SVA items
SCHIFFBAU-VERSUCHSANSTALT POTSDAM GmbH
No. 2, August 1996

Quality from Potsdam

The Potsdam Model Basin is one of the first ship model basins with a Quality Management System worldwide and the only one in Germany.

The introduction and documentation of the Quality Managment System in all departments of the Potsdam Model Basin reached a succesful final after a working time of about more than one year. The Potsdam Model Basin was certified by Germanischer Lloyd, QS-Zertifizierung GmbH in January 1996. The Quality Management System is applicable to Research, Development as well as Consulting in Ship Hydrodynamics, Transport Problems and Hydraulic Engineering against the international quality assurance standard DIN EN ISO 9001. Structures, responsibilities, processes and necessary methods were organised, systematically arranged and documented. That means, that the Potsdam Model Basin works on basis of an universal and audited procedure.

QUALITÄTSSICHERUNG
GERMANISCHER LLOYD
QUALITY ASSURANCE

In addition, the DAP Deutsches Akkreditierungssystem Prüfwesen GmbH certified the competency of the Potsdam Model Basin for investigations in the fields of „Measurement on and Calibration of Fixed and Moved Objects in Water..." according to the standard DIN EN 45001 in March 1996.

Both standards guarantee high quality of our products and services for our customers. The orders are executed in accordance with documented, tested techniques corresponding to international standards from the quotation till the final report. In other words, our slogan is „efficient, competent, flexible and reliable".

Palace Neues Palais

Hamburg SMM '96

For the second time, the Potsdam Model Basin takes part in the Hamburg Shipbuilding Machinery and Marine Technology Exhibition and Conference. This exhibition has for us two advantages, international well accepted and moderate prices and the home-advantage.

A SME like ours has to chose very well, where and how to participate in an international exhibition. We think our choice is well done. Other points of importance are we believe in how to reach the clients, in what kind of services they may be interested, how to differ from the competitors.

We have two messages for our clients. First, we believe in quality as our way of life. Secondly, we consider computational fluid dynamics not as an exotic, but, as the same powerful tool like our towing tank or cavitation tunnel.

If you wish to get more details about these two messages you are kindly invited to join us in Hamburg at SMM'96 in exhibition hall no. 12, upper floor, place 12112. I and my colleagues would be pleased to meet you there.

Manfred Mehmel
Managing Director

Involving of Advanced CFD-Methods in Ship Design at SVA

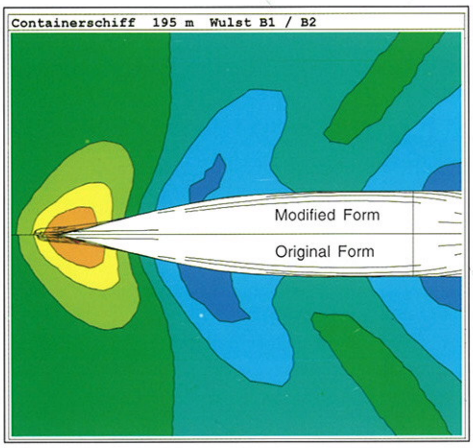
Computational Fluid Dynamics (CFD) is an increasingly important tool to calculate normally measured quantities in a towing tank. Although at present results of CFD calculations are not always accurate in the absolute sense, the trends are usually good reproduced. In this way, the naval architect has the possibility of investigating a wide range of alternative hull forms at relatively moderate cost.

The Potsdam Model Basin (SVA) has a wide experience with application of CFD-methods in the design and improving of ship hulls and associated areas. The SVA performs hull forms modification not only from point of view of reducing the total resistance but also with respect to improving the velocity distribution in the propeller plane.

