CADMATIC eXperience No 06

Marine Industry

Inside this issue

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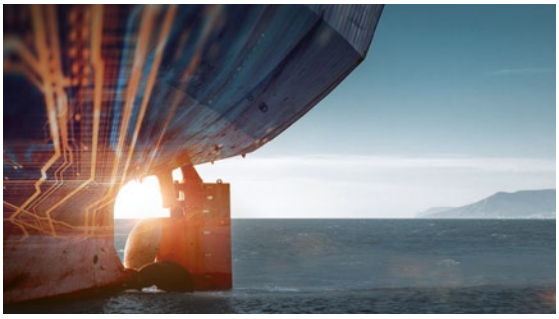

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Cover picture: GROENEWIND vessel designed by Su Ship Design with Cadmatic.

Cadmatic is turning 40

In 2022, we are celebrating the 40th birthday of Cadmatic. It's the perfect time to reflect on our roots, achievements, and where we are going.

Cadmatic's story started in the mid-80s as an in-house project at our mother company, Elomatic Ltd. The engineering and consulting company wanted to use 3D technology to improve their engineering projects' design, visualization, distribution, and total cost-efficiency. At the time, I am sure that none of the founding pioneers could, in their wildest dreams, have imagined that 40 years later, Cadmatic would be a globally leading software in ship design.

The first development project for a 3D design program was started in 1983, and by 1985 the first pilot project using the new 3D technology was completed. The improvements in design and overall efficiency were remarkable. Cadmatic Ltd was founded in the early 1990s with the responsibility of marketing and further developing Cadmatic 3D software.

We took a significant step when Cadmatic started cooperating with Dutch partners Numeriek Centrum Groningen B.V. (NCG) to develop comprehensive 3D design solutions for ship design under the NUPAS-CADMATIC brand name. The cooperation significantly strengthened Cadmatic's hull design offering. In September 2015, Cadmatic acquired all NCG's shares and business operations. Since then, our solutions have been offered under the Cadmatic brand.

Software for engineers – by engineers

What stands out for me in the Cadmatic story is that engineers developed our software to improve the effectiveness and efficiency of their engineering projects. We have never lost this close link to our engineering roots. It gives us insights into our customers' challenges in their daily work and guides the solutions we develop. We empower engineers to build a brighter future and a better world.

Our software offering has developed markedly from the early days when it focused on design. Nowadays, we also have a suite of information management products that complement our design applications. The pioneering eBrowser project review tool was the first of these.

We are at the forefront of the digital transformation that is taking place in shipbuilding, and we create solutions that are driving efficiency to new levels. Our digital twin solution eShare allows design offices, shipyards, turnkey suppliers, shipowners, classification societies and other project stakeholders to link, visualize, and share ship design, engineering, planning, production, inspection, and operation information in a web-based platform.

With our solutions, we strive to make the design, engineering, construction, and operation of ships better, faster, and easier. We look forward to doing this for the next 40 years and beyond!

I hope that you find the content of our eXperience magazine exciting and thought-provoking, and I look forward to your feedback.

Juha Asanti
Vice President, Marine Industry

User-friendliness of 3D modeling a key efficiency driver at Damen Shipyards Mangalia

Article summary

Romanian shipyard in Damen Group benefits from user-friendly 3D modeling to enrich detail design models before extracting production information. CADMATIC eBrowser used as review/ coordination tool by shipyard staff.

Customer challenge:	Cadmatic solution:
Need to enrich detail 3D ship models efficiently and effectively before extracting production information.	High-level topology saves time and reduces errors by automatically updating related information when changes are made to the 3D model.

"Compared to our previous software, it is much easier to do 3D modelling with Cadmatic. When you change something in the model, all other related parts change as well"

– Alina Conda, Head of Hull Production Support Office

Damen Shipyards Mangalia is a key cog in the Damen shipbuilding machinery and the largest shipyard in the Damen portfolio, spanning almost one million square meters. After receiving detailed design models created elsewhere in the Damen network, they enrich the detailed 3D models and extract the required production information with Cadmatic. Some detail engineering tasks are also being transferred to the shipyards 65-person-strong engineering team. The shipyard's foremen and production engineers make daily use of the CADMATIC eBrowser design review tool in production.

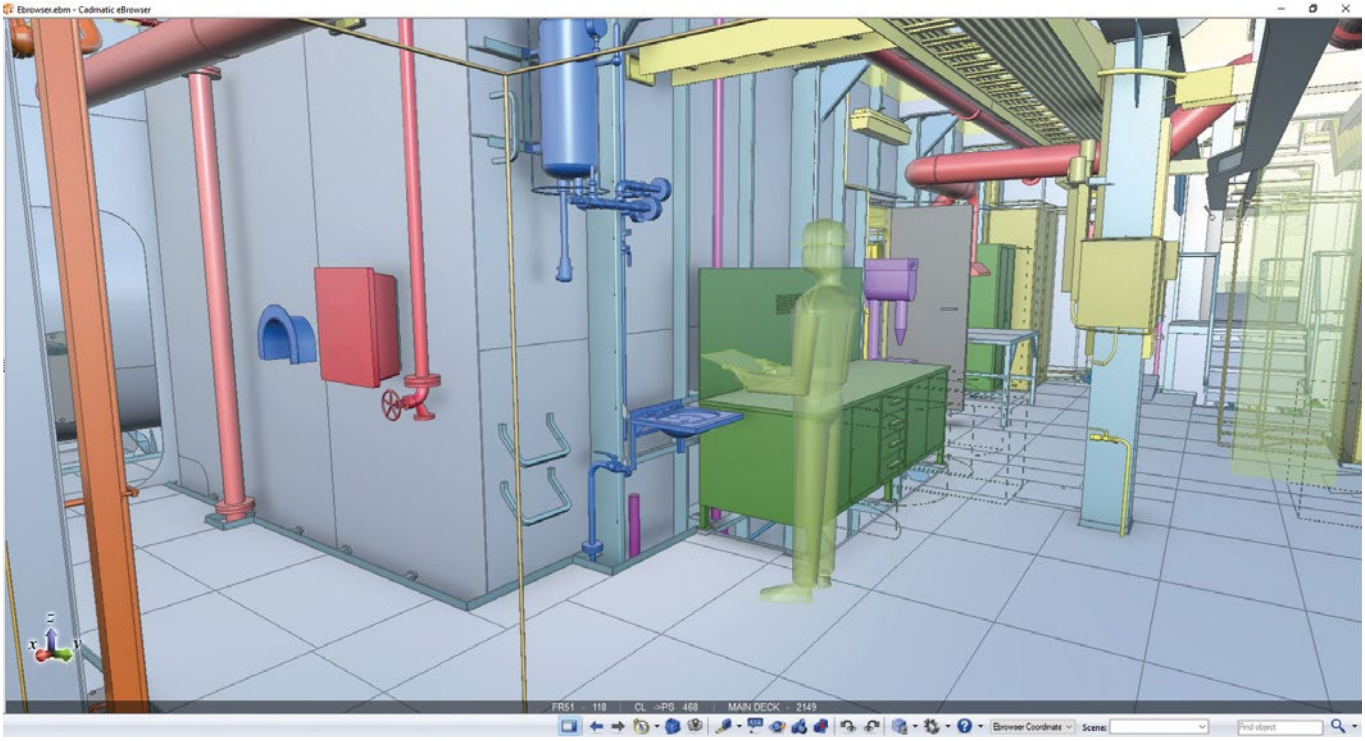
Damen acquired the Mangalia shipyard in 2018. Prior to this, the shipyard had been under Korean ownership and had used a different design software system for over 20 years. After the Damen acquisition, a switch was made to Cadmatic.

