HSVA
NEWSWAVE

THE HAMBURG SHIP MODEL BASIN NEWSLETTER 2005/1

Research, in close cooperation with our industry has always been the most essential part of HSVA's business activities.

"Newswave" is our newsletter, in which we always present a brief perspective on the work performed and on interesting projects, HSVA is busy with.

2004 was one of the most dynamic years in the maritime field, the shipping industry was booming mainly as a consequence of the worldwide globalisation. It seems like this trend will be strong enough also in 2005 and therefore creating new, challenging and interesting activities for HSVA.

Our highly-skilled staff is well prepared to interact with customers worldwide to optimise their products quickly and with high precisions. The leading role of HSVA in European and national research programs makes us a competent partner in all tasks related to hydrodynamics and related areas.

I would like to encourage you to continue to make use of our services. We at HSVA will do our best to make your products a success.

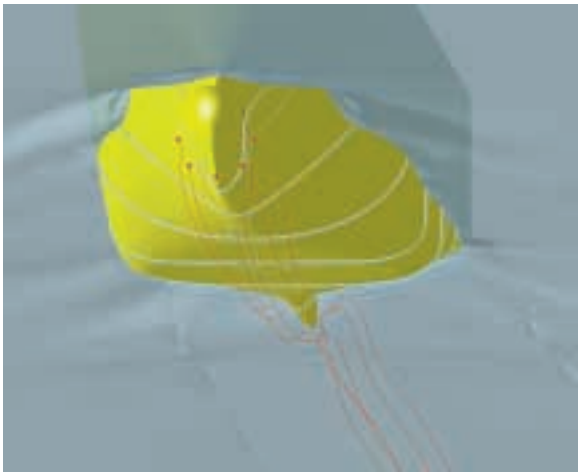
Jürgen Friesch
Managing Director

VIRTUE
EUROPEAN RESEARCH LEADS THE WAY TO THE NUMERICAL TOWING TANK

by Jochen Marzi

The European Integrated Project (IP) **VIRTUE** has been successfully launched on 1st January 2005. The project is funded by the European Commission following a proposal that has been submitted to the 2nd call of the present framework programme. VIRTUE stands for "The Virtual Tank Utility in Europe", an ambitious goal which is addressed by a strong group assembling the leading model basins in Europe, academia, software providers and marine consultants. Coordinated by HSVA, this group will improve and integrate state-of-the-art CFD tools in a comprehensive simulation environment of ship behaviour at sea aiming to complement real test basins in the provision of marine hydrodynamic services.

6th Framework Programme "Sustainable development, global change and ecosystems"



OBJECTIVES

During the next four years, VIRTUE will dedicate substantial effort to the development of new and the improvement of existing components and software tools to deliver a concise and holistic numerical analysis of marine hydrodynamic behaviour, namely The Virtual Towing Tank. The overall project volume of abt. 16.5 M€ / 10.5 M€ funding provides the basis for this massive endeavour.

VIRTUE aims at a significant increase in competitiveness of the European ship building and ship design industry and it will boost the range and quality of services offered by European hydrodynamics service providers as well as the R&D capacity of the branch.

Modern and integrated tools will allow complete analysis and optimisation of hydrodynamic performance of new ships and thus lead to unrivalled product quality at further reduced lead times. This will be achieved by 2 principal lines of development:

- A significant amount of the overall effort will be devoted to the improvement of CFD tool accuracy and flexibility. This will lead to better and reliable CFD predictions in all areas of interest which are expected to close the existing "quality gap" between numerical and experimental investigations
- The second main line of development targets the integration of presently disparate tools into a state-of-the-art platform on the basis of a comprehensive data model. The platform will provide improved communication between numerical tools and other sources required to perform complete hydrodynamic analyses for ships and marine structures.

PROJECT STRUCTURE

To meet its ambitious objectives VIRTUE addresses all areas relevant to the modelling and analysis of marine hydrodynamics.

Specifically, the VIRTUE project provides services from four different virtual tanks, traditionally reflecting the prime aspects of hydrodynamic analysis in ship design.

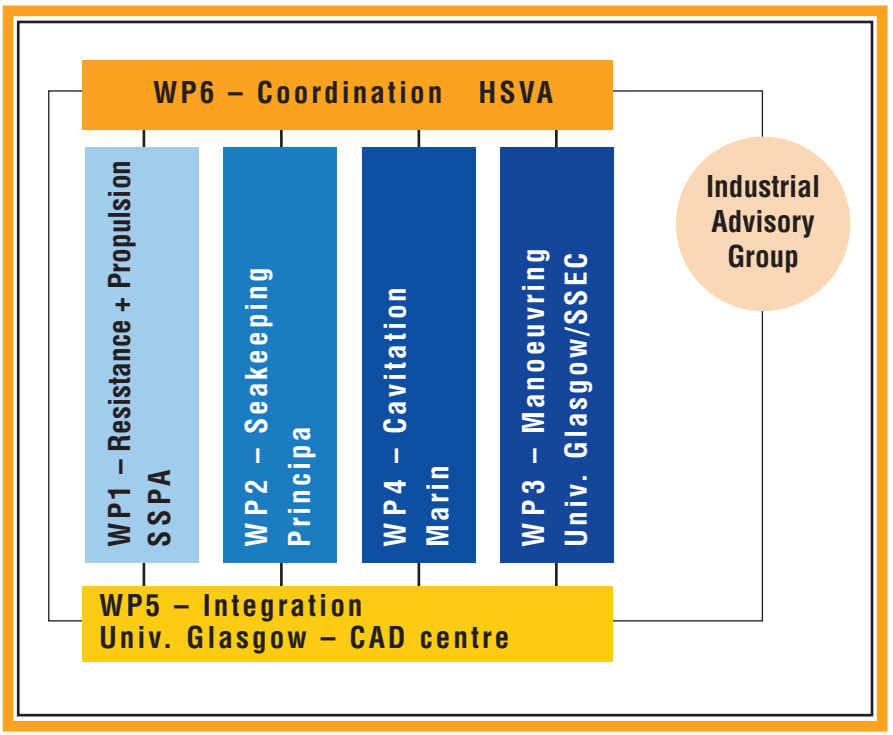
The VIRTUE – CFD work-packages:

