



Sonar Self Noise Investigation in HYKAT

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Dear reader,

Sincere greetings to all our clients, partners and colleagues. 2011 was again a challenging but also a successful year for HSVA.

We experienced that shipbuilding is shifting continuously further to the Far East. Shipping companies and shipyards nearly everywhere in the world are searching for innovative designs. Main emphasis is still – and growing stronger – placed on innovations related to the reduction of ship owners' costs and to the improvement of the environmentally friendliness of their products. Both should go hand-in-hand, and the model basin work gives a significant input to these questions.

All of us – ship owners, shipyards, suppliers and model basins – must direct ourselves towards new opportunities to ensure future success. We at HSVA would like to be your partner in that process and help you to develop together new and innovative solutions for both existing and new markets. We are proud to be part of this rapidly growing movement to reduce emissions and to improve the environmental status on our planet. We can help to develop a new generation of significantly more efficient ship hull forms and technical solutions requiring less

energy with fewer emissions. We will do our best to create real tailor-made solutions for your designs.

The prosperous offshore market is also focus of HSVA's activities; our new side wave generator will help us to find solutions for some of the many questions arising in that challenging field. The necessity to give fast answers requires the use of more and more CFD-work and our in-house RANSE solver FreSCo+ helps us significantly to find these answers.

In this issue of "Newswave" we update you on some recent projects at HSVA.

Even though we are again fully booked at the moment we will do our best to accommodate all your expectations within a short time.

Over the year there will be several opportunities for you to meet our team. Among others, we will be present at OMAE 2012 and finally at SMM 2012 here in Hamburg. We all look forward to seeing you in Hamburg or elsewhere.

Juergen Friesch - Managing Director

Development of a New Efficient Method for and Deformations Based on the



Fig. 1: Vessel for testing GNSS – The “Kobe Express” operated by Hapag Lloyd

by Katja Jacobsen

Within the R&D project MODESH (Motion and Deformation of Ships) a new system, which allows long term measurements of ship motions and deformations, has been developed by HSVA together with Germanischer Lloyd and GeolT Berlin. The new method is based on the “Global Navigation Satellite System (GNSS)“ Technology and the project is funded by the German Federal Ministry of Economics and Technology (BMWi). For testing and development purposes the GNSS system is currently installed on the

container vessel Kobe Express operated by Hapag Lloyd (Fig. 1). During a voyage across the North Atlantic from Hamburg to Halifax in January 2012 the system was validated with simultaneous measurements of motions and accelerations by using a gyro measurement system.

The new GNSS measurement system allows continuous measurements of ship motions in six degrees of freedom together with their time derivatives (velocities and accelerations) for months. The GNSS system provides superior results in comparison with conventional

techniques like GPS or gyro measurements, which often show shortcomings concerning the accuracy of the results and the reliability of the measuring system. Furthermore, if the need arises the system will be able to determine global deformations like ship bending or torsion.

The measurement of ship motions in all six degrees of freedom with the new GNSS technique requires a system of three GPS antennas mounted on the ship (Fig. 2). The arrangement of the three antennas is arbitrary, though the optimal way is to form an orthogonal triangle

Long Term Measurements of Ship Motions Global Navigation Satellite System

as large as possible. A suitable location is the compass deck with plenty of space providing in general an unrestricted satellite view for the antennas. Since the absolute position of each antenna is affected by the same aberration at each time step, this inaccuracy does not essentially contribute to relative differences between the positions of the three antennas, which are of interest in motion and deformation measurements. The accuracy of measured motions is very good, the measurement error for the translational motions remains below 1 centimeter and for rotational motions below 0.1° with an optimal antenna arrangement. For the determination of ship deformations two systems of three GPS antennas are required, one at the bow and one at the stern of the ship.

An important aim of the R&D project beside the testing of suitable hardware for the 6 DoF-GNSS system was the development of the software for recording and analysis of the GPS data. For long term measurements it is indispensable to implement a system, which is able to recover automatically after a system failure. In addition a large amount of recorded data has to be stored and administrated. For



Fig. 2: GPS antenna arrangement



Fig. 3: Development of suitable hardware

the administration of measuring projects, management of antennas and recordings, as well as for the subsequent analysis of the GPS raw data the MCC GUI (Modesh Control Center) has been developed (Fig 3).

After completion of the R&D project MODESH a new and innovative system for measuring motions on ships will be available at HSWA. This allows the determination of ship motions with an extremely high accuracy. Motions in all six degrees of freedom, velocities and accelerations at arbitrary ship-fixed positions can be measured. The new technique can easily be applied during sea trials.

For long term measurements the system has to be integrated in the ship construction, but can then work completely autonomously. The GNSS system can provide ship owners and operators valuable information regarding motions and deformations during long voyages or for long term statistics. The technique will also be used by HSWA for validating seakeeping and manoeuvring tests in order to improve model testing techniques. The intended measurement of global ship deformations during the ship operation provides information required for the dimensioning of the ship construction.