Following the SVA tradition to involve advanced CFD-methods in the ship design process, we carried out several corresponding projects recently. As example for such applications, some of the results of two different projects are presented below:

Improvement of a Ship Hull from a Resistance Point of View

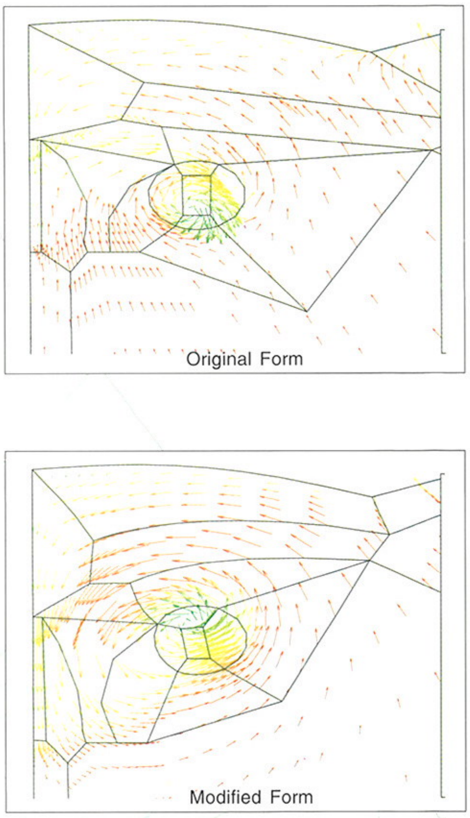
In collaboration with the Flensburger Schiffbau-Gesellschaft (FSG), SVA performed a ship form optimization for a container ship. FSG is a well known shipyard for using advanced CFD technology to provide optimized ship forms and maintain maximum design advantages. Therefore, the aim of the project was to reduce total resistance without decreasing the number of transported containers. In this project, many potential flow calulations were performed at different Froude numbers. Moreover, viscous flow calculation were conducted too. Many bulb forms were investigated using a bulb optimization program. The length, the cross section area and the height of bulb nose were widely varied. After the optimum bulb was found, the ship form with the original and the final bulb shapes were computed using fine grids with the program SHIPFLOW at SVA. The calculated free surface, wave resistance and pressure distribution were used to improve the forward and the after part of the hull. During different stages of the project more than five different versions of the hull form were developed based on the numerical results. The comparison of obtained wave patterns for the original form and one of improved versions gives an explanation for the reduction of wave making resistance. As you can see, the bow wave is slighty lower for the final shape and the waves trough at the forward perpendicular have almost disappeared. The calculated wave profiles along the model and the observed wave pattern go reasonable well conform.



Calculated Wave Pattern

Improvement of a Ship Hull from with Respect to Velocity Distribution in the Propeller Plane

On request of the renowned shipyard Blohm+Voss GmbH a further improvement of one member of the patented Fast Monohull family was achieved. The twin-screw ship has an unconventional hull form with a slender forebody and a tunneled stern. The tunnel provides optimal flow towards the large propellers. The stern tubes are connected together with each other by a horizontal fin fitted to the skeg, forming a T-connection. Viscous flow calculation was carried out covering the total hull including stern tubes and the other appendages. To do this a block-structured numerical grid model with 113 blocks was established. The results of the numerical investigation showed two different vortex systems per ship side, one at the inner radii of each propeller, one at the outer radii. Their senses of rotation were opposite to each other which obviously was detrimental. After performing an anaylsis of the pressure and velocity distribution along the sections especially in the tunnel region and around the appendages, the forms of tunnel, stern tubes and fin were modified in detail aiming at achieving one vortex with one sense of rotation. Viscous flow calculation was carried out again with the modified hull form. As can be seen below, the calculated velocity distribution in the propeller plane is now improved and shows a homogenious sense of rotation all over the propeller radii.



Calculated Velocity Distribution near the Propeller Plane

The high quality of SVA consulting work is a result of long term comprehensive research and development effort. Beside the numerical calculation of the viscous flow around ship forms, the SVA is engaged in the application of RANS-code to the analysis of marine screw propellers.