- The Virtual Towing Tank
- The Virtual Seakeeping Tank
- The Virtual Manoeuvring Tank
- The Virtual Cavitation Tank/Tunnel

Results from these development activities will be assembled in a 5th work-package – The Integration Platform – which provides the prerequisites for multi-objective optimisation in an all embracing way, based on common standards for data provision and results presentation.

After its kick-off meeting which was held in Hamburg on 18th January 2005, the project is now well underway to establish the ambitious large scale international collaboration. Common lines for developments have been defined and a suite of joint test cases for future validation of CFD code results is presently established as well as the requirements for a larger number of methods that will be finally accessible via the integration platform.

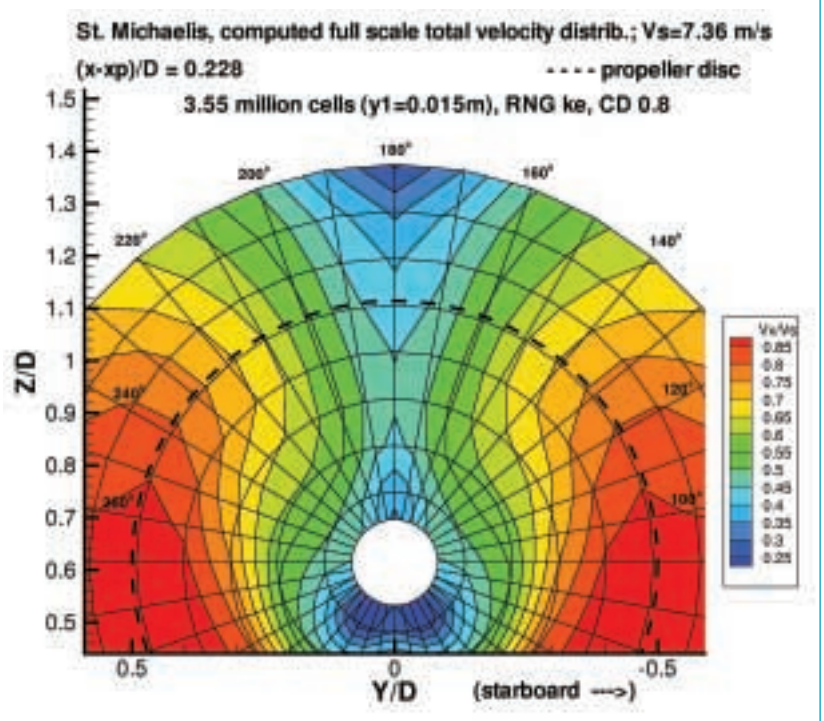
VIRTUE's web site is accessible under www.virtual-basin.org. The site will inform the public about latest developments via a News section.



The VIRTUE Project Structure

PROJECT PARTNERS:

HSVA (coordinator)	D
MARIN	NL
SSPA	SWE
Principia Marine	F
University of Strathclyde	UK
Atkins Consultants Ltd	UK
Tech. Univ. Hamburg-Harburg	D
Chalmers Univ. of Technology	SWE
Instituto Superior Tecnico	P
Ecole Centrale de NantesECN	F
Bassin d'Essais des Carènes	F
Bureau Veritas BV	F
VTT Tech. Research Centre	SF
SIREHNA	F
Germanischer Lloyd AG	D
INSEAN	I
FRIENDSHIP-Systems GmbH	D
ZIB	D
VICOMTech	ES
Napa Oy	SF
PRINCIPIA R&D	F
FLOWTECH	SWE
HUT	SF

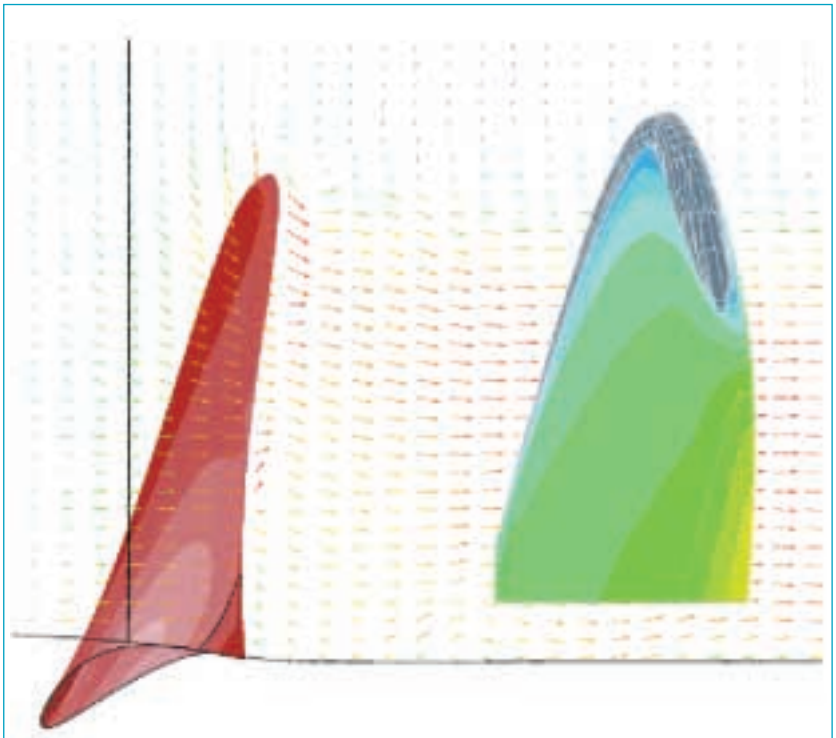


Full scale wake prediction for the St. Michaelis tanker.

