



SEA HORSE 35 in Brash Ice Channel near Luleå, Sweden

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Dear reader,

a warm welcome to our second edition of Newswave this year.

Especially in these difficult times for many parts of the maritime industry, networking, knowledge transfer and marketing are of fundamental importance for us, to keep our position in the world. The upcoming SMM in Hamburg therefore is an ideal platform to meet our clients, partners and colleagues.

We need to concentrate on our strengths to ensure that we can answer all questions related to hydrodynamics of ships and offshore constructions in open water and in ice covered waters. The design process of new ships has received more dynamism by the key role environmental protection is going to play. This is not only a challenge for us but a tremendous opportunity to stay technologically ahead, to be even more creative and more innovative. What our industry needs are reliable and affordable solutions and we are prepared to work with you to reach such solutions. Our new side wave

generator, which is now ready for commercial use, is one impressive example for our ongoing efforts to adjust our equipment to your needs. The planned installation of numerous offshore wind farms creates additional demand for more specialized vessels, not only with high lifting capacities but also innovative designs for crew and maintenance personnel transport.

We are again fully booked, but we try to be even more flexible to accommodate all your expectations within a short time.

I hope we will have a chance to meet during SMM in Hamburg in early September at our booth 106 in Hall B4 where we will present an outline of our latest developments. Besides interesting projects for our clients much research was done and many new research projects have been started in the last months. The team of HSVA welcomes you and we are prepared to answer any question you may have.

Juergen Friesch - Managing Director

Current R&D Project BRICE (Breaking the Ice) – Dynamical Investigations of Offshore Wind Turbines Influenced by Sea Ice

by Andrea Haase

A joint research project with German and Finish partners

Brice is a joint research Project of HSVA (Hamburg Ship Model Basin), Fraunhofer IWES (Fraunhofer Institute for Wind Energy and Energy System Technology) and VTT (Technical Research Centre of Finland). The work of the German partners (HSVA and IWES) is funded by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety within the fifth Energy research program "Innovation and new Energy Technology". The project has started in May 2011 and will terminate three years later in April 2014. It deals with sea ice induced vibrations of offshore structures.

Sea ice causes vibrations of offshore structures

As widely known from literature [1, 2] and also personally experienced by HSVA staff in former full scale trials drifting sea ice may cause severe vibrations of offshore structures. When sea ice hits an offshore structure many parameters influence what the interaction of structure and ice will look like. Material parameters of the ice such as flexural and compressive strength, the ice thickness, environmental parameters like drift velocity and direction, and properties of the structure such as stiffness and geometry contribute to the whole. In one of the worst scenarios the above named parameters meet in a certain constellation causing the structure to resonate in its eigenfrequency. Regarding the ice failure the crushing mode as shown in Figure 1 is mostly involved in vibration phenomena.

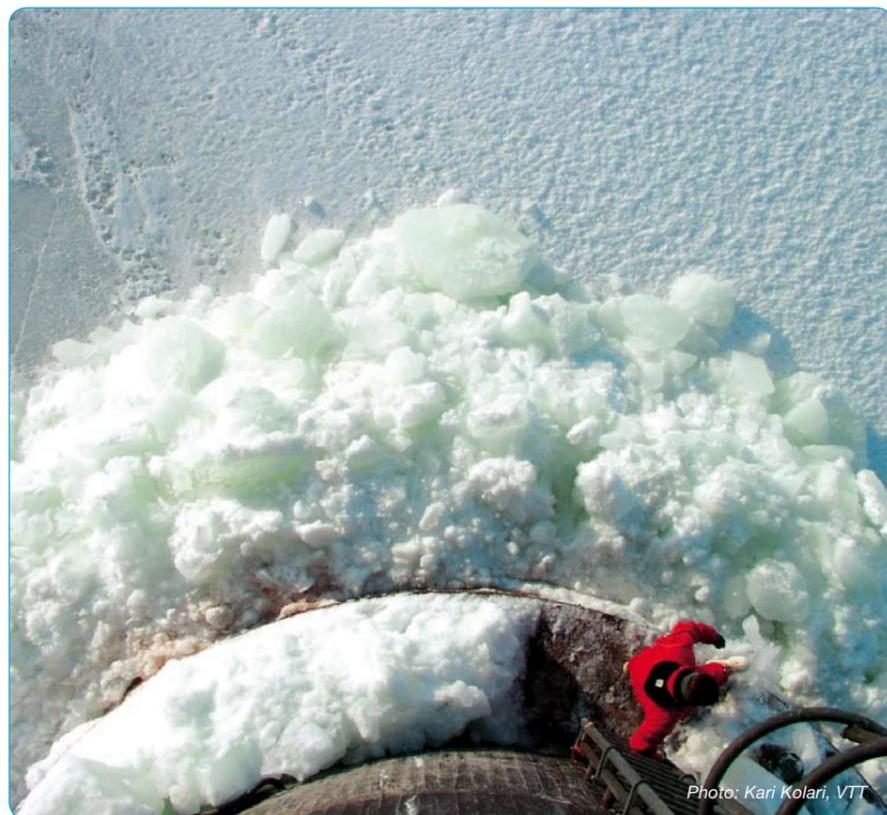


Fig. 1: Photo of sea ice failing against the lighthouse Norströmsgrund in crushing mode

Project goal is the development of models for dynamic ice structure interaction

The main goal of the BRICE project is to develop new numerical and physical ways to model the dynamic ice structure interaction. It must be noted that within the state of the art it has not become clear yet how the dynamic interaction can be scaled best for physical models. The work is broken down into four work packages BRICE-1 to BRICE-4. BRICE-1 deals with deriving ice loads in general and is done by VTT. As this is a German/Finish project the region of interest is the Baltic Sea. Information on annual ice, wind and current conditions are to be provided in a software that allows a design engineer to derive design loads for wind turbines easily. Within BRICE-2 the Fraunhofer IWES implements ice and new structure models into an existing simulation software for wind turbines. BRICE-3 splits up into a numerical and physical part. In both parts reusable model stands are created that are able to picture the dynamical behaviour of structure ice interaction. To check that the model stands work in principal physical tests and numerical simulations are performed for verification. In the test set-ups the lighthouse Nordströmsgrund is implemented of which full scale data exists. The contribution of Fraunhofer IWES is the numerical part and HSVA provides the physical part. Within the last work package BRICE-4 an optimized substructure for offshore wind turbines is developed and tested with the help of the physical and numerical model stands developed in BRICE-3.

