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Cover picture: Expedition cruise vessels built by West Sea shipyard and designed with CADMATIC.

Digital transformation is gaining pace

Digital transformation has been a buzzword topic for some years in the Marine Industry. Now, the industry is moving with greater pace from talk to action. We are seeing the beginnings of a digital revolution that is transforming current business models and creating new ones.

At CADMATIC, we are aware of the shift by shipyards towards embracing the vast opportunities that advanced digitalization can bring in the shipbuilding life cycle. We are supporting these transformation goals with our own roadmaps and solutions for optimized ship design and shipbuilding. We provide dedicated and user-friendly solutions that enable any shipbuilding organisation to take the first steps towards data-driven shipbuilding.

Contrary to some perceptions, digital transformation is not something reserved only for large and high-profile organizations. Medium-sized and smaller shipyards are also digitally transforming to increase efficiency and profitability. They understand that they stand to benefit by accelerating time-to-market, driving down costs, shortening lead-times, and improving quality in design, manufacturing, and the supply chain.

Data-driven shipbuilding and solutions that support digital transformation

CADMATIC's concept of data-driven shipbuilding is based on our vision of a transformed shipbuilding industry – one that is driven by data. We focus on data quality, consistency, and interconnectivity, as well as on minimizing or eliminating manual data handling. In data-driven shipbuilding, digital data streams are consistent, reliable, and reusable across disciplines, project phases, and ship series.

CADMATIC eShare is our cornerstone solution to support data-driven shipbuilding and drive digital transformation. It is an innovative and easy-to-use platform for the creation and utilization of digital twins. With eShare, shipyards can link, visualize, and share ship design, engineering, planning, production, inspection, and operation information in a web-based platform.

This powerful tool helps shipyards make faster and more accurate decisions. It acts as the single source of truth throughout the shipbuilding life cycle for all project-related information. See article on page 32 about the role of CAD/CAM in data-driven shipbuilding.

CADMATIC Floorganise is another tool that can improve operational efficiency at shipyards by bridging the information flow gap between engineering and design, planning, and production execution. See article on page 14.

We are excited about the digital transformation we are witnessing in the Marine Industry and look forward to working with our customers to ensure they can take full advantage of the immense opportunities it brings.

In addition to the above, this edition of our magazine contains four customer success stories that highlight how shipyards and design companies have improved quality and efficiency with CADMATIC software. We also have a feature on our activities in South Korea and put the spotlight on our successful cooperation with Dalian Maritime University in China.

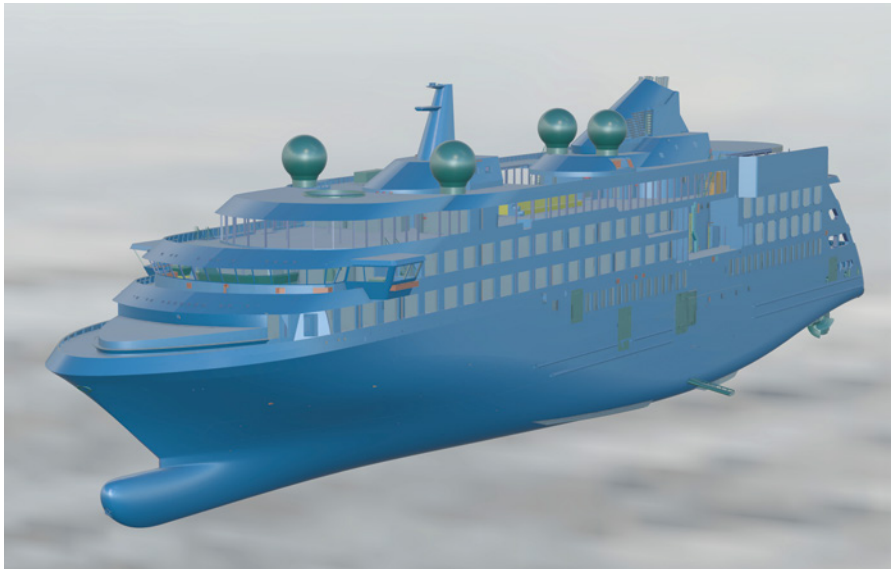
I hope that you will enjoy reading our latest magazine and welcome your feedback.

Geert Tepper
Vice President, Marine Industry

West Sea building exciting series of expedition cruise vessels

All hull and outfitting detail design with CADMATIC

West Sea shipyard, located in Viana do Castelo in the north of Portugal, has used CADMATIC software since 2014. The shipyard is currently building an exciting series of expedition cruise vessels. CADMATIC has been used for all the detail design of the striking ships by the yard and its subcontractors.



With a total area of 250,000 m^2, West Sea is one of the most important industrial areas in Portugal. It has all the facilities required to do shipbuilding, conversions, and ship repair of any vessel up to 37,000 tons, 190-meters long, and 29-meters wide.

West Sea was created by the Martifer Group in 2013 with an infrastructure concession from the former ENVC state-owned shipyard, which started using CADMATIC as far back as 1996. The yard is strategically located in the Atlantic Ocean close to several important international ports and at the center point of several international shipping routes.

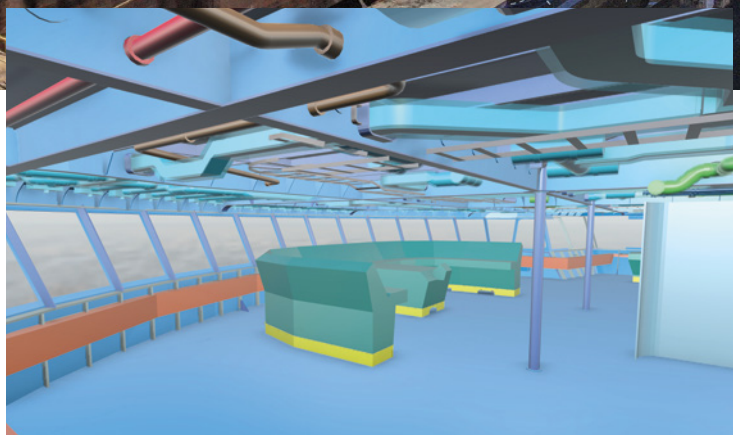
CADMATIC is used by the shipyard for hull and outfitting design as well as posterior production information retrieval. The outfitting design areas include piping, HVAC, cable trays, interiors, and steel outfitting.

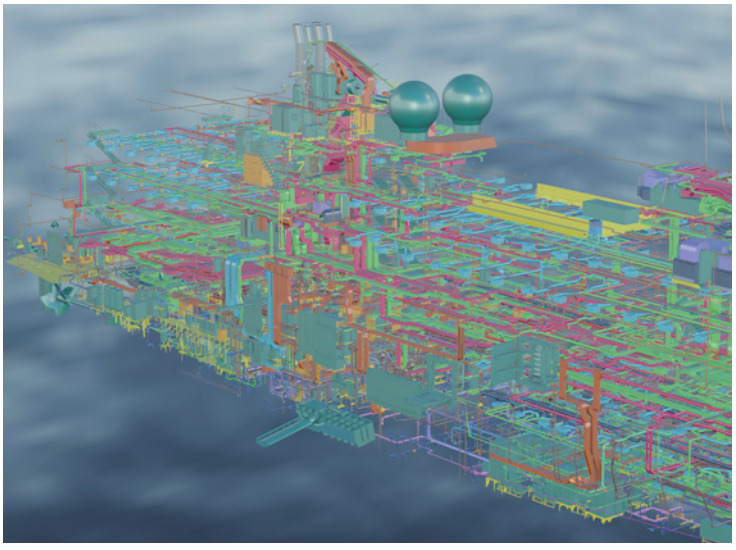
Depending on the workload at the yard, West Sea commonly subcontracts the bulk of modeling work for all design disciplines, while it focuses on production information and the interface with the shipyard's production department. The design of all the required corrections, design variations and changes in sister ship series is, however, done in-house by the shipyard's own personnel.

Eye-catching expedition cruise vessels

The first of a series of striking expedition cruise vessels was completed by West Sea in 2019. The vessel operates worldwide but has a specific arctic operation profile and capacity for 200 pax and 111 crew. The second vessel in the series was delivered in October 2020, while the third is set for delivery in June 2021.

According to West Sea Technical Manager André Queiróz, there are two more vessels in the series under construction, with a second delivery planned for later in 2021, and a another in 2022. One more vessel is included in the contract





"CADMATIC has a good level of coordination between hull, equipment, the fittings library, and the ship model. This is also valid for the control of production information retrieval and updates."

with an additional option for one more. The ships are intended for different markets and have significant differences in some systems, their interiors, and equipment.