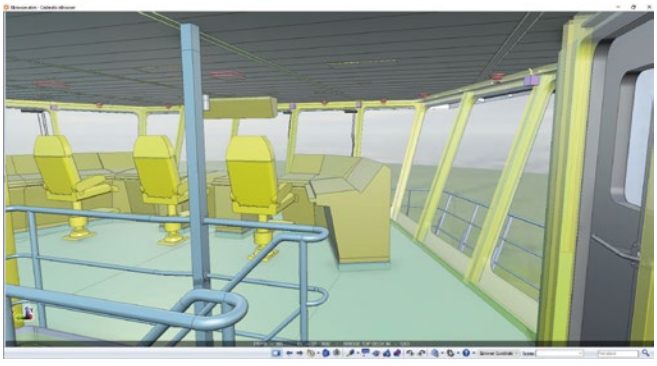
George Arnautu, Head of Engineering Department at Damen Shipyards Mangalia, says change is always difficult, but that it was a relatively easy transition to Cadmatic.

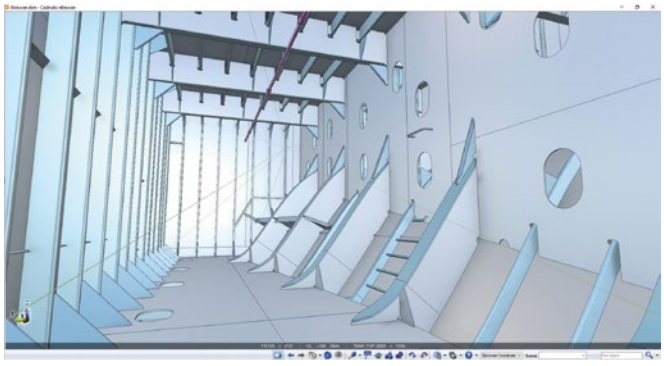
"It helped that we had experience in modelling with other ship design software, so it was not like learning a completely new skill. We had a lot of support from within the Damen group where Cadmatic is used widely," says George.

User-friendly and fast modeling

George's colleague, Alina Conda, is the Head of the Hull Production Support Office at the shipyard. She remembers that during the transition to Cadmatic they were immediately impressed with the user friendliness of Cadmatic.







"Compared to our previous software, it is much easier to do 3D modelling with Cadmatic. When you change something in the model, all other related parts change as well. This saves time and you have fewer errors in modelling," Alina says.

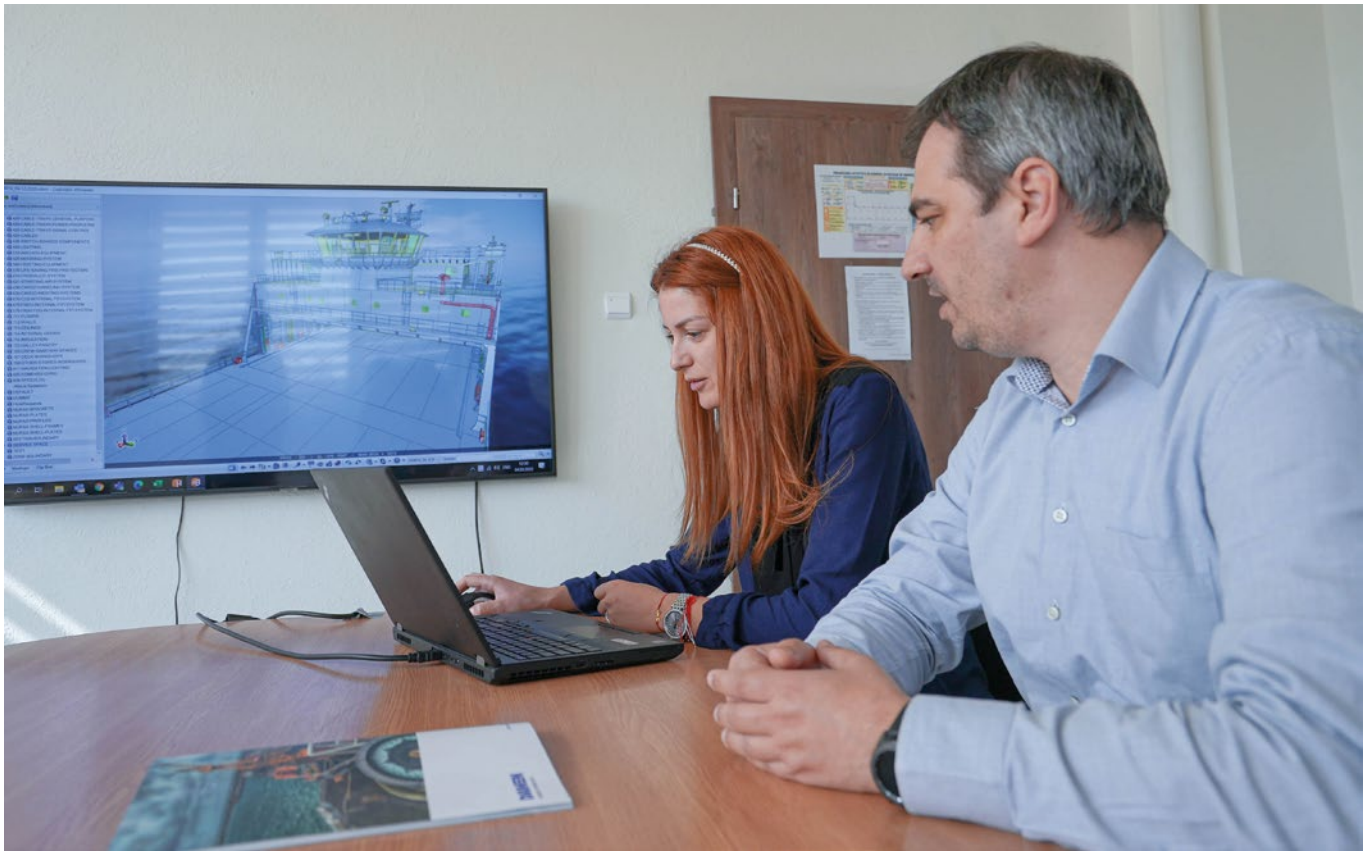
She gives some further examples of how Cadmatic has eased part modelling.