Currently a test stand for dynamical ice model tests is developed at HSVA

For HSVA the first challenge within BRICE-3 was to develop and test a stand that allows dynamical experiments to be performed. HSVA's

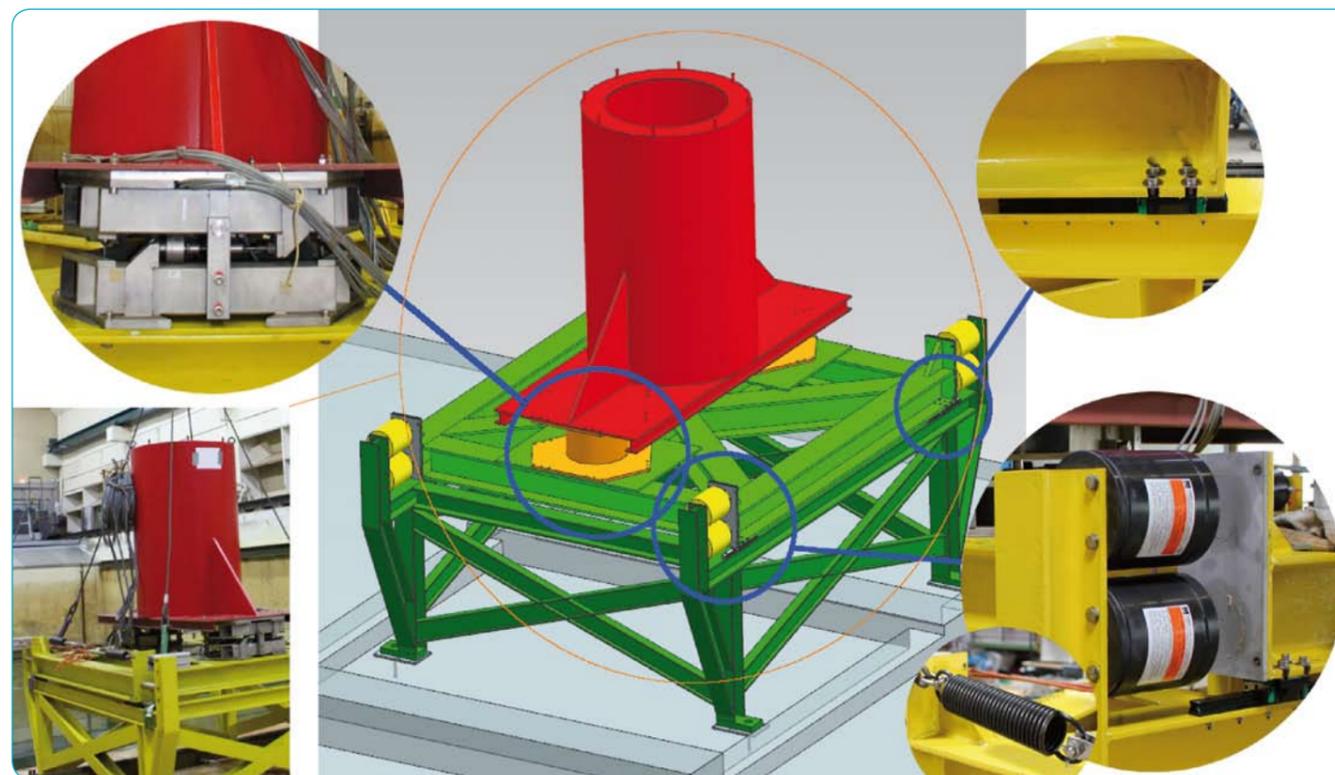


Fig. 2: Test stand for dynamical ice model tests at HSVA

engineers and technicians developed a set-up as shown in Figure 2. A steel frame is rigidly connected to the bottom of HSVA's large ice tank (lower dark green frame in the picture). On this frame a carriage is gliding forth and back on linear slides with least possible friction into the direction of the ice drift (upper light green part of construction). Thus the upper sledge is only free to move in one degree of freedom. Springs between the lower frame and the upper sledge (yellow parts in the picture) determine the motion. Thus the system stiffness of the full scale structure is represented by the springs only while the rest of the model set-up is assumed to be rigid. Upon the motion layer the loads on the structure are measured with load frames (orange part in the picture). On top of the load frames the structure is positioned (red barrel = model

of lighthouse Norströmsgrund). By the test stand description above it becomes obvious that HSVA decided to simplify the dynamical behaviour of the structure to a single degree of freedom phenomena.

Full scale data has been analysed to justify assumptions made for test stand

Allowing only lateral motion of the structure into one direction may not be correct for all scenarios of ice structure interaction but evaluation of full scale data shows that this assumption is a reasonable approach. An example of analysed full scale data is given in Figure 3. The left diagram shows the time history of acceleration measurements of the lighthouse Norströmsgrund. It can be seen that the lighthouse has experienced a periodical motion

which is known to match its eigenfrequency. In the left diagram the acceleration into eastern direction is given over the acceleration into northern direction. It can be seen that the motion of the lighthouse followed one direction mainly. Of course this motion can still be of different shapes looking at the full height of the lighthouse. Most likely the shape of the motion corresponds to the eigenform of the lighthouse's first eigenfrequency, but it still was decided that the lateral motion is a well justified approach as this is the motion assumed to govern the ice structure interaction at water line.

Next challenge: Performance of first model tests with new test stand

As the test stand has been built and first pre-tests have been performed successfully the

Added Resistance, Powering in Seaways and EEDI

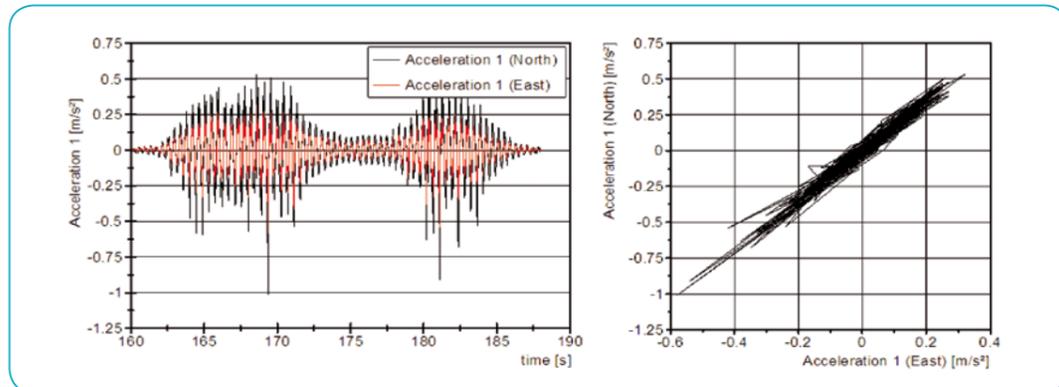


Fig. 3: Analysis of full scale data – accelerations of the lighthouse Norströmsgrund providing information on the shape of the lighthouse’s motion in the horizontal plane in case of resonance

References:

