issue 1-21

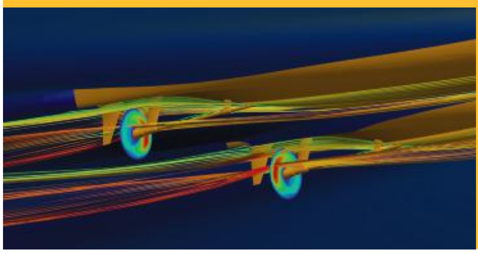
HSVA newswave

The Hamburg Ship Model Basin Newsletter

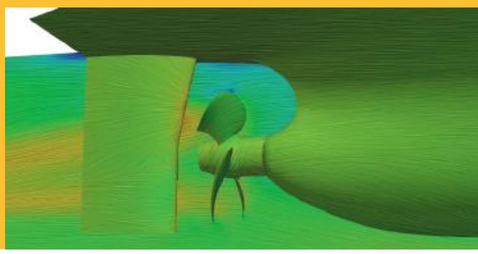
Frozen

drifting across the Arctic along with the natural ice drift

TrAM – the Stavanger Demonstrator CFD + EFD



CFD: Propulsion Simulation – On the path to daily industrial use



Virtual Model Test Attendance in Times of COVID-19

editorial

Dear reader,

These are the times for innovation. The corona crisis forces us to distinguish even more between high relevance and habit. Sometimes, we reach out of our comfort zone – on the other hand, many things which have been only talked about before are now just being lived and done, such as major steps in digitalisation. We are offering a new range of services, as you can see in this issue of NewsWave – and we have given ourselves a new, more customer-oriented structure, which is now based on our main product groups.

The technical expertise is divided into three major areas: "Ships", "Offshore & Specials" and "Arctic Technology". By doing this, we aim at giving more focus on our customers' as well as market needs, by treating the ship as an entire system. Offshore in the sense of new innovative ever changing technology, and related projects are given more emphasis next to Arctic Technology.

All HSVA employees are organised into pools, which provide the individual specialist teams with the resources they need. Inspired by agile working methods, these teams work independently on both customer orders and R&D projects. Project managers serve the customers as single point of contact to provide competent and holistic consulting. HSVA expects this to improve their customer service as well as to enable fast and flexible action on requirements and trends of the markets.

As in every deeper change there might occur some "hiccups", so please do not hesitate to contact us with your feedback and ideas. We are doing everything to continuously improving our services for you and to ensure an excellent level of innovation tailored for your needs. **We are driving excellence for the maritime future!**

Best wishes,

Prof. Dr. Janou Hennig

Our new management team for customer services

Dr. Florian Kluwe is responsible for the Ships division.

The Offshore & Specials division will be represented by **Dr. Christian Schmittner.**

Nils Reimer is responsible for the Arctic Technology division.

Axel Schult is heading our Manufacturing team.

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HSVA as part of MOSAiC
the biggest arctic expedition of all times!

by Andrea Haase

In fall 2019 the biggest arctic expedition of all times – the MOSAiC Expedition led by the Alfred-Wegener-Institut, Helmholtz Centre for Polar and Marine Research (AWI) – has started: Polarstern left from Tromsø harbor to travel towards north, where it was frozen into the ice for about one year drifting across the Arctic along with the natural ice drift (1). This is a high-tech repetition of the famous Fram Expedition 1893–1896. While Fridtjof Nansen's original intention was to reach the North Pole, this expedition's scope is to record interdisciplinary data during an entire annual cycle, including the arctic winter.

Figure 1: Drift of the Polarstern during the MOSAiC Expedition – blue line shows the drift of the Polarstern [1]

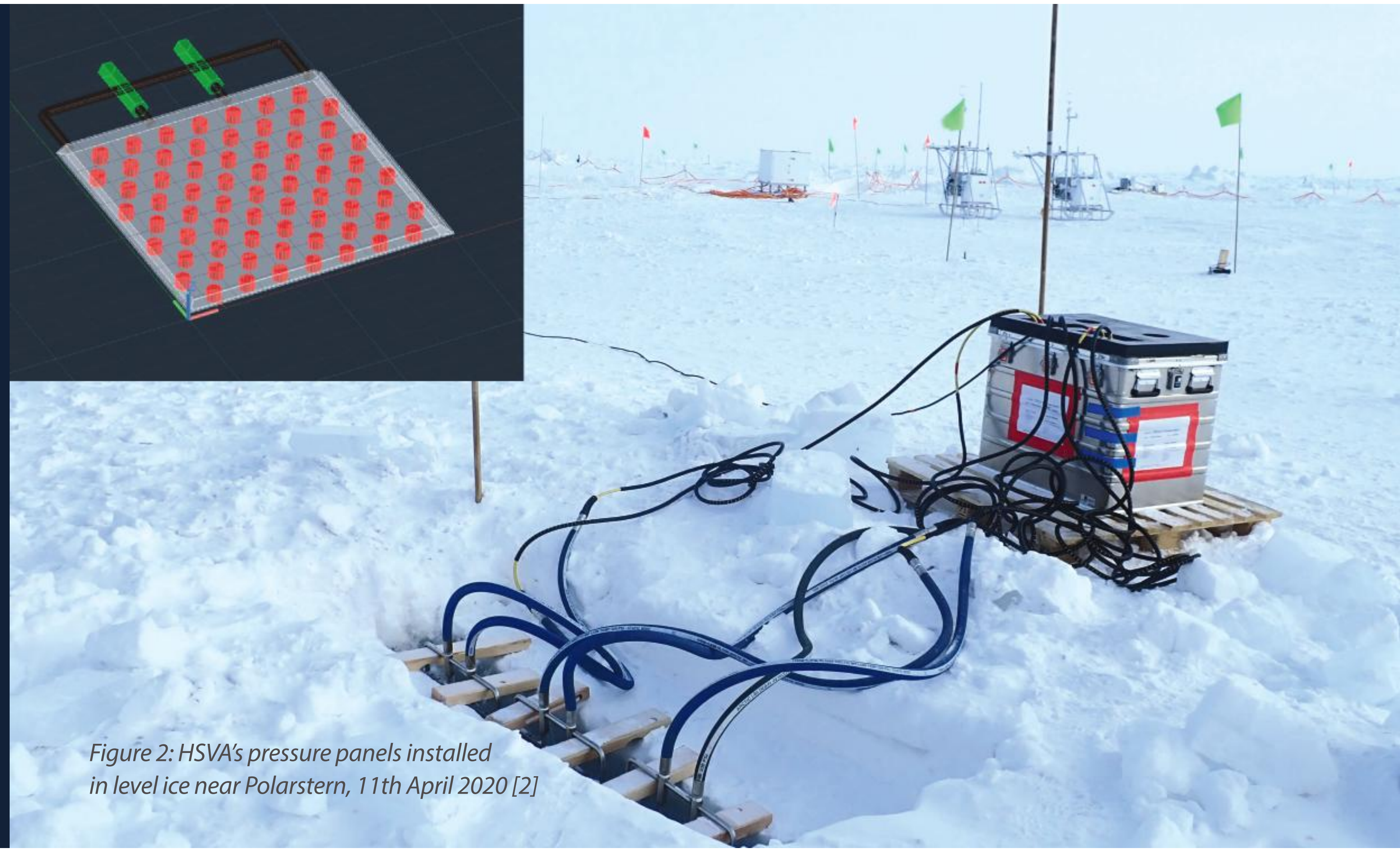

Figure 2: HSVA's pressure panels installed in level ice near Polarstern, 11th April 2020 [2]

The data shall serve mankind to understand this sensitive region, also with respect to climate change.
20 nations, abt. 600 people on board and further 300 people at home, were involved in this expedition. HSVA's role in MOSAiC is to measure lateral ice pressure in the vicinity of Polarstern and to monitor the resulting loads on the vessel itself. Therefore, HSVA had contracted the Hamburg University of Technology to install strain gauges and temperature sensors on the steel structure of the vessel. Partners from Europe, USA and Asia install and maintain ice pressure panels in the ice on behalf of HSVA. The recorded data are expected to give insight in lateral ice pressure in the vicinity of structures, but it is also to be understood as the basis for all kinds of generic ice studies. HSVA's work within MOSAiC is funded by the German Federal Ministry for Economic Affairs and Energy (reference number 03SX365A).

The system for measuring the ice pressure directly inside the ice, as shown in Figure 2, consists of three pressure panels. The panels were used by HSVA already during a trial with Canadian coast guard icebreaker Amundsen in Canada for measuring ice pressure close to a ship drifting against small ice floes. The measuring system for the data logging was located directly next to the panels in an isolated box. Here the data were recorded with a frequency of 10 Hz.

Each panel has a size of 500 mm x 500 mm and is separated into four zones. Inside of the panel zones are cylindrical test bars. At two of them strain gauges are applied with a nominal resistance of 2 kOhm (Fig. 2, upper left corner). The strain gauges in each zone are wired in a full bridge circuit and are connected with the 6 wiring technique to compensate the wiring resistance in the cable [2].

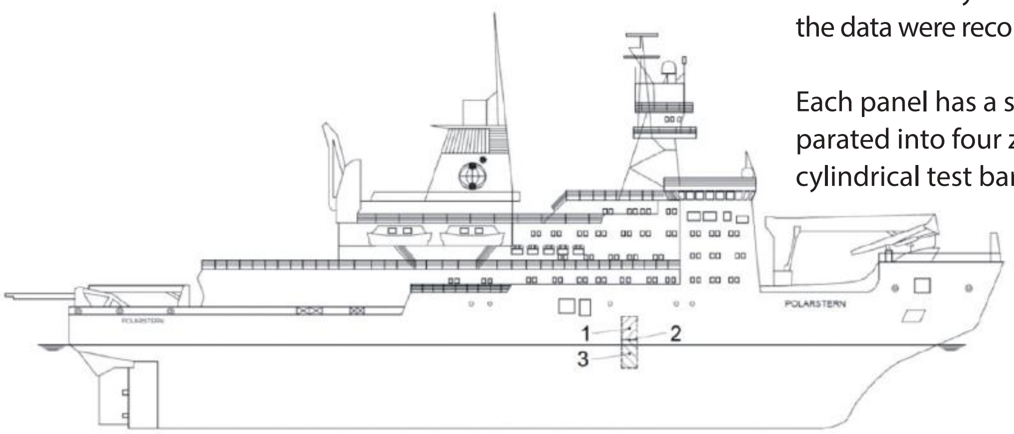

Figure 3: Strain measuring locations on Polarstern, 1 Void Space 100, 2 F-Deck 2, 3 Void Space 92 [3]

In addition to the direct ice pressure measurements in the proximity of the Polarstern, local strain measurements were carried out in an area at waterline height on several longitudinals and in a deck. The measurements allow investigating the actual pressure affecting the ship structure.

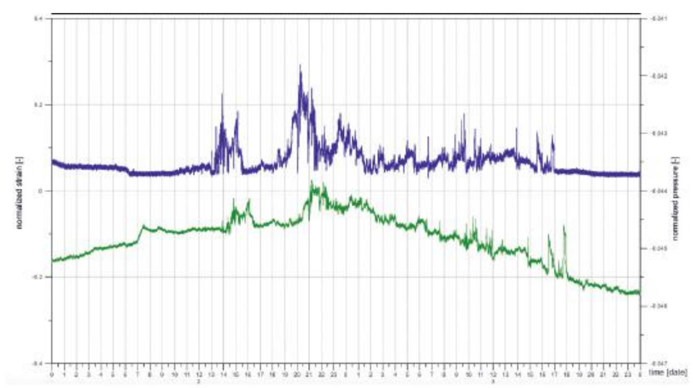

Figure 4: Measurement of the shear strain at Frame 2, Position 1 plotted together with the ice pressure at Panel 2, Zone 1 over the 2nd and 3rd of December 2019 [4]

After the data recording was ended in late April 2020, the measuring equipment was loaded to another research vessel and transported to Hamburg. The collected data from pressure panels and strain measurement system are currently compiled in a database and correlated to each other and the ambient conditions (including ice observations made by the expedition members). First analyses already show a clear correlation between the development over time for the measured ice pressure (panel) and strain determined at the longitudinal frames (4). ■

[1] Alfred-Wegener-Institut / eventfive. https://follow.mosaic-expedition.org. Last accessed on Aug. 14, 2020.

[2] Picture taken by Jenny Hutchings on behalf of HSVA

[3] Kubiczek, J. M. (2020). Messungen während der MOSAiC-Expedition mit RV Polarstern. TUHH, Institute for Ship Structural Design and Analysis.