"Before, we needed to input a lot of information before we could create a plate and it required several steps. In Cadmatic, you just click a button and then you can create the plate. It's the same for brackets. When you create a bracket in Cadmatic, you don't have to think about the dimensions for each bracket and whether a flange is needed, the software does that for you," Alina explains.

eBrowser used daily

CADMATIC eBrowser is a popular tool at shipyards where Cadmatic software is in use. Damen Shipyards Mangalia is no exception and George indicates that it is used daily by their foremen and

> *It is easier to get an overall picture of what you need to construct when you can look at the 3D model compared to using just 2D drawings.*



George Arnautu and Alina Conda have been impressed with how user friendly Cadmatic's modeling is.

production engineers.

"We use it a lot in outfitting. It is easier to get an overall picture of what you need to construct when you can look at the 3D model compared to using just 2D drawings. They can also view equipment and object details in the eBrowser model," says George.

eBrowser comes in handy when outfitting job cards are created. The shipyard's staff use eBrowser to search for and quickly find model objects related to the job cards.

Direct link with Cadmatic support

Having a direct link with the Cadmatic support team is something that George and Alina appreciate. They indicate that the collaboration with the support team is going well and that tickets left with the support team are handled efficiently.

"Before, we did not have a direct link with the software developers, all communication went through the shipyard owner at the time. With Cadmatic, we can discuss issues directly with the software developers and we get support every time we send them a request," says George.

DAMEN

Text: Ludmila Seppälä

The role of legacy data in the digital transformation of shipbuilding

Shipyards are increasingly embracing the immense possibilities offered by advanced digitalization in the shipbuilding life cycle. A key enabling component of this transformation is the use of reliable and modern software tools. Making changes in a shipyard's software landscape is no trivial matter, however, as the effects are felt throughout the entire value chain from design to production and beyond. These changes can, however, deliver significantly higher levels of productivity and profitability.

Shipbuilding projects are highly complex and commonly involve the use of numerous different software solutions, hundreds of engineers and designers, several companies located in different countries and continents, and even several building sites. Digital transformation touches and transforms the way the entire shipbuilding network works.

Legacy data from previous projects

When a shipbuilding company has made the decision to embrace digital transformation with the implementation of next generation software, a key consideration is how legacy data from previous systems and projects can be migrated effectively, and how the data can be accessed and reused where necessary.

There is currently no universal data exchange format in the shipbuilding industry and the complexity of linking design data with production and construction processes must always be kept in mind.

When changing to a new CAD software system, there are generally three different scenarios for the use of legacy data.

Scenario 1: Access to legacy data

The simplest and cheapest scenario is when only access to legacy project data is required and no reuse is expected. In this case, it is advisable to store the data in an information management platform, such as CADMATIC eShare.

It provides access to legacy data and ongoing projects, including 3D CAD data with inbuilt conversion possibilities for the main CAD formats, 2D documentation, options to integrate with external file storage or DMS/PDM systems, and laser-scanned data upload.

Scenario 2: Conversion and reuse of CAD data

CAD data conversion is considerably more complex. Several aspects require consideration, including the data structure, geometrical shape, and possible topological linkage between parts and between the 3D model and 2D documents. Depending on the case, the solution may involve converting only some parts, such as the equipment library and piping components, or the conversion of an entire 3D CAD model.

When converting an entire 3D CAD model, the original CAD system needs to provide export in the selected format, while the target system needs to handle the complexity of conversion and mapping. A middleware integrator often needs to be involved as proprietary CAD databases are highly specialized and their structures are often not shared between major market players in shipbuilding. Cadmatic has realized these kinds of native data transfer and conversion projects to Cadmatic from the following systems: Aveva Marine Outfitting®, PDMS®, Tribon®, NAPA®, and Nestix®.

Scenario 3: Multi-CAD systems

The use of different CAD systems for simultaneous design is the most complex scenario for shipbuilding software. It comes with high levels of complexity, administration and infrastructure support costs. The complexity arises from bi-directional automated export-conversion-import and use of native editable data in each system.

Usually, middleware integration and a conversion layer are necessary to facilitate the process. While exporting, mapping, converting, and importing data represent a straightforward workflow, an additional business logic might be applied to achieve the required level of automation and intelligence in the transfer.

Identify information flow gaps and benefit from industry expertise

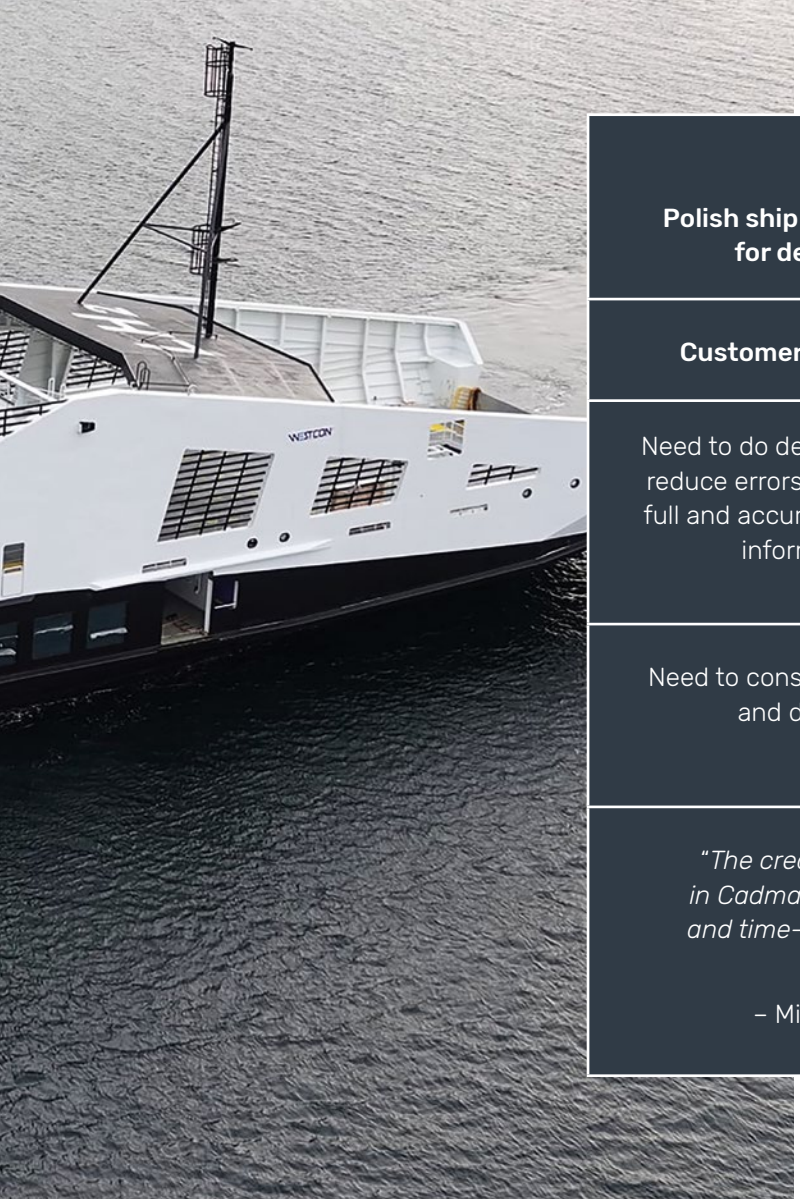
A thorough analysis of shipyard processes and needs is required before embarking on the path to digital transformation. No shipyard is the same, but tried and tested approaches and the help of an experienced partner can facilitate the process.