Detail design of vessels done with CADMATIC

CADMATIC has been used for all the detail design of the vessels, including all work done by subcontractors. CADMATIC has also been used to share the model with subcontractors for coordination purposes and with the relevant approval authorities and the owner.

In addition to the expedition cruise vessels, West Sea has used CADMATIC for the detail design of two offshore patrol vessels (OPV) for the Portuguese Navy and several river cruise vessels.

Coordination between hull, equipment, fittings library, and ship model

When asked what the most efficient aspects of CADMATIC are, André first points to the very good level of coordination between hull, equipment, fittings library, and the ship model, which he says is also valid for the control of production information retrieval and updates.

He also highlights some other software functionalities and features that are appreciated by West Sea.

"For hull design, the possibility to produce approval documentation from the model is essential. Some specific tools are also good for designers, like the HVAC module and space reservation for equipment maintenance areas. It is naturally also important that the library can be efficiently linked with the yard's standards. Last but not least, it is crucial that we can use CADMATIC to work with different subcontractors in different offices to keep the ship model coordinated and updated for all," says André.

WestSEA
VIANA SHIPYARD

Introducing Henk Kramer:

CADMATIC Senior Sales Manager

Who is Henk Kramer?
I am an avid runner and cyclist. When I was younger, I participated in sport a lot, from which I took a break during my student years to enjoy student life. When I picked up running again after my studies, it turned out I was still quite handy, with a personal best of 31 min. 20 sec. for the 10k and 2 hours 33 min for the marathon. Injuries eventually forced me to give up competitive running, but I then turned to cycling which has become my greatest hobby. Lately, even this has taken a back seat with the arrival of my first child, a baby girl born in September last year. Fatherhood has brought new focus areas.

How and when did you end up at CADMATIC?
I did my graduation project through CADMATIC while starting as a junior sales and marketing officer. That worked out well, so I have stayed on.

What is your current position and what are your most important tasks?
My current role is Senior Sales Manager for Information Management and Planning products. This is a new role since the beginning of this year that allows me to really focus on Information Management (IM) products and the new addition to our product portfolio – Production Planning.

What are the most challenging aspects of your work?
Keeping up with the rapidly changing needs of customers and the vast differences in ways of working. This requires both good process-analytical skills and technical knowledge to consult, rather than just sell a product.

What do you like most about your work?
The fact that it challenges me, and that no day is the same. My colleagues and customers are from different countries and cultures. This combines to make every day unique and interesting.

You recently signed a significant contract with Seaspan from Canada. Why is it important and how do you see the cooperation with them developing?
It is significant on several fronts. Firstly, because CADMATIC was selected after very thorough testing and comparison, and benchmarking with all our competitors. For Seaspan, the priorities were clear: They wanted to have a future-proof and production-ready solution without any surprises, as they have a government project spanning 12 years ahead of them. That we were chosen speaks volumes, we are definitely able to support such a shipyard in such a difficult and complex project. In this project, it is also unique that we have teamed up with our mother company Elomatic. They are consulting with and advising the yard on how to improve efficiency. This partnership has worked out well for all three parties.

What do you see as the greatest digitalization and digital transformation trends in the Marine Industry from your perspective?
Although many people have been talking about *"Digital Twins"* for years now, it is really becoming a reality now. We see more and more yards that want to integrate cross-department information streams. Using the 3D model as the central point for a digital twin has become realistic too. With CADMATIC, we are aiming at this trend with our Information Management portfolio, and we are trying to keep up or even stay ahead of these shifts in the industry. This means, for example, that AR and VR are by default included in our design and IM products. AI projects are under investigation and we continuously research UX. At the same time, we strive to keep everything as lightweight as possible to allow the globally distributed sharing of information from central hubs (cloud) with remote locations.

What stands out for you personally in CADMATIC's data-driven shipbuilding concept?
The fact that with IM we have created the missing link in the production chain. We have developed a product that really enables customers to leapfrog in efficiency from a one-way stream of information from office to shop floor, to a central, real-time, visual two-way communication tool. We have managed to lower boundaries between departments and make information available in a fast, visual and easy-to-manage way, even though the need for information is vastly different for each user group.

Co-creation with Groot Ship Design

Groot Ship Design believes in co-creation and achieving success together with customers. The design and engineering company from Leek in the Netherlands is well known for its Groot Cross-Bow® design and a hands-on approach to its naval architecture and engineering solutions. Groot Ship Design implemented CADMATIC in 2005 and uses the software for hull, piping, and outfitting engineering.

> *"The beauty of CADMATIC software is that you can work the way you want. There is no strict working order that works best."*

When Groot Ship Design was founded in 2005, CADMATIC was selected for modeling and engineering after 3D hull software candidates were evaluated. The first CADMATIC project was executed in 2007.

According to Jan Willem Cuperus, Managing Director at Groot Ship Design, they chose CADMATIC due to its user-friendliness, the availability of engineers familiar with the software, and the fact that their customers and potential customers were already using CADMATIC.

CADMATIC use was expanded from hull engineering to include piping and outfitting in 2010/2011.

"For customers in our area, we perform hull and construction engineering up to detail engineering and supply of PI. For customers in the Far East, we supply basic engineering packages that include construction plans that are prepared as CADMATIC 3D models from which the plans and data are generated," says Jan Willem.

Flexibility and ease of modifications

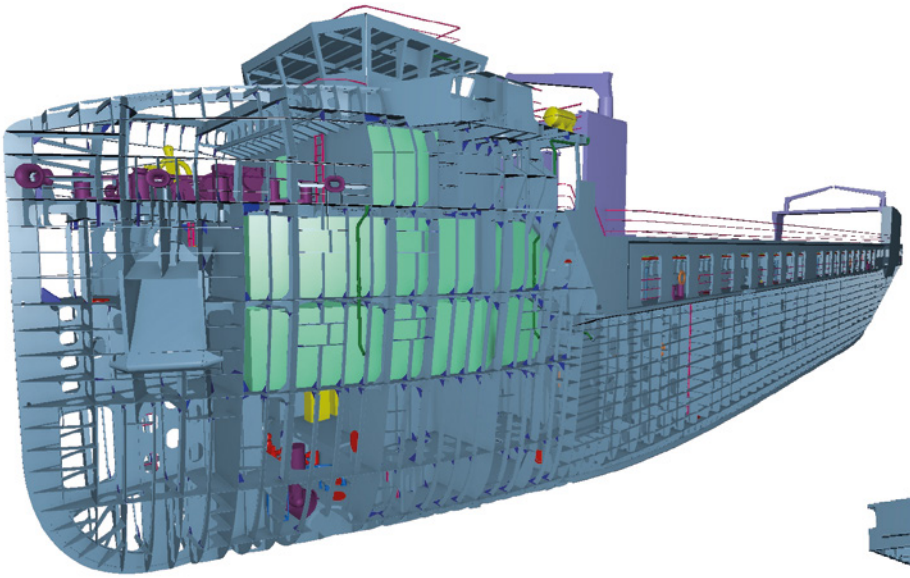
Huib van der Pas, Construction Expert and Manager of the GSD Polish office indicates that CADMATIC's flexibility and the ease with which modifications can be made are highly appreciated.

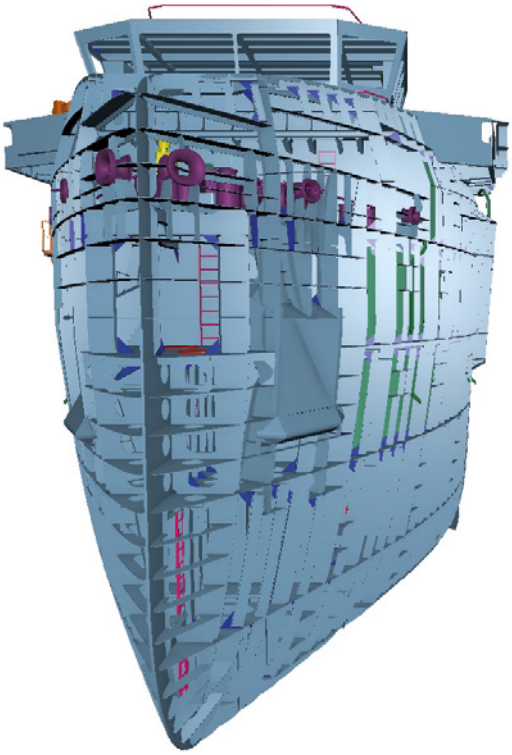
"You can see this, for example, in a basic engineering project where all floors in a double bottom are executed with 11 mm thickness in the entire midship, and it is then decided to change to 12 mm. In this case, you don't have to open each floor view, you can simply make a view in which you can see all floors in the section, clump-select them, and change the thickness for all floors at the same time," Huib explains.