[4] Beiler, M., Development of a database for the correlation of various types of ice pressure measurements, Bachelor Thesis

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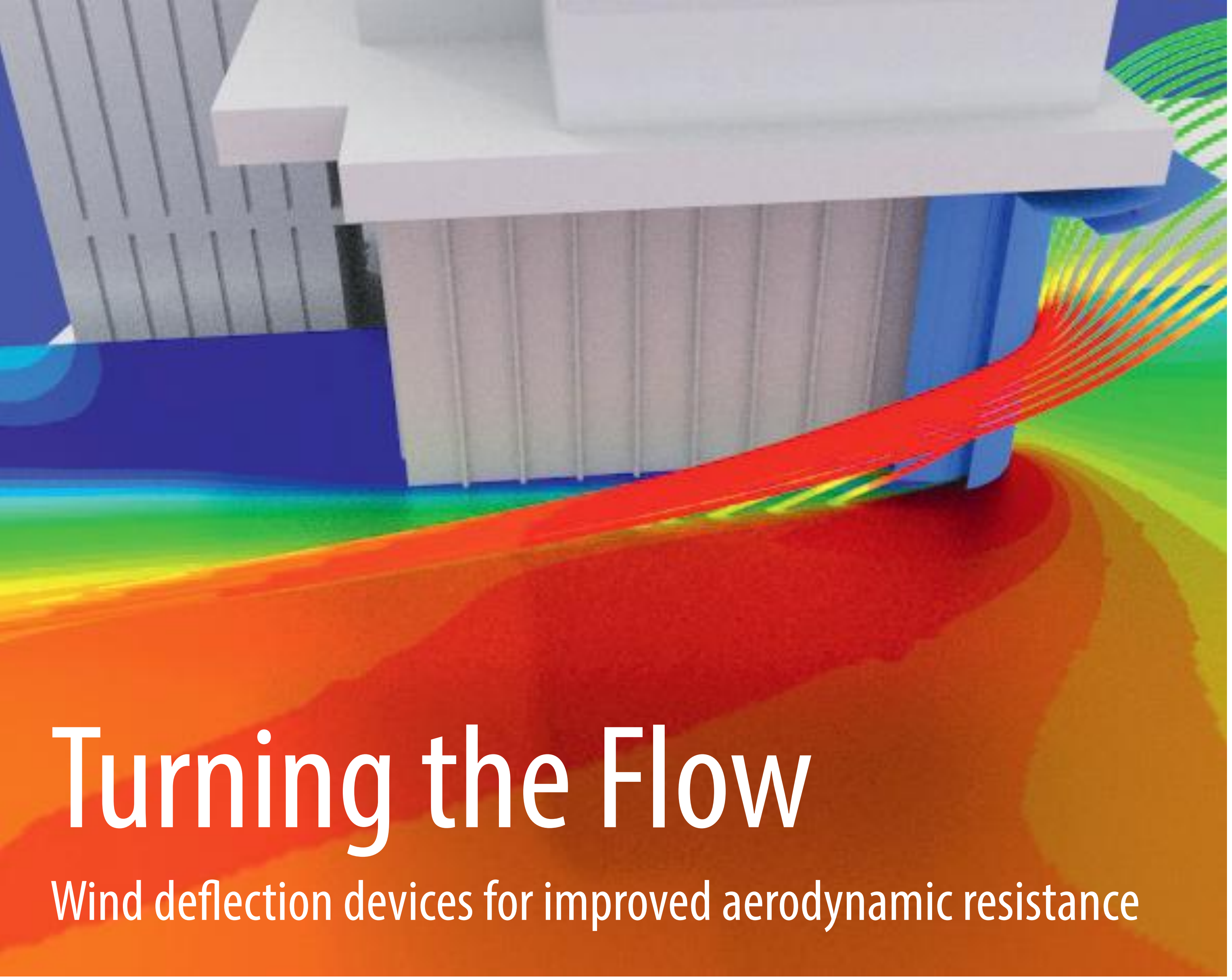


Turning the Flow

Wind deflection devices for improved aerodynamic resistance

by Jochen Marzi, Jan-Patrick Voß and Scott Gatchell

The ambitious IMO and European plans for maritime emission reductions in 2030 and beyond require a range of changes to today's "normal" waterborne transportation. To meet the targets, a change of propulsion technology and specifically fuels will be necessary. Although there is no clear winner on the horizon, it is evident that the next solution will come at a price. This in turn means that the total consumption of costly energy must be kept to a minimum and consequently all energy consumers must be revisited. Resistance is the prime cause of energy consumption for a cargo vessel. While hydrodynamic resistance has been extensively analysed and optimised over time, little attention has been paid to optimise the aerodynamic resistance of ships.

AERONAUT addresses aerodynamic drag reductions of cargo vessels

The wind resistance of ship superstructures is usually not high up on the agenda during the design phase of cargo vessels. As a result largely „cubistic" superstructure designs are the norm, mainly due to cost-effective production processes. This however has considerable disadvantages regarding wind forces and adds to the overall resistance of a ship. Aerodynamic drag can make up as much as 15 % of the resistance in adverse cases.

Inspired by technical solutions from the automotive industry, HSVA together with industry partners launched AERONAUT, an R & D project funded by Germany's BMWi to explore cost effective solutions improving aerodynamic drag. The project investigated promising spoiler and cowling solutions applied to the deck house for different cargo vessels. The following figure shows the instantaneous turbulent flow field in the (vertical) center plane (vxz left) and the flow field in a horizontal plane (vxy)

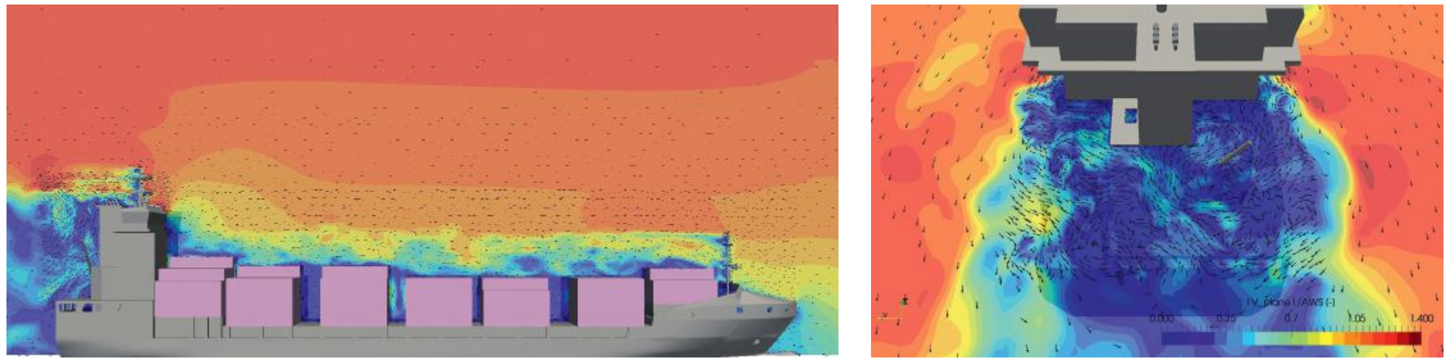


Figure 1: Instantaneous turbulent flow field in a vertical plane at center line (vxz left) and in a horizontal plane 20 m above baseline through the deck house (vxy right), obtained from a DES-simulation

through the deck house (right), both obtained from a DES-simulation for a 1000 TEU vessel supplied by partner Jüngerhans. These plots indicate the loss of kinetic energy in front of the deck house and the complex separated flow situation behind the deck house.

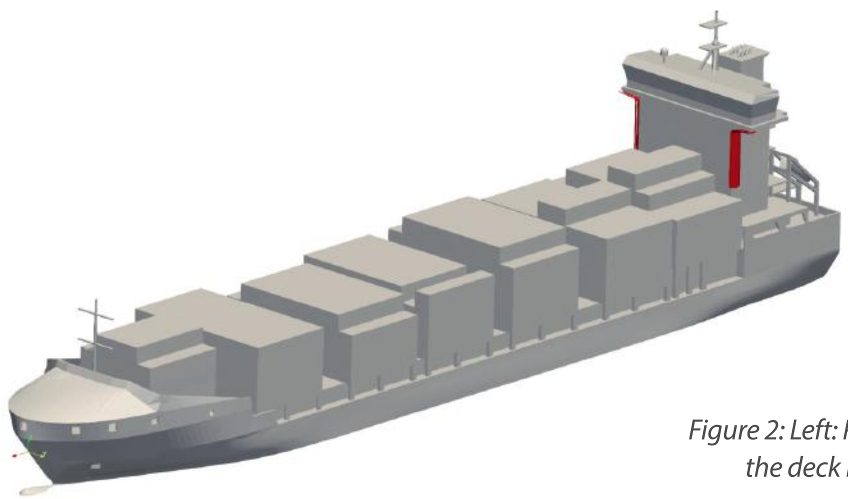
CFD Approach

Ship aerodynamic flow is characterised by sharp edged, blunt geometrical features leading to larger vortex shedding. These large, high-energy flow vortices are found in the entire flow field, specifically in the wake of the superstructure. These structures cannot be properly resolved using typical RANS / URANS simulations applied in hydrodynamics. DES-simulations offer a much better insight into the complex transient flow patterns around blunt (ship) structures. Validated by wind tunnel experiments performed by TUHH, the numerical developments in AERONAUT led to an efficient and highly accurate CFD flow analysis process for complex ship superstructures.

The Container Vessel Test Case

The test ship used in the project is a 1000 TEU container feeder. Operational data for the ship were made available in form of noon reports comprising speed, draft, wave height and fuel consumption. Although container vessels with varying configurations do not lend themselves easily to aerodynamic optimisation, an initial analysis indicated that even here the application of deflector blades on the edges of the deck house superstructure yields a positive influence. An optimal configuration for the deflector blade geometry was found in a design study using a parametric CAD model generated in CAESES©. The following figure shows the position of the deflector blade and its geometry. Note the small size of the device compared to overall ship dimensions.

Figure 3 indicates the flow around the deck house for the initial superstructure (left) and the configuration with deflector blades (right). The significant reduction of separated flow ("dead air region") shown in blue is obvious. ▶



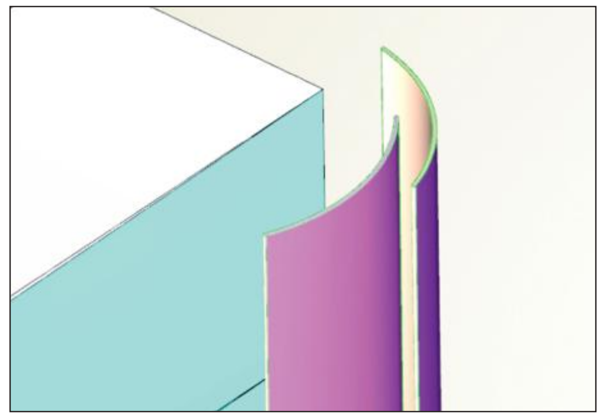


Figure 2: Left: Position of the deflector blade (red) on the front side of the deck house and detail of the 2 element blade section (right)

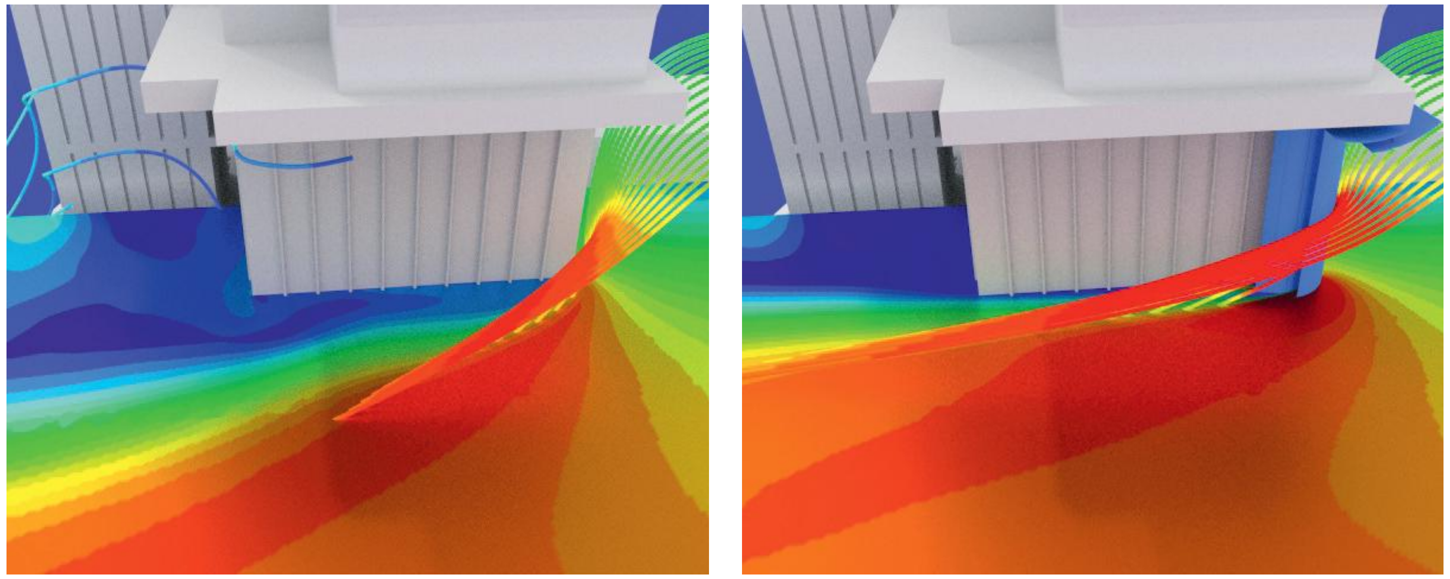


Figure 3: Improvement of corner flow on the front edge of the deck house using deflector blades

This leads to a reduction of total aerodynamic drag of the vessel of about 10 % as indicated in Fig. 4 showing the comparison of time series analysis of the aero resistance. These findings were confirmed during the wind tunnel experiments.

Full Scale Trials

In January 2020 the deflector blades were installed on board of the test vessel "Pictor J" during a short yard visit (see Fig. 5). New operational data indicate a tendency of an improvement, however more data are required to confirm this result. While on-board data logging will continue we expect to be able to install similar devices on more ships soon to assess the full potential of aerodynamic re-fits. The positive effect of the aerodynamic spoilers and deflector blades on the total resistance of a ship can already be concluded. ■

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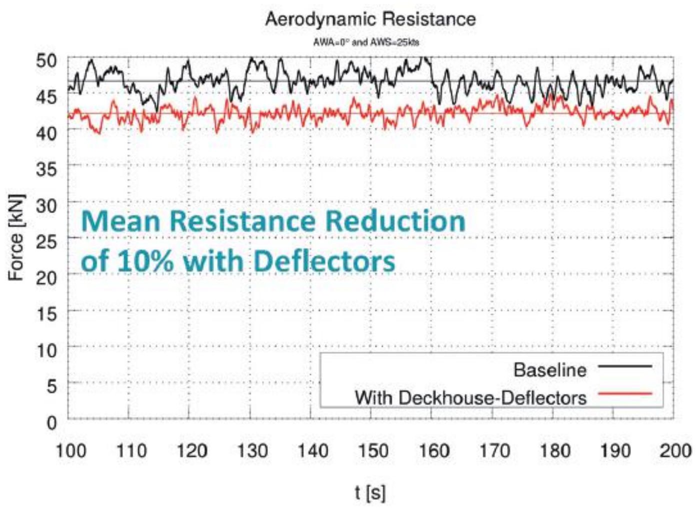


Figure 4: Total aerodynamic resistance for the 1000 TEU container vessel with stowage