The Potsdam Model Basin started last year a research project on this subject in collaboration with Advanced Scientific Computing (ASC), Holzkirchen. The project is sponsored from the German Ministry Education, Research and Technology. The TASCflow method is applied in this study. The governing equations: continuity equation, Reynolds-averaged Navier-Stokes equations and the turbulence model equations are solved using a rotating coordinate system.

Flow calculations of marine screw propeller geometries with and without skew have been made and compared to measured results obtained at SVA.

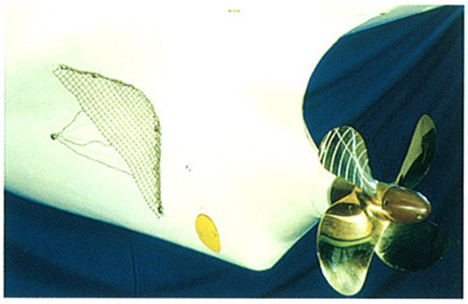
A summary of the results of this R&D project will be presented in the next edition of SVA items on CFD page.

Prediction of Propeller Induced Pressure Fluctuations at SVA

The specification for a propeller normally includes limitations of the maximum level of propeller excited pressure fluctuations on the hull. The pressure fluctuations result mainly from the displacement effect of the blades and from the pulsating cavitation at the propeller blades in the wake field. That's why the accuracy of a prediction of the propeller induced pressure fluctuations on the hull depends essentially from the prognosis of the unsteady cavitation. That is valid for the calculation as well as the model test.

In the SVA mode, measuring pressure fluctuations are carried out in a 850 mm * 850 mm test section of the cavitation tunnel K15A. The simulation of the full scale wake field will be realized by using a dummy model with additional wire grids. The length of the dummy models is about 2 m. The afterbody is maintained similar to the full scale in the range up to frame 2. The manufacture of dummy and model propeller is possible in less than 2 weeks.

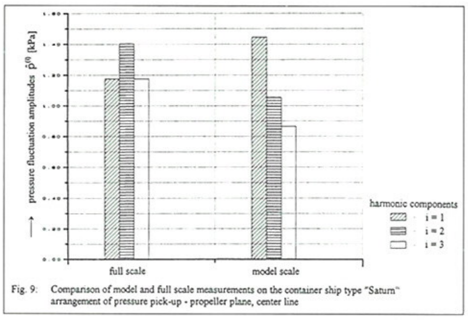
The influence of test parameters (simulation of the wake field, number of revolution of the propeller, gas content of the tunnel water) on the cavitation and pressure fluctuations was studied for different propellers and ship types at the Potsdam Model Basin (SVA). The aim of these extensive investigations was to reduce existing differences between model scale and full scale measurements as much as possible.



Dummy Model with Additional Wire Grids and a Model Propeller

Some of the results are shortly presented below:

- The prediction of propeller induced pressure fluctuations shows a good correlation with full scale, if the calculations and model tests have been carried out with the calculated wake field of the ship.
- The simulation of the three dimensional wake field with the help of a dummy model is necessary for model experiments for pressure impulse measurements. Measurements of pressure impulses on a flat plate with a propeller behind wire grids are only useful for a qualitative comparison of different propeller design parameters.
- The cavitation process determines the pressure fluctuations. The consideration of the scale effects is very important for the prediction of the pressure fluctuations on the basis of model tests with propellers in the cavitation tunnel. A great number of nucleis are necessary in the tunnel water to minimize the scale effects. The pressure fluctuation measurements in the SVA are carried out at a high gas content (O_2-saturation 0.60).
- An influence of the number of revolutions could be for propellers with strongly instationary cavitation on the propeller blades. In such case, it is appropriate to choose a higher number of revolutions for the model test,
- The prediction of the first and the higher harmonic components of the pressure fluctuations amplitudes on the hull is necessary for an examination of propellers and propulsion systems of ship.