According to him, the same goes for floor stiffeners where the end of stiffeners are related to shells and tank tops. A floor can be modelled and then copied over a large area of the vessel, which then adjusts itself.

Huib recalls a case where the midship construction plan and all the drawings were finalized and ready to be sent for class approval, when they received a request to increase the tank top height.

"In CADMATIC, we managed to change and fix the entire model in





CADMATIC 3D model images of the Hanse ECO. The vessel is a dedicated design for transport of short sea cargo in Europe.

one day, including the shell plate profile changes, and drawings."

He adds that there were naturally some things that needed to be done by hand or in specific views, but that the main part of the job was be done in a relatively short time.

Different design approach depending on scope of engineering

Groot Ship Design approaches projects that only require basic engineering slightly differently to projects that require both basic and detailed engineering.

In projects that only require basic engineering, they generally divide vessels in six parts: For the midship they use a double bottom section and two side sections in addition to the foreship, aftship and superstructure.

According to Huib, if you start with the midship, the advantage of this approach is that one engineer can do the double bottom and one can do a side section. The side can then be mirrored for a complete midship model. A separate section is then created in which the drawing is done so that if, for some reason, detailed engineering is required after all, the visible sections can be changed later in the drawing section, resulting in an as-built construction plan.

"Since the foreship, aftship and superstructure are often quite different, we keep one engineer on their own part of the vessel. This ensures that the engineers don't have to switch sections often and the small model loads quickly. We have the best of both worlds: we have reasonable loading times, and we don't have to load often

since the work is done in the same model," says Huib.

In cases where it is known that detailed engineering is also required, Groot Ship Design start design work based on sections. One section is modelled in detail, and then copied forward of the aft to create the entire midship. This means that details are not forgotten later. The same approach is used for a separate section for drawings, which means that the construction plan for class approval can be created.

CADMATIC flexibility has been a key factor in facilitating these different approaches.

"The beauty of CADMATIC software is that you can work the way you want. There is no strict working order that works best."

Distributing design work to subcontractors

Groot Ship Design also uses CADMATIC distributed design system to distribute engineering to subcontractors. In the north of the Netherlands, it is common practice that subcontractors for systems and engine rooms also perform the engineering.

"It is easy for all parties to cooperate and communicate in a single engineering model. The shipyard can see the status, the subcontractor responsible for systems and piping can see the construction and request penetrations for pipes, and the company responsible for the hull can also see collisions with equipment and anticipate them. Working from different locations and even from different countries can be arranged without difficulty," Jan Willem says.

As an example, Jan Willem points to an ongoing Hanse ECO project for RHAS, a multipurpose vessel designed specifically to carry short sea cargo in Europe.

The hull shape and bow part are particularly eye-catching. The vessel's hybrid propulsion system allows it to sail with the lowest possible emissions.

"Integrating all the new technologies and simultaneously preparing cutting documentation for the actual building requires flexibility from both our skilled engineers or naval architects and the software they work with. We very much appreciate these functions in CADMATIC. The construction model has been completed by our own engineers with main equipment and main routings. This allows the best arrangement of all (tight) spaces in the vessel. The integration of all these parts worked well, resulting in a well-maintained building schedule. The first vessel of the series of five was launched on 15 May 2021."

GROOT CROSS-BOW®

The Groot Cross-Bow® bow and forecastle configuration concept has already been used on a significant number of vessels, up to 30 vessels are sailing with the bow design and a significant number is under construction.

The configuration is based on a wave piercing principle that reduces the minimum required installed propulsion power. It reduces engine power requirements, thereby lowering fuel and oil consumption and related emissions.

The Groot Cross-Bow® also improves comfort on board and reduces damage to cargo by eliminating the strong flare associated with conventional bows. In heavy weather, it is particularly noticeable how the Groot Cross-Bow® lowers vertical accelerations.

GROOT SHIP DESIGN

Link 3D data and integrated planning

Reduce shipyard workshop hours by at least 15%

Data-driven shipbuilding and the digital transformation of operations present shipyards with the opportunity to achieve vast efficiency gains. For shipyard 4.0, research has shown that one source of operational inefficiency lies in the information flow gap that exists between engineering and design, planning, and production execution.

This information flow gap can be bridged by linking 3D data with an integrated planning approach. Bridging the gap promotes an optimized building strategy that is founded on up-to-date, integrated, and correct data across engineering, the supply chain and production, where it can reduce workshop hours by at least 15%.

The information flow gap – project perception versus workshop floor reality

Organizations are often plagued by information flow gaps between different organizational levels, from top to middle management and down to the shop floor. The overall efficiency of an organization is highly dependent on how well it manages information flows and how well it can eliminate any gaps. As the old cliché goes, a chain is only as strong as its weakest link.

The most successful organizations are characterized by sound situational awareness across all organizational levels that is based upon up-to-date and accurate information flows, as well as a common understanding of the status of projects down to the finest details.

In this respect, shipyards are no different. It is noticeable that at many shipyards, there is a mismatch between how higher management level executives evaluate project progress, and what is happening on the workshop floor level. Higher management levels are mainly concerned with the scope, schedule, and budget for the project and keeping them in line with

How to reduce production workshop hours by at least 15%

- Execute an optimized building strategy.
- Increase predictability of task progress and completion.
- Integrate planning: planning from project to production and from operation and control.
- Use a single platform for operational control, providing all insights, priorities, performance tracking and task readiness.

> *"Shipyard systems only partly address informational needs, rendering a gap between the insights required and those provided."*

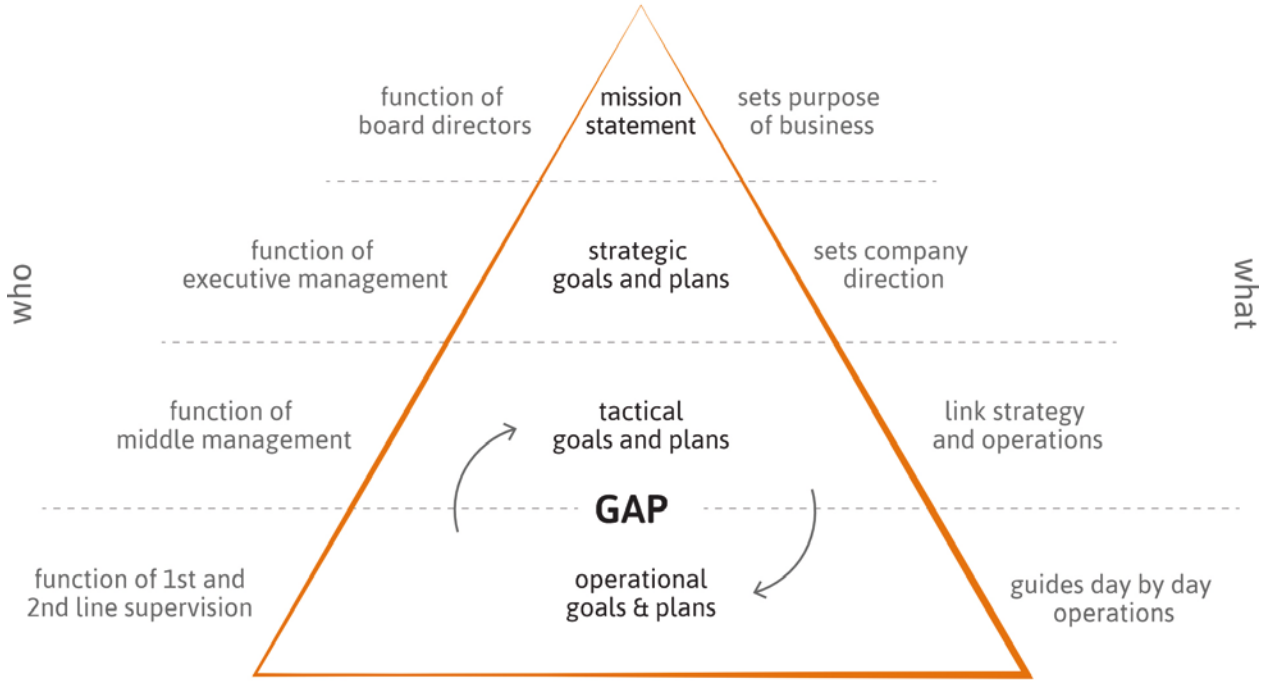
higher-level goals. They focus on assigning responsibilities and ensuring the functionality of lower-level departments to execute projects.

On the workshop floor, on the other hand, the focus is on day-to-day tasks: the what, the who, the when, and in what order.

On the workshop floor, insights are required, among others, about concurrent processes, relevant material delivery statuses, instant issue or change management recognition, and impact assessment for pending items as well as possible risks for operational performance. This information should provide guidance as to which activities need to be undertaken, when and in what sequence, and what resource should be used.

