compliance with limit values required by weapon suppliers**



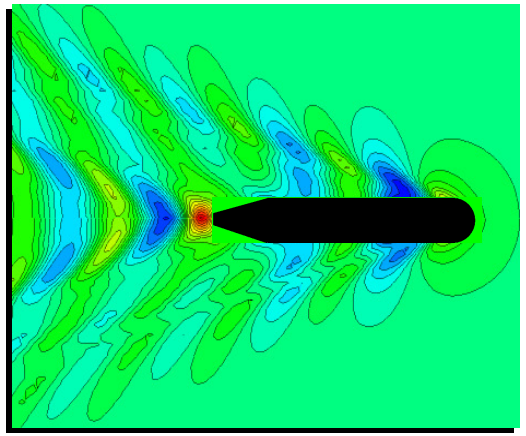


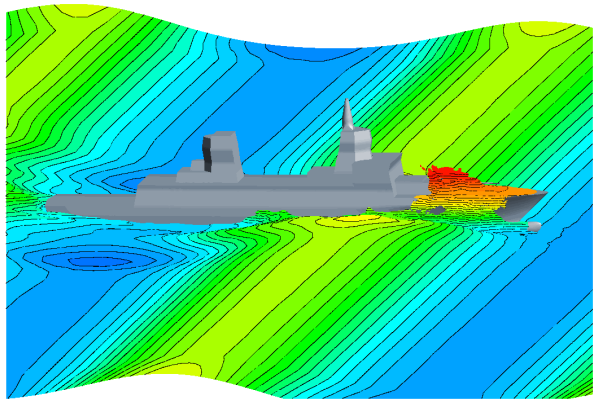
2. Naval Engineering Services – GL FutureShip

Issues/topics

- Signatures
- Energy efficiency
- Survivability
- Availability
- Lifecycle management / extension
- Unconventional design
- Troubleshooting

- **Fluid Mechanics & Hull Optimization**
- **Shock**
- **Strength & Fatigue**
- **Noise & Vibration**
- **Mechanical Engineering**
- **Risk Assessment**
- **Measurements**

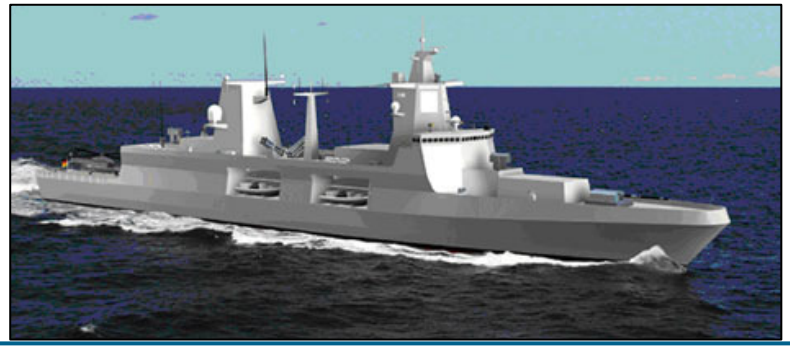




CONTENT

3. Naval Experience / References worldwide

- Royal Australian Navy Frigates (MEKO 200)
- German Navy Frigate F125
- Royal Malaysian Navy Corvette (MEKO 100)
- South African Navy Submarines (U209)
- Colombian Navy OPV 80 / CPV 40
- Latvian Navy SWATH Patrol Boats



3. Naval Experience / References worldwide

...some more examples

- Royal Netherlands Navy Joint Support Ship
- German Navy Task Force Supply Ship (EGV)
- Royal Thai Navy Landing Ship Tank
- German Navy Tall Ship GORCH FOCK
- Chilean Navy Tall Ship ESMERALDA

Any Questions???

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1. Classification / Non-Classification Service

2. Naval Engineering Services

3. Naval Experiences / References worldwide

Contact Data

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Thank you very much for your attention!