In addition to the direct project partners a group of leading maritime industrial parties has been invited to participate in the project's Advisory Panel. Here shipyards, operators, propulsion and equipment manufacturers will assist the project's steering group.

HSVA's Background in EU Research

The Hamburg Ship Model Basin has a long tradition in European Research. Since the early 90ies, a number of collaborative R&D projects such as EROCAV, MARNET-CFD, OPTIPOD, FANTASTIC, Leading Edge and EFFORT have been performed. During these projects some of the foundations of the VIRTUE IP have been established. EFFORT has already led to successful full scale RANSE predictions for a number of ships, validated on two test vessels available to this project.



Full scale propeller predictions performed in the "Leading Edge" project.

Propulsion Power of Very Large Container Vessels R&D Project ANCON Completed

by Friedrich Mewis

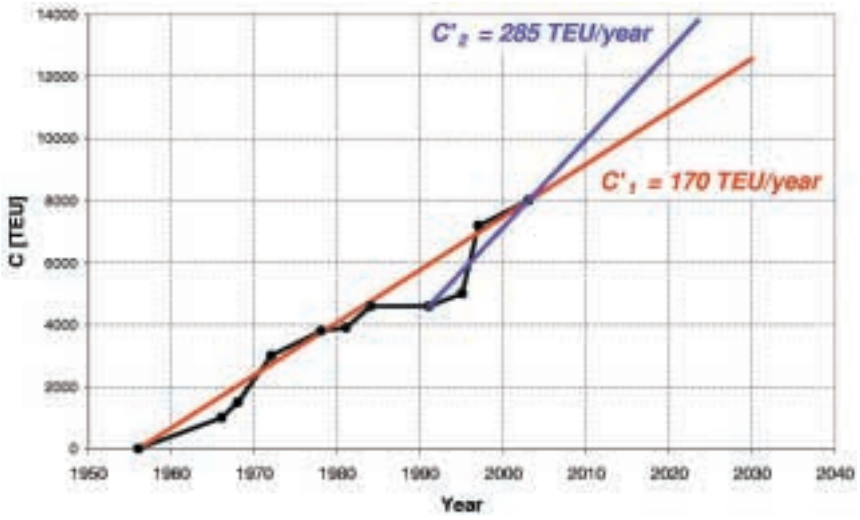


Fig. 1: Past and future trends in container ship capacity (TEU)

Ever since the first container ship was put into service in 1956, the capacity of the largest container vessels has increased more or less constantly over the years. Since 1995 a higher rate of increase in the size of the largest container vessels can be observed (Fig. 1).

The size and the capacity of container ships are increasing because container transportation is more profitable with larger ships.

It is important to determine the propulsion power requirement in the early design phase of container vessels because they usually have to perform well over a range of loading conditions. However, the service speed specified in the building contract is generally for one loading condition only, i.e. the design draught. Hull form optimisation is often limited to this condition.

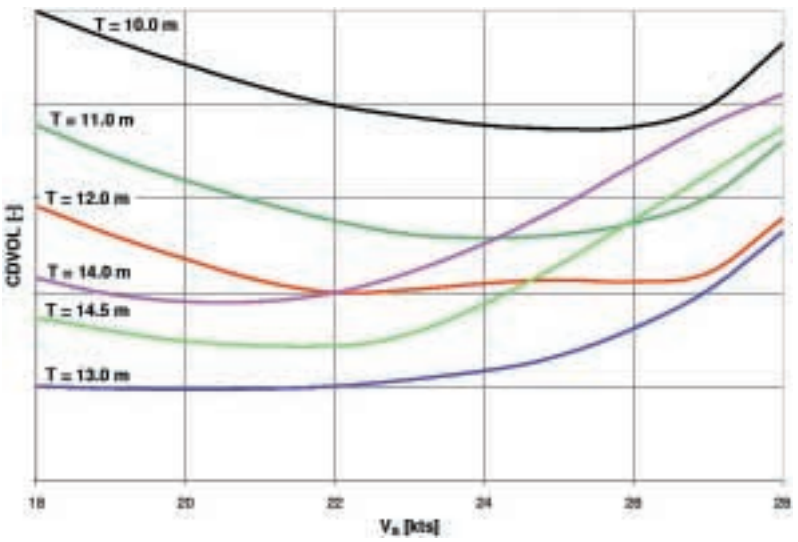
This situation is shown for an 8000 TEU container vessel in Fig. 2, where the dimensionless power/displacement coefficient is plotted as a function of the ship speed. These are results obtained in extensive investigations within the R&D project ANCON (ANtriebsleistung von groβen CONtainerschiffen). It can be seen that for the design draft of 13 m, the lowest relative power requirement has been achieved. For all other loading conditions tested the power consumption is less optimal.

Out of many post Panmax container vessels which have been investigated at HSVA in recent years, several were chosen by HSVA and the consulting shipyards Aker-Ostsee and NSWE for closer examination within the ANCON project. Further tests were performed for these ships in order to completet the available data for investigation. Using regression analysis methods (including artificial neuronal networks), a prediction method was developed which is specifically applicable for estimating the required propulsion power of very large container vessels.