It is crucial to address these information needs to enhance the ship production planning and control processes. A key success factor in this regard is the level of detail that the information contains. If the information can delve down into the job/person/day level, it greatly increases the accuracy of progress monitoring, dependability, timeliness, and predictability.

Shipyard systems usually only partly address these informational needs, rendering a gap between the insights required and those that are provided. This gap negatively impacts overall shipyard production and efficiency. The solution lies in implementing an integrated and automated planning & control approach that leverages the full power of digitalisation and data-driven shipbuilding solutions.



Management structure & planning process: The gap between tactical and operational goals and plans.

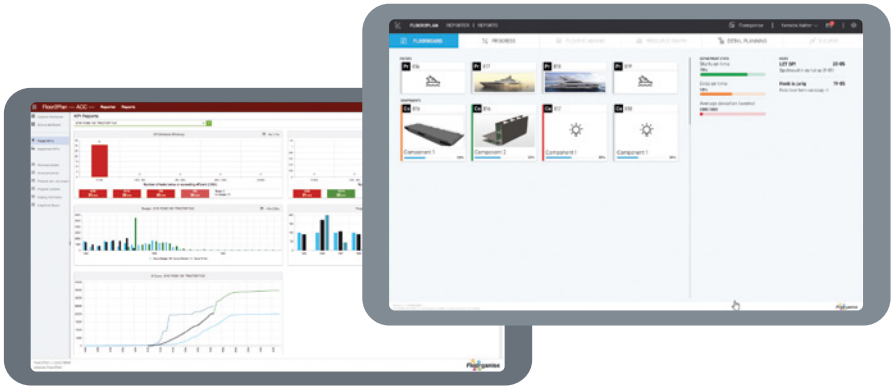
CADMATIC Floorganise solution to bridge the information flow gap between insights required and those provided

The CADMATIC Floorganise MES was designed to bridge the information flow gap described in this article. It combines all benefits from the eShare platform for digital twins for the complete product life cycle and Floorganise planning and production control. It enhances shipbuilding project planning and control processes through automation and integration of engineering data, the 3D model and available IT systems (e.g., ERP, time & attendance, project planning software).

CADMATIC Floorganise ensures that work preparators can retrieve the latest insights and statuses of all crucial elements, thereby executing activities efficiently and without issues, delays or failure costs.

Planning, production and engineering departments and even the supply chain can use the same 3D model in the CADMATIC eShare platform and planning and production control data. This allows them to create deeper more predictable and detailed plans on the actual 3D model in parallel, resulting in a process that follows the optimized building strategy based on the particulars of both the project as well as the yard.

Download wite paper – enhanced data-driven shipbuilding production planning and control:



Balenciaga – 100 years of shipbuilding excellence

Hull and outfitting design & software customization for CNC machine

Balenciaga shipyard was founded in 1921 on the banks of the Urola River in Zumaia, part of the Basque Country in northern Spain, from where it has launched over 370 vessels into the Bay of Biscay over its 100-year history. In its centenary year, Balenciaga is building its first vessel designed with CADMATIC software, one of two SOVs to be delivered to Østensjø Rederi by 2022. Amid other developments at the shipyard, it is consolidating the use of CADMATIC software for hull and outfitting design.

Balenciaga has invested significantly in recent years to develop the capabilities and capacity of the yard. A new main travelling crane was installed, and space was created to allow newbuilding construction in a new slipway, thereby allowing vessels to be built in parallel. In 2021, CADMATIC software was implemented by Balenciaga to boost hull and outfitting design. Balenciaga also have a site license for the CADMATIC eBrowser design review tool, which allows an unlimited number of users. This shipyard uses it for project review in its engineering department and by foremen on site.

According to Balenciaga's Alberto Vall, the shipyard is in the process of consolidating CADMATIC as the standard ship design software at the shipyard.

Software customization for CNC machine

As part of the software implementation, the CADMATIC software development team delivered a post-processor for a profile cutting robot and created capacity in CADMATIC to deliver customized information to the robot.

The machine had been in service for many years, and its documentation was no longer available. After an investigation, the team managed to identify the required input for the CNC machine and to create the customized CADMATIC output accordingly.

"The CADMATIC team's cooperation in developing the software was very good and they developed it fast," says Alberto.

Members of the Balenciaga production team (left) with the CADMATIC software implementation team, Verónica Alonso de los Rios (middle), Juan Prieto, and Chinmay Ambegaonkar.

Verónica Alonso de los Rios, Senior Sales Manager at CADMATIC, says that CADMATIC's ability to customize software according to customers' needs is highly appreciated.

"We have a long history of co-operating with clients to develop our software and where necessary to create special interfaces and customizations. They appreciate the fact that we are flexible and can adapt our implementations, but also the fact that we have in-depth knowledge of shipbuilding in general," says Verónica.

As the software implementation was done during the Corona pandemic, most of the training and services were provided remotely.

84 m service operation vessel designed with CADMATIC

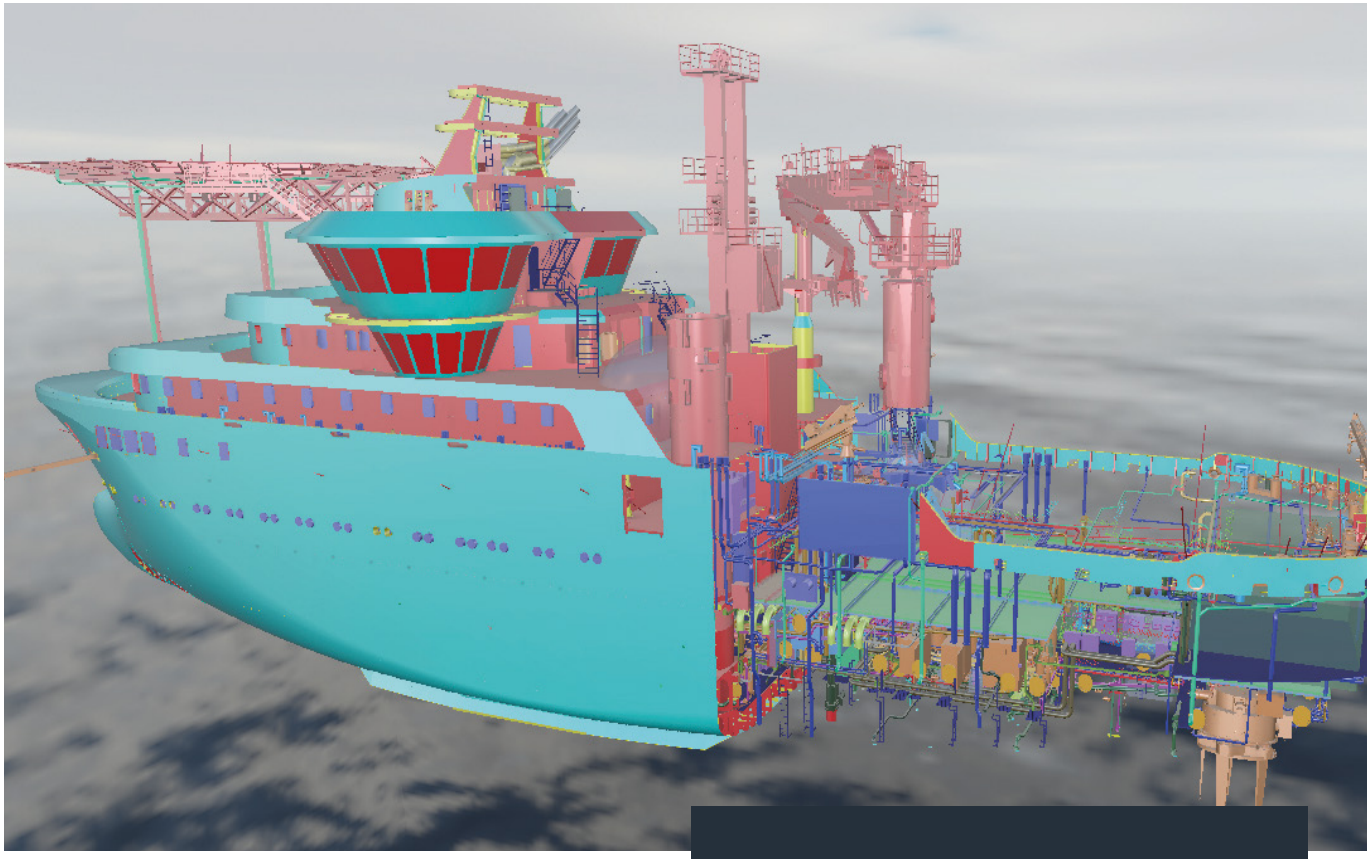
Balenciaga is currently constructing the first vessel that was designed with CADMATIC, a Service Operation Vessel that will house and support wind turbine technicians as they perform commissions and do maintenance work on offshore wind turbines.