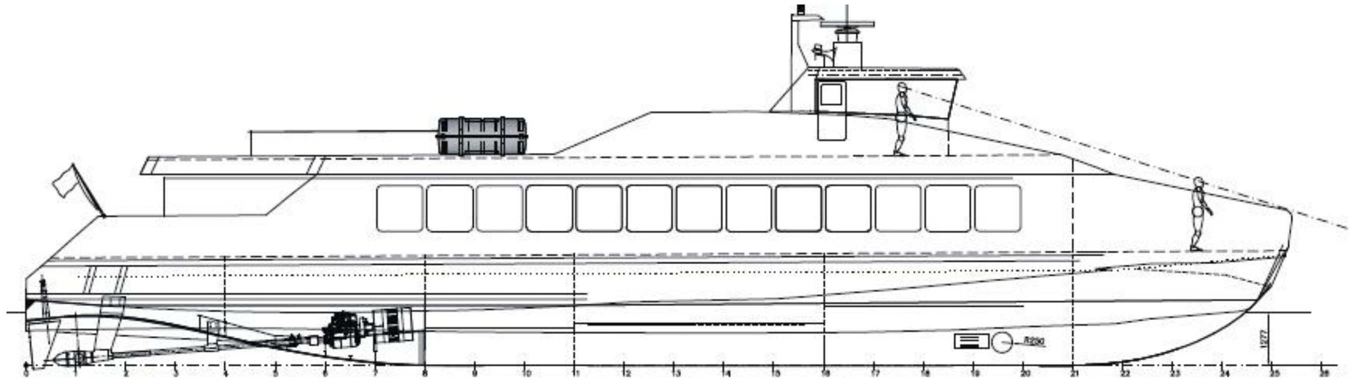
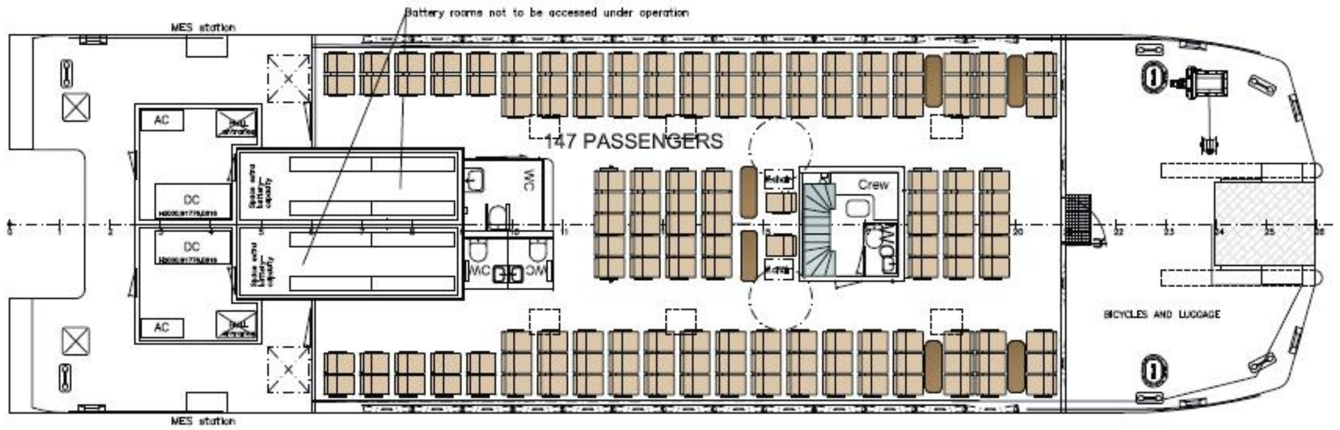


Figure 1: Preliminary general arrangement of the Stavanger Demonstrator

Numerical and experimental

optimisation study of a battery-driven fast catamaran



In the frame of the Horizon 2020 European Research project "TrAM – Transport: Advanced and Modular", which was briefly presented in earlier issues of Newswave, intensive numerical and experimental studies were carried out at HSVA on the hydrodynamic optimisation of the hull form and propulsion system of the Stavanger prototype, to be built and start operations on a multi-stop commuter route in the Stavanger area, Norway, before the end of the project in 2022 (https://tramproject.eu/).

by Apostolos Papanikolaou, Yan Xing-Kaeding and Johannes Strobel

A preliminary general arrangement of vessel (Fig. 1) was elaborated by the shipbuilder Fjellstrand AS. The external dimensions of the vessel providing the required passengers transport capacity were set equal to 31.0 m for the length overall and 9.0 m for the beam overall. The vessel should be able to carry up to 147 passengers with a service speed of about 23 kn, depending on loading condition, battery capacity and fitted e-motors.

A parametric model of the catamaran's hull form by use of the CAD platform CAESES® was first developed on ▶

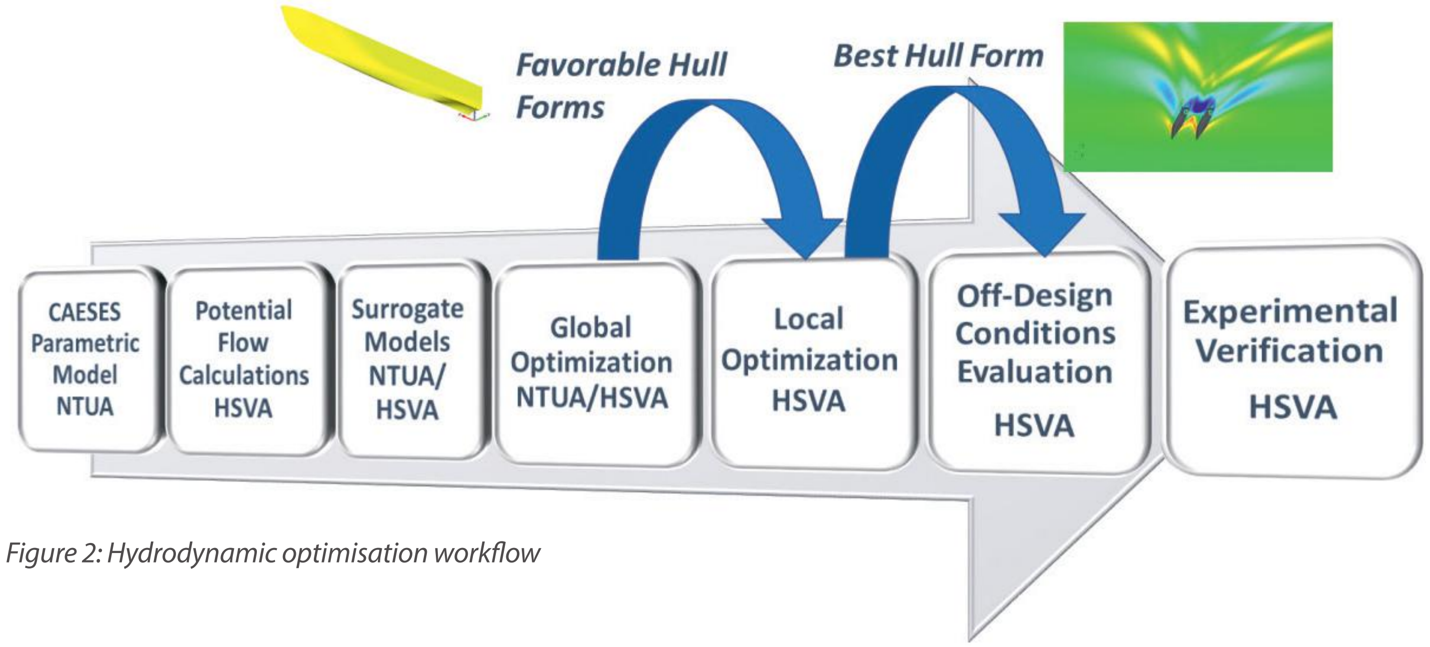


Figure 2: Hydrodynamic optimisation workflow

the basis of a set of 20 design variables, defining the main dimensions, as well as local hull form details, such as the width, immersion and shape of transom and the shape of the bow area of the vessel. The four most important parameters referring to the catamaran's main dimensions and the transom width were selected as design variables during the first-round optimisation studies. The hydrodynamic assessment of each design alternative was based on HSVA's in-house tools, i.e. the panel code for wave resistance **V-SHALLO** and the RANSE code ***FreSCo+***, for the total resistance and the refined local flow simulations at the catamaran's transom. Since these tools require considerable computing resources, it was decided to explore the possibility provided by CAESES® to pre-compute data for later usage. To this end, a series of so-called Design of Experiments (DoE) has been carried out, to obtain a large number of alternative hullforms (about 1,000), which were analysed by HSVA with the above-mentioned CFD tools. Based on the collected pre-computed data, surrogate models are developed, enabling the sufficiently accurate estimation of the quantities of interest during the optimisation study in practically zero time (in our case the calm water resistance of each design variant at various displacements and service speeds). Apart from drastically reducing the calculation time, surrogate models increase the robustness of the whole process by avoiding the need of remote computing.

With the most promising hull forms resulting from the global optimisation, the study was continued with more focus on the optimisation of the stern region aiming at high propulsive efficiency. This part of the hull form was mathematically captured by six local form parameters and

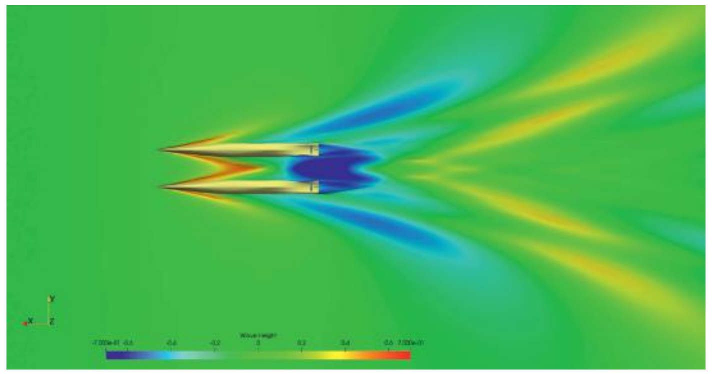


Figure 3 (left): Free surface deformation at 23 knots

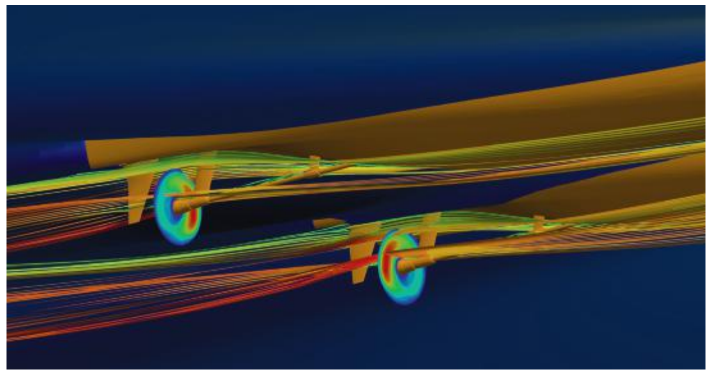


Figure 4 (right): Streamlines through propeller disc and propeller body force distribution at 23 knots

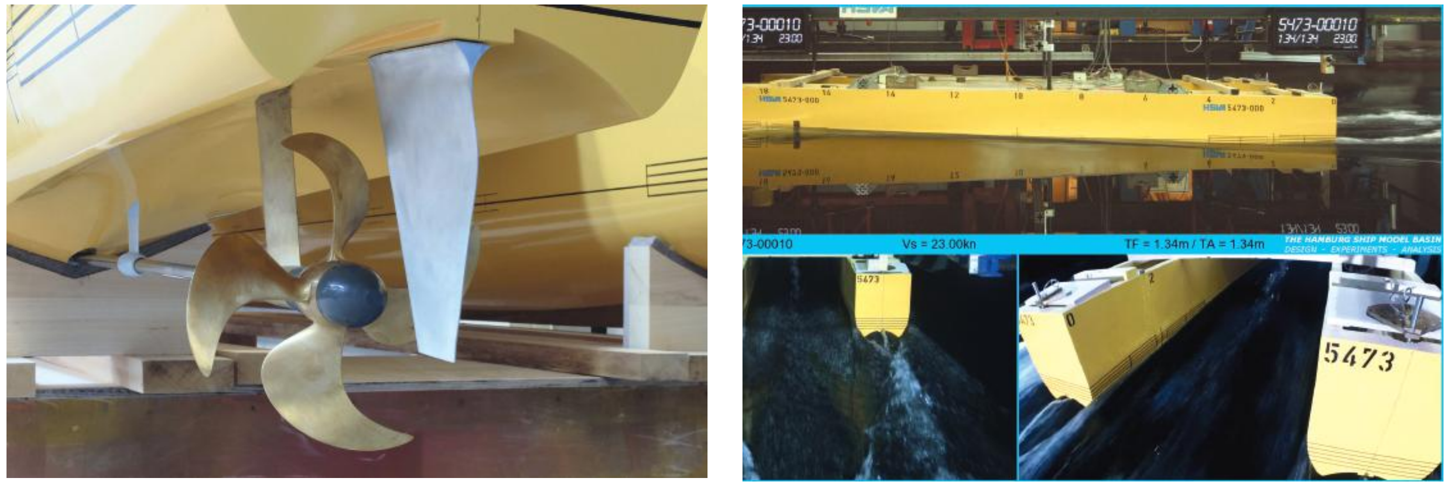
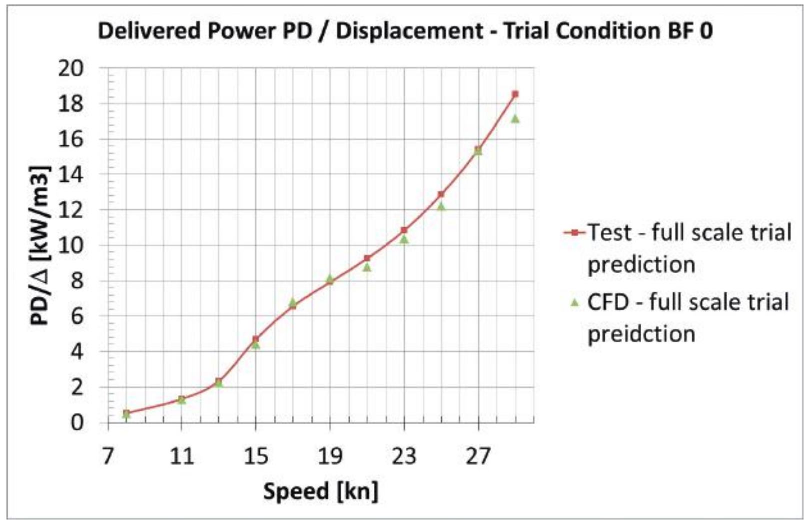


Figure 5: Views of the tested Stavanger model



in addition, five parameters related to the propeller characteristics were introduced. Generated designs were evaluated by use of HSVA's RANS-QCM coupled method, in which the RANSE code ***FreSCo+*** and the propeller panel code QCM are coupled through the actuator disk method at an iterative basis to evaluate the hydrodynamic performance at self-propulsion condition. In this procedure, the free surface, free sinkage and trim of the catamaran are being considered as well. The identified best design with respect to the required delivered horsepower (DHP) was further fine-tuned to minimise the risk of air suction in the propeller tunnel. Fig. 3 shows the computed wave field of the best hull form at a design speed of 23 knots viewed from the bottom, whereas fig. 4 shows the streamlines through the propeller disk and the propeller force distribution as simulated by the coupled ***FreSCo+***-QCM method.

