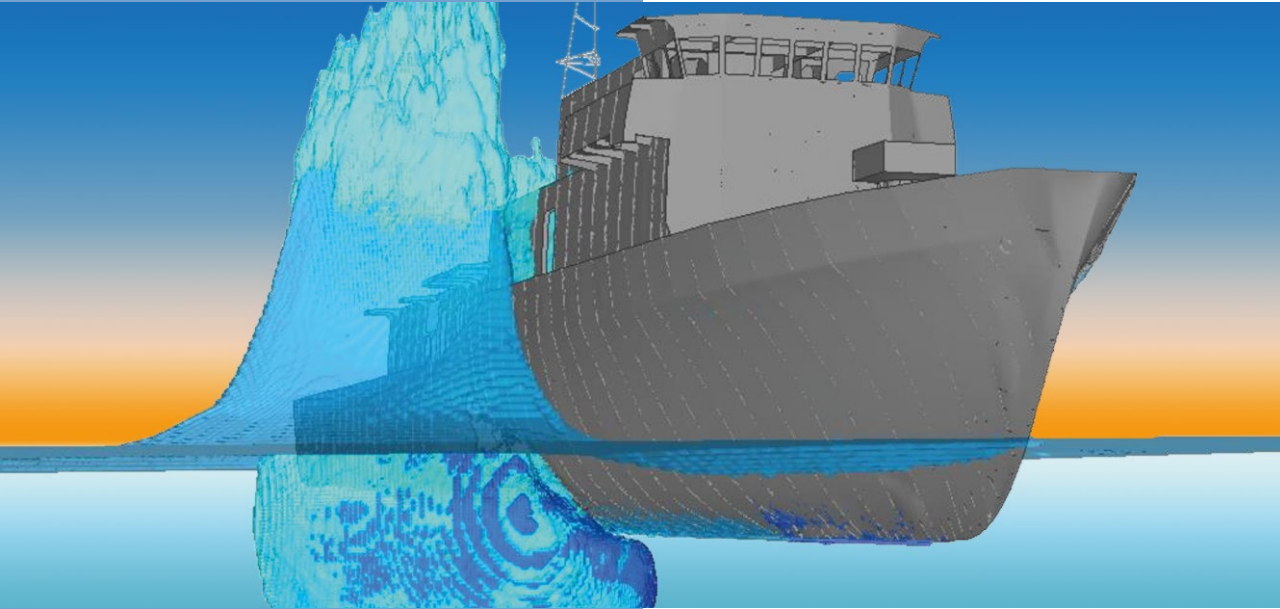


**IABG. The Future.**



## **DYSMAS Simulation Services**

Highly Accurate Shock Simulations  
for Naval Platforms

**iABG**

## DYSMAS Shock Simulations • Extensively Validated, Highly Accurate, Full of Insights

Shock resilience of modern naval platforms is often one of the main cost-driving factors for procurement and upgrade projects. It represents the extreme load scenario that drives the design. At the same time, it is difficult to verify by experimental means the real shock readiness of a new ship apart from moderate first-of-class trials, with the design load cases often remaining untested. With our DYSMAS shock simulations, IABG fills this gap and contributes towards design, optimisation and qualification of a platform.

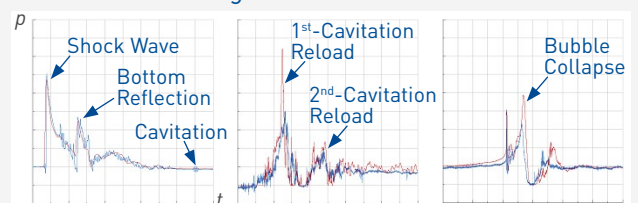
Our in-house tool DYSMAS (Dynamic System-Mechanics Advanced Simulations) is a highly accurate, explicit, fully coupled fluid-structure-interaction (FSI) solver specifically developed to calculate the response of any dynamically loaded systems, from elastically mounted components to entire vessels. It is capable of predicting complex high-speed physics phenomena, including underwater explosions (UNDEX), detonations close to the water surface (FLOATEX), in-air detonations including after-burn effects (AIREX), as well as high-speed deformation, fracture and penetration of structures. DYSMAS simulations cover the whole range of threats for naval platforms, from conventional (e.g., mines, torpedoes) to asymmetric warfare (e.g., IED). They are applicable for surface and submarine vessels as well as any other land, air and sea systems exposed to shock threats.