The basic 3D model of the vessel was provided by a subcontractor, after which Balenciaga used CADMATIC Hull to add production information, generate the build strategy, and produce the outputs required to build the vessel according to the yard's procedures. Among others, the shipyard also routed piping below 50mm.

Alberto is pleased with the project progress.

"The project is running really well, and we hope to meet the scheduled delivery date in 2022."

The vessels are equipped with technology that will reduce greenhouse gas emissions by at least 30%, while their hydrogen propulsion technologies pave the way for zero-emission operation.



CADMATIC 3D model of Service Operation Vessel being constructed at Balenciaga for Østensjø Rederi.

Service Operation Vessel particulars

- LOA: 83.40 m
- Lpp: 71.65 m
- Breadth: 18.60 m
- Depth to Freeboard Deck: 7.20 m
- Accommodation: 60
- Speed: 10.00 kn
- Salt Ship Design: SALT0358

"We have started the process of consolidating CADMATIC as the standard ship design software at Balenciaga."

BALENCIAGA SHIPYARD 100TH ANNIVERSARY

Cooperation with Dalian Maritime University in China bears fruit

CADMATIC Marketing Communications Specialist Jiawen Zhang interviews Linfang Su from Dalian Maritime University

When I contacted Linfang Su from the Dalian Maritime University (DMU), she was busy preparing the publication of textbooks for the course Computer-aided ship design and production. It was in 2014 when she came to the Netherlands and introduced the idea of creating the course. I still remember the sparkle in her eye and excitement about the project. This was the beginning of long and fruitful cooperation between CADMATIC and the university.

Linfang Su works as Vice Professor in the in the Department of Naval Architecture and Ocean Engineering. She is active in building relationships between the university and various companies in the marine industry. Her goal is to get more resources to build the course and to provide her students with more opportunities. In 2019, CADMATIC's cooperation with DMU received recognition from the China Association of Higher Education, when it was listed as one of the top 100 case studies in the country.

In a recent interview with Linfang Su, I reflected with her on the constructive collaboration between our two organizations over the years.

Jiawen: *"2020 was a difficult year for everyone. I am pleased to see that your course Computer-aided ship design and production has received much positive feedback. Could you please briefly introduce the course?"*

Linfang: *"Indeed, last year was tough. Thanks to the support from the university and various companies, the Computer-aided ship design and production course has been launched. It is our achievement. The course is highly valued by both the university and the "Shipbuilding and Offshore" program. We aim to realise the digital transformation of education by combining the course contents with real projects and utilizing the advantages of universities and companies. The course has 32 hours and lasts 2 months. Six hours are planned for students to use CADMATIC Marine Software in Hull and Outfitting design. Besides me, there are five more teachers from Haerbin Engineering University, Dalian Maritime University, and the Dalian Technical University that bring their expertise in marine design, marine engineering and information engineering to the course. The course is offered twice a year and so far more than 1000 students have applied."*

Jiawen: *"You just mentioned that 6 hours of the course are assigned for software use. What advantages do you see in combining theory and practice?"*

Linfang: "To meet the trends of

More about Dalian Maritime University

Dalian Maritime University is a maritime institution under the Ministry of Transport, People's Republic of China. In 1960, the University was designated a national key university. The University consists of 21 teaching and research units and has 50 undergraduate programs and confers professional master degrees in 14 fields. The university is designated as one of the "Project 211" institutions. Only about six percent of the universities across China were selected in this project.

Jiawen Zhang (left) and Linfang Su (right) with Olga Dvirnaya (middle) from Admiral Makarov National University of Shipbuilding.

the marine industry, we need to integrate multiple disciplines across various industries. Therefore, we hope this course will meet the need to deliver multi-talented marine experts. CADMATIC Marine Design Software has been well received in China. Its powerful functionalities have been recommended by many companies in the marine industry. The opportunity to experience ship design in real 3D environments allows the seamless integration between theory and practice. Students become more capable of solving complicated engineering problems, which benefits them in their future internships and professional careers.

Jiawen: *"Talking about multi-talented marine experts, I know that Dalian Maritime University encourages and helps students to do their internships at design institutions and shipyards. Doubtlessly, the cooperation between the university and companies will play a great role here. This time, CADMATIC was listed as one of the top 100 case studies in China. What value do you think the cooperation will bring to higher education?"*

Linfang: *"Firstly, I highly appreciate CADMATIC's contribution to higher education. In fact, our cooperation mode can be regarded as a leading exemplary case study. We have received free software licenses from CADMATIC and established a joint ship design lab. Our cooperation keeps bearing fruit. We are sharing our success with more students through the course, and we actively promote CADMATIC 3D design. It has not been easy, however, but we have never given up. Now, besides CADMATIC, we have also signed cooperation agreements with companies like SDARI, Shanghai Respect and the Wuhan Design and Research Institute. We invite companies to develop the course with us and send excellent students to companies to gain more knowledge and experience. I feel great happiness when I see students getting their ideal job offers. If students are waves, our cooperation is the wind."*

Jiawen: *"Well said! Before we conclude, I have heard that the course will be improved further. Could you reveal some details?"*

Linfang: *"We need to add more contents. We are experiencing a digital revolution and both shipbuilding and information science are undergoing transformations. Shipyards and design institutions are coping with the trends, and education should follow as well. We hope to bring the most advanced CAD shipbuilding technologies to students with the help of the course."*

South Korean shipyards showing strong interest in data-driven shipbuilding

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CADMATIC's increased presence in the South Korean market in recent years is bearing fruit. Alongside MTI Corporation, CADMATIC's long-standing partner, enhanced sales and local technical support resources have been key in driving interest in CADMATIC's data-driven shipbuilding solutions.

Seongman Yu and JH Song are two key members of the CADMATIC team in South Korea. Seongman has been the country's CADMATIC Sales Manager since September 2019, while are JH Song took up the position of Technical Manager in November 2019. They are supported by CADMATIC's Mehryar Delalat (Director, New Business Development) and MTI Corporation, a ship design system company that has been a CADMATIC partner for over 20 years. MTI adds great value to the partnership with its extensive experience of CADMATIC software and intimate knowledge of Korean shipbuilding.

According to Seongman, well-known and large Korean shipyards are looking for digital transformation and data-driven shipbuilding solutions. He adds that they are constantly reviewing new design systems to secure the future competitiveness of their design systems.

"Digital transformation, along with AI, digital twins, and the virtual ship concept are key trends pursued by Korean shipbuilding customers for next-generation design systems. They are showing strong interest in our data-driven concept and related solutions. We provide solutions to meet today's challenges, but with a strong focus on meeting future challenges too," says Seongman.

MOU with HHI a notable success story

A notable success story achieved by the CADMATIC team in South Korea was the signing of a MOU with Hyundai Heavy Industries (HHI) in April 2020, whereby CADMATIC was selected as one of the candidates for the corporation's next-generation design system.

"Together with HHI, we are working to realize their goal of digitalizing their shipbuilding process as much as possible based on their roadmap. Our information management solutions are an essential part of this development, empowering users by bringing all the relevant data of 3D projects to one point, the single source of truth."

Seongman indicates that they have established good relationships with most major Korean shipbuilders such as HHI, DSME, HMD, HSHI, Daehan, Daesun, Sungdong, SHI, STX, Gangnam. Mid-tier shipbuilders such as Daehan Shipbuilding, Daeseon Shipbuilding, and Seongdong Shipbuilding have also shown growing interest in CADMATIC's next-generation design systems.

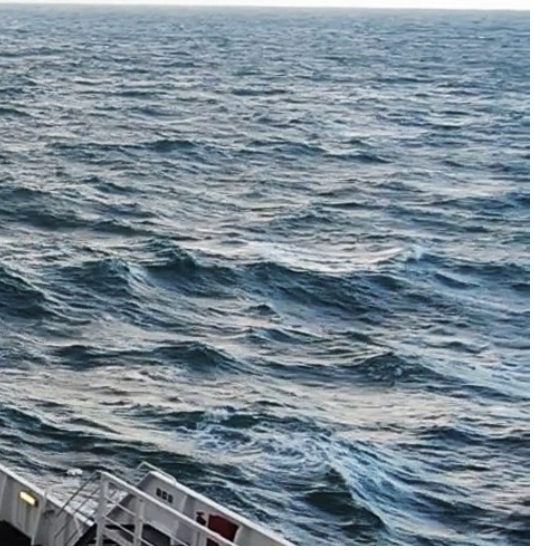
In additional to ship design and shipbuilding companies, CADMATIC is in talks with Korean universities and education institutions to introduce CADMATIC software and solutions.