Numerical CFD simulations for the optimised hull form were verified by calm water resistance and self-propulsion tests at HSVA's large towing tank, enabling a firm prediction of the speed-power performance of the full-scale ship under trial conditions. The 5.34 m catamaran model (scale 1 : 5.6) was fully equipped with propellers, shafts, brackets and rudders, as well as open bow thruster tunnels. An aft view of the fully equipped model and the model under way are shown in Fig. 5.

The conducted resistance and self-propulsion tests for various speeds, displacements and trims confirmed the numerical CFD predictions. A comparative speed-power diagram, with the delivered power scaled with the catamaran's displacement, is shown in Fig. 6.

It was verified that the propulsive efficiency of the optimised catamaran reached remarkable 78 % at the design speed. Achieved results allowed the operator and the shipyard to proceed to the final selection of battery capacity and electric motors' power for the desired speed profile of the Stavanger demonstrator.

Reference:

Papanikolaou, A., Xing-Kaeding, Y., Strobel, J., Kanellopoulou, A., Zaraphonitis, G., Tolo, E., Numerical and Experimental Optimization Study on a Fast, Zero Emission Catamaran, Journal of Marine Science and Engineering, MDPI, 2020, 8, 657; doi: 10.3390/jmse8090657 (open access)

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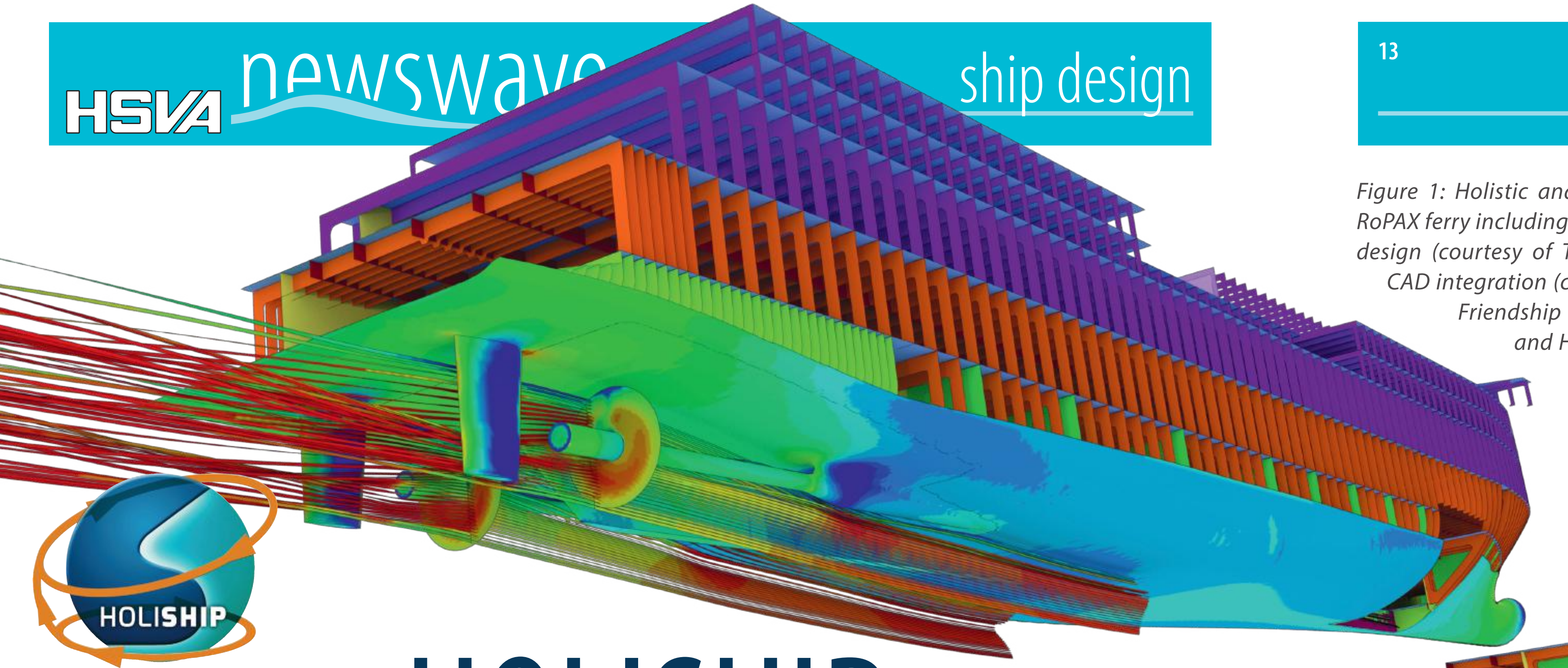


Delivering HOLISHIP

The HOLISHIP project - Holistic Optimisation of Ship Design and Operation for Life Cycle (www.holiship.eu) has been accomplished at the end of 2020. Navigating difficult waters during the last year, due to the global crisis and its implication on the working situation of all partners, we managed to meet all our objectives and delivered excellent results, as attested during the final review.

by Jochen Marzi and Apostolos Papanikolaou

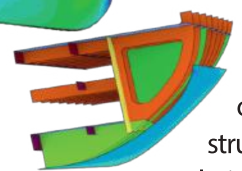
Back in September 2016 the project start marked a major milestone in a long line of developments focusing on the development and adaptation of design tools and on application case studies for almost all of the 40 project partners. Embarking from often insufficient tools, lack of functionality or integration, the HOLISHIP project after its first phase reached an established design system of platforms and individual design / analysis tools to deal with all relevant ship design issues. Fig. 1 illustrates the interplay of different design disciplines, particularly structural design and numerical flow analysis performed by project partners Tritec Ltd. and HSVA.

As introduced in NewsWave 2017.1, the HOLISHIP approach takes ship design to a new level by integrating different disciplines such as market demand, economy, efficiency, safety and environmental footprint considerations in a holistic way. A comprehensive overview of the first phase, tools and platforms considered is given in Vol. I of the HOLISHIP book (Papanikolaou, 2019). ...

The second phase applied the technologies developed in phase 1 to a range of 9 different application cases, each of them being rather different and representing the total breadth of maritime design. Run by technology leaders and acknowledged industry experts these application cases include the concept and contract design of an OSV with a special focus on energy simulations to capture the needs of complex and energy intensive offshore operations up to pipe laying as well as a rather different case of the design of lightweight superstructure blocks for large Cruise Liners. Further application cases include life-cycle considerations for a Research Vessel which sheds light on the installed equipment and contributes to the concept of predictive maintenance, a new approach

towards concept design using a System and Architecture management tool linked to the HOLISHIP platform, a virtual test of advanced manoeuvring devices for small cargo vessels, retrofit of existing large bulk carriers and container vessels for improved operational performance plus three concept design studies. The latter focuses on an offshore platform in ice and two ferries, a double ended coastal ferry and an advanced RoPAX ferry design which demonstrate the early design integration of different disciplines, particularly the interaction

Figure 1: Holistic analysis of a RoPAX ferry including structural design (courtesy of Tritec Ltd), CAD integration (courtesy of Friendship systems) and HSVA's CFD analysis



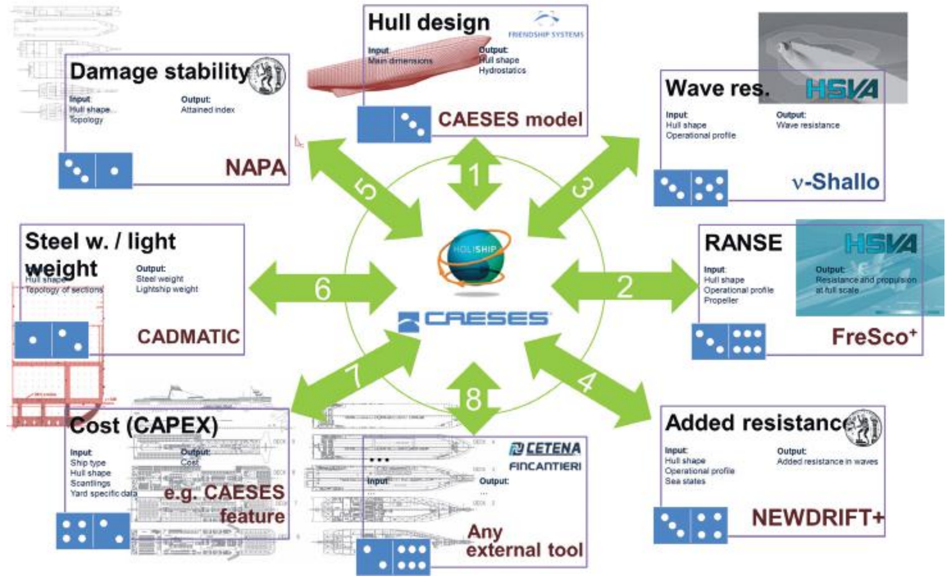


Figure 2: HOLISHIP integration concept – schema

of hydrodynamic analysis with structural, stability and cost or LCA analysis according to the overall schema of the HOLISHIP architecture shown in Fig.2.

For HSVA this means a considerable step forward integrating our own hydrodynamic services in early design steps, thus creating a new opportunity to interact with our customers at a very early stage of ship design. Statistical as well as CFD – tools will be accessible already during concept evaluation and allow exploring a much larger design space than in the past. For the case of the double ended ferry this is illustrated in the following figure. Here a large range of hullform variations based on a parametric CAD model generated in Friendship's CAESES® platform has been explored using fast CFD tools (HSVA's panel code v-Shallo) to find optimal solutions in terms of resistance.

Following the overall philosophy of the HOLISHIP approach, these data were stored in a response surface (surrogate modelling) and further used in the global optimisation leading to a series of promising (Pareto front) hull form designs. These designs were further optimised in a local hull form optimisation procedure by use of HSVA's FreSCo+ RANS code, focusing on the bow and stern region, where the interaction of the hull form with the fitted propulsive and steering devices is being considered. More information including videos covering public events are available from the project's web site at http://www.holiship.eu/holiship-workshop-2020/ or http://www.holiship.eu/holiship-smm-digital .

However, this is not the end: HOLISHIP goes forth. At the time of writing partners undertake first steps to establish a joint

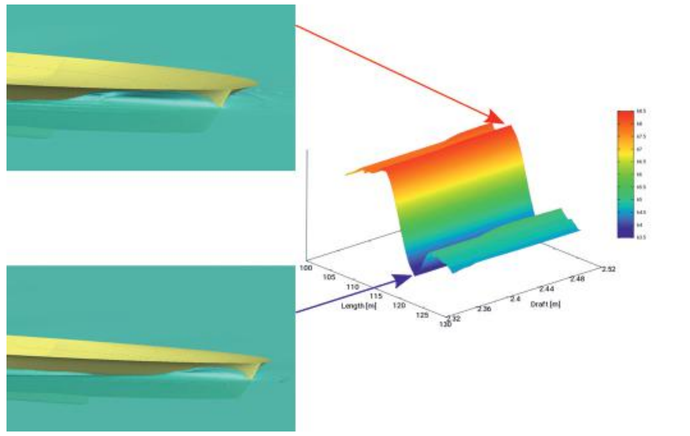


Figure 3: Parametric hullform optimisation for a double ended ferry

"Marketplace" to exploit the successful developments in a future commercial operation. This will allow future customers to make full use of advanced design and analysis tools and concepts, either as a complete service or integrating specific components in individual design process. ■

Reference:

Papanikolaou, A. (ed) "A Holistic Approach to Ship Design, Vol. 1: Optimisation of Ship Design and Operation for Life Cycle", SPRINGER Publishers, ISBN 978-3-030-02809-1, 2019. (Vol. II on Application Case Studies to appear in January 2021)

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European Commission

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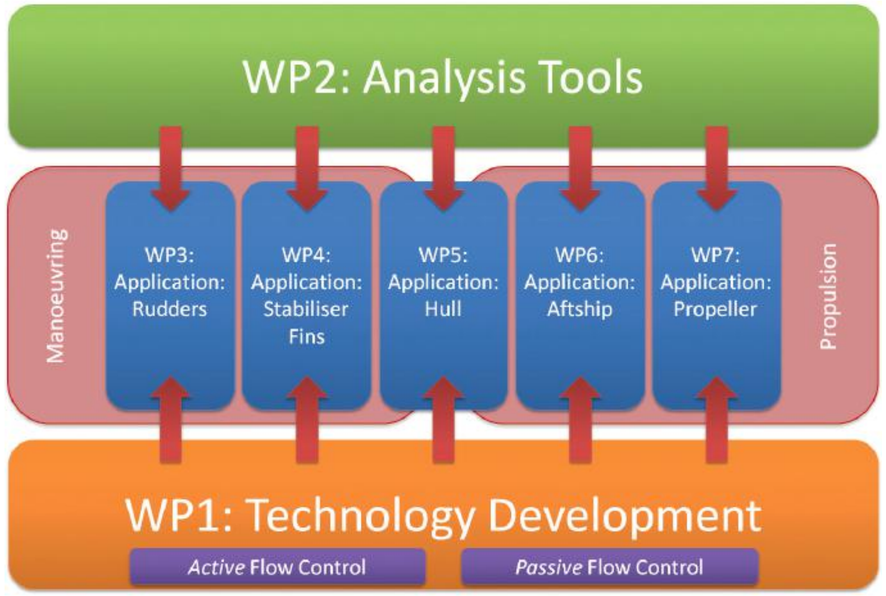

Figure 1: Structure of joint research project SAMSON

SAMSON

Tailor made Flow Control unlocks New Solutions in Ship Design

The quality of the flow around the ship determines to a large extent its dynamic properties such as resistance and manoeuvring characteristics. A targeted, adjustable control of the flow therefore has great potential to improve the hydrodynamic performance of ships, also with regard to emissions and the environmental footprint.

by Florian Kluwe and Jörn Kröger

Methods of flow control – in particular for controlling the boundary layer close to the body – have been used in aerodynamics since the 1930s with the aim of improving e.g. flight characteristics, minimising fuel consumption. To this day, active and passive methods are investigated and used equally. While passive measures are characterised by their robustness, active ones allow a more targeted influence on the flow and can be switched off without loss when not in use. In contrast to aviation, methods for flow control in shipbuilding have so far hardly been used except for the occasional application of vortex generators and in the broadest sense for some propulsion-improving measures.