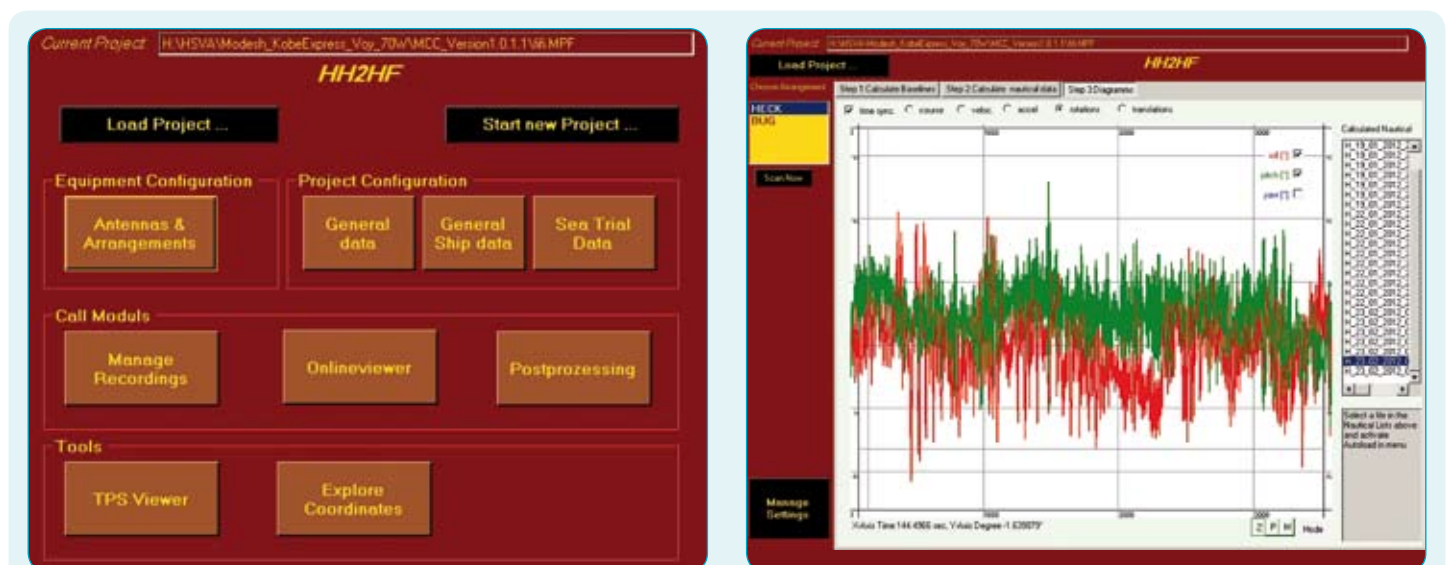


Fig. 4+5: MCC GUI (Modesh Control Center) for the administration of projects, management of recordings and analysis of data (left) and the Postprocessing and Analyse Viewer (right)

Optimizing Ships in Service for Slow Speed Steaming

✍ by Uwe Hollenbach (HSVA) and Michael Wächter (SDC)

Investigation for Reederei F. Laeisz, Rostock in co-operation with SDC Ship Design & Consult GmbH, Hamburg.

Defining the Operational Profile

The aim of this investigation was not to optimize the hull form with respect to the fuel oil consumption only. The aim was to find the biggest gain in overall technical and commercial efficiency, which means Δ FOC/ conversion-cost, taking into account steel weight, stability and propulsion issues. All of this not just for one design point but for a realistic operation profile, e.g. a draught and speed range.

For that purpose the actual operation profile of the vessel, subject to the optimization, has been studied in detail based on the voyage data of one year in operation.

Several combinations of draught, speed and trim were detected, representing the typical

operating scenario of the vessel. These conditions and their probability were considered as input for the hull form optimization and finally for calculating the expected reduction in fuel oil consumption.

Hydrodynamic Optimization

The existing hull form and numerous different bulbous bow / fore body alternatives have been investigated for a number of draught and speed combinations.

The proposed modifications more or less did not change the performance on the design draught at the design speed. The most promising variant for this condition even showed an improvement of 1%, while the variants more favorable for slow speed steaming showed losses of 2% in the worst case.

Remarkable improvements could be found especially for the slow speed / light loaded draught combination. With the most promising variant being optimal for the design draught savings of up to 4% could be found for the slow speed / light loaded draught,

while savings of up to 11% were predicted for the variant being optimal for the slow speed / light loaded condition.

Steel Design

Two optimization studies were finally investigated with regard to steel work to be done, taking into the account the general feasibility and conversion costs:

In the first attempt a new bulbous bow which replaces the current bulbous bow forward of a particular frame was optimized.

For the second study the area of changes to the hull lines was extended more to the aft of the vessel. During the optimization it turned out, that the hull has to be more voluminous. In this case the existing structure aft of the bulbous bow could be kept except the shell. Besides the higher costs (more steel to be replaced) the downtime of the vessel will be higher compared to the first attempt.

The expected changes in the light ship weight for each study and compared to the current hull form has been calculated. Using



Fig 1: C/V POMMERN – 2,680 TEU Container Vessel

latest design software in combination with existing construction drawings, the weight and centre of gravity has been determined in detail and also the effect on deadweight and stability.

Engine Plant

Due to the new hull lines, the operating point of the main engine will change. It will be checked if the main engine and corresponding systems are suitable for these changes and which modification might become necessary.

It is the intention to do as small changes as possible to the existing machinery items.

Summary

Different optimization studies with different improvements but also varying complexity were developed.

Material costs, modifications on installed systems, labor costs at yard and downtime of the vessel are only few of the costs expected for such a conversion. The most important question is the return on investment (ROI).

For this reason comprehensive calculations of the fuel consumption of the vessel have been done, showing the expected gain of the different modifications.

Finally a significant potential in efficiency has been detected, taking into account the expected gain on fuel consumption, the actual operating profile and the estimated conversion costs. The ROI of the best option has been calculated, which might force the owner's decision to realize the project.

HSVA and SDC in cooperation are in the position to give the owner the whole package of information on hands to take his decision.