"Even during the Corona pandemic, the CADMATIC team in South Korea have actively continued connecting with stakeholders in the local shipbuilding market. I can see that our efforts are bearing fruit, CADMATIC is now a well-known brand in South Korea and our growth prospects are good," says Mehryar Delalat.

With wind power towards zero-emission maritime traffic

Text: Antti Yrjänäinen

Ever-tightening environmental regulations, combined with the pressure to lower fuel costs, have made wind power an attractive option as transport energy for ships. Many sail applications have been developed, but no real breakthrough has been achieved. Suspected uncertainties have slowed the reemergence of wind-based propulsion. However, there have been clear fuel economy benefits from the installations made. Emission reduction targets force the development and application of new environmentally friendly technologies, such as wind power in shipping.



Utilisation of wind power						
Means	**Propulsive force**				**Electricity generation**	
Type	Soft sail	Wing sail	Rotor sail	Kite	Axial turbine	Radial turbine
Application	Traditional sails	Hard sails, wing profiles	Flettner rotors	Towing kite systems	Windmill	Savonius wind turbine

Table 1. The different ways wind power can be utilized onboard.

Wind as a ship's propulsive force

Of the solar radiation energy that reaches the earth, 2–3% is released into the wind. It is completely pure, unpolluted energy that is freely available. Before the era of motor ships, shipping was based on wind power. 100 years ago, the last sailing ships in active service reached peak speeds of up to 17 knots when sailing from Australia to Europe – a speed that modern bulk carriers cannot reach.

At the same time, the world's largest and fastest sailboats reached speeds of over 11 knots in yacht races. In cargo transportation, sail propulsion has been abandoned, while racing sailboats have developed tremendously, utilizing advanced wing sails and lightweight structure technology. The most extreme reach top speeds of over 50 knots. The development of the use of wind power in ships was forgotten for 100 years, but interest in it has been revived.

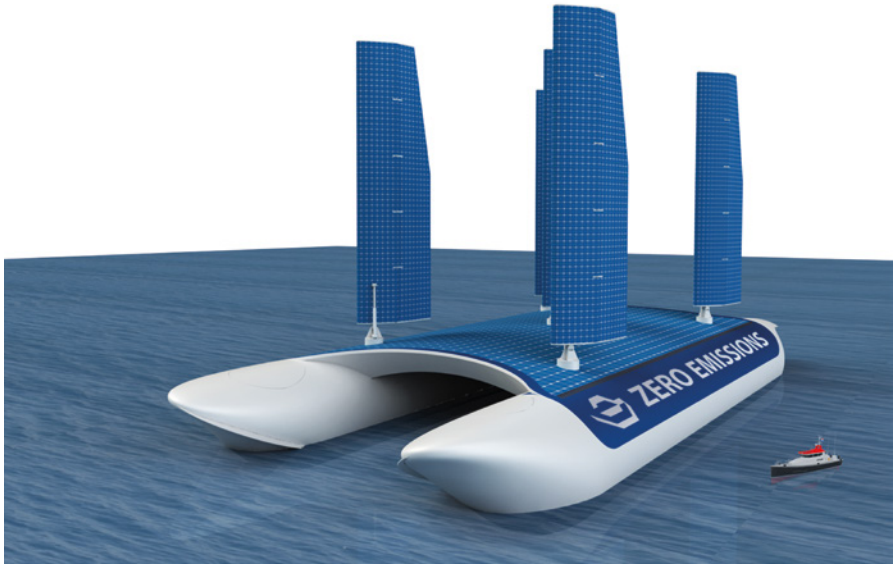
Today, consumers are aware of environmental issues, which makes even large global suppliers demand environmentally friendly activities throughout the whole transport chain. This universal attitude has materialized in IMO's (International Maritime Organization) target of halving maritime emissions by 2050. It drives the thinking of the whole maritime industry very strongly. Operators are looking for zero-emission solutions for propulsion power generation. This need is met by developers of wind energy-based equipment.

Conditions for wider deployment of wind power

Logistics chains are based on a precisely scheduled transport performance. On motor ships, this is easy to implement and achieve, although weather conditions can sometimes bring their own challenges. Sailing ships are completely dependent on favorable weather conditions. Instead of fully sail-powered propulsion, wind-assisted propulsion permits keeping to schedules. Hybrid solutions make it possible to achieve significant savings in fuel consumption and thus also in emissions. In practice, such hybrid solutions have been able to verify annual fuel savings of around 10% (corresponding reduction in CO_2 emissions) cost-effectively, without reducing the service level of ship transportation.

If flexibility regarding schedule requirements can be introduced, the savings could be even greater. At its most extreme, all propulsion could be based on wind power – as it was before the era of steam engines and motor ships.

The most significant barriers to the uptake and wider use of wind propulsion are primarily related to various uncertainties. One is the price of fuel, i.e., the projected cost that needs to be reimbursed. In



©Elomatic/Jukka Mikkonen, Pekka Koivukunnas

"Sail-based or sail-assisted propulsion is one way of achieving carbon-neutral shipping."

Figure 1. A concept of a wind powered handy size bulk carrier, 37 000 Dwt.

particular, the low price of fuel and its unforeseen fluctuations have dampened interest in the implementation of wind propulsion. It is often questioned whether the proposed technology is at all suitable for ships and their operational profiles. Also, what is the usability of the devices, and how do they affect safety factors? These technical matters can be verified and tackled by accumulated information of every new pilot installation. Ultimately, investors require a *"proven design"* for a financially sound investment. The feasibility of proposed installations has to be carefully analyzed and evaluated based on the vessels' operation and environmental circumstances.

Wind energy solutions

Traditionally, wind has been used on ships directly for propulsion power. The wind can also be harnessed to produce electricity with a turbine.

However, the dimensions of such a device and, consequently, the height of the centre of gravity and the movements of a ship, do not allow a working combination to produce the needed electricity for a propulsion motor.

There are more than 30 separate projects around the world studying or developing the use of wind power on ships. These projects are mostly being conducted by research institutes, but also by some commercial actors. Many of them are at a very low level of technological maturity. So far, there are hardly any commercially ready products on the market, besides sailing solutions derived from sail boats. One exception is Norsepower's rotor sail. Based on the activity of the cluster, new solutions will be coming onto the market in the years ahead.

Classification societies have also done their work. The most significant classification societies have already published their guidelines and rules with respective notations for the classification of wind-assisted propulsion installations for different types of wind-assisted applications.

Assessing the benefits

Environmentally friendly technology creates benefits for society. However, wind power equipment must also be a commercially viable investment for the shipowner, without reducing the level of ship performance. The payback time of the installation needs to be assessed. It, in turn, is heavily dependent on the price of fuel to be replaced by wind power. Unfortunately, fuel price fluctuations are large, making it challenging to predict future price levels reliably. In competition with fluctuating bunker prices, wind offers a more stable outlook, however, with uncertainties related to individual voyages.

Most wind-powered devices are currently at very early stages of development. The productization and series production of different types of equipment will create new opportunities and further improve their price competitiveness. At the realized fuel cost levels, the payback times for the equipment have proven to be reasonable, but the value of the installation improves when the fuel price is high. Each case must be assessed individually, however, based on the ship's operational profile and wind conditions in the operational area, in addition to the ship's characteristics.

Thoughts for the future

The paradigm of the whole current ship concept will change if the propulsive power of ships is produced only with wind power. The largest single component of operating expenses, i.e., fuel costs, will be excluded. On the other hand, compromising on speed raises the importance of capital costs as transportation performance declines. Achieving the maximum benefit affects the whole ship concept and its characteristics.

Based on the above, the thought can be taken even further. If a ship is rendered unmanned, another large item of operating expenses, i.e., the personnel costs, would be eliminated. At the same time, all facilities and systems related to living onboard and the ship's personal safety equipment become unnecessary, contributing to reduced capital costs. As a small concession, the ship would be equipped with solar cells, batteries and electric thrusters for port operations and occasional calm weather. Based on this philosophy, a concept of a sail-bulker was developed by Finnish Engineering & Consulting company Elomatic (See Figure 1).

To achieve stability, the vessel is of the catamaran type. Both hulls are tubular and double hulled, with the second shell inside forming a cargo space. The bow and stern parts have a streamlined design for good seagoing characteristics. The deck and sails serve as a platform for solar cells. It is a futuristic concept study, which is important for testing and evaluating novel ideas and solutions. By testing ideas and calculating their feasibility, these now utopian concepts will be refined step by step into the workhorses of our seas, into emission-free means of transport. Although developments in the sector are swift, it seems that it takes very long for actual commercial installations to become widespread. The proposed emission reduction targets require faster development.