The SAMSON Project

The joint research project SAMSON, carried out by a consortium consisting of Hamburgische Schiffbau-Versuchsanstalt GmbH (HSVA), IB Fischer CFD+engineering GmbH, Mecklenburger Metallguss GmbH (MMG), the Department of Fluid Mechanics at the University of Rostock (LSM) and Damen Marine Components – Van der Velden Barkemeyer GmbH (VDVB), aims to investigate the potential of active and passive flow control for shipbuilding applications and to demonstrate the effectiveness for a number of application cases. These target manoeuvring as well as seakeeping characteristics and power demand providing new options to reduce emissions and to enhance safety of shipping.

SAMSON addresses the fundamentals of the technology and the associated tools as a basis for the application scenarios in work packages 1 and 2. The effectiveness of the active and passive measures applied is verified in a comprehensive test campaign with in total five application scenarios where flow control is applied to rudders, stabiliser fins, hull, aftbody and propeller.

Adaption to Marine Applications

For ship rudders, propellers and stabiliser fins passive flow control measures are chosen. These are implemented by the use of contoured leading edges of the profile as shown in

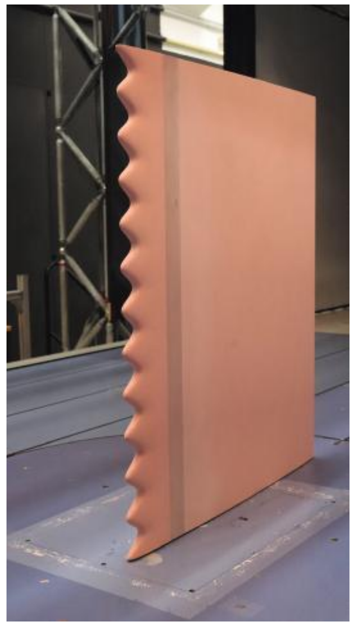

Figure 2: Wing with contoured leading edge to increase the maximum lift angle

Fig. 2 as an example. The contouring of the leading edge in the form of so-called „tuberculae" aims to act as vortex generators at increased angles of attack and to delay the separation of the flow. An improved post-stall behavior of the profile is also achieved. In order to narrow down optimal configurations, series of contoured leading edges with varied parameters are systematically investigated numerically and experimentally.

For flow control at ship hulls and rudders the consortium has opted for an active mechanism. The fluidic oscillators chosen represent a flow-through, oscillating system whose operating point is determined by the supplied volume flow and the internal geometry. The interaction of the oscillator with the flow to be controlled is effected by a jet oscillating in space and time. The advantage of these systems is their high energy efficiency, as the volume flows required to control the flow are small. Since the oscillation of the jet is generated purely by hydrodynamic effects, the result is a very simple and robust design without additional mechanical components.

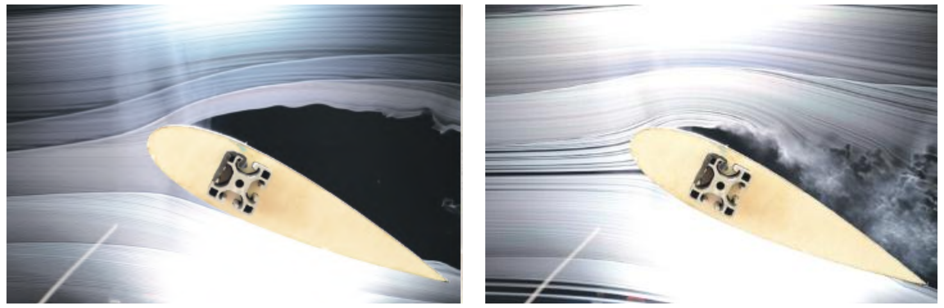

Figure 3: Delay of flow separation by active flow control

Layout and Design by Adjoint Approach

In addition to the layout of the oscillator itself, the optimum positioning of the control devices is crucial to gain a maximum effect on the flow. For this purpose HSVA is extending an adjoint RANS approach (Stück et al., 2011) to identify areas in which the placement of actuators has a significant, positive influence on the respective target value. The adjoint procedure decouples the numerical effort from the number of optimisation parameters. Thus, the method supports the identification of advantageous configurations in the early design phase with high numerical efficiency.

Experimental investigations

The effectiveness of the measures is initially estimated numerically in the development phase. Subsequently, multi-stage experimental studies are carried out in the course of the technology development utilising HSVA's large towing tank and HYKAT facility. In order to gain access to the identification of scale effects, model tests are carried out at different scales.

Flow details are visualised by laser-based PIV (Particle Image Velocimetry) measurements. In order to gain maximum insight the flow field, obtained e.g. from PIV measurements, is decomposed into its main modes by the POD method (Proper Orthogonal Decomposition). The periodic structures identified in this way support a deeper understanding of the effect of the applied control mechanisms and their interaction with the flow. ■

Acknowledgement
The research project SAMSON carried out from 2019 to 2022 is partially funded by German Federal Ministry for Economic Affairs and Energy within the framework program „Maritimes Forschungsprogramm", registration number 03SX496B.

Reference:
Stück A., Rung T., 2011. Adjoint RANS with filtered shape derivatives for hydrodynamic optimisation. Computational Fluids. 47(1):22–32.

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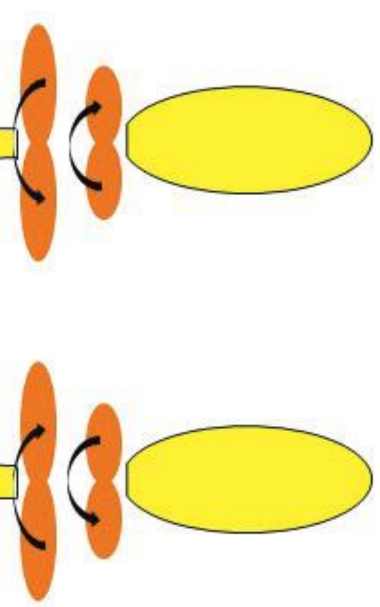
A new propulsion concept for large container vessels

Newest MarTERA founded project twin-crp-pod ULCS to come



twin-crp-pod ULCS is the shortest version for: Application of hybrid CRP-POD propulsors on ultra large twin screw containerships to increase propulsive efficiency, reduce GHG emissions and improve navigational safety.

by Julia Schmale

The reduction of fuel consumption and minimisation of greenhouse gasses emission are vital for shipping industry. All possible ways to achieve environmental targets should be taken into consideration. Conventional propellers typically achieve an efficiency around 70 %. They spend about 40 % of the losses into rotational losses in the wake, vortex generation, noise production, cavitation, etc. The recovery of such losses is one of the major ways to contribute to a more rational, environmentally friendly use of energy. Ultra large container ships on one hand have individually the highest carbon footprint, but on the other hand take advantage of economy of scale and transport huge amounts of goods worldwide. Therefore, this type of ship is a perfect target for taking an action to investigate on energy efficient solutions.

The overall goal of the project is to minimise fuel consumption, improve manoeuvring abilities and increase navigational safety by introducing three high-efficiency innovations to Ultra Large Container Ships (ULCS): twin propeller configuration, pod propulsors and contra rotating propellers concept.

Research on mentioned topics will be carried out by means of sophisticated numerical CFD methods, at a state-of-the-art towing tank fully equipped to investigate such a complex hydrodynamic issue like twin-crp-pod solution. Manoeuvring and ship handling related tests will be carried out with the use of manned models on a natural lake. All technical investigations will be accompanied by life cycle analyses that will be carried out with the most complex tools including assessment of the environmental negative impact on land, sea and air resources.

The consortium consists of a world-leading hydrodynamic institute, a propeller designer, a design office, a ship handling operator, a ship handling training provider and a university. By bringing together a wealth of knowledge on propeller-hull interaction, structural integrity and manufacturing processes the consortium guarantees proper achievement of the project goals. Partners are: Foundation for Safety of Navigation and Environment Protection, Center of Maritime Technologies, Gdańsk University of Technology, Seatech Engineering sp. Z o.o., Otto Piening GmbH and CVBA BRABO.

The project started in September 2020 and will be realised during a three years period. Such a time allows for identification and deep analyses of present situation regarding application of twin propeller and crp-pod solutions to Ultra Large Container Ships. The course of the project is divided into six work packages distributed through 36 months in such a way, that all numerical and especially experimental tests will be carried out in a most appropriate time to allow further investigations on the proposed innovation.

Within the project HSVA will enhance the comparative propulsion testing method in HYKAT (see Newswave issue: 1-2017) to assess unconventional arrangements like the twin-crp-pod or others as well. This will enlarge HSVAs service portfolio. Improvement of hydrodynamic efficiency has been identified at HSVA as a key issue for the future of the shipping industry as it helps to reduce emissions and to save fossil resources at the same time. For the future

the enlarged portfolio allows to measure pod forces as a standard during model tests at high Reynolds Numbers and in the realistic 3D-wake-field in HYKAT at the same time. For small propeller modifications, propeller cap fins, or asymmetric rudders such comparative propulsion tests are state of the art in HYKAT already. When the MarTERA founded project "twin-crp-pod ULCS" is accomplished, they will be on offer for pod propulsion systems or hybrid concepts as well. ■

The project is funded by the German Federal Ministry for Economic Affairs and Energy (reference number 03SX520A).

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Improved Design of Unconventional Propellers

Research Project DEffProForm Awarded Approval

by Tom Lücke

HSVA joins forces for a prospective, national funded research project DEffProForm - Design von effizienten Schiffspropellern mit unkonventioneller Formgebung / Design of efficient ship propellers with unconventional shape – together with several project partners:

Technische Universität Hamburg, Inst. für Fluiddynamik und Schiffstheorie (TUHH)

Universität Rostock, Fakultät für Elektrotechnik und Informatik (URO)

ISA Propulsion GmbH & Co. KG (ISA)

Mecklenburger Metallguss GmbH (MMG)

Friendship Systems AG (FSYS)

Schiffbau-Versuchsanstalt Potsdam GmbH (SVA)

Within DEffProForm the consortium investigates unconventional propellers like tip-fin propellers, see Fig. 1, aiming to reduce the fuel consumption by increasing the efficiency.

HSVA is involved threefold in its core fields of expertise as there are:

- **Design**
- **Computational Fluid Dynamics (CFD)**
- **Experimental Fluid Dynamics in model as well as full scale (EFD)**

When changing the strategy from so called conventional to unconventional and therefore to extreme shaped propellers the complexity of the geometry, design procedure and corresponding flow- and cavitation phenomena is expected to increase. This means to make new experiences and probably face new problems. These topics are the ones to be investigated and to be solved in the planned research project DEffProForm.

It is necessary that the potential of these unconventional propellers will be recognised and predicted correctly. Therefore we plan a further development of the design procedure for such propellers as well as of our numerical tools (QCM and ***FreSCo$^+$***), to gain a similar confidence for the prognosis of these particular shapes as for the conventional ones.

For validation purpose of the designs and the numerical tools, ▶

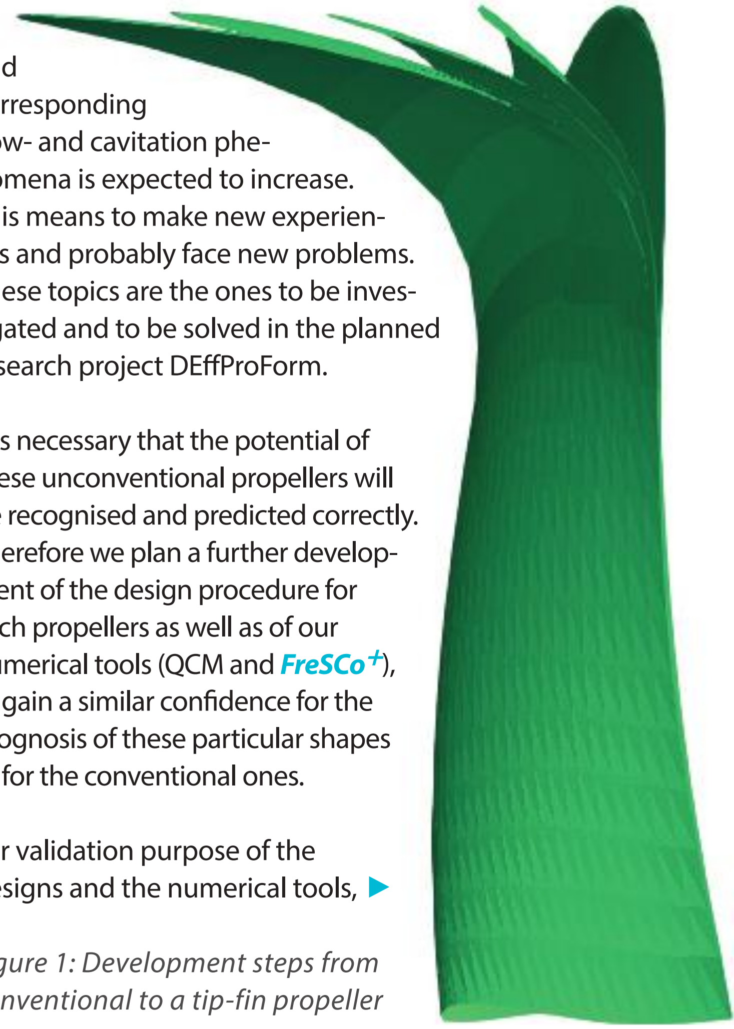

Figure 1: Development steps from conventional to a tip-fin propeller

model tests with the new propeller designs in HSVA's large towing tank, large cavitation tunnel and the HYKAT will be performed. Full scale (trial) observations as well as powering measurements will close the circle towards the ability of evaluating the propeller characteristics in the view of theoretical and experimental results.