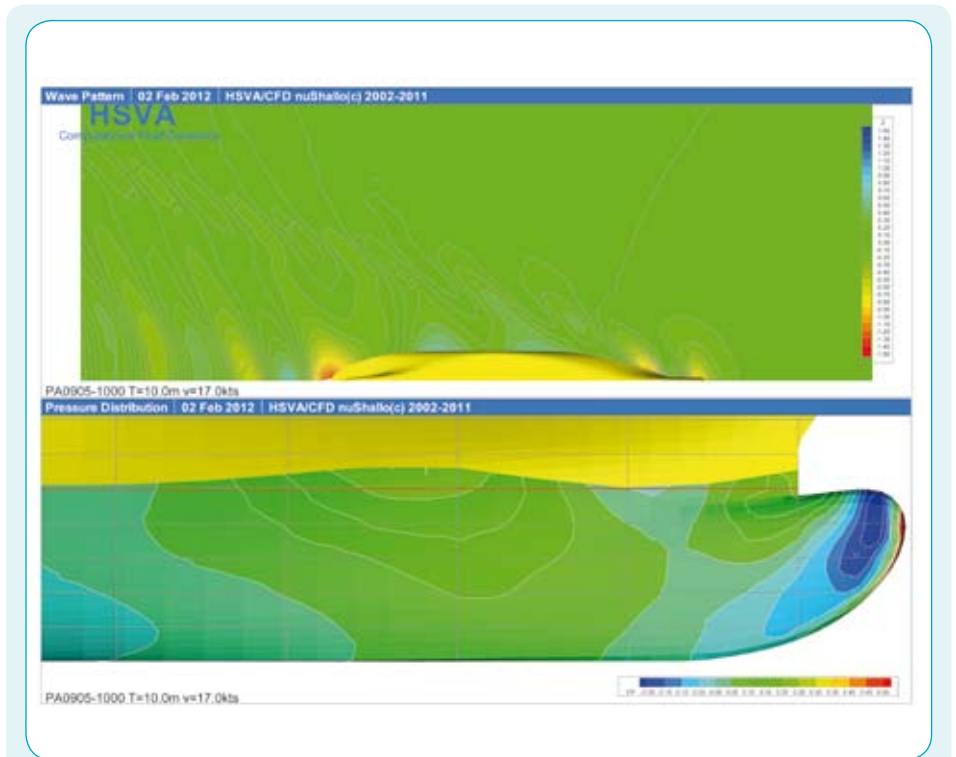


Fig. 2: CFD results for the existing vessel, draught 10.0 m, speed 17 knots

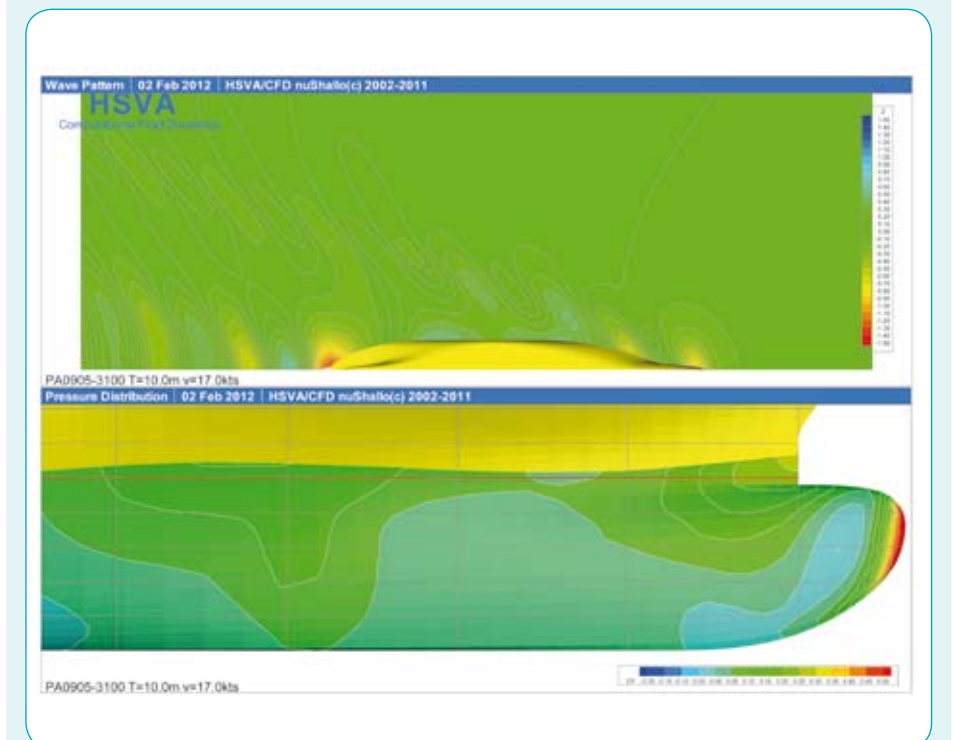


Fig. 3: CFD results for one of the proposed modifications, draught 10.0 m, speed 17 knots

RENOLIT Adhesive Film Reduces Frictional Resistance Significantly

by Christian Johannsen

In HSVA Newswave 2007/1 frictional resistance investigations in HYKAT have been reported already, featuring silicone coatings at that time. As had been pointed out in this issue, the determination of frictional resistance reductions for ship or boat coatings does not make any sense if not carried out at Reynolds numbers relevant for those vessels. This Reynolds number is high for a ship indeed, since it is the product of the large vessel length and the high flow speed divided by the water viscosity ($Re = V \cdot L / \nu$). Values in

the range of 10^9 are typical for seagoing ships for example. The challenge involved in a laboratory test set-up is to achieve sufficiently high Reynolds numbers under completely repeatable and reliable conditions.

The same test set-up as described in 2007 for this purpose has now been used again to do such investigations for an adhesive film invented by RENOLIT SE, Frankenthal, Germany. This set-up features an 8 m long axis-symmetric body exposed in HYKAT to flow speeds up to 10 m/s (Fig. 1). This of course does not cover Reynolds numbers up to 10^9 , but – as can be

seen in the results below – it is fully enough to observe tendencies in the sensitive range, in which frictional resistance coefficients significantly vary with flow speed.

RENOLIT is well known as a worldwide leading manufacturer for high quality self-adhesive films, which are used mainly for the graphics and automotive industry. With a new product range, called RENOLIT Maritime, the company focuses its research and development efforts on the ship building market. The first basic idea was to have a technical film on a ship body with a special embossing that reduces frictional



Fig 1: 8 m long axis-symmetric body for laboratory test

resistance and provides an anti-fouling effect. The so called Dolphin I self-adhesive film reduces not only frictional resistance and serves as mentioned with anti-fouling, but offers also tangible advantages in comparison to paint. It is easy applicable and guaranties an evenly thickness over the whole ship body. RENOLIT Maritime and partners are currently working out a further Dolphin 2, 3 and 4 to improve the anti-fouling effects and are active in the maritime market to offer new and innovative full product ranges as "Otarie" an anti-fouling solution that will be tested at HSVA as well and will be released in the course of the year.

The test program performed in HYKAT was quite easy: First, the test body was coated with a standard anti-fouling product. The body resistance was measured by means of a high precision balance installed inside the test body in a speed range up to 10 m/s. Then RENOLIT adhesive film was applied without removing the anti-fouling before. Finally the body resistance was measured again and the resistance difference was related to the theoretical frictional resistance of the cylindrical body surface. The result is shown in Fig. 2 versus the Reynolds number. As anticipated above, the speed dependence of the

friction reduction fades with increasing Reynolds number, showing a clear and encouraging trend. A gain of 7.7% over a standard anti-fouling has been found at a Reynolds number of $7.5 \cdot 10^7$. Even a bit more seems possible with higher Reynolds numbers onboard.

The tests have shown both the large potential of RENOLIT adhesive film for frictional resistance reduction as well as the large potential of this unique test set-up for investigation of friction reducing coatings of any kind.