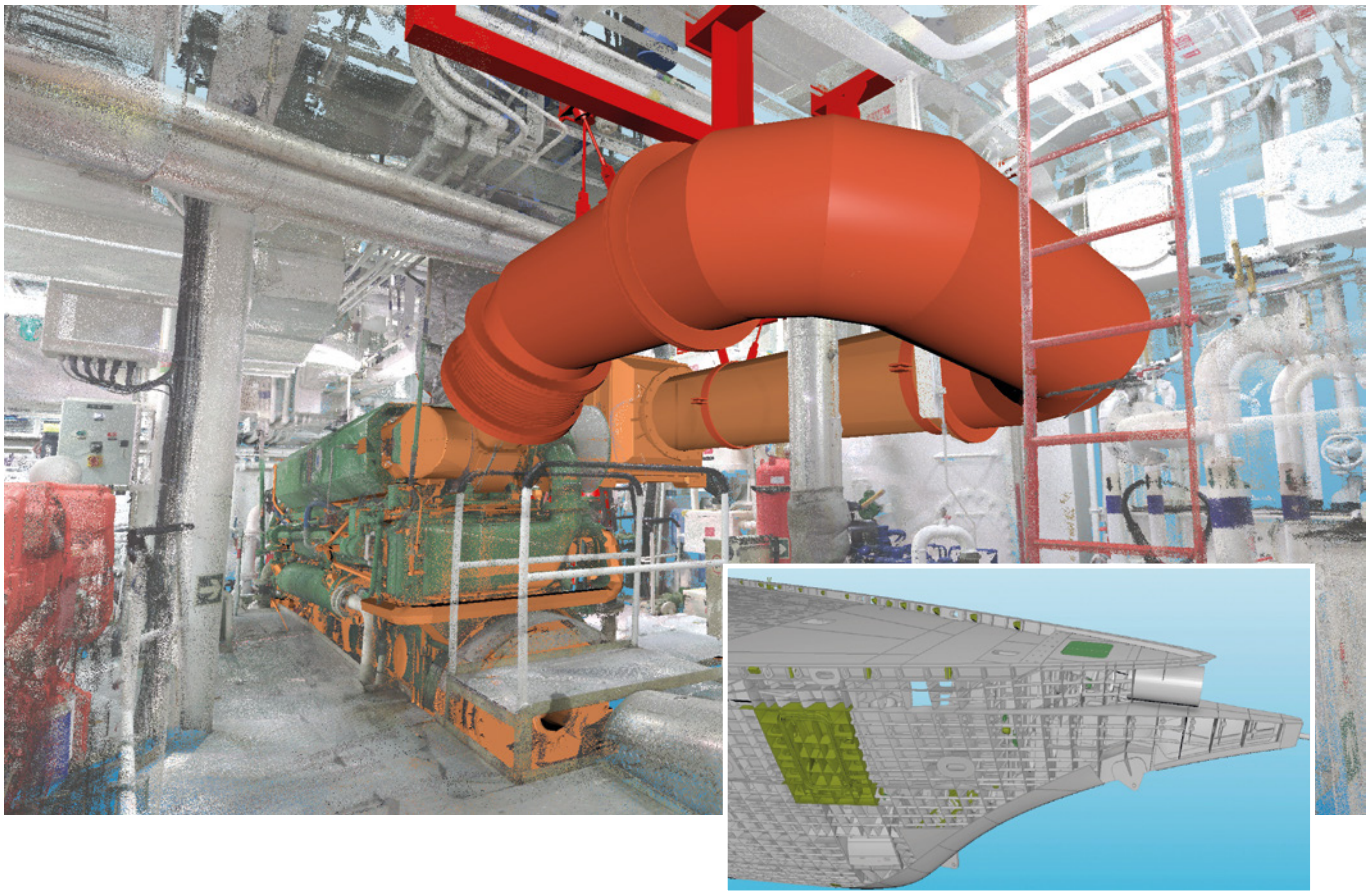
Sail-based or sail-assisted propulsion is one way to achieve carbon-neutral shipping. Various sail solutions are already a cost-effective way of producing part of the propulsion power. This share can be increased in the future, and in some cases wind power will undoubtedly be the main driving force again for some ships at least.

Every new sail-assisted propulsion installation paves the way for wind-assisted propulsion in general. The more data is gathered and knowledge of the use of such devices is gained in various sea and wind conditions, the better the benefits can be evaluated and verified. Technical barriers can be overcome by researching, developing, and testing.

The key element for wider utilization of this pure energy is economic competitiveness. Some of today's solutions have generated a return on investment for the shipowner in less than 5 years, which simultaneously reduced CO_2 emissions by 10%. If the bunker price trends upwards and marine CO_2 emissions are part of any carbon tax instrument or carbon emission trading, such as the European emissions trading system (ETS), it will result in a lucrative market for wind assisted propulsion system suppliers. This will also assist shipowners to reduce fuel costs.

Antti Yrjänäinen (M.Sc. Naval Architecture) works as Sales and Project Manager at CADMATIC's mother company, Elomatic Ltd. This article was first published in the Top Engineer magazine 2/2020.

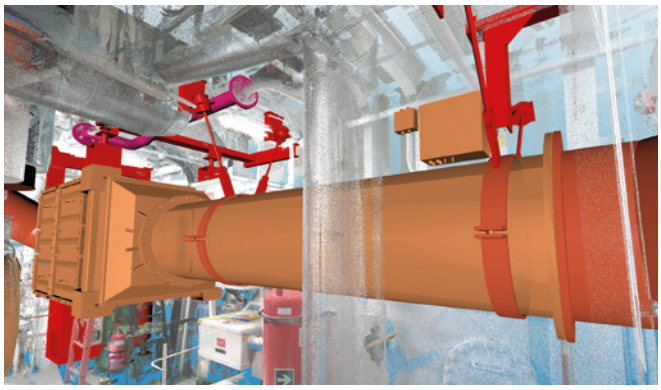
Figure 2. A rotor sail installed on a Ro-Ro vessel.

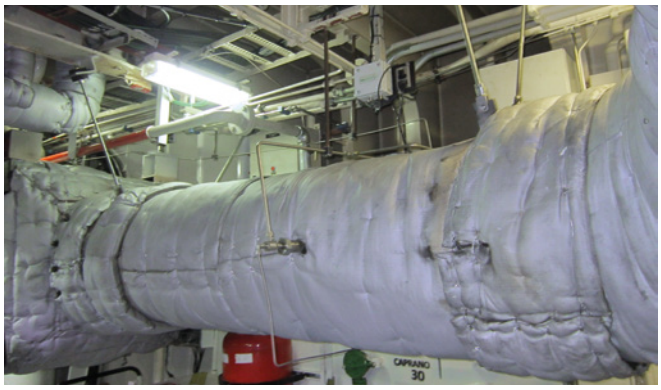


MULTI.engineering's over 20 years' design excellence with CADMATIC

In 2021, MULTI.engineering (Multi) is celebrating its 25th anniversary. It has been a CADMATIC user for over twenty years. The company's headquarters are located near the banks of the Scheldt river south of Antwerp, close to its roots at the former Boel werf in Temse. Multi's other offices are located in the Netherlands and Slovakia.

Multi utilizes CADMATIC software mainly for projects in the maritime and offshore sector, but on occasion also for industrial projects. Its services range from concept design up to detail design in terms of engineering, while support is also provided on site by engineers or inspectors during construction and commissioning of maritime assets. In terms of engineering, Multi covers various disciplines such as naval architecture, structural, outfitting, and mechanical design in house. For other disciplines, partners are available to ensure that complete support can be offered to Multi's clients.





CADMATIC 3D model with laser-scanned point cloud as overlay and installed end result.

"Our clients are active in yacht building, work ships and offshore, both for new construction, maintenance and/or modifications. In addition to the credo "no engineers, no future", commitment is a very important principle for us, namely a team that is driven to successfully complete projects. That's what MULTI.engineering is all about, in other words, about involvement," says Dieter Hoeterickx, Multi Design & Engineering Manager (Maritime & Offshore).

CADMATIC is the main CAD software tool at Multi and is used in various types of projects and project stages.

"For newbuilding projects, we use CADMATIC during the basic and detail engineering and allow the client to follow the progress in 3D and exchange to calculation software. With the detail engineering package, we deliver full production packages to the yard for all steelwork from hull sections to shell plates and loose outfitting. The same applies to all piping work, where we try to use CADMATIC diagram when possible, to have a more streamlined detailed engineering process and provide the client with a full production package according to their expectations."