[1] Kärnä, T. and Kolari, K., Mitigation of dynamic ice actions on offshore wind turbines, Proceedings of the Third European Conference on Structural Control 3ECSC, Vienna, Austria, 2004

[2] Määttänen, M. et al., Novel ice induced vibration testing in a large scale facility: Deciphering ice induced vibrations, Part 1, Proceedings of the 21st IAHR International Symposium on Ice, Dalian, China, 2012

first ice model tests are approaching soon. In the ice model tests focus will be put not only on the structure but also on the model ice in terms of ice properties and failure modes. For the correct dynamic behaviour it is crucial

that also the failure of the ice corresponds to what happened in full scale. Several tests of ice properties and documentation of failure mode will ensure to have high quality results at the end of the first ice model tests phase.

scale facility: Deciphering ice induced vibrations, Part 1, Proceedings of the 21st IAHR International Symposium on Ice, Dalian, China, 2012



Fig. 1: A container ship model advancing in short oblique waves generated by the new Side Wave Generator in HSVA’s large towing tank

First DP Model Test ever done in Level Ice

by Andrea Haase

Within the second phase of model tests of the R&D project DYPIC (reported on in Newswave 2010/2) tests in level ice have been performed successfully with two different models. Even a full turn in level ice was performed in DP mode. After a lot of data had been collected during the first phase of model testing, HSVA’s DYPIC partner Sirehna used the time between the two campaigns to come up with the DP system that allowed such great performance! The DP system will stay at HSVA and will enable HSVA to offer DP model tests to our customers.



Fig. 1: Drill ship model has performed a full turn in level ice solely controlled by DP

by Petri Valanto

...are of interest in the upcoming R&D project PerSee dealing with the performance of ships in actual sea conditions. Financially the project is supported by the Federal Ministry of Economics and Technology (BMWi). The duration of the project will be 3.5 years, from October 2012 to March 2016. Beside the HSVA, seven other German partners, mainly universities and companies in the maritime field will contribute to the success of the project.

PerSee deals also with the optimization of ship hull forms in selected service conditions. For this purpose numerical and experimental methods will be developed for determining the added resistance and the required propulsion power in seaway. After

a successful integration of the numerical codes in the optimisation software several different ship types will be optimized. Furthermore the question of the minimum power required for safe manoeuvring in heavy seas will be investigated.

These general goals of this joint research project are ambitious. The HSVA will concentrate in developing a numerical-empirical method for evaluating the added resistance in seaway. It is planned to use a numerical method based on strip theory to determine the ship motions and to concentrate on the improvement of the present formulations especially in the area of short waves. These are important for modern large ships, which spend most of their time at sea in waves clearly shorter than the ship length, where not

only wave radiation due to ship motions, but also wave reflection on the ship hull is particularly important. Such formulations are also useful both in establishing a rational sea-margin for vessels designed for slow steaming and in the evaluation of the results of sea trials carried out in usually low seaways.

Relatively little is known about the added resistance in wave directions other than head seas. For the determination of the optimal propulsion point, not only the resistance in head seas is important, but also in other directions. It is hoped that HSVA can throw more light on this issue, not least by taking advantage of the unique testing possibilities the new Side Wave Generator in the large towing tank can offer.