Cadmatic, as a developer and supplier of the fastest-growing shipbuilding solutions on the market, has decades of experience in facilitating the most complex data migration projects and can assist any shipyard in the digital transformation journey and handling of legacy data.

Download free white paper on 3D CAD data exchange in shipbuilding projects to learn more about available possibilities and best practices.

“Hydrogen-ready” Hydra showcases design excellence

Midcon Designer Ltd



Article summary

Polish ship design company has used Cadmatic since 2005 for demanding basic and detail design projects.

Customer challenge:	Cadmatic solution:
Need to do design efficiently, reduce errors, and generate full and accurate production information	Cadmatic used for basic and detail design of vessels. Significantly reduces documentation errors compared to manual 2D work.
Need to constantly improve and develop	Cadmatic is continuously developing to make users' work easier

"The creation of shell plating and production documents in Cadmatic is a great help. Normally, this is a very tedious and time-consuming job that we currently cannot imagine doing without Cadmatic"

– Michał Strabel, Midcon Chief Executive Officer

In August 2021, Norwegian operator Norled took delivery of the *"hydrogen-ready"* Hydra, a double-ended Ro-Pax ferry and one of the first passenger vessels designed with capabilities for liquid hydrogen propulsion. The basic design of the vessel was developed together by LMG Marin and Midcon Designer Ltd (Midcon) from Poland with Cadmatic software.

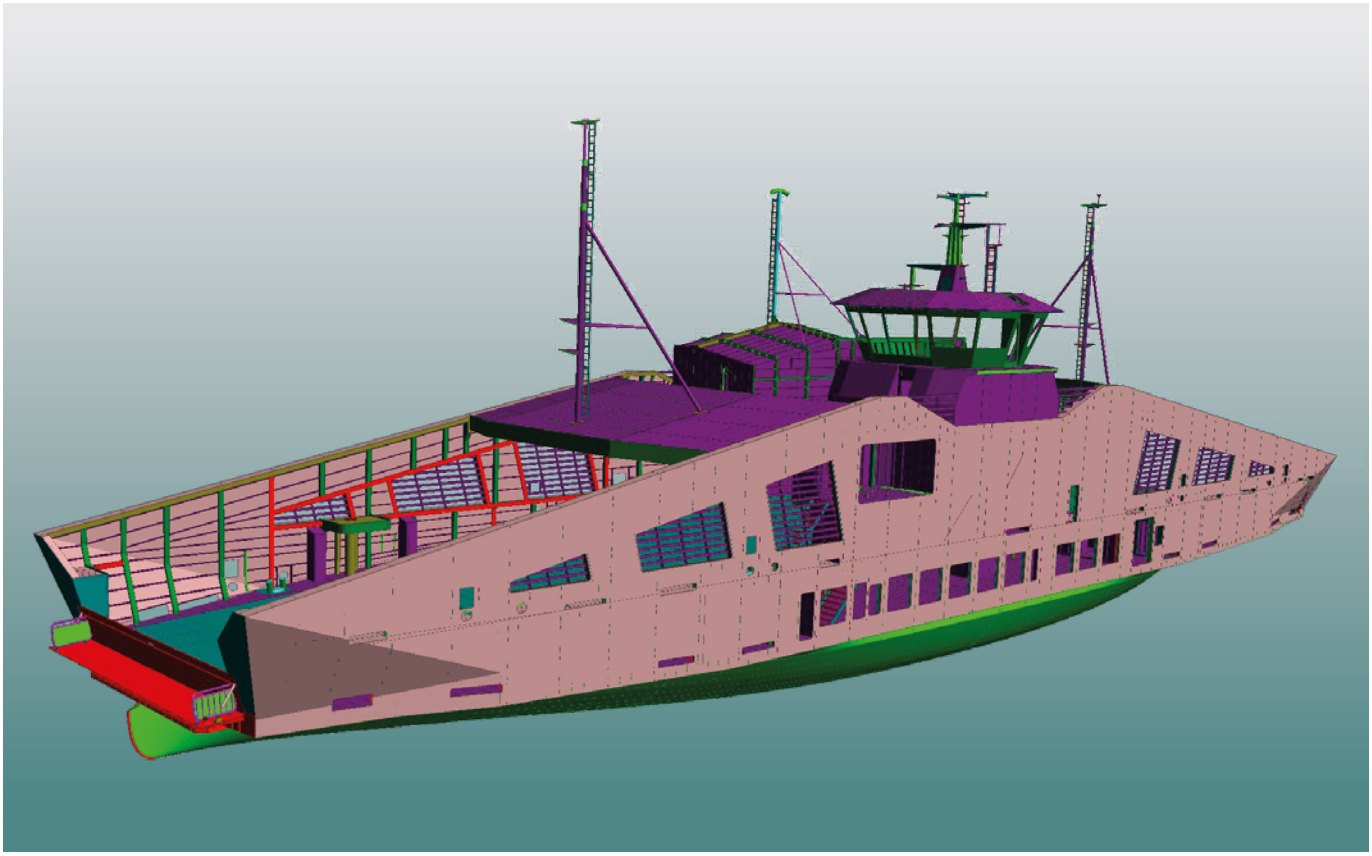
The vessel stands out for various reasons, among those its highly distinguished shape, sloping main deck, passenger section under the main deck, several interdecks on different planes, and the partial roof above the deck. The vessel is 82.4 meters long and can carry up to 292 passengers and 80 cars.

Hydra design project gave a lot of joy

Midcon Chief Executive Officer Michał Strabel says that it gave his design team a lot of joy to combine everything on the Hydra project into a coherent whole.

"This project really allowed us to showcase our skills and experience. The inconspicuous pocket for the MOB boat, which is covered with a shutter on the side, turned out to be quite a challenge, but we love challenges. To provide enough space and integrate the pocket into the structure of the ship, we had to generate several ideas and make many modifications before we achieved the desired effect," says Michał.

For the time being, Hydra is operating on battery power, but can switch to run solely on LH2 once fuel availability is secured. The hydrogen tank was placed on the open deck, which Michał says was



nothing new for his team.

Some interesting novelties in the design, however, include the protective wall between the tank and the wheelhouse, the rooms for servicing the hydrogen system, as well as the vessel's gas mast. Michał indicates that this was important to prevent gas accumulation and accommodate the very low system operating temperature of -196 °.