This method takes the complete data collective into account, and can easily be supplemented with new test results and ship forms. This makes it possible to provide reliable speed-power predictions for new projects without revealing confidential data for the specific ships in the collective.

The reliability of the method is sufficient for the prediction of ship speed within a range of about ±1.5%. Nonetheless, the most reliable method remains a prediction based on the result of dedicated model tests carried out for the specific project at hand.

Fig. 2: Power/displacement coefficient CDVOL for an 8000 TEU C/V at different loading conditions.



New Equipment Allows 6D Bearing Force Measurement During Tests in HYKAT

by Christian Johannsen

A Japanese shipyard has commissioned HSVA to perform model tests in context with their development of a new propulsor arrangement.

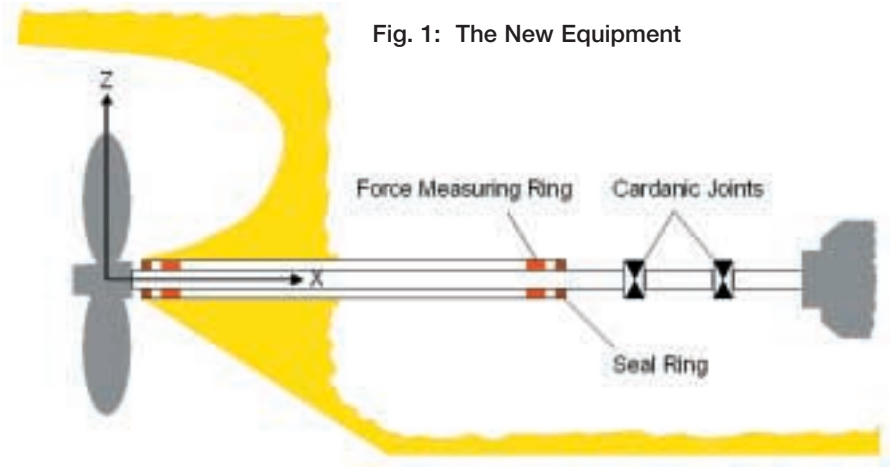


Fig. 1: The New Equipment

These model tests required the measurement of all six components of the shaft bearing force variations under several different conditions. While time dependent measurement of propeller thrust and torque variation (FX, MX, see Fig. 1) could easily be done with the existing propeller dynamometer, a new testing equipment had to be developed for the remaining four components FY, MY, FZ and MZ.

The new device consists of a special stern tube of 750 mm length. At both ends of this tube, behind the seal rings, the shaft is supported by special bearing rings for measurement of horizontal and vertical force variations as shown principally in Fig. 1.

Before applying the equipment for the Japanese client it had been calibrated statically and its function was checked dynamically using the eccentric-mass discs shown in Fig. 2. Those discs generate a rotational speed depending force and moment respectively. Due to static bearing friction effects the accuracy of the new device is not the best with still standing shaft. Nevertheless, with rotating shaft especially the force and moment variations can be measured with an accuracy of about 5 %. The latter are the values of interest when talking about shaft bearing forces.

Beside the ongoing project with the Japanese yard the new equipment extents the variety of services that can be offered by HSVA to our clients.