Development of a Small Hybrid Double End Ferry

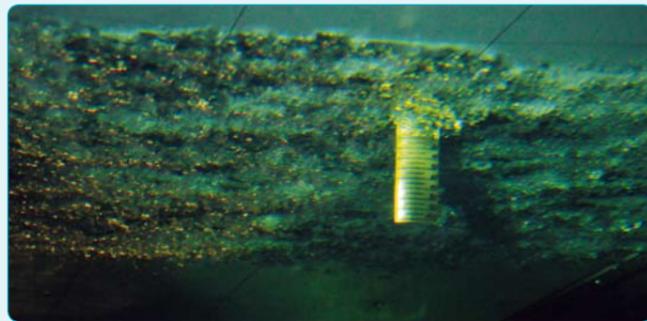


Fig. 5: The side view of the bubble carpet

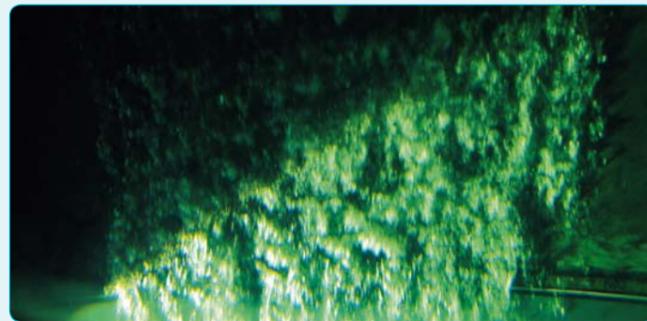


Fig. 6: The bubble carpet from below



Fig. 7: The bubble carpet from below

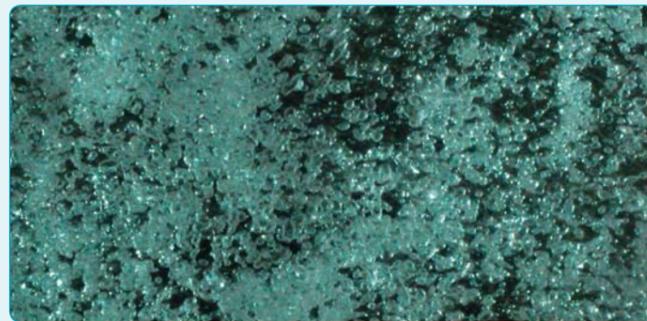


Fig. 8: The bubble size distribution

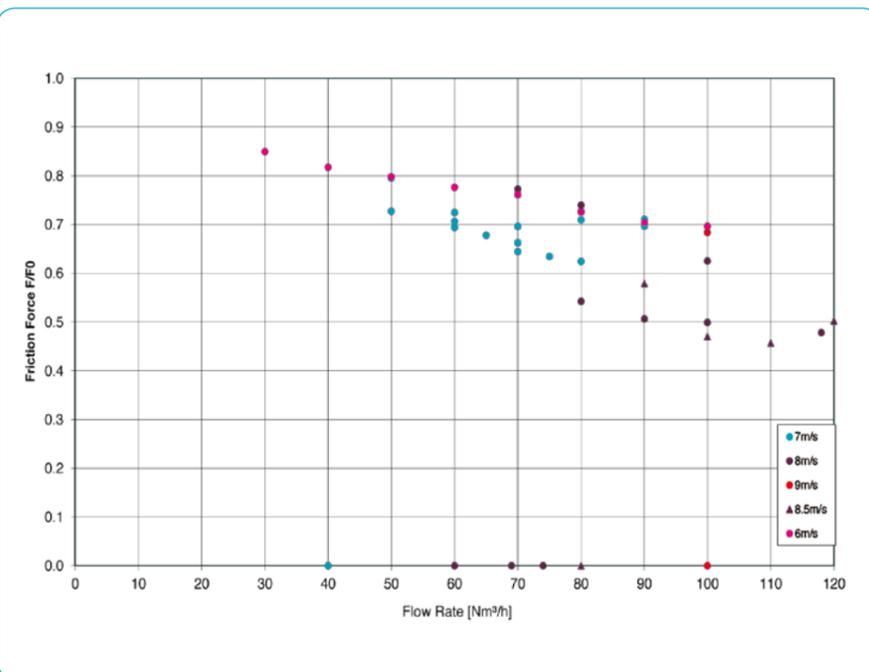


Fig. 9: The relative friction force

Outlook

The results of these tests encouraged DK Group ACS to equip a new build vessel with the optimized ACS and to perform sea trials in autumn 2012 to demonstrate the full performance of the air lubrication system. During the testing in HYKAT the full potential of the bubble tail could not be investigated due to the limited length of the test section top opening of 8m. The achievable power savings are expected to increase linearly with the effective bubble tail length.

The development of energy-saving ships is a measure to cope with the surging fuel prices and with environmental issues such as GHG emission regulations for international shipping operations. The first choice for the ACS are ships with large flat bottom area and low Froude number, for which the frictional resistance dominates the total ship resistance.



Fig. 1: VSP and protection girder arranged on the starboard bow

by John Richards (HSVA) and Mikko Mattila (Deltamarin Ltd.)

HSVA was contracted by Deltamarin Ltd. of Helsinki, Finland to perform hydrodynamic investigations within the scope of hull form and propulsion system development for a new double end ferry. The scope of work included both numerical seakeeping studies as well as powering and manoeuvring model tests.

The ferries are to have a length of about 40 m and are designed to carry about 150 passengers and more than 20 cars at a service speed of 9 knots using diesel electric propulsion.

The design of small ferries is a challenging task in itself, but in this specific case the target was also stretched to reach a new level of environmental friendliness and operational efficiency for a difficult operational environment. The port facilities for this vessel provide only limited protection from wind and waves. Due also to tidal considerations, the port consists essentially of just a slipway where the vessel 'docks' using only its propulsive system and ramp to remain stationary. Especially when entering and/or leaving the slipway there is a risk of misalignment that could result in damage to the propulsion units. Thus the hull form needs to provide some passive protection.

One of the key issues in this design was the selection of the propulsion equipment because this had such a large impact on the hull form itself. Several different propulsion alternatives were considered and also the number of propulsion units was looked into. The different potential propulsion concepts included azimuthing thrusters, pump jets and Voith-Schneider propellers. In the end the Voith-Schneider propellers (VSP) were seen to be the most feasible solution and were selected for final development of the hull form.

Both 4 unit and 2 unit solutions were studied, but the price of equipment in conjunction with displacement and performance considerations led in the end to a solution with two drives. These were located both at different ends and different sides of the vessel leading to an asymmetric arrangement.

The hull model was fitted with protection girders mounted at each end between the VSP and the stem (or stern) as shown in Fig. 1.



Fig. 2: View of the appended Model (without VSP) for the resistance test

On each side of the vessel opposite to the VSP a course stability skeg was fitted (Fig. 2). The alignment of the course stability skegs was optimized for minimum total resistance.

As testing an asymmetric model was a new experience, some thought was put into how to perform the tests in a way which would give best reliability of the resistance and propulsion test measurements. The procedures were agreed upon between Deltamarin, HSVA and Voith Turbo, who supply the model VSP for the tests. Generally the model is led in a simple guide system which keeps it on a straight course during a test run. If the vessel is asymmetric then it will tend to yaw during the test which induces lateral forces and also unwanted longitudinal drag forces in the guide system. Therefore in order to achieve a realistic result the thrust direction of the two VSP drives needs to be oriented such that the vessel sails freely on a straight course with minimal yaw and drift tendencies. The solution to this problem was to first find the required VSP orientation with active drives during PMM tests. These thrust alignment settings were then applied during the subsequent propulsion tests.

The manoeuvring tests were carried out under HSVA's Computerized Planer Motion Carriage (CPMC) in the tracking mode i.e. with the model sailing under its own power and following a programmed zig-zag course. During this test the model was outfitted with controllable pitch VSP and was steered using the aft drive only.

Overall the model tests have shown quite good results and provide valuable supportive data for the further design development.

Putting from the Rough – Numerical Modelling of Surface Roughness

by Hannes Renzsch and Scott Gatchell

Unlike a fine wine or cheese, the surface quality of a ship's hull does not improve with age. Immediately after launch, the hull surface begins a slow, steady degradation as it accumulates algae, crustaceans, and corrosion. These lead to increased resistance and, ultimately, to increased fuel costs. Although it is well known how these imperfections develop and they can be recreated in physical experiments, surface roughness is generally not treated in standard RANS models. Other than in empirical formulae like the ITTC friction line where empirical allowances are included, RANS codes usually assume a hydraulically smooth surface. Recent developments have pointed in a direction for modifying standard turbulence models and the near wall treatment of the flow to account for roughness effects.

In the EU-funded project TARGETS (Targeted Advanced Research for Global Efficiency of Transportation Shipping –

www.targets-project.eu), partners study surface roughness in experiments and apply that knowledge to further enhance the capabilities of HSVA's in-house RANS code FreSCo+ to include accurate numerical predictions of surface roughness effects. The Technical University in Hamburg-Harburg (TUHH) has implemented an approach based on the equivalent sand-grain size concept to model roughness effects on ship-hull surfaces. This feature, along with others like the adjoint solver, RANSE-BEM coupling, ship motions in seaways that have been described in the NewsWave 2011/2, clearly extends the present state of the art.

To assess the effect of this surface roughness model on predicted vessel resistance, the flow around the underbody of a bulk carrier was simulated at various degrees of roughness. The computations were run with a model scale of 1/16, and a speed corresponding to a Reynolds number of $2.84 \cdot 10^7$. A range of sand grain roughness

values were investigated in the range from 0 (smooth), 100, 200, 500, 1000, 1500 and 2000 μm at model scale, respectively.

The results indicate a marked increase of friction, and correspondingly, total drag between the smooth and the rough hull surfaces. Figure 1 depicts the friction coefficient distribution on the hull for smooth surface and a sand grain roughness of 500 μm .

A significant increase of the friction coefficient C_f over the majority of the hull surface can be observed. Only in the stern area where the boundary layer is quite thick and the shear stress is low are some similarities evident.