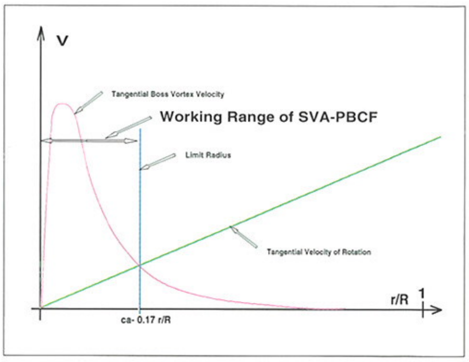


Comparison of Model and Full Scale Measurements on a Container Ship

Rudder Propellers with End Plates and Boss Cap Fins

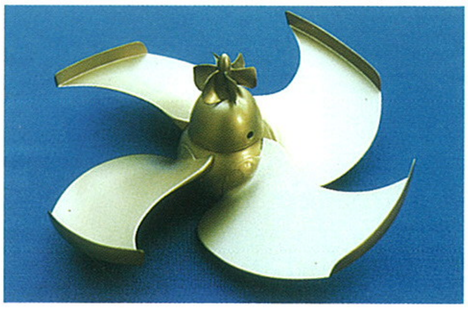
In cooperation with SCHOTTEL an innovative propeller concept has been developed wich makes it possible to reduce the losses caused by turbulence at the propeller.

The diagram shows the peripherical velocities of the hub vortex and the propeller as a



Working Range of SVA-PBCF

function of the distance from the rotational axis of the propeller. The intersection of the two velocity curves gives the radius limitating the range in which the peripherical velocity

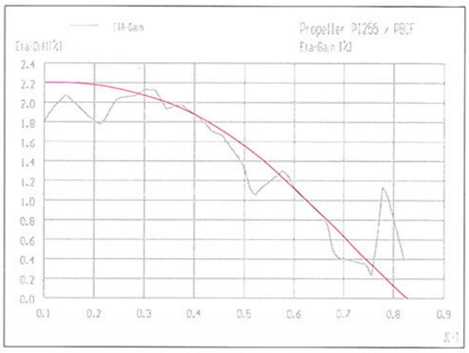


Model Propeller

of the vortex is greater than that of the propeller. In this range, it is possible to utilize the energy contained in the vortex for generating thrust.

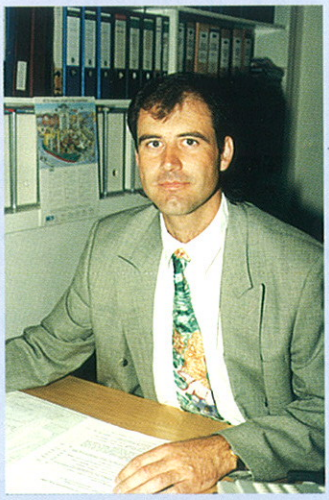
SVA has designed a Hub-Vortex-Vane Propeller that operates within this limiting radius and makes use of the high differences in velocity to recover the energy more effectively. The HVV Propeller diverts the high tangential velocities in the direction of the jet, thereby generating additional thrust. Another effect of this propeller is that the diverting torque of the vortex assists the engine torque, which means that drive power can be saved.

This HVV Propeller has been successfully tested in full size at a SCHOTTEL-Rudder propeller.



Efficiency increase with SVA-PBCF (results of model tests)

Members of the Staff



Rainer Grabert

Rainer Grabert became head of the Towing Tank Department in April this year.

He studied Naval Architecture at the University of Rostock. In 1987 he graduated and joined SVA. Since this time he has worked in the Towing Tank Department in the field of resistance and propulsion and has also been responsible for ship design.

His main activities are the optimization of resistance and propulsion properties of ships and bulbous bow design especially by using CFD tools and the development of power prediction methods. In the last years, he was responsible for several research and development projects in this fields.

He is married with one daughter. His hobbies are sports and music.