Brought to life in the 1980's by IABG, DYSMAS is continuously validated against laboratory experiments and full-scale UNDEX trials on decommissioned navy vessels. Since 1996 a German/US Project Agreement is dedicated solely towards the advancement of DYSMAS. While the programme has since become the standard tool of choice for all shock related studies for the navies of both nations, DYSMAS simulation services by IABG are available to governmental organisations and industries of all NATO member nations and beyond.\* With the insightful simulation results and over 30 years of experience in the field, IABG supports government and industries with the design of platforms and components, the planning of shock trials, the proof of shock resilience as well as the development of design guidelines and rules.

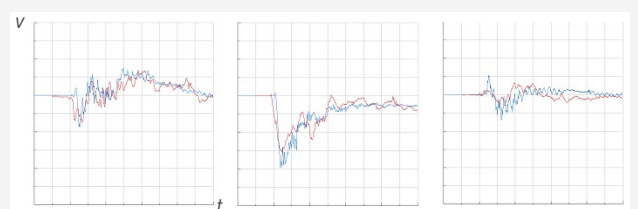
### Key Features of DYSMAS

- **Lab-scale to full-scale live fire validation** of the programme for fluid dynamics and structural dynamics
- Detailed representation of underwater explosion phenomena including primary shock wave, bottom reflection, cavitation, reloads, bubble collapse and jetting
- Extensive material database and failure models for state-of-the-art shipbuilding materials, including steels, aluminium and fibre-reinforced plastics
- Validated models for a wide range of shock mounts enabling **highly accurate predictions of shock response spectra** for elastically mounted equipment
- Applicable to **surface and submarine vessels**, and also to **confined and shallow waters**, including bottom effects of various types of bottoms

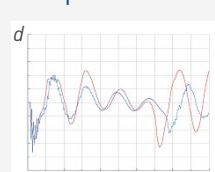
### Fluid Pressure Signal



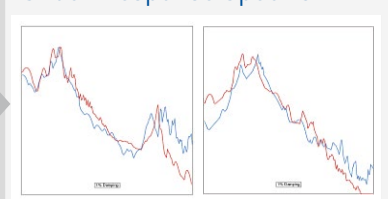
### Structural Velocities



### Shock Mount Displacement



### Shock Response Spectra



— Measurement — DYSMAS Simulations

DYSMAS Full-Scale Validation Campaign:  
U206 Live Fire Test (by courtesy of German MOD)

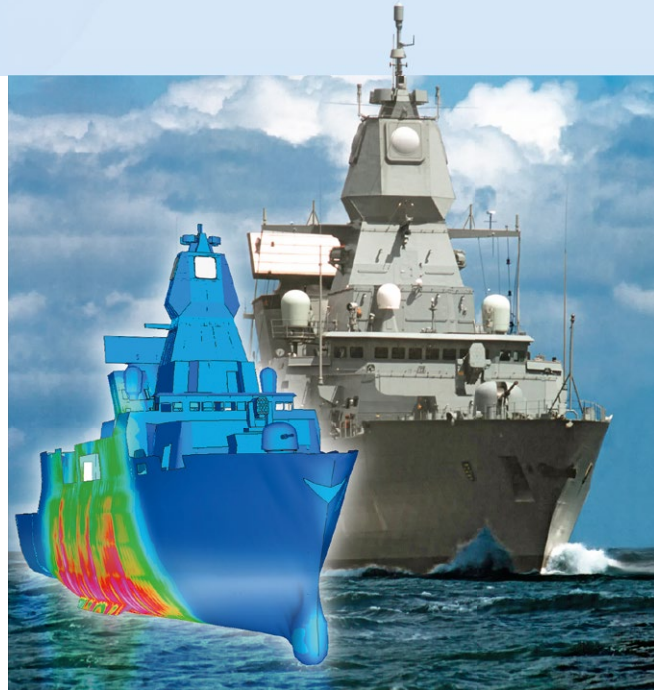
\* Export to foreign nations subject to permission by German Export Control (BAFA)