Another highly interesting aspect is the slight increase of pressure drag (C_p) with increasing surface roughness shown in Figure 2. To point out this effect more clearly Figure 3 depicts iso-lines for 50% of the free stream velocity and the section shapes amidships at two locations on the aft-body. The green iso-lines are corresponding to the smooth surface and the red to a sand grain roughness of 500 μm . The black lines represent the ship sectional shapes.

It can clearly be seen that, while the boundary layer thickness amidships is very similar, a significant difference occurs at the aft-body. This difference correlates well to the aforementioned pressure coefficient (C_p) plots, indicating significantly better pressure recovery on the aft-body of the vessel with the smooth hull.

In the next step, the RANS results were compared to the traditional, empirical methods of surface roughness prediction, most often provided by the ITTC'78 and ITTC'08 friction lines. The ITTC has two different recommendations for the surface roughness correction, both based on re-

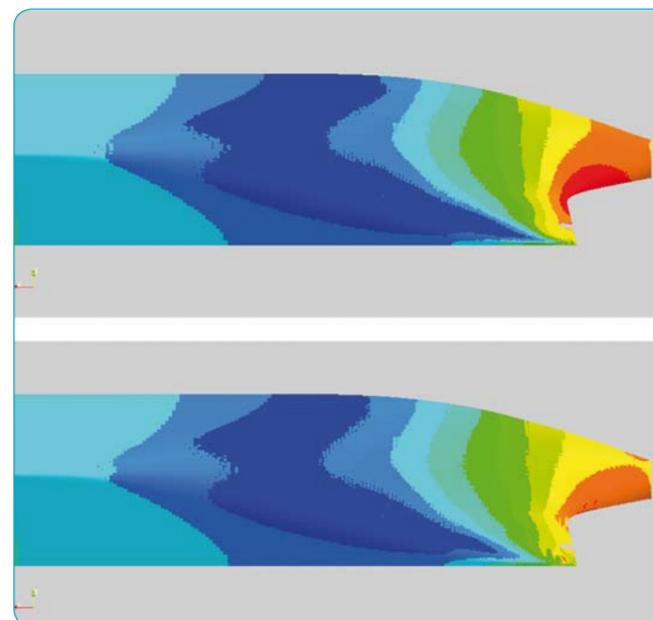


Fig. 2: Pressure Resistance Component. Top: smooth, bottom: rough

gression of full scale data. The results from the FreSCo+ computations are plotted against these ITTC recommended values. Figure 4 shows the effect of surface roughness on friction, pressure and total drag compared to the roughness correction to friction as advised by the ITTC'78 and ITTC'08. The resistance values can be decomposed from the total (C_T) into a friction (C_f) and a remaining, pressure (C_R) component.

The ITTC'78 and ITTC'08 friction lines themselves have a similar pattern but the absolute change differs considerably. The result of the RANS simulation lies in between the two ITTC lines. From laboratory measurements there are strong indications that the magnitude of correction by the ITTC lines is plausible but the local distribution is not. The surface roughness model incorporated into the RANS simulation will result in more ship-specific assessment of the effect of deteriorating hull surfaces.

The current methods, using ITTC friction adjustments, for accounting for added resistance due to changes in surface quality provide only part of the solution and paint a very generalised picture. While intuitively the surface roughness affects the friction component of resistance, the initial tests with FreSCo+ show that the pressure component of resistance is affected as well. These new developments will allow a more comprehensive investigation for life-cycle predictions of ship performance.



Fig. 3: Boundary Layer Thickness at various Sections. Green: smooth, red: rough

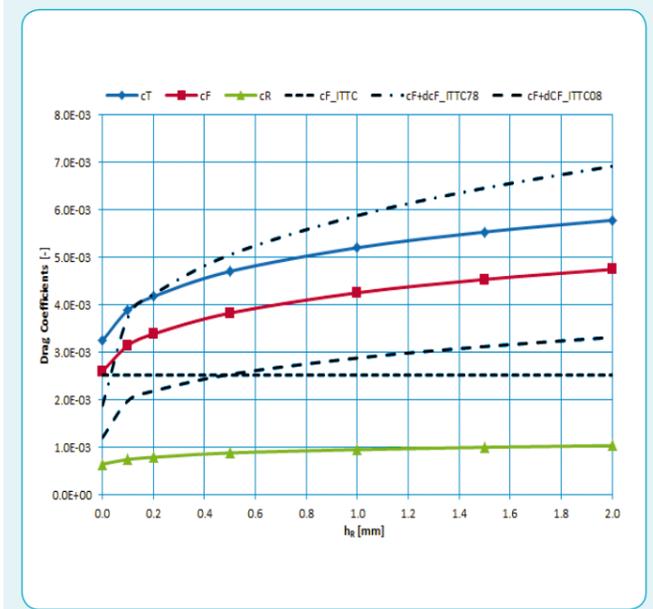


Fig. 4: Resistance Coefficients for RANS Computations and ITTC Empirical Formulae

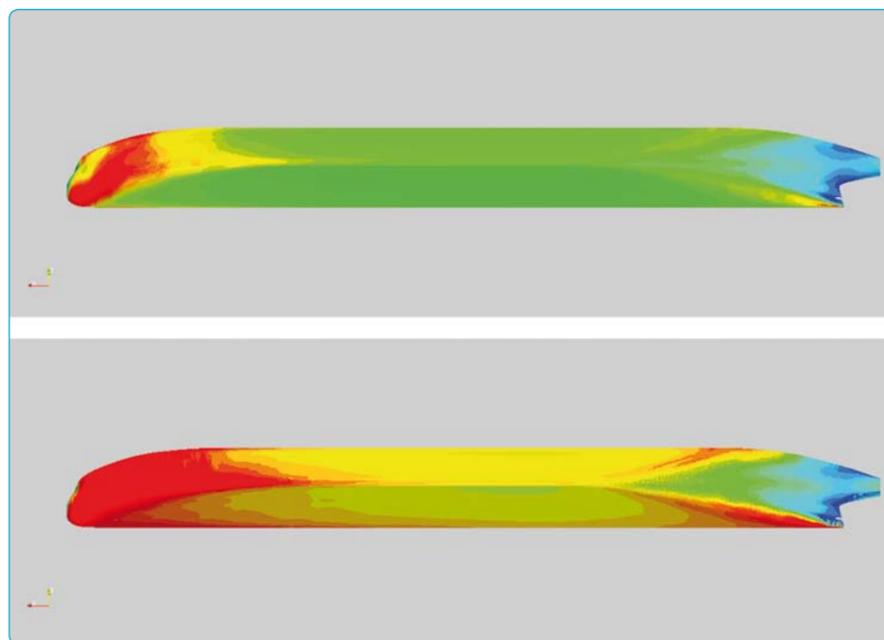


Fig. 1: Friction Resistance Component. Top: smooth, bottom: rough

Using RANS Results & High Speed Tunnel Tests to Improve Propeller Performance Scaling

by Heinrich Streckwall

Within the European PREFUL project HSVA is reviewing common procedures used to deduce the large scale propeller efficiency from model test results. It is intended to end up with an improved scaling approach, still simple enough to correct tests results within a few minutes. The PREFUL partners working in parallel on the subject of propeller performance in model and full scale are CTO, the Polish model basin and MMG, the German propeller manufacturer. Within the project we do RANS calculations for selected propeller geometries, first in model scale and then in full scale. With the model scale hardware we perform high-speed tunnel tests to overcome limitations that are given by the towing tank equipment.