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5th SVA-Forum

„Integration of Computational Fluid Dynamics Methods in Ship Design Process"

Due to the rapid changes in a more competitive world market, it is important for shipbuilding that new technologies and methods are not only developed, but rapidly put into use. During the last years, numerical calculation methods have become a valuable tool in ship design. The integration of this advanced technique in the ship design process provides high quality design with maximum cost saving. The experience on the influence of using this technique in ship design and its advantages is for many ship builder limited yet.

Following the SVA tradition, SVA is organising a new SVA-Forum for ship designer, ship builder and ship operators. Emphasis will be given to advances and application of new numerical methods and improved techniques in ship design.

The Forum will be held at the Potsdam Model Basin (SVA) on Tuesday, 15th October 1996.

Programme

09:00 - 10:00	Registration
10:00 - 10:05	Opening
10:05 - 10:30	Prof. Dr.-Ing. H. Söding, Institute of Shipbuilding, Hamburg University Progress in Wave Resistance Calculations
10:30 - 10:55	Mr. K. Rieck Potsdam Model Basin Advantages of Application of Numerical Calculation Methods in Ship Design
10:55 - 11:20	Dr.-Ing. M. Abdel-Maksoud Potsdam Model Basin Calculation of Viscous Flows around Unconventional Stern Forms
11:20 - 11:45	Dr.-Ing. S. Krüger Flensburger Schiffbau-Gesellschaft CFD - Optimization of a 20 000 tdw Bulk carrier
11:45 - 12:30	Discussion
12:30 - 13:15	Coffee
13:15 - 14:45	Demonstrations of several examples for the application of available numerical methods for evaluating improvments of different hull shapes

Innovation for Short Sea Shipping

The Potsdam Model Basin and the Hamburg Ship Model Basin initiated a discussion forum „Innovation for the short sea shipping" in June 1995. About 80 representatives from ports, yards, shipping companies, research institutes, consulting companies and political institutions have found together to discuss every two month these problems and to report about first activities and results.

Conclusions of this discussion forum after one working year are:

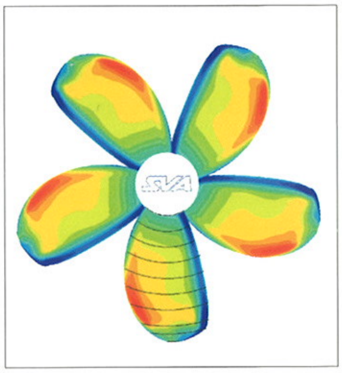
1. The short sea shipping plays an important role to solve traffic problems as well as nowadays as in the future.
2. There are many interests to introduce shipping in the logistic chaine, but there are to overcome some difficulties related to harmonising politics and economy.
3. For the dislocation to the short sea shipping there are some problems, like
   - efficiency of the short sea shipping opposite road and rail transport,
   - operation in a restricted space,
   - necessity of growing marketing in favour of shipping.

   The demand for the development of short sea shipping has to be formulated and implemented.
4. New ideas and innovation are necessary as well as for the vessels only as for the adjoining processes.
5. First ideas for projects were founded. Other projects are realised like the project „Multimodal transport between the german north sea - nordic states/west and south Europe".

In different working groups, there are work the representatives to fit the short sea shipping in multimodal transport and logistic line as an effective part.

VORTEX a New SVA-Tool for Propeller Calculation

The development of a further part of the Numerical Cavitation Tunnel VORTEX has been finished. The VORTEX package consists of nine stand-alone programs for PC and workstation. The kernel of program package (the program VORTEX) realizes a stationary Vortex-Lattice method for ship propellers. The estimation of the cavitation behaviour of the propeller in the instationary wake field of the ship is possible together with the program CAVIPLOT by a quasi-instationary computation. The program package is completed by routines for geometry edition and visualization of vortex-density-distribution and velocity distribution around the propeller. First customers are the classification society Germanischer Lloyd and Schottel.



Calculated Vortex Strength Distribution