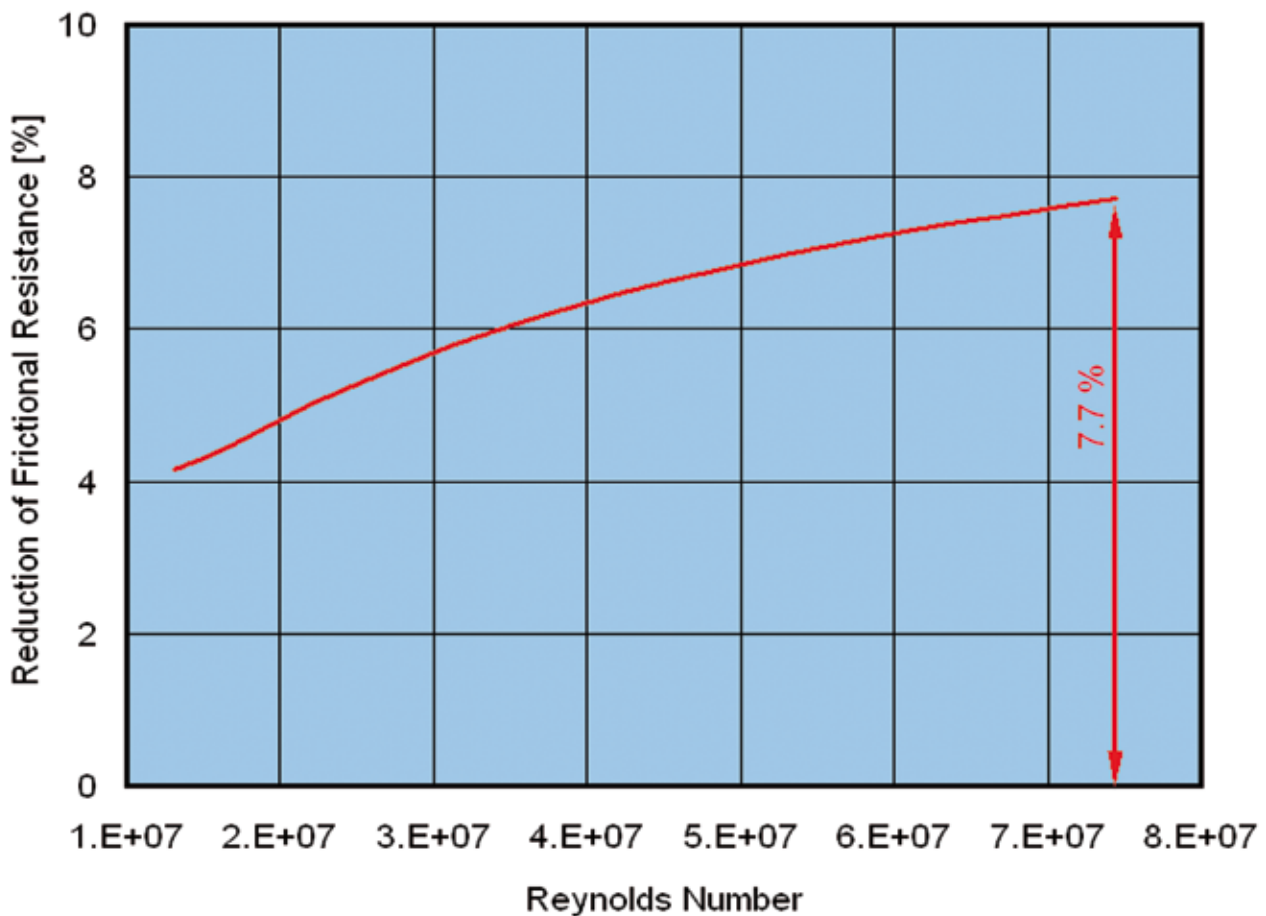


Fig 2: Frictional resistance reduction achieved by RENOLIT adhesive film

Give Your Propeller More GRIP

by Yan Xing-Kaeding

The economic pressure of the increasing energy prices together with recently enforced environmental regulations to render ships and shipping operation greener are the driving forces of today's maritime operations. This has renewed the attention given to Energy Saving Devices (ESDs) by both ship operators and ship builders.

Following the EU-Project TARGETS (see the last edition of NewsWave 2011/2) which aims at improving ship energy efficiency by providing improved hydrodynamic solutions for resistance and propulsions and develops an advanced energy management systems, a new EU-project GRIP (Green Retrofitting through Improved Propulsion) has been started focusing on the improvement of the interaction between the existing hulls and the (possibly new) propeller through the application of ESDs.

The aim of the GRIP project is to reduce fuel consumption in shipping by 5% (with individual ships up to 10%) and thus reduce energy consumption and hence both cost and emissions. Its first objective is to give a sound basis for the selection of suitable ESDs for different ship types and operating conditions and support owners during decision making. The second goal is to give insight into the detailed requirement on the design of the device by performing an analysis of interaction between hull, propeller and ESD and the structural integrity of the device using modern design and analysis tools.

Within GRIP, the most promising ESDs will be studied for several ship types (such as tankers, container vessels, bulk carriers and RoRo vessels) giving insight into flow changes, relating them to performance improvement and energy savings. By conducting a survey based on performance,



Fig 2: GRIP logo

cost and Return of Investment (ROI) for each ESD, a preliminary selection of ESD groups to be studied in GRIP has already been performed; Pre- or upstream Duct, Pre-Swirl device, PBCF, Rudder Bulb/Fin, Mewis Duct and further combined systems will fall into the research scope of GRIP. HSVA will play an active role in GRIP and will lead the design Work Package for customised ESDs.