Finally, however, the new and hopefully improved scaling procedure is supposed to work with flat plate skin friction coefficients and some easy available data representing the blade outline. Such an approach may be called a strip method. It is to be validated by the aid of RANS results and tunnel tests. Establishing a strip method we identify 3 main advantages against former scaling approaches like the one recommended by the 15th ITTC (ITTC'78) or the Lerbs/Meyne-method currently used at HSVA:

- 1) A strip method recognizes details of the blade outline where only very limited data (on a 'characteristic' radius) are entering the ITTC or Lerbs/Meyne-method.
- 2) One can compare a strip method with friction forces from RANS results not only globally but radii by radii.
- 3) If transition from laminar to turbulent flow turns out to be a decisive phenomenon for our scaling efforts, a strip method shows the capability to account for distinct laminar and turbulent flow regions on either side of the blade.

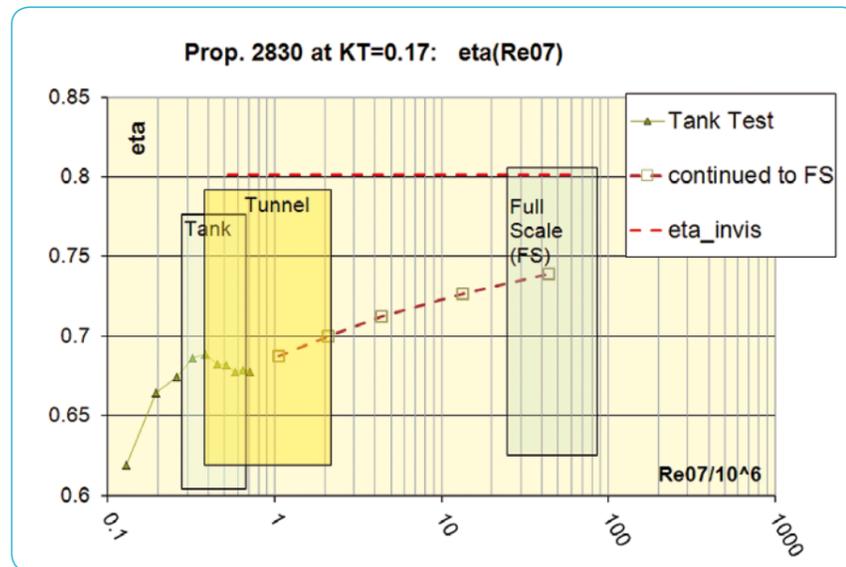


Fig. 1: Motivation for Open Water tests in the cavitation tunnel: achievable Reynolds-numbers are higher than in ordinary Tank Tests

The relation of typical full scale Reynolds-numbers to those achievable in open water tests performed either in the towing tank or in larger cavitation tunnels can be taken from Figure 1. This figure suggests that for a given thrust coefficient $KT=0.17$ the full scale open water efficiency of a particular propeller reads 0.74, while it reaches 0.68 in towing tank tests and (at best) 0.70 in high speed tunnel tests. Figure 1 also implies that the open water efficiency might not monotony increase with the Reynolds number ($=Re$) for the towing tank Re -range while it does so for the higher Re -values attainable in high speed tunnel tests. Finally Figure 1 addresses the artificial construct of an inviscid propeller, here estimated to show an efficiency of 0.8.

Common to all scaling methods the inviscid propeller represents a reasonable starting point to attain the full scale propeller efficiency. If we would know the inviscid propellers efficiency, the scaling down to the full size propeller should produce quite reliable results. Accordingly our first idea was to

compare inviscid efficiencies predicted by various methods.

This was especially interesting as the various methods use different ways to define and evaluate the inviscid propeller (the Meyne method identifies the ideal efficiency η_i as the inviscid propellers actual efficiency, the ITTC'78 method introduces a model scale friction line to address the difference between measured and inviscid efficiency, a propeller Panel method delivers the inviscid efficiency as the genuine uncorrected result while finally the RANS approach reflects the inviscid state if one takes only normal forces into account).

Figure 2 gives inviscid efficiencies for two propellers using the above mentioned methods (on the right of Figure 2 we added with 'VLM' a Vortex Lattice approach as an alternative to the Panel method analysis). The columns are piling up efficiency from the model scale level (black) to the inviscid value (light gray) passing through the full scale level somewhere

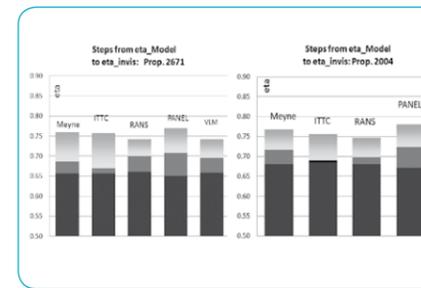


Fig. 2: In the left diagram the predicted efficiencies relate to propeller 2671 at an advance coefficient $J=0.79$. The right diagram holds for propeller 2004 at $J=1.0$.

in-between (dark gray). We found a reasonable agreement for the inviscid columns and had to register less coincidence for the full scale bars. For the propeller 2004, tested in HSVA's largest conventional cavitation tunnel at the highest attainable Reynolds number, the ITTC method (applied with standard roughness settings) predicts no difference between model scale and full scale though the Reynolds number for the latter state would be still 1.5 orders of magnitude higher. Generally we concluded from this exercise that, developing a strip method, we can use the inviscid propeller concept to validate against pure calculations (based on RANS or Panel method).