Cadmatic user since 2005

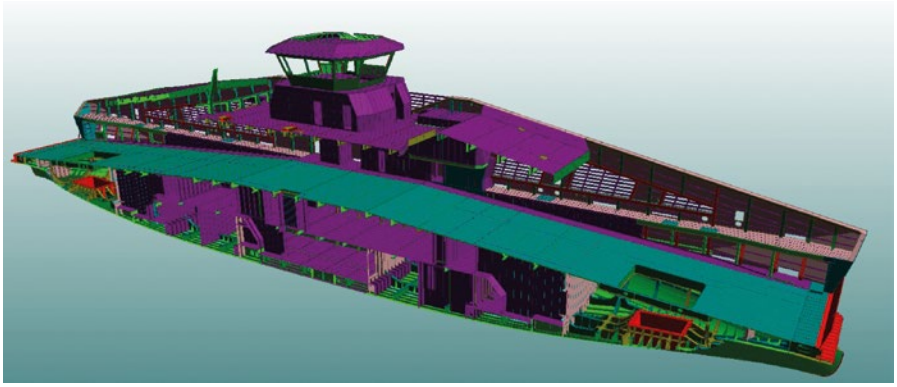
Midcon is an experienced Cadmatic user and started its first projects with the software already in 2005. It specializes in seagoing vessels, but has also completed projects such as shuttle boats, tugs, icebreakers, passenger ships, bulk carriers, container ships, coast guard units, barges, drilling ships, and FPSOs. Cadmatic is used for the basic and detail design of the vessels.

"For detail design, we use both CADMATIC Hull and Outfitting and generate full production documentation. For basic design, we usually only use CADMATIC Hull, but sometimes we receive a 3D model for a device or system that we import with CADMATIC Outfitting. In more complex projects, this speeds up the work a lot and guarantees a well-designed project."

Michał says that Midcon models the entire structure of ships during basic design, and sometime the shell plating too.

"This allows us to obtain a consistent model from which to

Michał Strabel, Midcon Chief Executive Officer



Hydra, a double-ended Ro-Pax ferry and one of the first passenger vessels designed with capabilities for liquid hydrogen propulsion

generate documentation and two important pieces of information: the weight of the fuselage with the center of gravity, and the material list for our clients."

According to Michał, a well-designed 3D model ensures that the generated cross-sections are consistent and significantly reduces the number of errors compared to documentation prepared manually in 2D.

"The creation of shell plating and production documents in Cadmatic is a great help. Normally this is a very tedious and time-consuming job that we currently cannot imagine doing without Cadmatic," Michał adds.

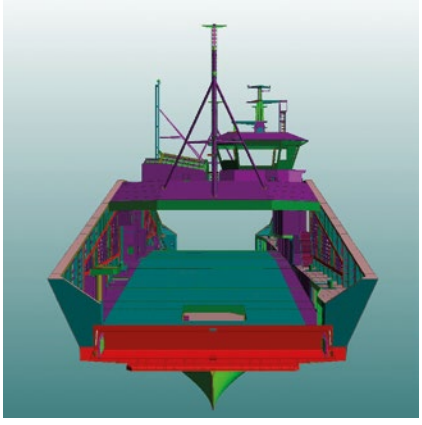
CADMATIC eBrowser is also used often at Midcon to share the model with colleagues for discussion and planning.

"eBrowser makes our work much easier and faster. It is a fantastic tool that gives you the ability to view any problem or collision from all sides. It greatly facilitates communication and ensures that we are discussing the same thing."

Delving deeper to get more out of the software

Michał concludes by saying that Midcon is increasingly delving into Cadmatic to discover new opportunities and ways of making their work even more efficient.

"I think that Cadmatic can offer us a lot and facilitate our work. I am also happy that the software is constantly evolving to make our work easier."



midcon DESIGNER LTD

Text: Ludmila Seppälä

Will a new ship design solution improve efficiency or jeopardize ongoing projects and work processes?

It is not news to shipbuilders that there are benefits to be gained from modern design solutions and a data-driven approach to shipbuilding: accelerating the time to market, reducing costs, and shortening lead-times to name a few. What is holding shipyards and ship design offices back from implementing these clearly beneficial solutions?

Risk or benefit? Design solution implementation has far-reaching implications

There is no simple answer to this question. One area of concern is that a new design solution has very far-reaching impacts on all facets of the ship design and shipbuilding process as well as shipyard organization overall and that there is a significant risk of making things a lot worse before you make them better.

Depending on how long it takes before things become better, the financial and business risks are immense. Maintaining the status quo can in many cases be easier, especially if the shipyard is currently efficient and the order-book is full. Why risk downtime or worse? A compelling reason is that the benefits to be gained simply far outweigh the risks, especially if you put proper and proven systems in place to mitigate the risks.

One should also consider taking a longer-term perspective: you may be efficient now with current methods and tools, but how competitive will you be in 10- or 15-years' time if you do not modernize now? Will the new generation of ship designers accept the use of outdated tools? Can experienced designers adopt new technologies and adapt to new tools? Can designers respond fast enough to the challenges posed by new regulations in shipbuilding and new industrial practices such as scrubbers, ballast water retrofits, LNG, LPD, or hydrogen challenges imposed by the modern society?

Implementation without jeopardizing on-going projects and existing work processes

At the end of the day, even when all fears related to a new ship design solution are alleviated, the sheer scale of the implementation project and general resistance to change is enough to cause hesitation for many.

There are, however, ways of getting teams up and running quickly so that benefits can be seen fast. It is a question of managing the risks and implementing new solutions in a meticulously planned, systematic, and shipyard-specific manner. Choosing an experienced partner that has been there and done that for organizations similar to yours also goes a long way to mitigating risks. Using a tried and tested approach to implementation is a solid foundation for success.

Should you implement on your own, with support and guidance from the solution provider, or use consultants?

Nowadays, ship design solution implementation projects are often outsourced to local representatives or even partner consultancy companies, who often have only limited knowledge about the application itself and only a consultative feedback loop to the developer of the solution. This way, solution providers tackle the lack of their own implementation resources and create distance between themselves and the end users.

Having direct access to the solution provider enables fast feedback and provides users with the opportunity to tap into the provider's in-depth functionality knowledge. It also allows users to learn from best practices of using a particular solution.

Cadmatic has collected all the best practices from the over 35 years of experience gained in discussions, feedback, and implementation projects at over 900 ship design companies and shipyards in one white paper that can be downloaded via the QR code.

Learn the best practices of CAD solution implementation – Download white paper

Read more and download white paper about a systematic and proven method of implementing new design solutions at ship design companies and shipyards and managing related risks.

Su Ship Design – Multidisciplinary design excellence

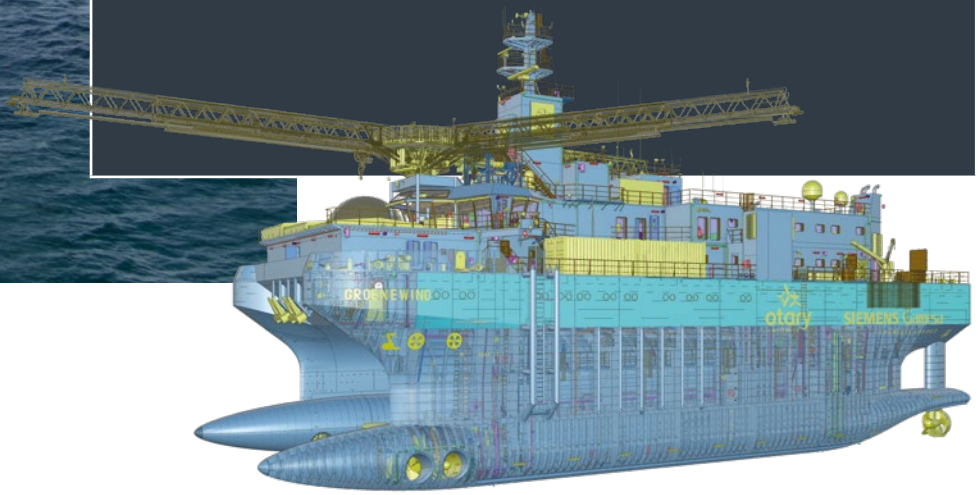
Advanced detail design of service operation vessel GROENEWIND

Article summary

Turkish ship design, engineering, and consulting company uses Cadmatic for demanding detailed design projects.