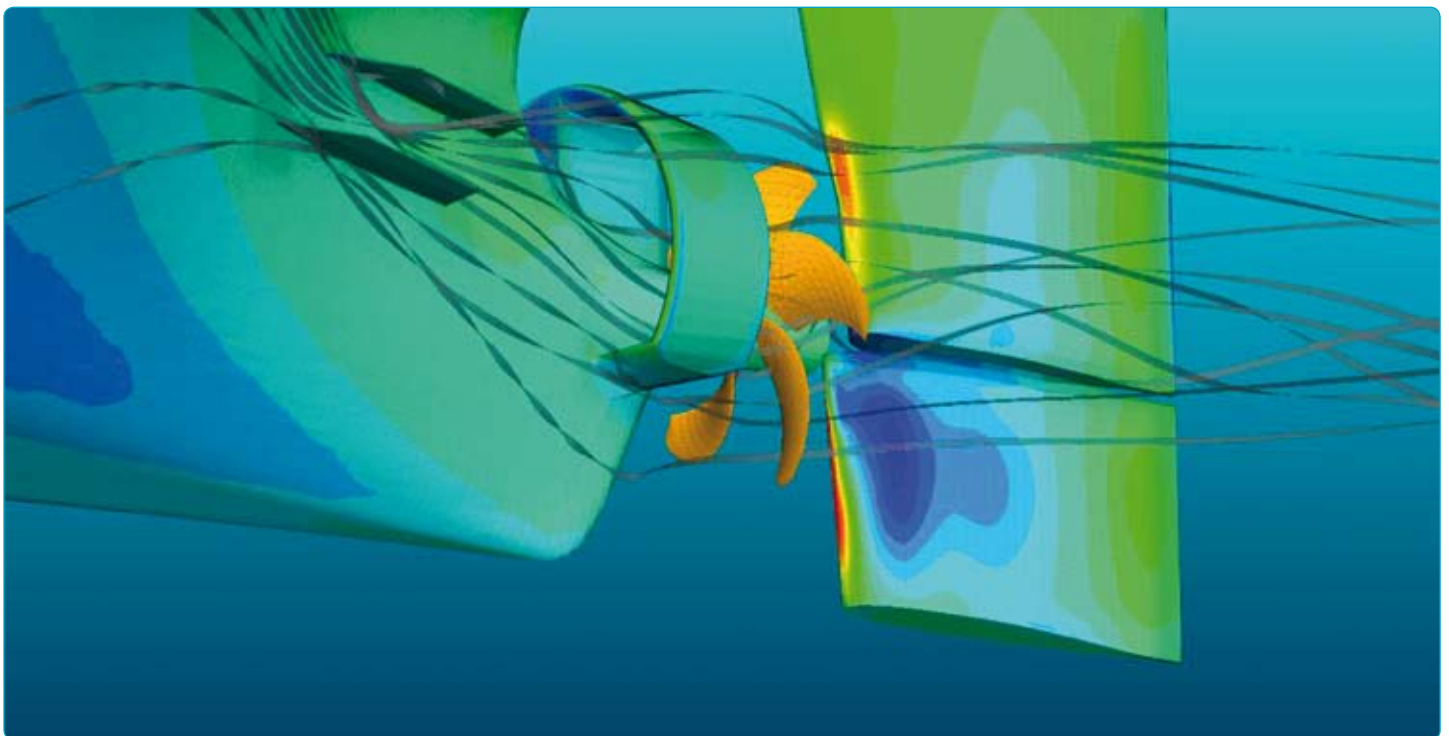


Fig 1: CFD test

Dredger Builder Asks: Can Viscous Flow Calculations Replace Model Tests?

✍ by Uwe Hollenbach and Scott Gatchell

Vosta LMG in Lübeck, Germany has requested HSVA to perform viscous flow calculations in support of the hull form design work for a Propelled Cutter Suction Dredger. Potential flow calculations were not considered due to the unusual and complex hull form of this vessel. The target of this investigation was to determine the resistance of this unusual and highly complex hull form on which to base a speed-power prediction in order to minimize the risk when selecting the main propulsion plant well in advance of the model test.

Viscous flow computations were performed using HSVA's in-house code FreSCo+ for a design speed of 10.0 knots. The VoF (Volume of Fluid) predictions allowed for free sinkage and trim and total resistance including pressure (wave) and viscous effects was determined.

The complex geometry called for a high resolution grid resulting in a large number of computation cells (>5.5 million cells) for the symmetrical problem. HEXPRESS© was used to generate the grid. The transient VOF predictions were performed using the adapted HRIC scheme with EIS surface sharpening implemented in FreSCo+, the transient computations using an adaptive time stepping to capture the complex wave formation in the vicinity of the hull.

The viscous flow calculation performed three months in advance of the tests predicted a full scale resistance of 314 kN for this project.

The model tests performed in HSVA's large towing tank resulted in a predicted resistance of 303 kN. The deviation between the prediction based on viscous flow calculation and the one based on model tests is +3.6%,

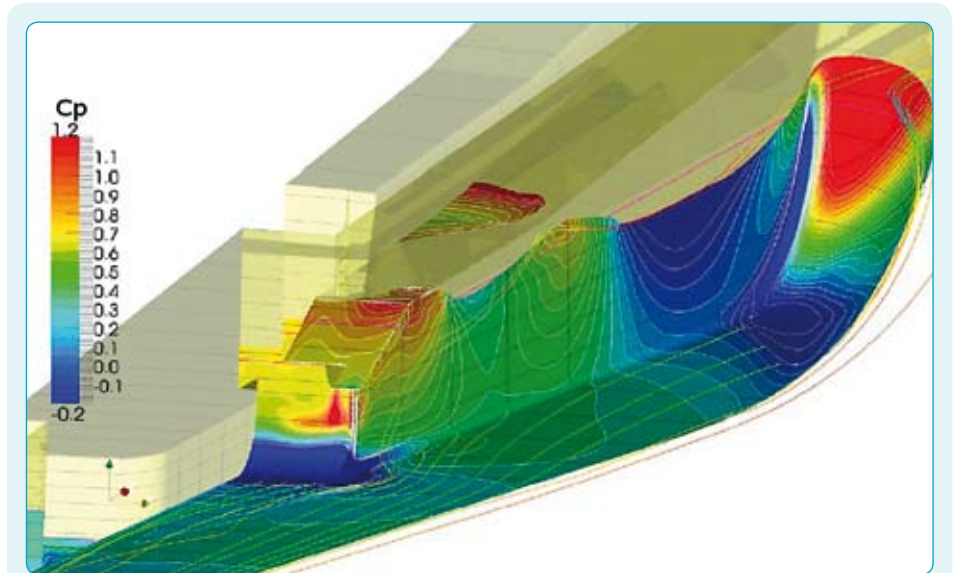


Fig 1: Pressure distribution and flow lines near the boundary, view from forward

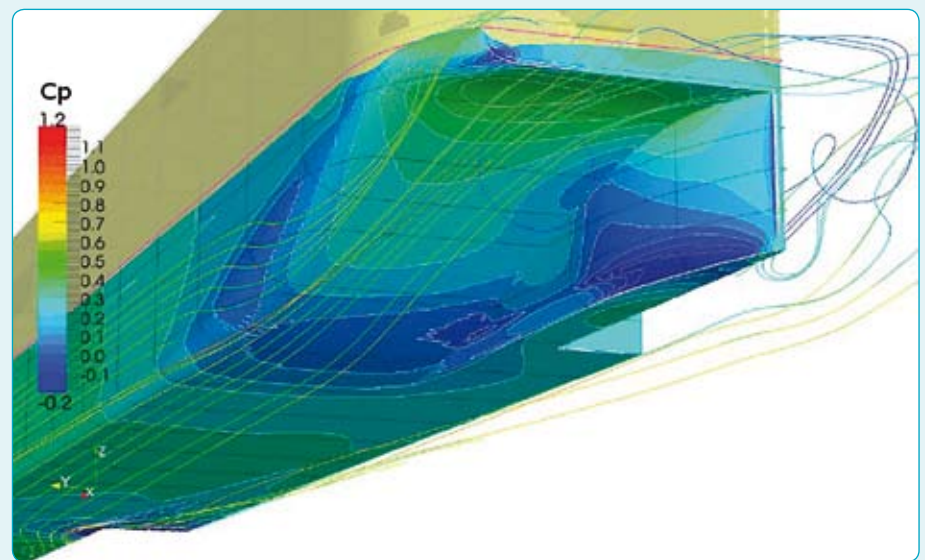


Fig 2: Pressure distribution and flow lines near the boundary, view from aft

which means that the resistance predicted by the viscous flow methods is slightly more conservative than the model test in this specific case. In any case this viscous flow based prediction turned out to be much more accurate than the statistical prediction made earlier on in the project.