To obtain reasonable friction lines for our strip method we considered first a surface element method and assigned local skin friction coefficients cf to any element. To simulate model scale conditions we separated each side of the blade surface into a laminar zone and a turbulent flow domain. Figure 3 compares results for the skin friction $\Delta cf = cf_{FS} - cf_{MS}$ increment according to the surface element approach (left) and from RANS results (right). Δcf is the desired distribution giving us non dimensional forces and moments to convert model scale performance to full scale. Note that the normalized skin friction cf_{FS} is not always

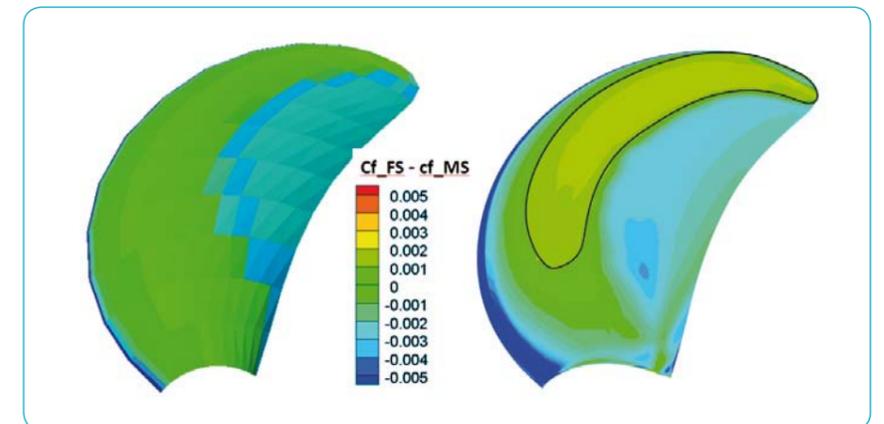


Fig. 3: Difference between full scale and model scale skin friction according to surface element method (left) and RANS results (right) on suction side

smaller than the model scale value due to a partially laminar flow at the model propeller surface.

From the surface element method we finally stepped to a pure strip method which uses a global section drag coefficient C_D . Such section drag coefficients represent a chord wise integration of skin friction and are solely dependent on the local Reynolds number as shown in Figure 4. Besides section drag coefficients derived from the above

mentioned surface element method, this figure gives a fitting curve which can be used to run a strip method.

Using the fitting curve of Figure 4 HSVA will now start to apply a strip method (principle shown on the right of Figure 4) parallel to the standard Lerbs/Meyne scaling approach. On the long run we hope to enhance also our speed and power predictions by stepping over to the strip method.

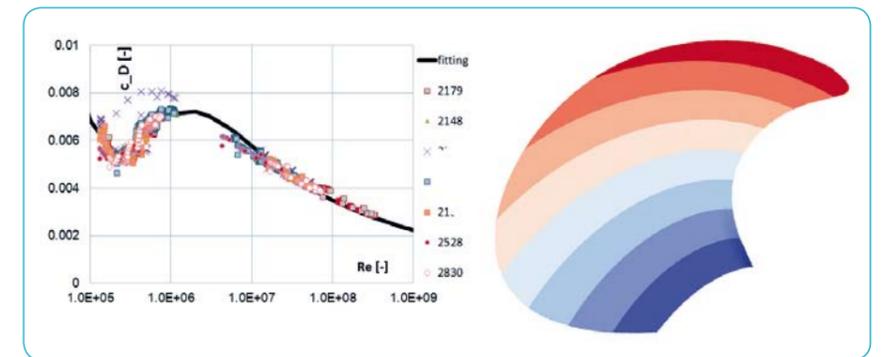


Fig. 4: Summary of results from the surface element method which simulates the skin friction behavior in accordance with the RANS analysis. This summary displays the model scale and full scale section drag coefficients found for 7 propellers each at 10 radii. A fitting curve is proposed to feed the strip method (principal of process on the right) with approved section drag values

Optimisation of the 50k DWT Tanker DREAM50

by Uwe Hollenbach, Hans-Uwe Schnoor and Oliver Reinholz

had to combine optimal propulsion efficiency with highest cargo payload.

In early 2012, HSVA and its subsidiary Ship Design & Consult GmbH (SDC), based in Hamburg on the HSVA premises, were contracted by the Constanta Shipyard SNC (Santierul Naval Constanta S.A.) for further improvement of the hydrodynamic design for a new generation of 50k DWT Tankers which are currently under development at the SNC design offices. By the end of 2012, the first two units are already scheduled for manufacture on the Romanian shipyard based on the shores of the Black Sea.

However, the project's history dates back to 2007, when the first generation of the SNC Tanker class was thoroughly investigated at HSVA. The first calm water tests back then showed that there was some room for improving the performance since the project was to herald significant fuel saving. Following a maximum efficiency – minimum emission policy and with special regard to the ever-increasing importance of the upcoming EEDI (Energy Efficiency Design Index) the Shipyard decided to push the terms with a new Tanker generation and to provide a new benchmark vessel. For the given ship size, the new design

Consequently, the initial hull lines from 2007 and especially the propulsive arrangement of rudder and propeller were further optimised by HSVA's and SDC's specialists. The modifications were supported by extensive CFD calculations, using both the Potential and Viscous approach. Following a request by SNC to incorporate the newest and most economic long-stroke main engines with very low rpm, the aft body hull lines were designed in a way to accommodate the largest propeller diameter possible, however without jeopardizing a favourable flow around the aft shoulder and into the propeller plane. A further new request required for a revised bulbous bow with satisfying performance over a wider range of draughts between light load and scantling conditions. Intermediate hull form drafts were counterchecked against load condition and general arrangement requirements by SDC.

Full-block single-screw vessels are often prone to course instability. In order to counteract this hazard to future vessel operation, measures such as course keeping fins have been included into the aft body layout. The need for larger rudder an-

gles for course-keeping is thus minimized which has a positive effect on propulsive efficiency.

At the current stage, the initial powering tests being finished, the first test results indicate significant efficiency improvements and confirm the reduction of the hull resistance as predicted by CFD. The modified restraints to the hull form allowed the design of a much more efficient vessel. In comparison to the initial design, the vessel's required delivered power at design draught and speed was decreased by abt. 13%, the achievable speed increased by almost 0.6 kts. The same magnitude of improvements was achieved for the scantling draught condition. It has to be noted, however, that the largest fraction of the improvements results from the increase of the propulsive efficiency. This is a direct result of the new design boundary condition set by the usage of long-stroke main engines and the related strongly increased propeller diameter.

The project's next stage will also involve MAN DIESEL as the propeller design supplier. The tailor-made propeller will be combined with a CFD-derived Costa-type rudder bulb fitted to the rudder. This device will be fitted in order to recover energy losses in the propeller slipstream, predominantly with regard to the hub vortex. The related model tests will be conducted in HSVA's Large Towing Tank in the 3rd quarter of 2012, just in time for steel cutting of the first two Tanker units.

With the project still in full swing, the Shipyard's expectations and requirements are already fully met.