HSVA's large Hydrodynamics and Cavitation Tunnel (HYKAT) (Fig. 2) is in charge of cavitation tests with famous full scale correlation, which speaks for the importance of the right wake field, as the environment of the working propeller and simultaneously the right local flow characteristic on the blades due to the high Rn. This allows us to use the HYKAT twofold within this research project. First, the propeller designs will be investigated by cavitation tests regarding the impact on their environment (pressure pulses on the ship hull) and their local impact on the blade itself (possible erosion risk). Second, due to the presence of the ship model, the real three dimensional working environment of the propeller is already available, which makes it possible to investigate Reynolds-Number-sensitivity of unconventional propeller shapes by means of relative propulsion tests as well. The high Rn is attainable in the HYKAT, since the installation of the hull with suppressed free surface allows the tests to be performed far above Froude-scaled speeds. Energy saving devices and unconventional propellers have been investigated in this respect recently under the benefit of this high Rn (Müller, 2017), (Johannsen, 2018), (Lücke, 2019).

The aim of these additional relative propulsion tests will be to find out, if the unconventional propeller designs show a similar dependency from Rn in behind- as well as in open-water-conditions as conventional propellers do.

Further the local flow fields around the propeller blades

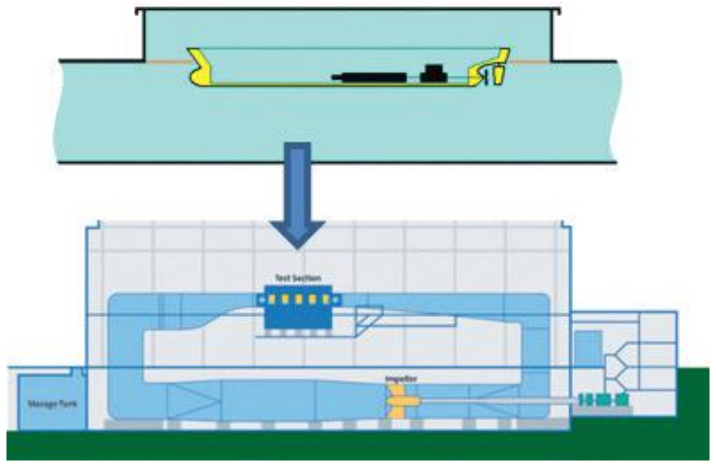

Figure 2: HYKAT with installed ship model

will be visualised by limiting stream lines via EFD/CFD and in the propeller's slip stream by PIV-measurements. The latter will be performed in conjunction with the project partner URO. These visualizations will help us to understand the particular flow phenomena, which stand behind efficiency changes of different designs and the differences between CFD solutions and EFD results. Particularly for this application a transition turbulence model will be implemented into the HSVA in-house RANS solver ***FreSCo⁺***, in order to capture complex flow phenomenon in all scales or Reynolds-Numbers.

As an example the limiting stream lines as well as the distribution of friction-coefficient cf are presented in Fig. 3 for a conventional propeller.

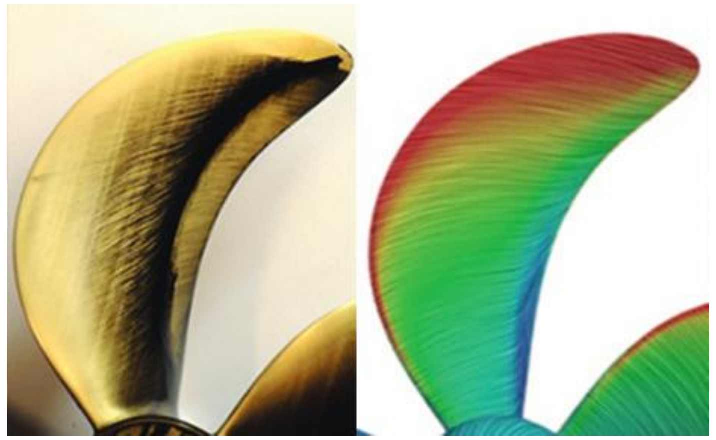

Figure 3: Flow visualisation by EFD/CFD

The exchange of expertise amongst all project partners will lead to a fruitful development community which has been proved already in the last joined national research project HYKOPS. We are looking forward to share some news at this place in the near future. ■

Reference:

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Johannsen, C.: (2018), "Propulsion Testing in the HYKAT Cavitation Tunnel", A Yücel Odabaşi Colloquium Series, Istanbul

Lücke, T. (2019)," Particular Model Propeller Behavior in EFD & CFD", Sixth International Symposium on Marine Propulsors, smp'19, Rome, Italy, May 2019

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Improved prediction of ducted propeller propulsion performance

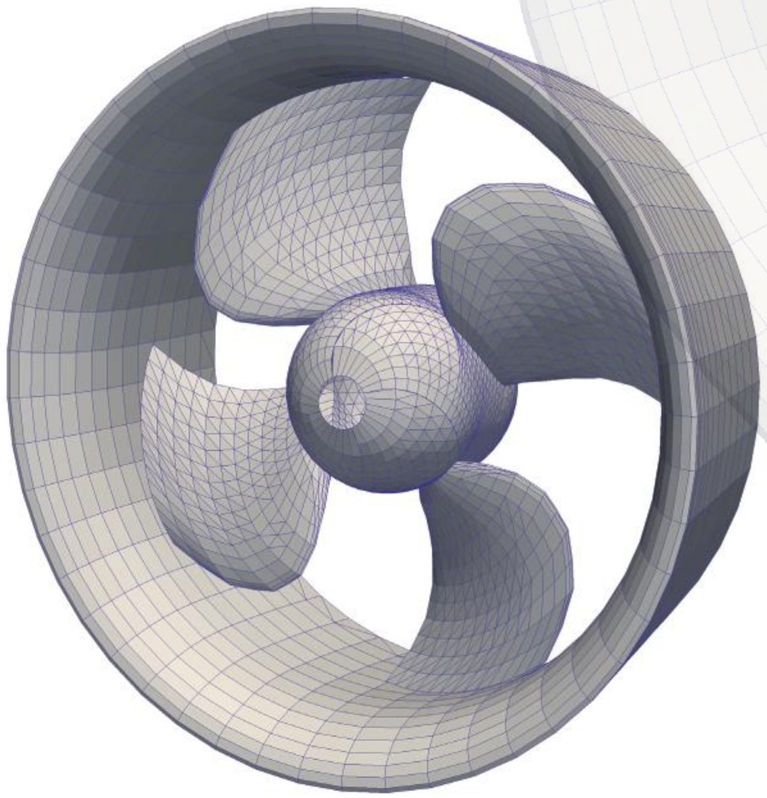

Figure 1: Panel System of Propeller and Duct

Ducted propellers are widely used for vessels with a high demand of thrust at low speeds such as tugs, trawlers, ice breakers or multi-purpose vessels. Furthermore, additional resistance due to heavy seas or ice can be a reason for the application of ducted propellers in order to ensure the ships ability to deliver an appropriate amount of thrust at a given propeller diameter.

by Peter Horn and Thomas Klemme

For estimating the power consumption and the main particulars of the propeller in the early design phase of a ship, the common practice is to estimate the open water characteristics based on propeller standard series. For conventional open propellers data from the well-known and widely used Wageningen B-Propeller Series are utilised. Ducted controllable pitch propellers are challenging as they have more degrees of freedom in the design space: not only diameter, number of blades, area ratio and the pitch, but also duct/propeller diameter ratio, duct length, duct profile and the design pitch of the controllable pitch propeller within the duct can be adjusted and optimised. Standard series providing variations for the full matrix of variables as set out above are not available to date, mainly due to the huge number of variations that would need to be tested.

To overcome this, HSVA has developed a new approach combining experimental results with numerical simulation. The basis are open water characteristics of ducted propeller systems either obtained from open water model-tests or from an available series (e.g. Wageningen D-Series). The next step is to apply HSVA's propeller panel program PPB (Propeller Potential Based [1]). PPB is based on potential flow theory disregarding viscous and rotational effects of the flow. This results in low computational effort enabling quick response time and fast optimisation. The PPB results give a good approximation for displacement driven effects like duct profile or diameter ratio. Also changes in the propeller geometry can be investigated. Several computations to work out the desired gradients of the design ▶

parameter are performed. Combining the measurement data with the results from the simulations, open water characteristics for propeller and duct characteristics not covered by the series or the measurement database can be estimated. This resulting open water curve is used for the further speed power prediction process.

The described process gives much more freedom in choosing and applying a suitable propeller-duct combination with the appropriate pitch setting of the propeller and duct configuration compared to the standard process using propeller series data. In contrast to higher order numerical simulation, e. g. RANS, the panel code simulation

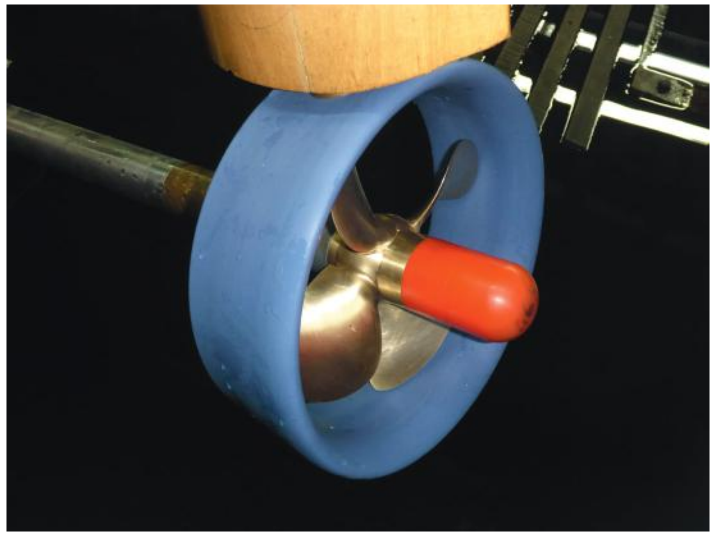

Figure 3: Model test of propeller and duct

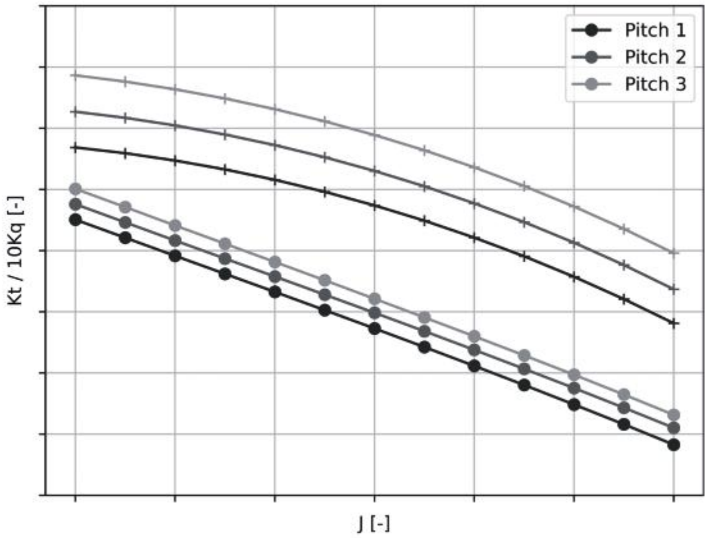

Figure 2: Computed open water characteristics with different pitch settings

takes only several seconds. It is therefore a new valuable brickstone on the way to an improved prediction of ducted propeller performance.

Next step is the investigation of the reliability of higher order numerical flow simulations to calculate open water curves. Combining towing tank results, standard series data, lower and higher order numerical simulation, it is planned to create a ducted propeller series for easy and fast use in the early ship design stage. ■

[1] https://www.hsva.de/our-services/software/prop_panel_code.html

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EEXI and CII on the horizon

IMO pushes for decarbonization of shipping

by Oliver Reinholz

The Intersessional Working Group on Reduction of GHG Emissions from Ships (ISWG-GHG) proposed a set of concrete measures for implementation.
These proposals are currently being evaluated and refined and are expected to be adopted by the Marine Environment Protection Committee in its 76th session (MEPC 76) in June 2021.

Coming into force in January 2023, two new measures will significantly affect the existing and operating fleet: the new Energy Efficiency Existing Ship Index (EEXI) and the new carbon intensity indicator (CII) as part of the ship's Energy Efficiency Management Plan (SEEMP).

The approach on existing ships is twofold: to address technical (how the ship is retrofitted and equipped) and operational measures (how the ship operates) in order to reduce carbon emissions.

HSVA is currently assessing the impact of these new measures and is working on recommended hydrodynamic approaches and solutions for all relevant vessel types and sizes. We are preparing for assistance to ship owners and operators aiming at finding optimum tailor-made strategies for implementation.

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CFD: Propulsion Simulation

On the path to daily industrial use

CFD calculations based on RANS equations have become more and more common in recent years for the prediction of resistance and for the optimisation of ship hulls. The consideration of the propeller in these calculations significantly increases the complexity of the simulation, but the additional information derived from these results is well worth the effort.

by Peter Horn, Jörg Brunswig and Tom Lücke

Nowadays, even complex propulsion systems like multiple propulsors, ducted propellers, podded drives, the combination of propeller and pre-swirl stators can be assessed by CFD. Although there may still be differences between numerical and experimental results due to the simplification of mathematical models and due to discretisation errors in time and space, the results can be used for certain applications to derive profound conclusions from the engineers' point of view.

In this article, three different approaches of RANS propulsion calculations are presented with their specific advantages and disadvantages.

At HSVA, we perform RANS calculations using ***FreSCo^{+}***, a successful software project developed in cooperation with Hamburg University of Technology. The growing demand for computing resources is met by our in-house high performance computing (HPC) facility. For model scale simulations, the skin friction correction to simulate the self-propulsion point is inherently implemented in the propulsion models. Full scale results are derived either directly by full scale simulations or based on the well proven HSVA standard correlation method for model tests. For our validation studies we benefit from our extensive database of model test results of the last decades.