As shown in the above example, especially today when the model basins are fully booked the viscous flow calculations performed by experienced engineers can support the designers with valuable and adequately reliable quantitative results for an unconventional hull form in the early design process.

Investigation of Flow Noise to Improve SONAR Self-Noise

✍ by Herbert Bretschneider (HSVA)
and Christian Will
(Christian-Albrechts-Universität zu Kiel)

The Christian-Albrechts-Universität zu Kiel (CAU) in cooperation with the Forschungsbereich für Wasserschall und Geophysik (FWG) der WTD71 ordered a two weeks test slot in 2011 for flow tests with a streamlined body in HYKAT to investigate flow noise.

The turbulent boundary layer generated between the free stream and a boundary is associated with fluctuating pressures, so called pseudo sound. The non-rigid wall (dome) forming the boundary will be excited to flexural vibrations causing the radiation of sound. This flow noise is an important source of SONAR self-noise and depending on flow speed, dome material and the distance of the SONAR sensors to the dome. The objective of this test was to increase the performance of SONAR systems by mitigation of self-noise.

Subject of these tests were plane acoustic windows of 2.1m by 0.8m integrated into a streamlined body – a scale 1 model of “FLAME”, a towed body manufactured by ATLAS Elektronik and used for similar investigations at the open sea, with dimensions of $L \times B \times H = 5.3\text{m} \times 0.9\text{m} \times 1.3\text{m}$, manufactured by HSVA – installed in the HYKAT test section (see Fig. 1, Fig. 2).

Measurements of acoustics and pseudo sound were performed with a 16 hydrophone array including the original baffle inside the body at different distance to the acoustic window. The pressure fluctuations at the surface were recorded with five flush-mounted hydrophones. Eleven accelerometers were used to determine the vibration of the window, the body and the hydrophone array. So the whole sequence from the turbulent boundary layer with fluctuating wall pressure to the induced structure born sound and the flow noise in the interior of the model could be determined. Additionally the far-field

radiated noise was measured with the hydrophone in the acoustic chamber below the test section.

The test matrix comprised flow speeds between 4kts to 14kts, different acoustic windows from pure perspex (see Fig. 4) to highly sophisticated damped GRP sandwich construction made by ATLAS Elektronik (see Fig. 3), draughts at keel depth from -1m to 10m with controlled gas content.

The aim of the experiments was to investigate the development of the turbulent boundary layer depending on different plate materials, flow speeds and “depths” and its effects on structure born sound as well as its limiting effects on acoustic measurements. Subsequently we present an example from wall pressure measurements.

In Fig. 5a spectrogram of the wall pressure fluctuations is shown for a time series of five minutes measure time with frequency plotted versus time. The temporal evolution



Fig. 1: View of the stern and starboard



Fig. 2: View of the bow and starboard



Fig. 3: Window made of GRP sandwich with part of the sensor equipment



Fig. 4: Window made of perspex

illustrates the stationary behaviour of the turbulent state. In particular no transients are observed which could have disturbed the measurement. Therefore averaging over the whole measured time is suitable. Typical averaged power spectral densities

(PSD) of wall pressure fluctuations for two different flow velocities are plotted in Fig. 6. The shape of the decay of the power spectral density indicates turbulent flow for both speeds. The substantial increase of turbulent pressure fluctuations with flow velocity has a

significant influence on SONAR applications. These tests demonstrated again the suitability of HSVA's large Hydrodynamics and Cavitation Tunnel (HYKAT) for sophisticated noise investigations.

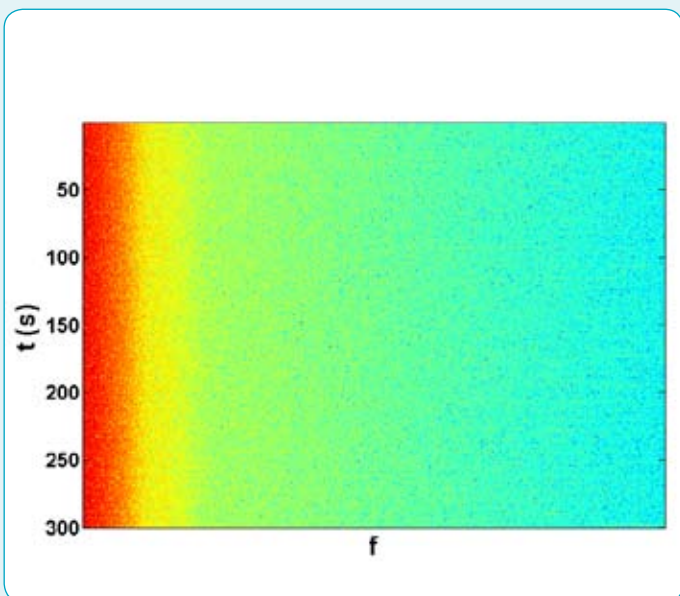


Fig. 5: Spectrogram of wall pressure fluctuations of a turbulent boundary layer for a measured time series of 5 minutes. The flow velocity was 5m/s.

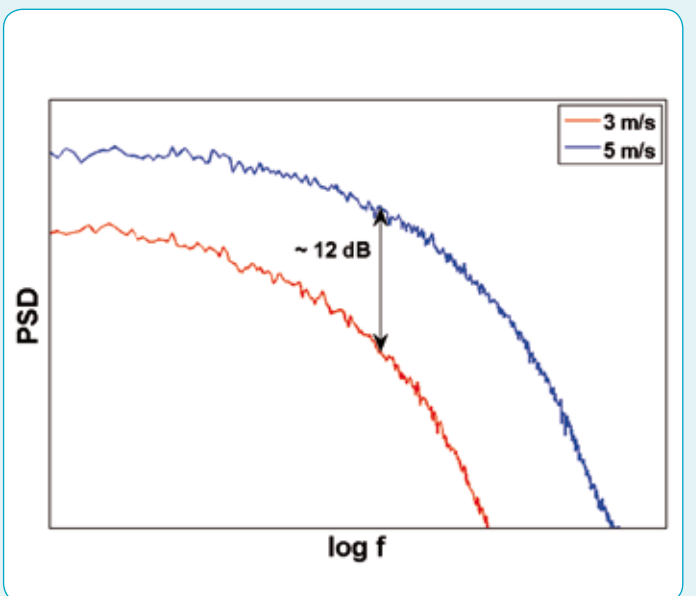


Fig. 6: Power spectral density of wall pressure fluctuations for speeds of 3m/s and 5m/s (Detail). The difference is approximately 12dB at the marked arrow.