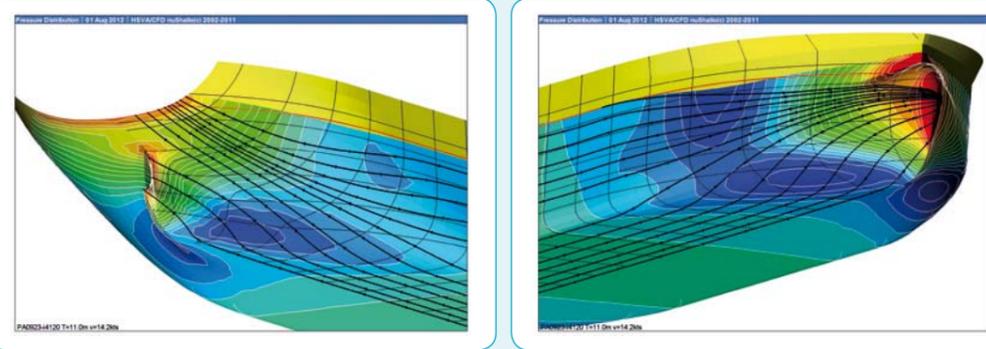


Fig. 1+2: Computed Pressure Distribution and Flow Lines

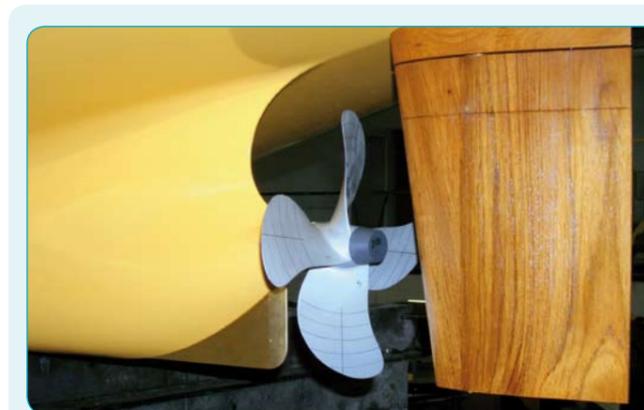


Fig. 3: Rudder-Propeller Arrangement for Stock Propeller Condition

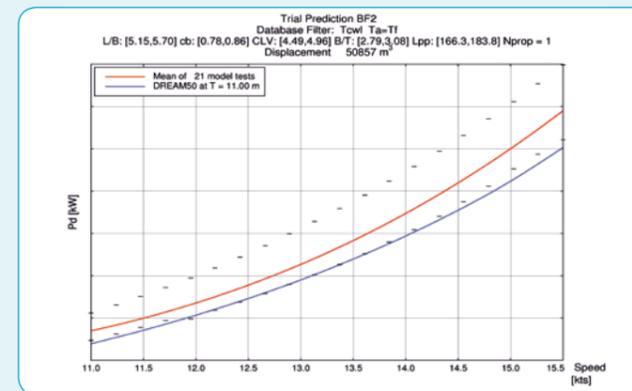


Fig. 4: Performance Check against HSVA's Database

HSVA Stroboscope Controller goes Android

by Jens Reemts

Stroboscopes play an important role in cavitation observation, since they make it possible to freeze the propeller motion by flashing short light pulses at the desired angle of rotation. By this the human's eye will see a still picture of the rotating propeller. The new HSVA strobe controller was developed in order to replace different existing solutions at HSVA with one configurable system for all test facilities. The system is based on a standard RISC-Microcontroller running at 15 MHz. The key features of

the strobe controller are simple adaption to different shaft encoder configurations, special functions for propeller observation, and full remote control via Android smartphones.

A shaft encoder, also called a resolver, converts the motion of a shaft to a digital signal. This signal has to be processed into information such as speed and angular position of the shaft. The number of pulses per shaft revolution is the resolver resolution and is usually in the range between 100 and 3600 pulses per revolution. A still picture of the rotating propeller is obtained

by producing trigger pulses for connected stroboscopes at the same angle of each propeller revolution. In order to achieve an angular resolution of 1° for the still picture from various resolver resolutions, different modes of operation are implemented in the stroboscope controller. The system automatically switches between a simple counter mode, when the resolver resolution is high enough, and a time interpolation mode when the resolver resolution is too low. After setting up the propeller properties like number of blades and shaft offset angle the user can easily switch the view to any blade and angular position. In addition a Free-Running mode is implemented, where the still picture moves in slow motion with approximately one revolution per minute. The outputs for starboard and port stroboscopes can be enabled and disabled separately. All relevant informations like active propeller blade, actual frequency and active stroboscopes are displayed on a front panel LCD, while push buttons are used to control the main functions.

One of the nicest feature of the strobe controller is the remote control option by an Android smartphone running the HSVA StrobeControl App. As soon as the app is started, the strobe controller automatically connects to the smartphone via bluetooth and transmits all relevant informations. Buttons on the touch screen are used for remote control of all functions. This feature allows the user to observe the propeller from any perspective with full control in one hand.



Fig. 1: Propeller observation at HSVA large cavitation tunnel

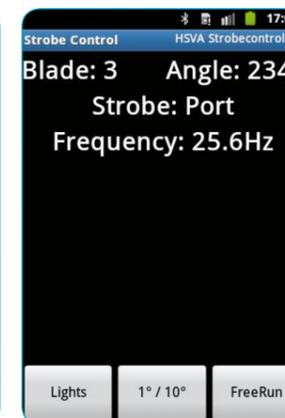


Fig. 2: Screenshot of HSVA StrobeControl App.

Member of staff

Dr. Jens Reemts joined the Propellers and Cavitation Department of HSVA in July 2011. His main field of duty is the improvement and development of test and measurement equipment, as well as the execution of non-standard experiments at HYKAT and the conventional cavitation tunnels. Jens Reemts studied physics at the Carl von Ossietzky University of Oldenburg and finished his PhD thesis in 2006. His research was focused on the electrical and morphological characterization of dye sensitized

zinc oxide thin films. Before joining HSVA, he worked more than five years as test system developer at the automotive electronics division of Bosch in Reutlingen. One of the first projects at HSVA was the development of a handy stroboscope control unit (see details in this issue). In his free time Jens Reemts enjoys climbing, mountain biking and playing volleyball. He is also addicted to Geocaching, the world wide GPS treasure hunting game.



Seakeeping Tests with a Floating Foundation for Offshore Wind Turbines

by Katja Jacobsen

In February 2012 remarkable seakeeping tests were carried out in the Large Towing Tank of HSVA for the determination of the applicability and operability of a floating foundation for offshore wind turbines. During the tests the dynamic behaviour of the foundation was investigated. The structure was equipped with measuring devices recording motions, accelerations at different positions and forces in the mooring lines. Two test series were performed: On one hand the dynamic loads on the founded

structure in different sea states and wave headings were measured. On the other hand the motion behaviour of the structure during transit under tow to a location was investigated in different sea states.

The tests were performed for the University Rostock and the TU Bergakademie Freiberg who are developing together with the companies Gicon and Jähning the first floating foundation for offshore wind turbines in Germany. Floating foundations have less impact on the environment and can be installed in water depth starting from 25 m and more.



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.