Refit projects with 3D scans

Multi has started using CADMATIC for refit projects for basic and detailed engineering of new areas, allowing their clients to review progress and shorten the time used for engineering.

It does refits for the installation of BWTS, SCRs, and scrubbers for commercial vessels. In yachting, the refits are more related to extensions of vessels, upgrades of technical spaces, or installations of new helideck/systems, etc.

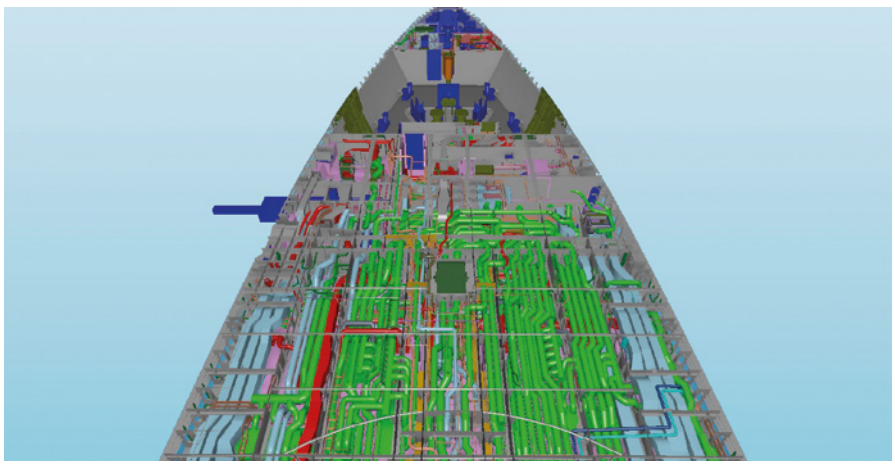
"We often work with 3D scans in refit projects to use it as an overlay during engineering with the point cloud in case of construction, or for mechanical work to reroute existing piping and new piping," says Dieter.

Electrical module to increase efficiency in mega yacht projects

Dieter says that Multi has also started using the new CADMATIC Electrical module.

"We have done some pilot projects with the electrical module for cable routing on mega yachts to increase the efficiency of the overall engineering process and maximize the use of the CADMATIC 3D model."

He adds that Multi is currently negotiating with another client to use the Electrical Module in other projects and considering the use of the new tools to create production drawings for rectangular HVAC ducting.



MULTI
ENGINEERING SERVICES

Data that fuels shipbuilding

The role of CAD/CAM in data-driven shipbuilding

Shipbuilding has a rich history that spans centuries. Traditionally, it is considered an industry that requires a lot of intelligence and science. Vessel design requires extensive knowledge about stability, shapes, structural strength, engines, equipment, materials strength, and much more.

> *"The future development of CAD/CAD trends emphasizes the role of digital information flows and the process of digital twin creation."*

Text: Ludmila Seppälä

Modern ships are complicated autonomous floating storages and transporters, power generators, refineries, living quarters, and leisure facilities. It takes years to design and construct modern vessels: the joint effort and coordination of numerous designers and engineers, meticulously organized work in materials and equipment procurement, assembly lines, workshop floors, and shipyard process management. Months of testing and adjustments are needed to ensure operational stability, train the crew, and set up maintenance schedules.

Shipbuilding as a data flow process

Looking at the shipbuilding process from a data flow perspective is fascinating. From concept and basic design up to the shop floor and operations – a massive amount of data is created and used for various needs. Calculations performed for stability and flotation are critical in the initial stages, but not needed in production. Planning of production and work breakdown sequences can be prepared after the detailed 3D model is complete. The grouping of engineering, design, procurement, and production processes is non-linear and often simultaneous; the same can be said about data flows.

One might think that CAD/CAM/CAE packages take care of the whole cycle from the beginning of the project to the very end. However, a closer look reveals that shipbuilding's digitalization process is fragmented and often too narrowly focused. There are many types of data that originate and evolve during the shipbuilding process: engineering and calculations, 3D geometrical and meta-data, logistical sequencing, work breakdown information, and production data generated according to specific machinery needs.

Shipbuilding's intense design focus and use of AI

The shipbuilding industry is distinctively different from other industrial sectors due to the intense focus on design. The so-called CAD-centric approach emphasizes the 3D model and its role in shipbuilding as the single source of truth.

The other significant trend is the use of AI and machine learning technologies. Machine learning mechanisms can assist in design decisions made by engineers and naval architects. Regulations and best practices are embedded in CAD/CAM systems to help and act as a reliable knowledge storing facility. This process is not novel, as the first specification-driven features date back to the origin of CAD/CAM systems. However, new technologies such as neural networks and algorithms for the use of big data have opened up new possibilities.

It is true that for shipbuilding, the 3D model and related

documentation extracted from it constitute a foundation. However, this leaves the shipyard processes uncovered. As a result, a functional gap was created between design data and the PLM/PDM/ERP needs to manage shipyard operations.

Digital twins are the hub of ship information model

A common trend in modern CAD solutions is to look beyond creating the 3D model and extraction of production information. Incremental digital twin creation places the 3D model as the hub of the information model, adding layers of integrated non-centralized data. Essentially, this can be any data from any system that has an application in the shipbuilding process.

This approach aims to resolve the information gap and directly link the design and PLM-related data. The role of the CAD/CAM solution changes – instead of a tool for engineering and design, it takes on a universal 3D dashboard position. Adding information on top of the 3D model resolves the linking of data and information perception. Instead of looking through datasheets, users can see a 3D rendering of the end model and manipulate the data on a 3D dashboard. Advancements in computing power and new technologies take this even further – the data is available in any format and on any device – up to life-sized holograms in physical locations with AR/VR/MR/XR technologies and wearable devices.

The future development of CAD/CAD trends emphasizes the role of digital information flows and the process of digital twin creation. However, for the time being, it remains focused on the end product of a shipyard, a vessel that is delivered to the shipowner.

The next gap in the digitalization process is between shipbuilding data and operation, maintenance, and shipping. Creating specialized digital twins for each stage of the vessel's life cycle, seems to be a cumbersome and ineffective approach. Developing and facilitating a universal digital twin requires a broader perspective on digitalization and data flows, in which the interests of shipyards and shipowners are aligned.

This article was first published in the January 2021 edition of the Naval Architect RINA magazine

Release Highlights

2020T3 & 2021T1

The 2020T3 and 2021T1 releases are packed with new features and improvements that will add efficiencies to and ease design work and boost design project management.

2020T3 highlights

- Support for local coordinate systems in CADMATIC Outfitting, eShare, eBrowser, and eGo.
- New options to annotate isometric drawings in Outfitting.
- New Hull Basic Design export format – OCX XML, compatible with DNV GL classification society requirements and significant additions for the creation and modification of profiles.
- In eShare, multiple 3D models can be merged in one project from 3DD, DWG, DXF, EBM, EBMX, and IFC formats.
- Other new features in eShare: multiple colorings for documents, saving, viewing, and the comparison of managed document revisions, additions for personal use of smart points, importing multiple smart points and creating hyperlinks, the possibility to use images for maps, including manual replacement and alignment, management of the eGo device fleet and the simplification of point cloud management, the VR interface for eShare.

Follow link for detailed 2020T3 release highlights:

2021T1 highlights

- Multi-selection of objects in same group in Outfitting.
- Electrical devices can be sent from CADMATIC Electrical to Outfitting as COS objects and linked to 3D objects.
- Pipes can be created by import from Piping Component Files (.pcf).
- Hull: harmonized rule system for plate and profile beveling, automatic beveling for profiles and face plates in cross section, and enhanced profiles as plate property function.
- Hull production: lugs are handled separately in coding and can be compared in automatic part numbering. New and customizable jig view options ease shell plate inspection.
- Hull Import and Export: Greater scope of NAPA Steel import, new Almacam Nest Data import option, and export to OCX XML improved so that plates' relations to other plates and fixed values and grids, as well as shell frames' relations to shell plates are preserved in the export.
- Hull documents can be published from Hull COS version to eShare and eGo
- Support for BCF markups and JT models, and more flexibility in configuring document links in IM products.
- In Electrical, I/O management, Import and 3D functionality, and storey settings have been renewed.

Follow link for detailed 2021T1 release highlights:

CADMATIC is a leading 3D design and information management software developer and supplier for the marine, process, energy and construction industries.

- CADMATIC'S headquarters are located in Turku, Finland.
- We have staff in Australia, China, Estonia, Hungary, India, Italy, the Netherlands, Poland, Russia, Singapore, South Africa, South Korea, Spain, Sweden, and the UAE.
- We have certified resellers and support partners in 15 countries in Europe, Asia, America and Africa. Our growing customer base includes over 6000 customer organizations in 60 countries.

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