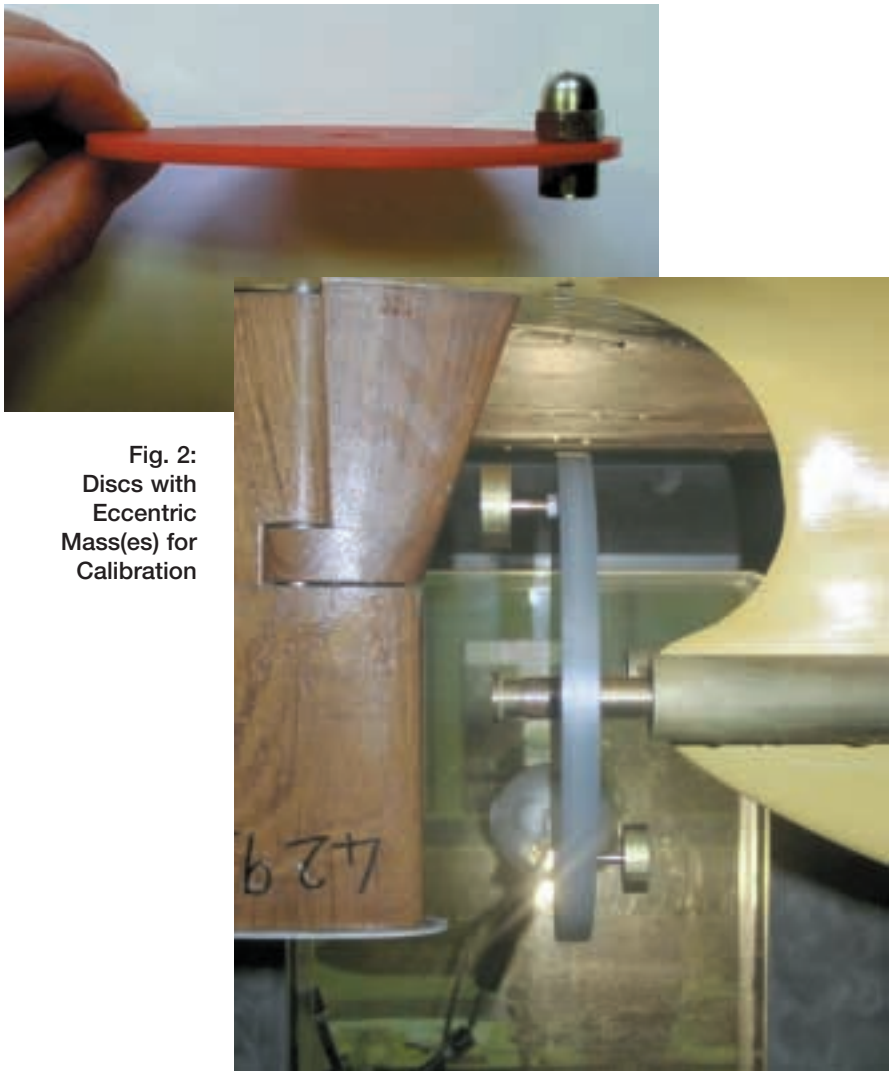


Fig. 2: Discs with Eccentric Mass(es) for Calibration

SAFEICE – An EU-Sponsored Project to Improve Safety and Economy of Arctic Shipping

by Petri Valanto

HSVA is actively participating in the EU-sponsored project SAFEICE, which started in September 2004 and runs for three years. The project aims to improve the safety and cost-effectiveness of arctic shipping and to reduce the potential risk of the environmental impact of navigation in the Arctic.

INTRODUCTION

In spite of hazardous conditions, an increasing number of ships is making their way through the ice covered waters of the Baltic or the Arctic. Growing international trade and the rapidly increasing transportation of oil are making Europe's Northern waterways – many of them narrow and iced over in winter – more active than ever. Not all of these ships are really fit for the ice conditions they are likely to meet. At the same time, the Arctic represents an extremely fragile environment, making the prospect of maritime accidents potentially devastating to local ecosystems and hugely expensive to clean up. An important artery for export of Russian oil goes through the Baltic Sea and the oil tanker traffic in other ice-covered Arctic seas such as the Okhotsk and Pechora is expected to increase sharply in the near future. With increasing traffic the risk of accidents in this severe environment has become higher.

Image H.Heikura, www.helsinginsanomat.fi

A 110 000 dwt oil tanker in ice in the Gulf of Finland.

SAFEICE will focus on developing means to improve the safety of ice navigation. The project will carry out research in three complementary areas: ice loading on ships, development of ship structures for improved ice load carrying capacity and an integrated traffic control infrastructure.

The participation of research organizations also from Canada, Japan and Russia in SAFEICE makes it possible to focus on the safety of arctic navigation on a worldwide scale. The project will be carried out with the participation of universities, maritime authorities and European, Canadian and Japanese

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SJÖFARTSVERKET

marine research institutes. The partners represent the vertical chain from scientific research into implementing the ice rules and enforcing safety at sea.

Customizing ships to enable them to travel through icy waters is an important factor in safe arctic navigation. There is, however, a need for a more direct and transparent design approach based on first principles for ships and also for the mechanisms that are used by the authorities.

The project will also find ways of enhancing and improving the support infrastructure given to ships in the region. This includes furnishing vessels with better 'ice state' information, including real time ice charts and forecasts.

A small dry cargo ship in level ice.

PROJECT OBJECTIVES

The SAFEICE project aim is to create a scientific basis for ice class rules (ship hull strength) and for setting requirements on ice classes.

The specific goals in the SAFEICE project are (1) to develop semi-empirical methods based on measurements to determine the ice loads on ship hull, (2) to find relationship between operational conditions and ice load, (3) to develop ship-ice interaction models, (4) to assess the design ice loads on ship hull, (5) to develop methods to estimate ultimate strength of shell plating and frames and (6) to develop methods to analyze ice damages.

These goals will be achieved (1) by compiling a database of earlier information on ice loads and ice pressures by NRC, HUT and NMRI. This is a collection of full scale ice load data measured on board ships of various types sailing in different sea areas. Ice load data sets are used in validation of deterministic ice load models, (2) by using advanced model tests with local ice load measurements on the model surface, (3) by using numerical models to obtain an overall view of the ice loading on the hull as a function of the ship speed in a suitable range of ice thickness values.

Ships operating in the Baltic Sea in winter sometimes get small dents due to ice loads on the waterline. Thus the first yield loads of ship structures are often exceeded. However, serious ice damages are rare. The ultimate load carrying capacity of the hull structure is therefore utilized in an empirical manner. Instead of elastic design, ice rules could in future be based on plastic design. The probability of loads exceeding ultimate strength of various structural elements can be estimated and the design load level can be explicitly determined.

WORK PACKAGE 6 - LOAD MODELING

The HSVA is the lead organization for the Work Package 6, Load Modeling. In the WP6 numerical models are developed (by AARI, HSVA, HUT and TTU) and used to estimate the ice loads on the hull. This gives the possibility to obtain the ice load distribution on the hull and to quantify the effect of speed or ice thickness and mechanical properties of ice to the ice load level for ice rules development. This overall behavior will be compared to model tests results carried out by NMRI, Japan on the load distribution. This information will be checked against the existing full scale ice load database consisting measured data on ship hulls in various ice condition worldwide. Thus a significant contribution towards a scientific basis for determining the ice loads on ship hull can be made.

HSVA itself will mainly use and further develop the computer code VENICE, which is used to compute ice loads on the ship hulls in SAFEICE but can also be used to determine the resistance of ships advancing in level ice. The code was developed during 1992-2000 under the sponsorship of the German Ministry of Research and Education BMBF. Thus results from this development are likely to find their way into the future ice class rules.