IRO-2: Investigation of Average Transit Speed in Model Tests with Different Ice Conditions



Fig. 1: Towed propulsion in ice floes

✍ by Nils Reimer

Aiming at the development of an ice route optimization based on reliable ice forecast and prediction of average transit speed of ships in different ice conditions within the research project IRO-2 funded by the Federal Ministry of Economics and Technology, HSVA Ice and Offshore department has conducted model tests in pressure ridges, ice floe coverage of different concentration and level ice under lateral pressure. All tests were carried out in HSVA's large ice model basin between October 2011 and February 2012,

while two ship models with differing ice breaking behaviour were used for the tests.

As the average transit speed in ice is very sensitive to the change of certain ice properties like ice thickness, strength and density, but also on the type of ice accumulation and concentration, methods need to be developed which provide correlations between the speed and these ice parameters in order to be used for travel time prediction and evaluation of ice covered routes. In a second step different routes may be compared within an optimizing process for navigation assistance.

Reliable theoretic methods have not been developed yet for deformed ice conditions and, therefore, model tests represent an essential basis to complete analytic calculations which themselves do take into account the main dimensions of ships, relevant hull shape parameters and certain ice properties.

The whole test campaign consisted of 13 series (ice sheets) which were used to prepare different ice conditions. For the tests in pressure ice ridges (5 ice sheets) see the article by D. Ehle in *Newswave 2011/2* (pp.8-9). For tests in ice floe coverage with different

concentrations four ice sheets were used in total while- with respect to comparable ice consistency- three different concentrations could be obtained from each parental sheet. The target ice floe concentration in the basin was reduced stepwise from 10/10 (full coverage with pre-sawn floes) down to 6/10 or 5/10 for both models and for each concentration a towed propulsion test (see Figure 1) was carried out at two different speeds. During each test the rpm and, therefore, the thrust of both propulsors was raised stepwise from idling condition to a value above the self propulsion point such that the resistance and thrust may be determined by linear interpolation. Besides speed, the pull force and thrust as well as the rpm and propeller torque were measured.

The results of the tests provide a correlation between the ice floe concentration and resistance which leads to a maximum speed for a predefined available engine output. The correlation shall cover the range between low ice affection close to open water condition up to a high coverage including permanent presence of ice submersion and ice



Fig. 2: Ice floe distribution in the basin

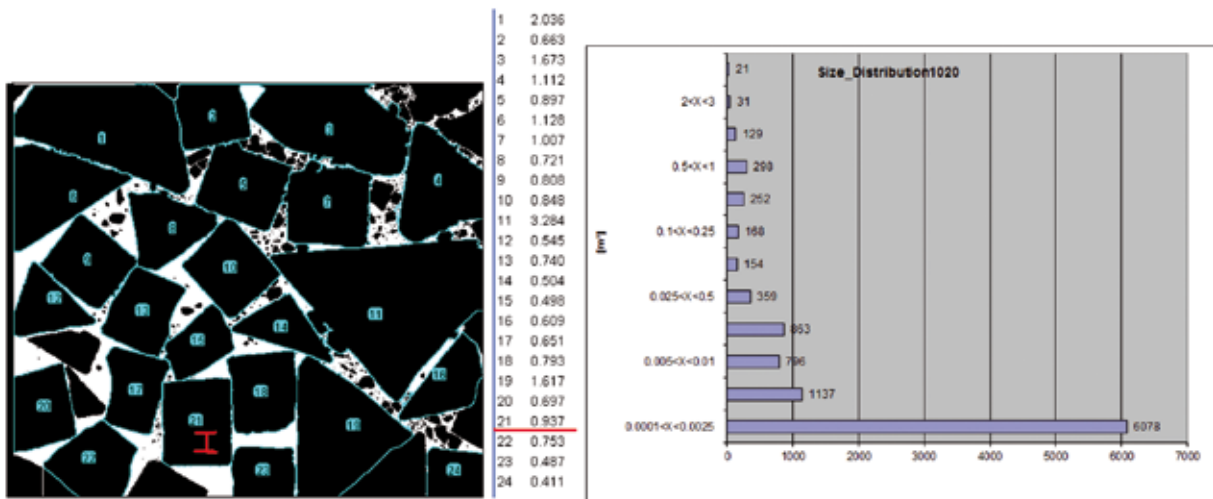


Fig. 3: Analysis of ice floe concentration

clearing resistance but a reduced component for breaking compared to closed level ice.

In order to obtain this correlation with an acceptable accuracy, special focus was put on determining of actual ice floe concentration for each test run by documenting the coverage with overhead pictures taken with a camera attached to a crane. The pictures were taken every 4 m on two transverse positions above the basin and assembled afterwards to display the full basin area (see Figure 2). The actual post-processing was carried out with the visual analysing program ImageJ developed by Wayne Rasband, an employee of the Institute of Mental Health USA. Provided that the completion and scaling of all pictures is done accurate, the program is not only able to provide the overall concentration of coverage but also the frequency distribution for different floe sizes (see Figure 3).

The remaining four ice sheets were used to carry out level ice tests with additional lateral pressure. In nature, this additional pressure is caused by ice floes drifting against each other or against landfast ice. The ice drift is mainly driven by the wind forces and typically acting at speeds below 2 knots. The influence of lateral pressure on the ship resistance in ice is thereby mainly caused by the increase of frictional resistance due to higher normal forces acting on the parallel midbody.

For the model tests, the ice sheet was divided into three parts with a length of 20 m. While the first and third parts consisted of usual level ice, in the second part the ice was cut free from the tank walls and three wooden frames, each equipped with two pressure tubes, were installed between the ice sheet and the side wall (see Figure 4). The total length of all frames covered 18 m. At each

frame two load cells were installed in line with the pressure tubes to measure the forces applied by the tubes. The pressure was regulated separately for each frame by valves. For each of the two ship models two different pressure levels between 5 and 10 kPa were applied to the ice sheet. Afterwards the model was towed through all three zones and the resistance was measured. After the model had entered the pressurized part with a certain length (more than one ship length) transverse cracks began to establish and the free ice floes were pushed towards the model (see Figure 5).