Actuator Disk Model

With this approach, the propeller effects are modeled in the RANS flow field within a cylinder at the position of a propulsor, see Fig. 1. Axial, tangential and radial velocities are induced into the flow field based on a given dataset of open water propeller characteristics. The most important benefit of this method is that the flow around the ship hull is simulated more realistically than by a simple resistance calculation, providing additional insight during the hull form optimisation process. The propeller geometry is not resolved in the CFD model, but its effects are averaged in space and time. The method is accurate enough to determine an estimation of the thrust deduction coefficient, which makes it a valuable tool for the designer. It is not a precise prediction tool for other propeller hull interaction coefficients or even the final power consumption. We rather use this method to investigate the flow in the way of the propeller slip stream: which modifications in the hull lines can be made to improve the propeller flow. The approach is quite efficient using barely any additional calculation time. The interaction of multiple propulsors can be investigated or the behavior of a propeller slip stream in seaway. It is most suited for the very early design stage of the hull form development as no detailed propeller information is required as input. ▶

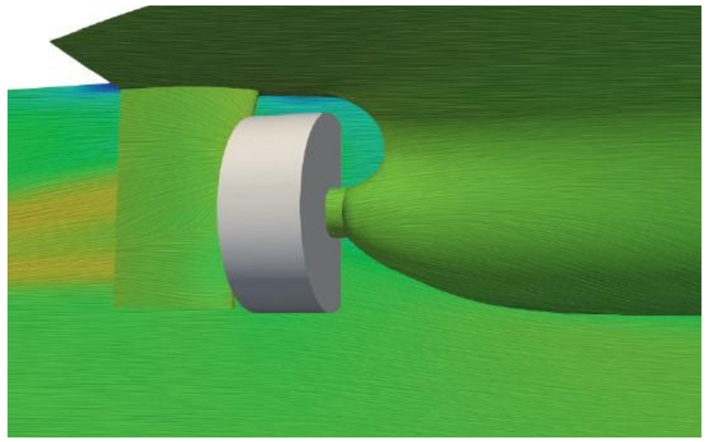


Figure 1: View onto the stern of NAWIGATOR XXI and the cylinder (grey) containing the actuator disk

RANS-BEM coupling

This approach is based on the bi-directional coupling of a boundary element method (BEM) with our RANSE solver ***FreSCo+***, see Fig.2. The BEM consists of a vortex lattice method (HSVA's in-house code QCM, Quasi Continuous Method) and a friction correction algorithm, both parts

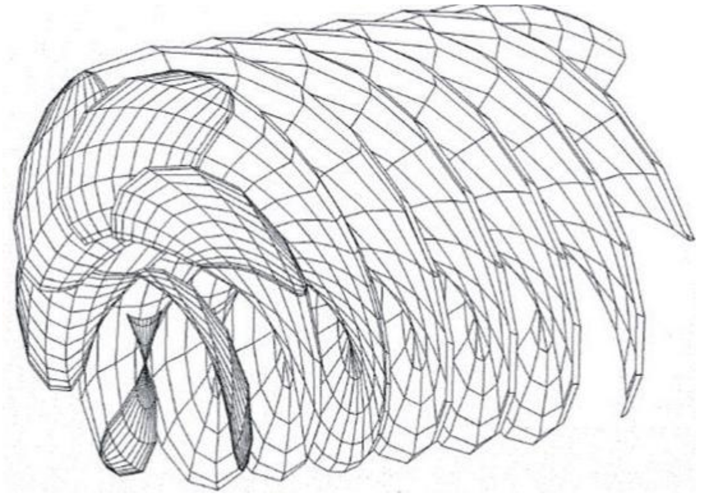


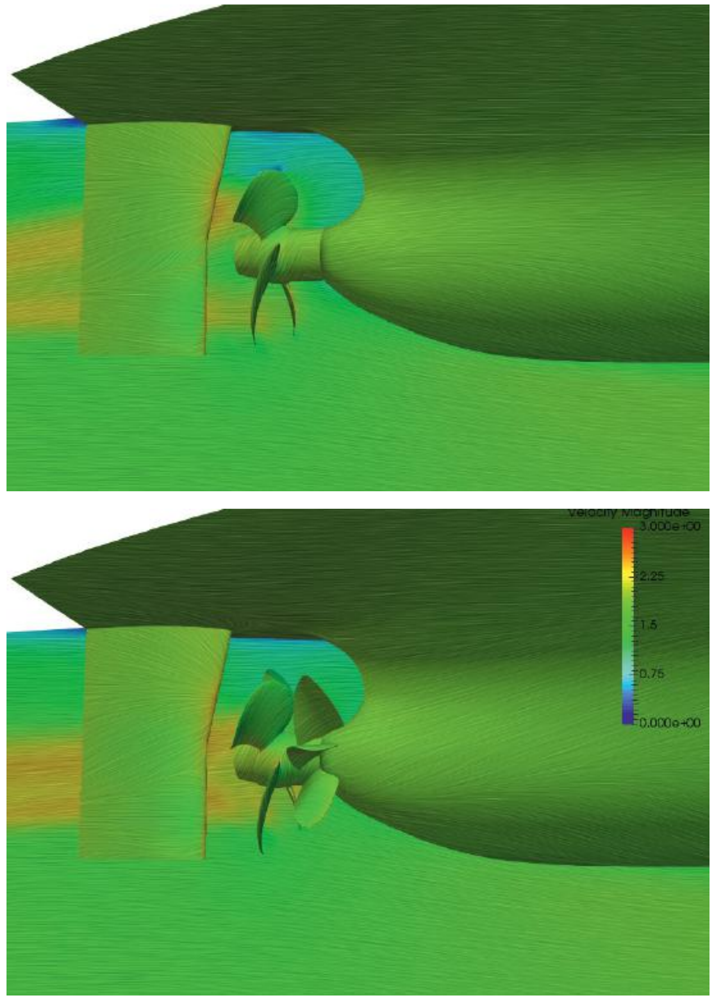
Figure 2: Lattice representation of the propeller and its slip stream

working on the resolved propeller geometry. In each coupling step, the propeller model receives the velocity field (wake) from the RANS solver. It determines the self-propulsion point and transfers the propeller-induced flow back to the RANS solver. The wake field is resolved in space and averaged in time. The method yields all relevant propulsive data including effective wake fraction, revolutions, thrust, torque, propulsive efficiency and delivered power.

QCM, like ***FreSCo+***, is fully parallelised and therefore quite efficient on resources, especially when compared with the RANS-RANS approach described in the following section.

RANS-RANS coupling

The most sophisticated method by far is to fully resolve the propeller-geometry in the finite volume calculation, see Figs. 3, 4. This approach delivers a completely time-resolved solution providing the deepest insight into the details of the propeller. The relative motion between propeller and hull is realised using the sliding interface technique. Due to the large number of additional control volumes required to resolve the propeller geometry, the computational effort is quite high. Therefore, the focus for this method is the design of the propulsor itself and the comparison



Figures 3, 4: View of the stern of NAWIGATOR XXI w/o and with PSS and the resolved propeller via sliding grid technique

of different propeller geometries behind the ship. Often, complex propulsion arrangements are analysed, for example a propeller working behind a pre-swirl stator, see Fig. 4.

Outlook

The numerical approaches described in this article provide a versatile set of tools to successfully assess hydrodynamic problems related to ship propulsion at levels of detail best suited for the application. Our focus is to further improve the reliability of propulsion results derived from numerical CFD and to constantly validate the results with our database. ■

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Load-variation propulsion tests

use of linear drive technology for active damping of force oscillations

Substantial improvements to HSVA's experimental setup for load variation tests were achieved by applying modern linear drive technology to the coupling between ship model and towing carriage.

by Malte Rejzek

Forced mechanical oscillations at the coupling point can now be reliably damped. These oscillations are mainly caused by the interaction of the large model mass in combination with minimal deviations in the speed of the towing carriage. This setup significantly reduces the measurements uncertainty in the force signals and widely isolates the vibrations of the towing carriage from the ship models. The system is a result of an internal development effort at HSVA and several student thesis.

Starting from simple spring or damper elements in the connection point showed some early success. These elements though, must be adjusted to the ship model parameters and the test speed, otherwise the relative position between the towing vehicle and the model is not maintained. The effort for manual tuning is not acceptable and naturally led to an automated system. The active damping system was developed from these test results and uses modern control technology to simulate a combination of spring and damper elements. It is able to adjust automatically to the parameters of the ship model and the settings of the towing carriage. Additionally to the static test properties, automatic calibration is applied during the first phase of each test run.

The main component of the system is a linear, permanently excited drive, through which the pull force is applied on the ship model by using a coupling rod and corresponding force sensors. In combination with its servo converter and a PLC control system, the drive can be operated either force-controlled or position-controlled.

Figure 1 shows the schematic set-up of the system. The PLC of the damping system is connected to the towing carriage, as well as integrated into the operator interfaces. This provides the damping system with current values and allows the operation to be fully automated.

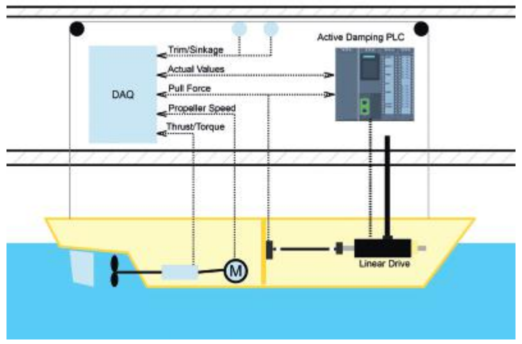

Figure 1: Principle design of the active damping system

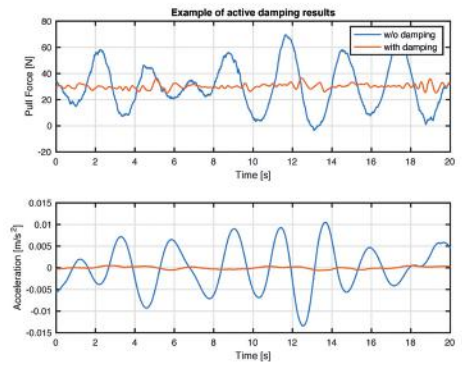

Figure 2: Effect of active damping on the signal characteristics

The test results show a reduction of the force oscillations by up to 80 %, which substantially simplifies the evaluation of the test runs. Especially slow steaming ships with high displacement have caused additional work in the evaluation so far. The higher signal quality simplifies this process. Repetition of the test runs is much less frequent. Figure 2 shows an exemplary test result compared to a test without damping system. Both force oscillations and accelerations in the ship model are significantly reduced. The automated mode of operation eliminates the need for manual propeller control to find the self-propulsion point and increases the reproducibility of the measurement results. The system can approximate the propeller speed associated to a certain coupling force iteratively in the adjustment phase of the test run.

In addition to the hardware development, the implementation of modern evaluation methods is an important part of the continuous improvement process at HSVA. The active damping system delivers a decisive part of this development in order to meet ever-growing demands of our customers. ■

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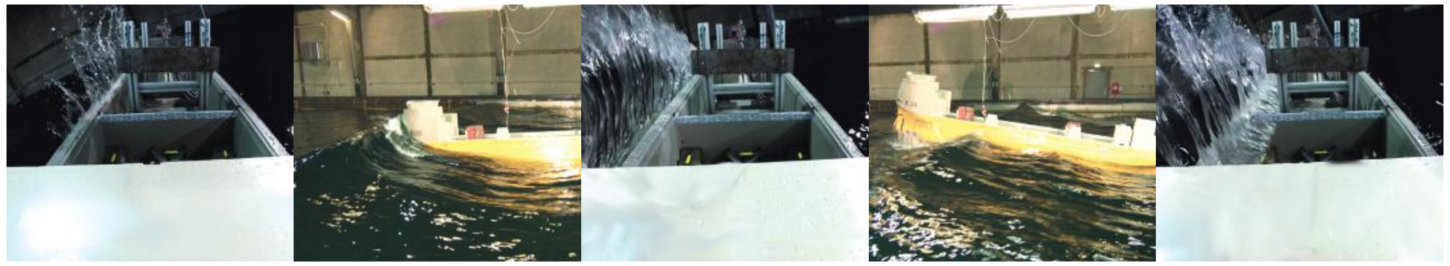


Multi-purpose, multi challenges – multiple solutions

HSVA's design support for superior multi-purpose vessels

With the goal of enhancing vessel designs by achieving less energy demand, less environmental footprint, improved safety and increased flexibility HSVA acts as consultant for the shipping industry. The hydrodynamic optimisation of multi-purpose vessels in particular has been a special field of activity in the recent time at HSVA.

by Johannes Strobel and Peter Horn

Multi-purpose vessels

Multi-purpose vessels carry a wide range of cargo types with broad variety in size and weight. One vessel may be able to carry diverse goods, sometimes even at one voyage. Spacious cargo holds with flexible hatch covers facilitate the transportation of bulky goods such as wind turbines, rotor blades or towering cargo cranes.

SPLIETHOFF GROUP

Spliethoff Group is one of the largest shipping companies in the Netherlands. With almost a century of maritime expertise behind it, the Group has a broad portfolio of specialised services in sectors including dry cargo, breakbulk & project cargo (Spliethoff), project & heavy lifts (BigLift Shipping), container & RoRo cargo (Transfennica), shortsea (Wijnne Barends), yacht transport (Sevenstar Yacht Transport and DYT) and tonnage provider (Bore). For more information, please go to www.spliethoffgroup.com.