Further information on SAFEICE can be found in

www.hut.fi/Units/Ship/Research/SafeIce/Public

National Research Council Canada | Conseil national de recherches Canada

Finnish Maritime Administration

HUT

AAHHH

CHALMERS

SOUND FROM COSMIC PARTICLES ?!

by Sebastian Boeser & K.-U. Evers

Fig. 1:
Light is generated in a neutrino interaction in the ice and registered by light sensors in pressure balls

Neutrinos are about the strangest objects, that are nowadays known in the particle zoo of elementary physics. They do not carry electrical charge, and apart from their low mass, their unreadiness to undergo any interaction with matter is their most striking feature. About 60 billion neutrinos from the sun reach us on every square centimeter per second, but only a dozen of them will interact with an atomic nucleus while traversing the earth.

It is this feature of the neutrino, which – although creating a big challenge for their detection – makes it an ideal messenger for processes in the depth of the universe. They can reach us from regions, from which no ray of light would ever escape, as for instance the center of our sun with temperatures of a few million degrees. But also from sources outside our galaxy neutrinos are expected to be generated in very energetic processes. The desire to get evidence for neutrinos from these sources has led to a totally new generation of detectors, the neutrino telescopes, with which the sky can be observed in neutrino light. The detection principle is the same for all of them: a neutrino travels through the earth, eventually hitting a nucleus. In the subsequent reaction, a short and very dim flash of light is created which can then be detected by very sensitive light sensors, so called photomultipliers (see Fig. 1)

As this process is very rare, a very large number of nucleons has to be permanently monitored for such a reaction - corresponding to a very large detector volume, typically the size of a few million cubic meters. As the medium needs to be transparent for normal light, natural media are used, e.g. in the case of the detector installed about one kilometer deep in the Russian lake Baikal. Together with the AMANDA detector, which uses the three kilometer thick ice cap of the south pole (see Fig. 2), these experiments were the first to establish this new window to the universe.

However, the neutrinos detected so far are still of terrestrial origin and

Fig. 2: The AMANDA detector site at the geographic south pole

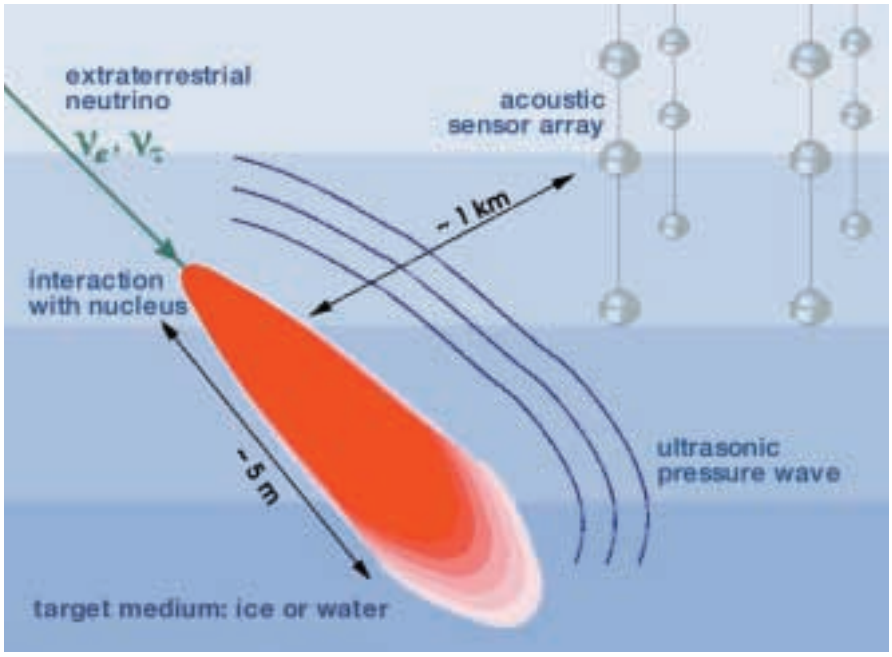

Fig. 3: A neutrino interacts with a nucleus, and creates an acoustic wave, that can be detected at large distances

generated in the interaction of cosmic rays with the earth atmosphere. This is mostly due to the fact, that although being very large at lower energies, the neutrino fluxes drop very quickly when looking at high energies as they are expected for extragalactic sources. A succeeding experiment at the south pole, named IceCube, is currently built, which in its final stage will encompass a volume of more than one cubic kilometer, i.e. one billion cubic meters and therefore have larger chances to catch one of the rare non-terrestrial neutrino interactions.

On the other hand it is already clear now, that even this volume will not suffice to measure the full predicted spectrum of neutrinos up to the highest energies expected. A further increase in detector size will – for financial reasons – hardly be possible: the light generated by the interaction is absorbed in the ice after a few meters, thus putting an upper limit on the spacing of the individual light sensors.

For that reason, new techniques are currently under investigation – among others the acoustic detection in which not the light from the neutrino reaction is detected, but the short ultrasonic pulse which is generated in the same process. The sound signals are very small and far below the hearing capabilities of a human ear, but in contrast to the light, they can travel through the ice for a few kilometers, before being absorbed. Thus, a detector can be build with comparatively few sensors distributed over an even larger volume (see Fig. 3)

The first challenge in this new field is the development of suitable ultrasound sensors, which are sensitive enough to register the minimal sound pressures of a few millipascal. Since beginning of 2003, a team of scientists at DESY in Zeuthen is concerned with the construction of such sensors and corresponding transmitters. These are usually build on the basis of piezo ceramics, which are also used in commercial hydrophones. When applying a compressive force to the ceramic, an electrical signal is produced, which can be amplified and recorded. Due to the pressure of up to 500 bars which will develop in the deployment in the ice, the use of pressure housings, either of glass or metal is necessary to protect the electronic circuits (see Fig. 4).