Customer challenge:	Cadmatic solution:
Need to complete detail design efficiently and update designs quickly when revisions are made.	Cadmatic used for all detailed design. High level of topology means that design revisions can be implemented quickly and accurately.

"With Cadmatic it's a big plus how easy and quickly revisions can be made" – Burak Acar, Head of Sales and Marketing



Su Ship Design is a multidisciplinary ship design, engineering, and consulting company from Altinova Turkey. They handle all the detail design tasks for Cemre Shipyard, among others, and use Cadmatic for all detail design.

Su Ship Design's services cover a truly wide scope with a focus on quality and attention to every detail. They do concept design, basic design, detail design for structure & outfitting as well as machinery & piping.

The company is also a registered R&D center and has recently published its first two scientific publications. According to Burak Acar, Head of Sales and Marketing at Su Ship Design, they have several more scientific publications in the pipeline.

SOV GROENEWIND designed with Cadmatic

A recent demanding project completed by Su Ship Design was the detail and advanced detail design of the service operation vessel GROENEWIND. The Small Waterplane Area Twin Hull (SWATH) vessel is deployed for wind farm maintenance activities, where the SWATH design ensures low wave impact compared to traditional monohull SOVs.

The detail hull design, HVAC modelling, piping modelling and electrical cable tray modelling of the vessel were all done with Cadmatic.

Burak says the fact that the vessel was the first of its kind added a significant layer of complexity to the project.

"Cadmatic assisted us to manage the demanding design tasks in this project. The software has strong detail design features. 3D modelling is probably the best feature of Cadmatic and it is also a big plus how easy and fast revisions can be made," says Burak.

Integrating electrical design with 3D modeling improves the bottom line

It is still rather commonplace for some shipyards to consider electrical design as an add-on to main design disciplines such as structural hull and outfitting design. As such, it is often outsourced and completed in its own silo separately from the rest of the ship design project. Shipyards can significantly improve efficiency by integrating electrical design with the rest of their ship design. This may require integrating work from subcontractors and demands a clear understanding of which party takes charge of which task, but it's worth the effort.

Currently, many shipyards have learned to live with a bearable level of inefficiency when it comes to how electrical design is handled in ship design projects. This often comes in the form of a lack of information from suppliers and the inability to follow project progress and manage changes efficiently. Changes from electrical subcontractors often come unexpectedly and at the last minute, which then requires more changes to the ship design.

It is no small matter, however, when your electrical designer informs you that you, for example, need to make more space for 25 additional electrical cabinets on a design that is already tight. Depending on the scope of changes required, it can even affect delivery in the worst-case scenario. Ideally, this should be avoided with a design approach that integrates all disciplines, including electrical design, from the very beginning of a ship design project.

As ship design and shipbuilding have evolved, we have seen increasing amounts of such integration between different design phases and disciplines. So far, electrical design has been left mainly out in the cold, largely due to its 2D roots and the fact that external turnkey suppliers or subcontractors have traditionally handled electrical design separately.

An integrated approach ensures that the design project remains under control without any last-minute surprises and delays.

Integrated design approach has great benefits

It makes sense to include electrical design as part of an integrated design approach, however, and the benefits are enormous. Shipyards should expect more from their electrical design suppliers in this regard.

Electrical documents such as schematics, diagrams, arrangement drawings, electrical equipment, switchboards, and cabinets can all be linked to the 3D model. There is also scope to link manufacturing information, supplier data and PLM/PDM/ERP data. With this approach, the project documents and information are always up to date and synchronized with 3D models, which eliminates the need to do time-consuming and error-prone manual checks.

An integrated approach ensures that the design project remains under control without any last-minute surprises and delays. It also improves quality by eliminating human error associated with the manual updating of documentation and models when design changes are made. In short, it improves the bottom line.

CADMATIC Electrical differentiates itself from competitors by offering electrical design that is integrated with 3D modeling. Try the trial version and take advantage of fully integrated design.

Case – Glosten implements CADMATIC Electrical for integrated design

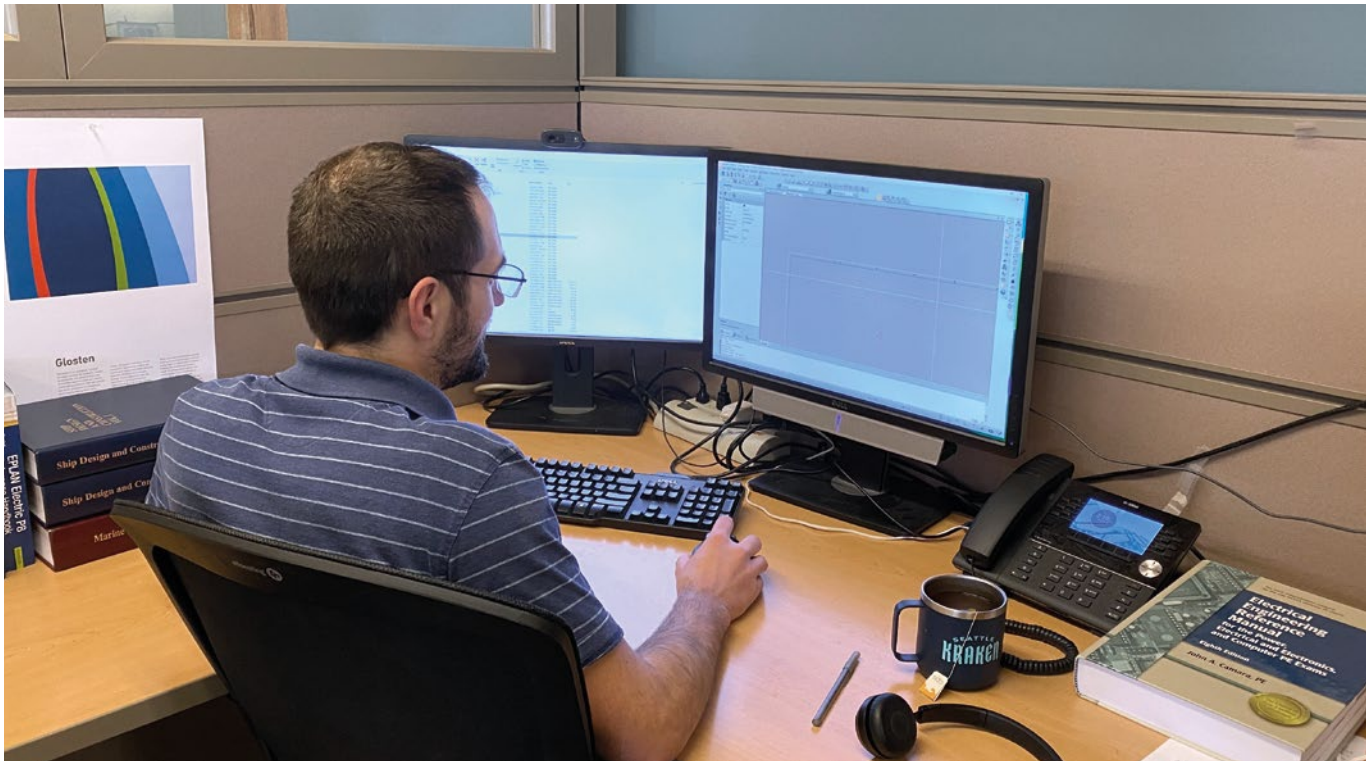
In 2022, Glosten implemented CADMATIC Electrical after a rigorous evaluation process and comparison with competitor offerings.