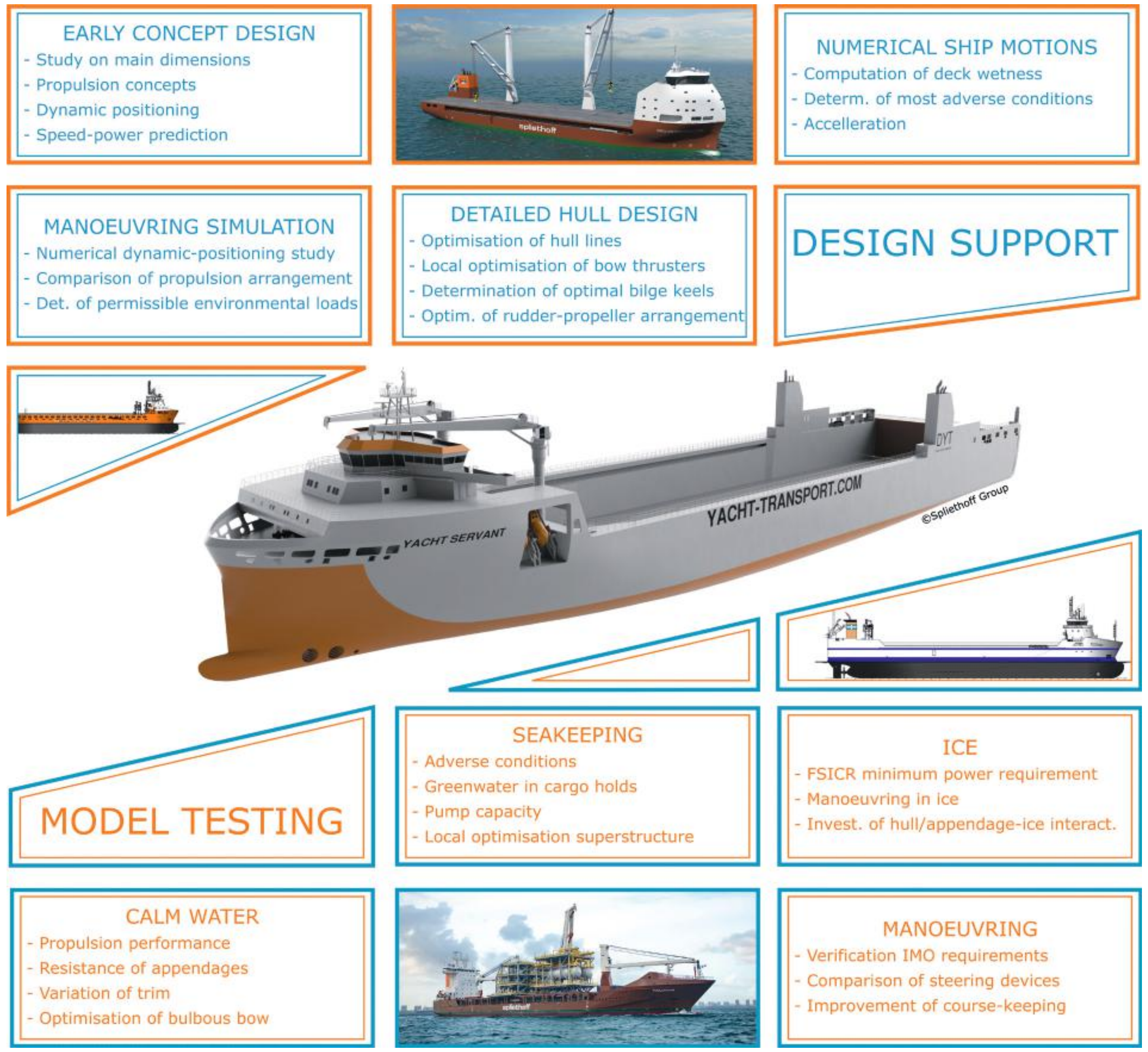
Due to the possibility of operating the vessel without any hatch covers on the cargo holds, the authorities require extensive verification according to the IMO guidelines MSC/Circ. 608 to prove that no danger of loss of stability occurs by flooding the holds in heavy weather conditions. As this criterion is a determining factor for the range of operation of the vessel, extensive work is done on a clever design of the super structures which may impede the water ingress into the holds. The goal is to maximise the allowable draught for open-top operation which certainly maximises the flexibility of the vessel for transport solutions.

Besides the excellent seakeeping behavior a well-balanced manoeuvring system is crucial in order to be capable to turn and move at close quarters. But not only harbor manoeuvring is a determining scenario.

The operational performance in calm water and occasionally in brash ice is a crucial factor for a successful and competitive hull design. Plenty of hull appendages such as prominent transversal thrusters, bilge keels, ice knifes and propulsion devices require a detailed design in order to minimise hydrodynamic drag and maximize functionality.

HSVA's solutions

In order to meet the above mentioned complex demands of multi-purpose vessels HSVA supports a comprehensive and interdisciplinary approach from the very early concept design to the final model tests.



Selected services in the context of the design phase and the model test phase are shown in the enclosed graphic.

Recent cooperation

In the past years HSVA has been contracted several times by Spliethoff Group, one of the largest shipping companies in the Netherlands operating a reasonable number of multi-purpose vessels, module carriers, coaster vessels, RoRo vessels, semi-submersible vessels and heavy-lift vessels, in order to support the fleet renewal program for Spliethoff's versatile vessels. The cooperation comprised several new buildings as well as retrofitting projects. The support ranged from the very early design phase (concept study of different propulsion and aft ship arrangements for the semi-submersible Y-Type vessel) via comprehensive hull form optimisations (B-Type, Y-Type) to thorough calm water, manoeuvring and seakeeping model test series. Significant power savings could be found during the optimisation of hull form and hull details such as the bow thruster tunnels of the new B-Type ship designs. For the P-Type vessels, the allowable draught for open-top operation could be maximised during the seakeeping test session by physically optimising the superstructure on-site. Further a dynamic positioning capability study was carried out for a conceptual design, supporting to the development of the propulsion concept and the related general layout of propulsors.

Spliethoff's approach of putting major attention to all hydrodynamic aspects in a very early stage of the design process finally results in superior ship designs. HSVA appreciates this approach and is happy to support Spliethoff with various kinds of services. We are looking forward to continuing the successful cooperation as the complexity of Spliethoff Group's versatile fleet provides perfect utilisation for HSVA's wide and interdisciplinary experience and expertise in ship hydrodynamics. ■

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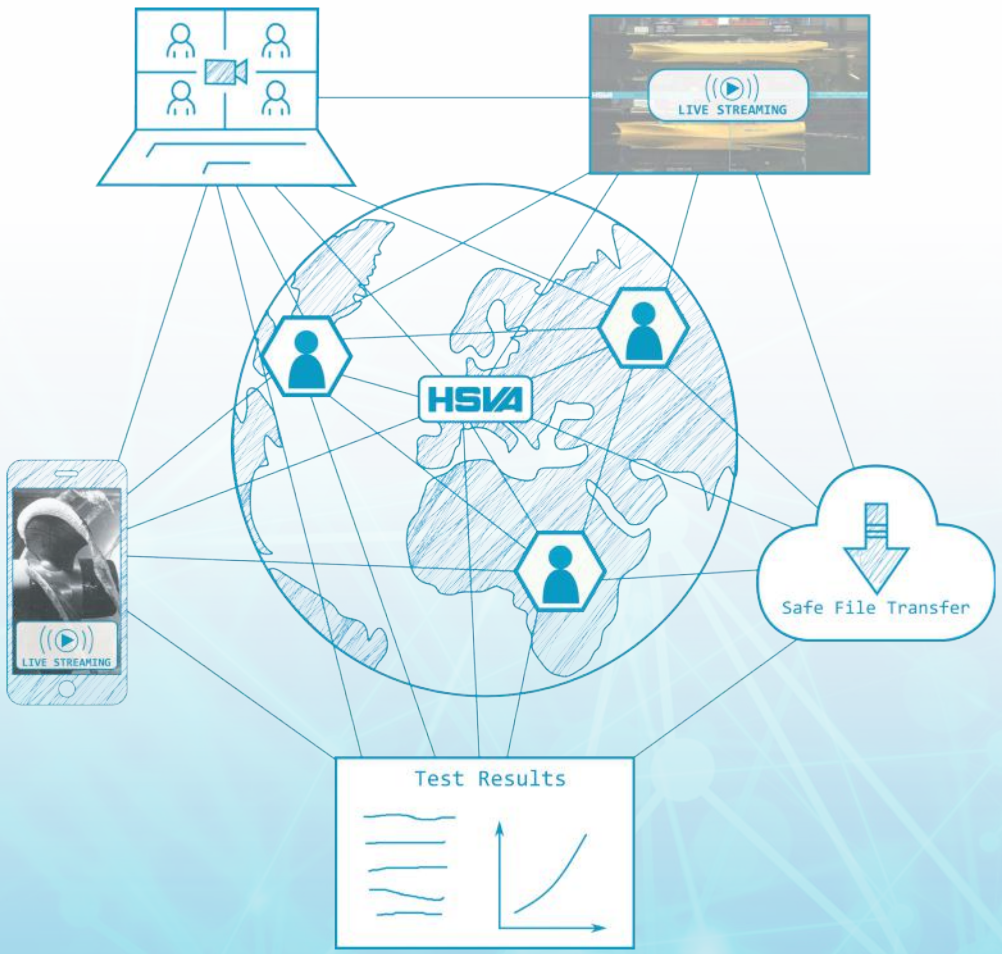

Connecting people – Saving resources!

Model Test Attendance in Times of COVID-19

by Johannes Strobel and Sören Brüns

Since model testing exists it has ever been common practice for shipyards as well as shipowners to witness testing of their ships in person on HSVA's premises. While all customers are still welcome at HSVA, the discussion on the environmental footprint of excessive business travelling, the pressure for reducing costs in the maritime industry and last but not least the recent restrictions due to the COVID-19 pandemic have put focus on alternatives – made possible by modern communication technologies. Already before COVID-19 has dominated our daily news, HSVA has taken measures to provide remote witnessing of experiments and established a comprehensive bunch of communication tools. HSVA operates an own server for video meetings based on the open-source technology Jitsi Meet assuring highest standards of privacy and data security (https://conference.hsva.net). Manifold live streams may broadcast visual impressions, live data of measurements may be shown in tables and diagrams and intermediate virtual meetings are connecting all people who are involved in the project. Easy file transfer of high resolution video recordings, photographs and reports is enabled by using HSVA's private safe file transfer protocol server.

Everyone is welcome at HSVA! However, HSVA makes contribution to saving resources by offering a remote attendance. True to the slogan "Driving excellence for the maritime future" HSVA is glad to connect people, extend coverage and intensify customer relationships. ■

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Additive Manufacturing at HSVA

From HSVA's model manufacturing workshop, our customers expect excellent quality and a high level of detail at competitive costs, even for complex geometries. Additive manufacturing, also known under the term 3D-printing, can be an efficient alternative to labor-intensive classic production methods based on wood, metal or composite materials.

Figure 1: HSVA's MJM printer

by Axel Schult and Jörg Brunswig

HSVA invested in 3D-printing technology about ten years ago. The first machine, a resin Multi Jet Modeling (MJM) printer is still in service and delivers excellent accuracy (better than 100 micron) and surface finish for part sizes up to 320 x 320 x 200 mm, although at a quite substantial price point regarding the consumable material, see Figures 1 and 2. Fortunately, in course of the rapid development of additive manufacturing in the recent years a more cost-effective solution has come up. Supported by the demand of a rapidly growing do-it-yourself community (sometimes called the maker movement), building things at home that used to be reserved to industrial production facilities before, affordable additive manufacturing devices have become available. Today everybody has at least a rough idea on how a 3D-printer looks like. These machines mostly use the fused deposition modeling (FDM) process. Printers are available in a wide range of sizes and price nowadays and HSVA now has two devices in service. Both are industry grade printers, but focus on different requirements. One offers a quite large print volume of 700 x 700 x 900 mm, the other device – shown in Figure 3 – has a smaller build volume but a higher accuracy and better surface finish. Both printers process PLA, ABS and other materials, although we mostly use PLA. These materials cost about 10 % of MJM material cost. The additive manufacturing technology allows creating extremely detailed parts with minimal manual effort. At HSVA, we use the method to manufacture appendages like rudders, fins and headboxes, pod unit housings as well as model superstructures used in seakeeping campaigns. Figure 4 shows a variety of parts created with different devices. 3D-printing allows us to precisely adapt the model parts to the individual requirements regarding accuracy, surface finish, structural strength etc. If the surface quality is important, the parts can be sanded or resin-coated. For the FDM printers, the shell thickness as well as the amount of infill structures can be increased to improve the structural strength of the model part. Figure 5 gives an indication of the surface quality created by our largest FDM printer.

The process starts with creating a CAD model, ideally considering the special requirements for 3D-printing. For example, overhangs of a certain size must be supported by break-away structures, which can deteriorate the achievable surface finish, so quite often, clever CAD design can facilitate the following steps and improve the quality of the product. The next step is the preparation of the CAD model for 3D-printing, called the slicing process. A specialised software tool cuts the model into horizontal layers, calculates the best path for the printing head and writes a file with motion commands to be interpreted by the printer, see Figure 6. The printing process itself may take from a couple of hours to a few days, but the machines run fully automated, except for refilling material if necessary. Finally, the surface of the part can be sanded or resin coated (if necessary).

Here at HSVA, we will keep an eye on future developments of this great technology, so that we can always deliver the best possible quality at the most competitive prices for our customers. ■

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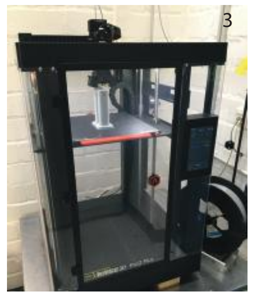


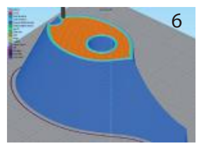

Figure 2: Pod housing printed by MJM machine
Figure 3: HSVA's medium-size FDM printer
Figure 4: Variety of typical printed parts
Figure 5: Surface finish of HSVA's large FDM printer
Figure 6: Screenshot of slicing software

Dr. Jörn Kröger

joined the department for Resistance & Propulsion in December 2019 as Senior Scientific Consultant and Senior Project Manager. With his background in ship design, fluid dynamics and numerical methods, he focuses on the coordination of research projects and complex ship design projects. Jörn received his Diploma in Naval Architecture at Hamburg University of Technology (TUHH) in 2009. At the Institute for Fluid Dynamics and Ship Theory of TUHH he received his PhD in the field of simulation-driven design and optimisation. After working for Blohm & Voss, he joined Pella Sietas Shipyard as project manager in ship design and later held the position of Head of Design and Development. Grown up in Hamburg, Jörn enjoys to spend his holidays sailing the North and Baltic Sea.

in brief

HSVA Completes ISO 9001 Certification

Delivering best quality to our clients has always been one primary goal of HSVA's activities and guides our team's daily work. Sustaining excellence requires proficient procedures, planning and control as well as a self-motivated team aiming at constant improvement.

by Florian Kluwe

Consequently, ensuring a high quality service with associated first-class results, HSVA has been working with an internal quality management system for many years.

Increasing quality awareness and requirements for formal documentation of quality procedures throughout the industry as well as increasing pace of innovation have driven the HSVA's decision to invest into further enhancing its quality practices in compliance with ISO's management systems standards.

Since 2018 a newly created implementation team has established a completely restructured quality management system, including the harmonisation of quality practices throughout the company. Furthermore several internal digitalisation projects where part of this initiative increasing the efficiency and effectiveness of corporate communications and availability of information. Formal recognition of our new QM-system has been gained by the certification according to ISO 9001:2015. For this purpose, HSVA has partnered with Lloyd's Register.

Further, HSVA would like to thank MARSIG GmbH, Rostock, for supporting this project with professional advisory.

We believe that becoming ISO 9001 certified reinforces and demonstrates our commitment to continually improving and providing high quality services to all of our clients.

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