Fig 4: The 12 cm diameter iron ball and glass ball sensors calibrated at the HSVA ice tank

Another non-trivial task is the calibration of the sensors. The expected acoustic signals from the neutrino interaction have durations in the order of a few hundred microseconds, but with a velocity of sound of several thousand meters a second, this would still correspond to several ten centimeters. Accordingly, a sufficiently large experimental setup is required to get a signal which is not distorted by reflections from the container walls.

As ice volumina in that size are typically not easily accessible, a calibration has first been performed in water. With a size of 10 m x 12 m x 5 m, the deep section of the "ice tank" at the Hamburgische Schiffsbauversuchsanstalt (HSVA) provided ideal conditions. In a direct calibration, the different sensors were compared to a reference hydrophone of know sensitivity. Two different methods were used: sending a continuous sine wave, the sensitivity at a given frequency can be determined very precisely. By sending a short pulse

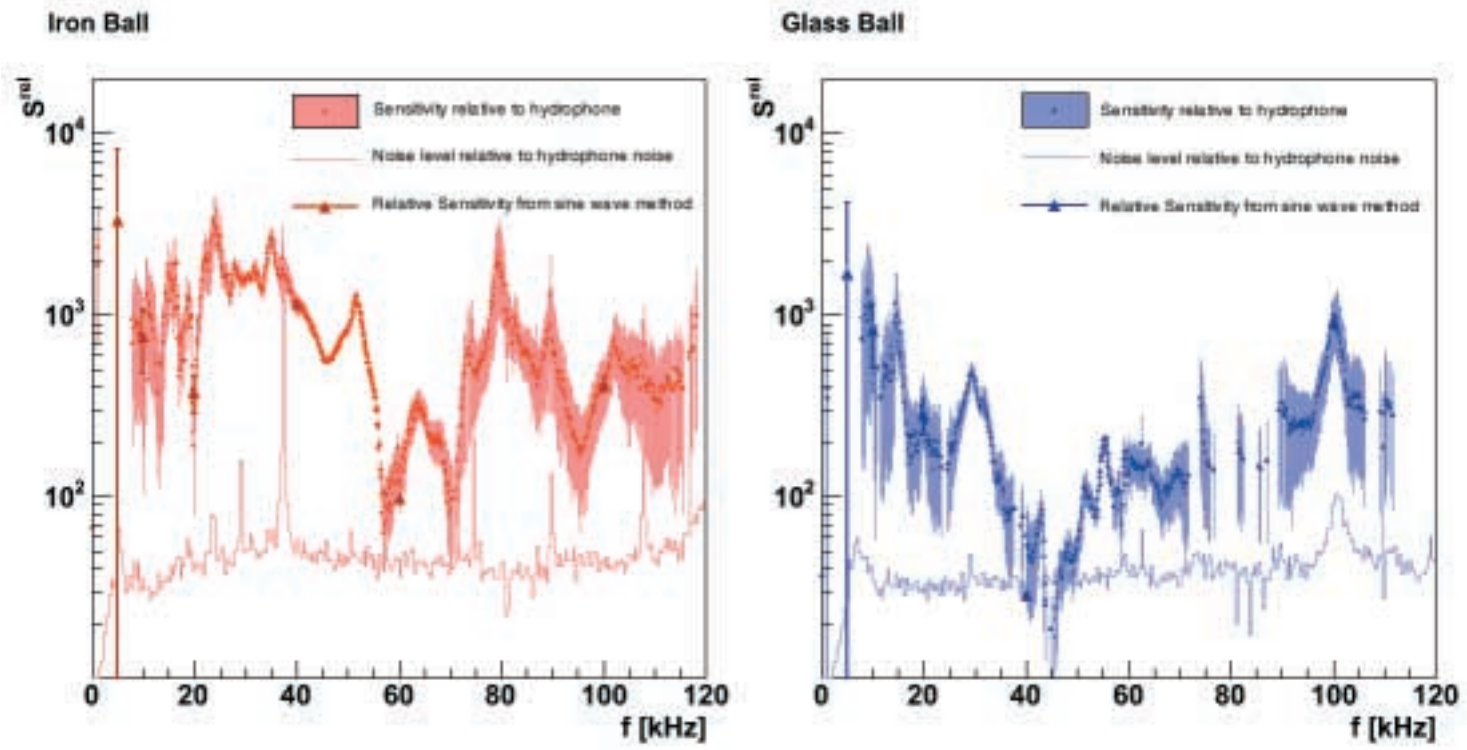

Fig. 5: Relative sensitivity vs. frequency for the iron ball sensor and the glass ball sensor

instead, a broad frequency spectrum can be excited. Comparison of the spectrum will then yield the sensitivity of a whole frequency range in a single measurement. Both methods agreed very well in their results (see Fig. 5), showing that the sensors build in Zeuthen can detect signals up to a factor of 40 smaller than comparable commercial hydrophones.

One of the necessary requirements for a future construction of an acoustic neutrino detector has thus been fulfilled, giving hope to the exciting possibility that in the future, the ghostly neutrinos can not only be seen, but also be heard.