### Benefits for Navies & Governmental Organisations

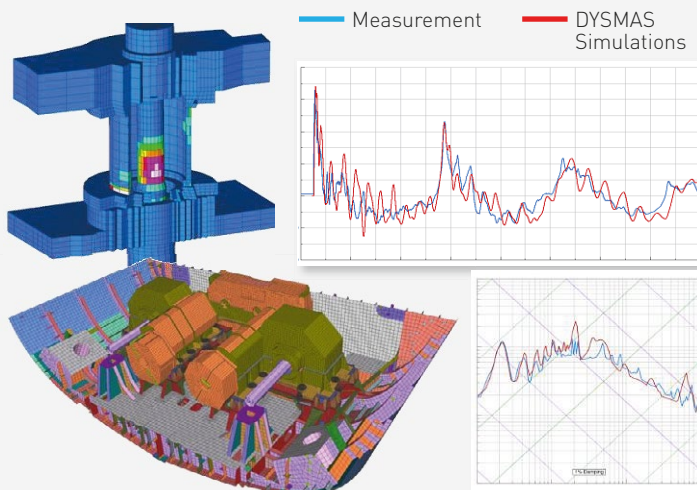
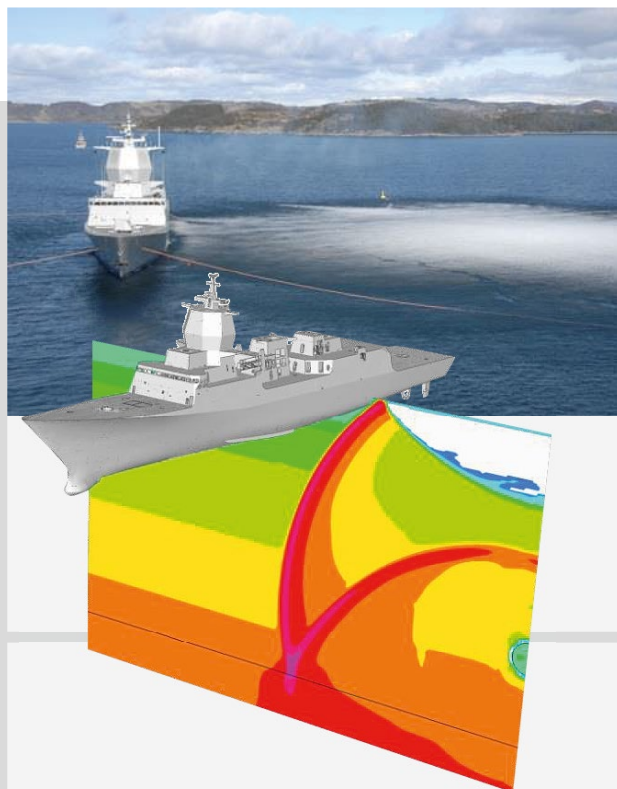
- Understand design options within procurement projects
- Develop and verify shock hardening concepts
- Develop ship building design guidelines
- Prepare, design and plan first-of-class shock trials
- Obtain detailed insights into structural response under operational conditions
- Verify shock readiness of procured vessels under design loads

### Benefits for Shipyards and other Industries

- Achieve shock-proof designs & design optimisation
- Assist qualification process, e.g. in accord with MIL-S-901D
- Gain insight into performance of shock hardening concepts
- Analyse shock mounting systems



F124 First-of-Class Test & Simulations (by courtesy of German MOD)



### F310 – First-of-Class Tests & Simulations (2011, by courtesy of NDLO Naval Systems)

Analysis can be on a global or local scale with all levels of details, depending on the type of application. For the F310 first of class test, IABG performed global shock response simulations (left) as well as highly resolved structural response analysis of, for example, the gearbox mounts (top).

### References

- German MOD • ONR (USA) • Dutch MOD • NDLO Naval Systems • ThyssenKrupp Marine Systems • Abeking & Rasmussen • Schopf Maschinenbau • Atlas Elektronik • Benteler Defence



#### AUTOMOTIVE



#### INFOCOM



#### MOBILITY, ENERGY & ENVIRONMENT



#### AERONAUTICS



#### SPACE



#### DEFENCE & SECURITY

## About IABG

We are a closely networked business group and offer integrated, future-oriented solutions in the sectors Automotive • InfoCom • Mobility, Energy & Environment • Aeronautics • Space • Defence & Security. We understand the requirements of our customers and support them independently and competently. We implement effectively, efficiently and with target orientation. We operate reliably and sustainably. Our international market presence and our success are based on technological excellence and a fair relationship to our customers and business partners.

As a development partner we provide quality control services and develop solutions in the areas of functional efficiency, quality, design, and materials. We offer a broad spectrum of products and services, ranging from numerical analysis to experimental testing to the realisation of turnkey, customised test systems that we operate for the customer.

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