According to Adam Brown, Marine Mechanical and Electrical Engineer at Glosten, vessel electrical systems are getting more complex and require an integrated software package that can help maintain information and make sure parts and cables get updated throughout design deliverables when there are changes.

“Electrical one line and cable block diagram drawings can include hundreds or even thousands of cables; using basic AutoCAD® would result in major data management problems when equipment and cables appeared on multiple drawings,” says Adam.

Some of the key features Glosten considered when evaluating the different electrical design software packages were database backends, project setup times, ease of use, functionality, and integration with other software packages.

“After trying out several software packages, we chose CADMATIC Electrical. It proved to be quick for users to get up to speed with and create their first drawing, and we really liked the integration with other Cadmatic software packages like Diagram and Plant Modeler. In addition, we have had good experiences working with the Cadmatic support and sales teams. Outstanding software support was one of the primary reasons we chose CADMATIC Electrical,” Adam explains.



Adam Brown, Marine Mechanical and Electrical Engineer at Glosten, has been highly impressed with the integrations between CADMATIC Electrical and other Cadmatic software tools

Benefits of integrating electrical design with 3D modelling

- Receive accurate cable length information earlier
- Reduce re-work by handling equipment that needs electrification in a database
- Improves quality by eliminating human error due to manual data handling
- Improves decision making as real status of electrical project can be seen at any time
- Ensures data integrity by managing electrical elements in a database
- Automatic output updates when changes are made to equipment or cables
- Shortens lead-times and drives down costs by managing accurate information
- Efficient management of electrical changes during all design stages
- Electrical elements are part of the digital twin
- Improves communication between shipyards and electrical subcontractors

Try the trial of CADMATIC Electrical and and take advantage of fully integrated design.

Cadmatic office in Vancouver supports Seaspan and drives business development

Cadmatic has expanded its presence in Canada in 2022 to support Seaspan Shipyards and their subcontractors like Genoa Design International, Vard Marine and Elomatic, as well as other Cadmatic clients in the region such as Glosten and Edison Chouest Offshore. The rolling out of a new office in Vancouver is driving business development in the entire North American region.

The Vancouver office address:
Cadmatic Inc
949 3rd St W
North Vancouver
BC V7P 3P7
Canada

Cadmatic's key customer in the region, Seaspan Shipyards, specializes in new construction of and repair work on ferries, Coast Guard vessels, naval ships, barges, tugs, yachts, fishing vessels, Arctic Class and research vessels of all types and sizes.

The local Canadian business entity, Cadmatic Inc. operates out of the Capilano Business Park in North Vancouver close to Seaspan. The office is already home to several employees and ongoing recruitments are set to expand the staff compliment. Juan Nunes Prieto, Manager, Business and Operations North America, is set to relocate permanently from the Netherlands to Vancouver soon to support the Vancouver office and to develop the Cadmatic business in Canada and USA.

"Face-to-face meetings are very important in America, and I look forward to settling permanently in Vancouver so that I can regularly meet our current and potential clients. I think there is quite a lot of untapped potential in the market, both for our design applications and information management solutions," Juan Prieto says.

North American market holds much potential

According to Juha Asanti, Cadmatic Vice President, Marine, North America is a region that holds much business promise for Cadmatic.

"There is a lot of commercial shipbuilding for local markets in North America and there is, for example, a lot of river barges, workboats and ferries being built in the region. The construction of coastguard and naval vessels and their support vessels is also a very big business. We can add value to all these kinds of design and construction projects," says Asanti.

Juan Nunes Prieto Manager, Business and Operations North America will support the Vancouver office and to develop the Cadmatic business in Canada and USA. He will relocate permanently to Vancouver in 2023.

Introducing Juha Asanti:

Vice President, Marine

Who is Juha Asanti?
I was born and raised in Turku and still live nearby on the island of Kakskerta in the Finnish archipelago. I am married and have two energetic kids. I hold two master's degrees in Industrial Economics and Economics. In my free time, I participate in outdoor activities: skiing, snowboarding, biking, hiking, and jogging. I also like to do woodwork in the house or on my 50-year-old boat. Boating in the archipelago is close to my heart and during the summer I spend a lot of time by the sea or out on the water.

How and when did you end up at Cadmatic?
In 2009, after finishing my first master's thesis, I started working at Cadmatic as a Technical Application Specialist. In 2012, I moved to sales. After that, my areas of responsibility expanded, including most recently a role as Vice President, Regional Offices where I was responsible for managing our international offices.

What is your current position and what are your most important tasks?
I was appointed as Vice President, Marine Industry in February 2022. My main responsibility is to grow the Marine business turnover and make Cadmatic the number one choice globally. My tasks range from defining and executing higher level strategic goals to being involved in customer cases, working together with the global partner network and sometimes participating in marketing and R&D-related activities.

What are the most challenging aspects of your work?
The marine industry is constantly developing and evolving, which is a great and fascinating challenge; no customer case is the same. Our clients need to become increasingly competent, which sets the bar high for the software used in their projects.

What do you like most about your work?
Working with great people, be they colleagues, customers, or partners. I am also genuinely fascinated by the projects our customers are doing, whether we are talking about the largest vessels in the world or the most complex cruise liners. I love combining two things close to my heart: the sea, and technological forerunners. Being able to fulfill and even exceed our customers' ever-increasing requirements brings great joy and satisfaction.

What do you see as the main trends in ship design and shipbuilding?
Digitalization is playing an ever-increasing role. Companies worldwide are starting to see the great opportunities technology and digitalization can bring. We are only at the beginning of that journey, and we will still witness significant technological advancements in the field. Green energy and sustainability issues will remain critical topics, not just driving regulatory compliance but also as forces behind creating a competitive advantage for shipowners. We already see tremendous developments in fuel transition towards green energy. Electrification is naturally a big issue in shipbuilding, but there are also several other exciting developments in fuels like hydrogen and ammonium.

How do you think Cadmatic addresses customer needs concerning these trends?
We constantly monitor current and future trends to ensure that our software meets our customers' needs. We are very proactive in this regard. We are in close contact with our clients and work closely with universities, research institutes, technology providers, and other organizations in the industry to ensure we stay tuned in to what is happening in the industry.