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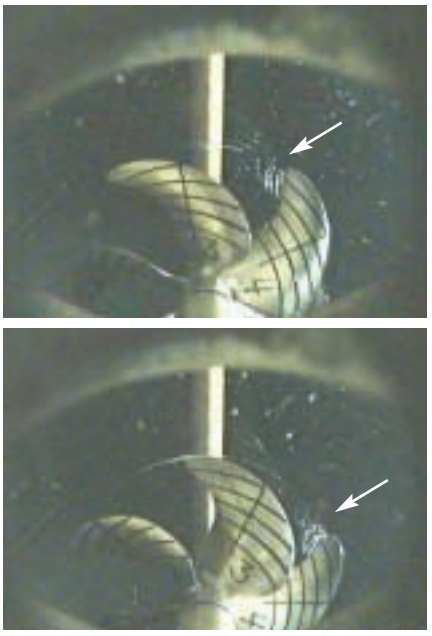
UNEXPECTED HIGHLIGHT IN HYKAT

by Martin Pohl



What in the beginning looked like a routine cavitation test in HYKAT turned out to be a highlight in cavitation testing. The model propeller to be investigated attracted attention not so much by cavitation but by propeller singing with an awkward squealing noise. This phenomenon is connected with regular vortex structures being shed from the trailing edges of the blades.

Singing of model propellers occurs from time to time, but in this case the vortices were visualized by cavitation, which is quite an exceptional phenomenon. Within the 15 years of HYKAT cavitation tests such pronounced and clearly visible vortex structures have not been observed before.

Odense Sea Trial confirms HSVA's Pressure Pulse Prediction

by Christian Johannsen

Over the past ten months not less than seven projects have been conducted in HYKAT, HSVA's large cavitation tunnel, to predict the level of propeller induced hull pressure pulses for various container vessel projects of the Odense Steel Shipyard, Ltd. in Denmark.

Almost all these tests were carried out in the design stage of the vessels to avoid subsequent vibration problems in full scale, caused by too large excitation levels. In one case, however, the model tests were conducted to examine the reliability of HSVA's pressure pulse predictions. For this purpose an operating condition was modelled in HYKAT, which had been investigated by Lloyd's Register in full scale before. Of course the full scale result was not disclosed to HSVA before presenting their prediction...

Nevertheless, HSVA's prediction of the hull pressure amplitudes of propeller blade rate differed by only 1 kPa from the value obtained in full scale. This is a good confirmation for the suitability of the HYKAT facility for hull pressure pulse predictions. It also forms a good basis for continuation of the fruitful cooperation between Odense Steel Shipyard and HSVA in this field.

RECENT RETIREMENT

Dipl.-Ing. Jochen Laudan

In January 2005 Jochen Laudan left HSVA, heading for a well deserved retirement after a long professional career, of which he spent 39 years at HSVA. Those knowing him well will expect him not to simply lean back but actively enjoy new challenges arising from his many hobbies like singing, skating, cycling, to mention just a few.

Jochen Laudan was one of the longest serving colleagues at HSVA. Since he joined HSVA in 1965 he has been active in many areas of research and industrial projects. His vast experience covered exceptional experiments such as dedicated flow field measurements for ships in model and full scale and, recently, aircraft in the large towing tank. Jochen Laudan also pioneered numerical developments and applications at HSVA. Since 1997 he headed the CFD department which he constantly expanded. His superior knowledge of the field earned him a great reputation with clients and colleagues.

We greatly appreciated his openness and guidance given to his younger colleagues. It is not without regret that we say Good Bye, wishing him all the best for a new phase of his life.

Dipl.-Ing. Peter Schenzle

After 11 years as a researcher at the University of Hamburg, and more than 25 years at HSVA, Peter Schenzle has retired in April of this year. During most of his career at HSVA he has been involved as a scientific and research project manager in the Resistance & Propulsion Department.

Mr. Schenzle is a specialist in marine aerodynamics and hydrodynamics with a particular interest in their application for sailing ship design and performance. He was the manager of the Indonesian-German R&D-Project INDOSAIL between 1980 and 1995. Within that project a modern motor-sailing system for medium size coastal and ocean-going vessels was developed and successfully tested on a prototype cargo vessel.

From 1990 to 1993 Mr. Schenzle was a member of the Powering Performance Committee of the ITTC. Since the spring of 2000 he has been lecturing sailing ship theory and technology at the Technical University of Hamburg-Harburg. His international experience together with his understanding for new ideas in combination with his wide theoretical and practical knowledge are the basis for his high national and international esteem.

HSVA held a colloquium on the occasion of Peter Schenzle's retirement on the 25th of April 2005 with more than 40 participants.

Following his retirement, Peter Schenzle will continue to support HSVA as a consultant in the field of ships aero- and hydrodynamic performance.

notes

On 23rd February 2005 another successful

SEMINAR FOR SHIPOWNERS AND OPERATORS

has been celebrated by HSVA.

This was the third seminar in a sequence of successful, customer-orientated seminars, which is held every two years by HSVA.

The role of the model basin in ship optimisation, hull form optimisation, speed trial performance, significant reduction of required power due to brash ice model tests and a workshop on rudder optimisation for fast high powered ships have been the main topics of the last seminar. New developments more sophisticated investigations and tests emanating from the discussions between HSVA and our customers like ship owners and equipment suppliers are already under way in HSVA's facilities today.
HSVA will continue the seminar.

HSVA's new website will be available from May 2oo5 under the well known **www.hsva.de**

MEMBER OF STAFF

NORBERT KOHLMETZ

Norbert Kohlmetz joined HSVA in 1975 as technical draughtsman in the CAD-office, beeing mainly engaged in the preparation of drawings for model manufacturing. After the installation of our 3 and 5 axis milling machines for ship and propeller model manufacturing he was responsible for programming and handling of these machines. In 2004 he was promoted to CAD-office department head. Since that time he is additionally responsible for the coordination of the work between the drawing office, the model workshops and the towing tank operation.

In his spare time he enjoys travelling around Europe and he likes to work with his computer.

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