After the resistance test the edges of the broken channel were cut into straight lines and the model was positioned between two floes (see Figure 6). Then the same pressure as in the previous test was applied but in this case the model was free running, while



Fig. 5: Model in pressurized zone with transverse crack

both thrusters were remote controlled. The thrust was raised in steps until the model, stuck in between the two ice floes, was approaching with very low speed. From this point on the thrust remained constant and the model was creeping forward, while the contact area between parallel side walls and ice was decreasing continuously until the model started to accelerate significantly.

The results of the tests will be used to quantify the effect of additional normal forces acting on a ship. Assuming an ice drift model is available to predict reliable pressures for a given area, the reduced average transit speed can be determined.



Fig. 4: Installation of side pressure device in ice basin

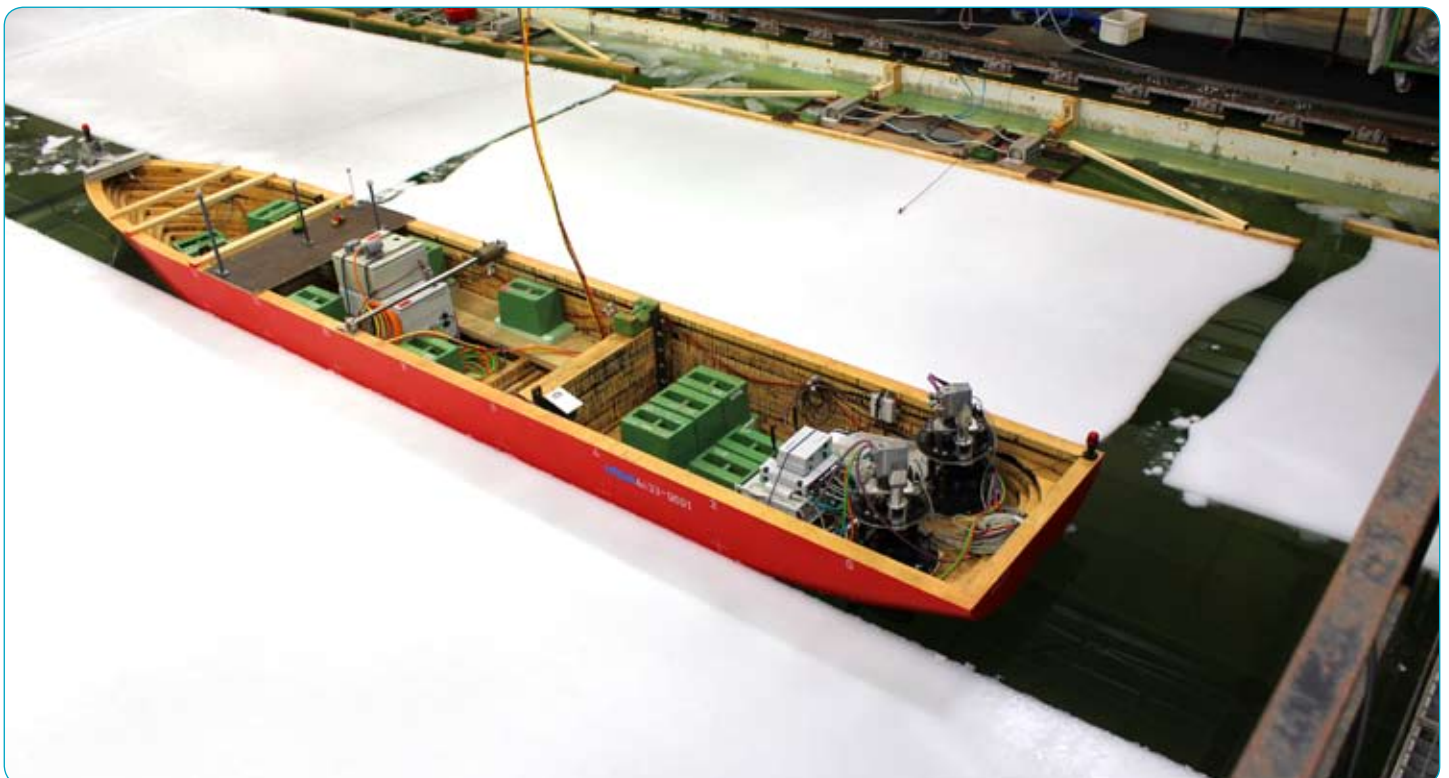


Fig. 6: Approach test in channel with side pressure

Member of staff



Dr. Yan Xing-Kaeding joined HSVA in November 2011 as research engineer and project manager in the CFD department, where she started directly working on a newly launched EU-project GRIP (see

details in this edition). Among other challenging tasks she will also strengthen the further development and application of the in-house viscous flow solver FreSCo+, jointly developed by the Institute of Fluid Dynamics and Ship theory (FDS) of the Hamburg University of Technology (TUHH) and HSVA.

Before joining HSVA, she has worked in the aerospace sector for more than six years as system engineer and CFD project leader in the department of Environmental Control System at Airbus. Yan Xing-Kaeding who was born in China, has studied in the civil engineering department of the Dalian University of Technology in China and made her master thesis in cooperation with the Hiroshima University under a student-exchange program initiated by the "Japan International Education Association". After

that she has started to work as a scientific employee at the FDS/TUHH in the year 2000. There she was involved in the research projects investigating flow-induced floating-body motions in viscous flow by implementing the 6-DOF rigid body dynamics into the solver. Further she extended the method to predict motions of floating bodies/ships subjected to waves and more complex ship motions during maneuvering operations. In 2006 she obtained her doctoral degree with distinction and was awarded the Georg-Weinblum-Preis in the same year.

Yan Xing-Kaeding is married and has two children. In her spare time she enjoys reading, swimming and jogging. She also likes traveling and exploring the landscape/culture of the world.

First CROWN63 Bulk Carrier delivered

On 28th February 2012 the first CROWN63 bulk carrier "JS AMAZON" was delivered by Dayang Shipyard of Sinopacific Shipbuilding Group to Greenship Bulk Pte. Ltd. The sea trials proofed the excellent powering performance and confirmed the powering predictions based on the calm water tests performed by HSVA. The power consumption is 20% lower than the EEDI reference line and meets the requirements of the second EEDI phase (attested by Bureau Veritas). HSVA is proud to be partner of the shipyard and responsible for the optimisation of the hydrodynamics of hull and rudder.



SMM 2012 Congress Center Hamburg

From September 4th-7th the Shipbuilding, Machinery & Marine technology international trade fair (SMM 2012), the most important maritime exhibition in Europe, will take place at the Hamburg Congress Centre.

HSVA is looking forward to meeting with you at our booth No. 106 in hall B4, to present our current research projects as well as recent developments.