What are your most important goals and focus areas for the next few years?
My most important goal is to ensure that Cadmatic is the clear market leader worldwide. It is a very ambitious goal, but with the talent and ambition we have in the company and how technologically strong we are now, let alone in a few years, I am confident we can reach this goal. We are growing rapidly in terms of turnover, but we are also increasing resources throughout the organization. This allows us to quickly develop new features and enhancements and make the market aware of those advancements.

If you had to pick one Cadmatic value you most associate with, what would it be and why?
All our values are important, and it is easy to relate to any of them. If I had to pick one, it would maybe be Succeeding Together. It connects well with what we do in our customer projects. When we help our customers succeed in their projects, we also succeed. It reminds us that our internal development projects or customer cases, are never one-person shows but a team effort. When a team cooperates the way we do, the result is often a success.

Standalone intelligent General Arrangement tool for holistic basic design

This article is a modified version of a Cadmatic paper presented at COMPIT 2022. It describes an approach for a standalone software solution that generates the basic design documentation for any type of vessel in a multi-company and multi-software environment.

Naval design, engineering companies, shipyards, shipowners, and regulatory bodies often use different tools and software solutions for specific tasks and to present output documentation. This results in an enhanced need for an overall project follow-up and impacts the overall shipbuilding management process, Bruce (2021).

Ideally, the 3D model of a vessel should be defined so that any changes to the main dimensions or any item in the model triggers the system to update the whole model accordingly. During the basic design stage, several dimensions influence the main dimensions of the vessel. They affect, for instance, the ship weight, stability, and damage characteristics. The ability to modify these dimensions at any time throughout the entire project ensures a high level of model malleability. Furthermore, automatic model recalculation gives the naval architect the workspace necessary to optimize the model iteratively

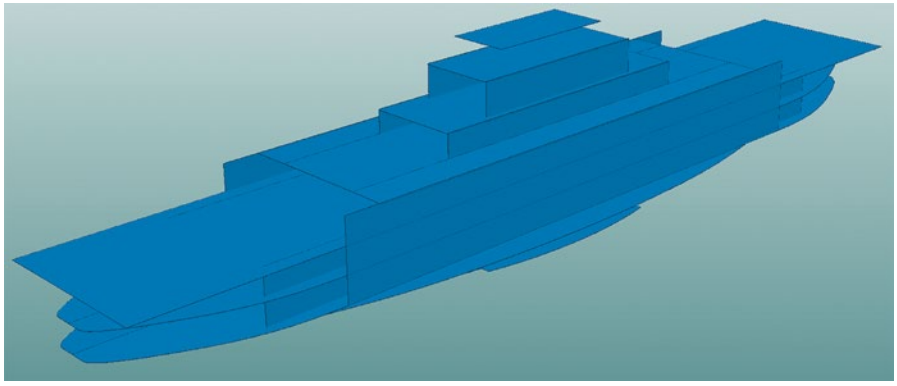
Parameters in Adaptive General Arrangement tool

The main dimensions can be represented using parameters in the Adaptive General Arrangement tool. These parameters are defined once conceptually and are used throughout the project. The parameters can be defined as fixed values, such as the main dimensions, or mathematical formulas.

Other parameters can be used in mathematical formulas, for instance, to define dimensions dependent on the main dimensions, creating an inter-dependency between these values. One can, for example, define a reference distance between decks dependent on the fixed value parameters for the deck positions.

Enhanced parametrization using reference surfaces

Further refining of the theoretical model can be done by using the parameters to define conceptual surfaces with properties named reference surfaces. These surfaces are concealed flat surfaces with properties such as thickness and material type, which are used as the topological basis of the plate definition. The actual steel structures cross-refer the reference surfaces and are given the same properties. They are updated accordingly when changes are made to the linked reference surface.



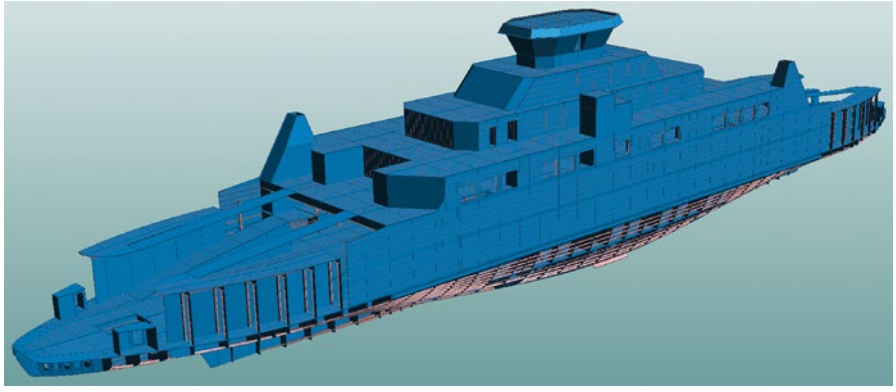


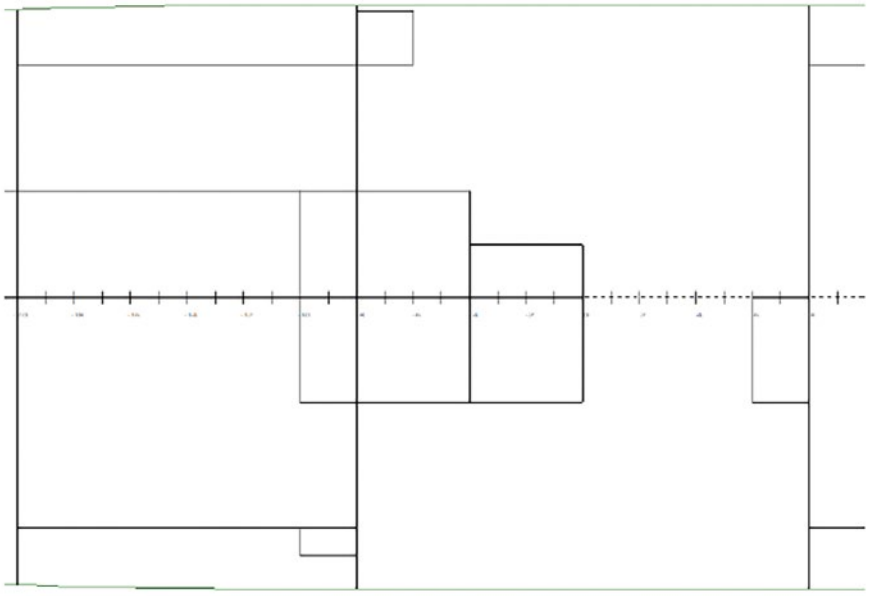
Fig.1 Reference surface model (top) and steel model (bottom) of a Ropax

Besides the high degree of malleability, detailed engineering in the following design stage is also much faster as the plane and the properties are predefined in the reference surface. Consequently, it is possible to define a whole topological system where altering a single parameter modifies every key construction in the ship, taking all the conditions into account.

Fast layout definition through sketching

To capture a complex vessel, naval architects break the design into pieces, designing on the floor and deck level. They try to create a sufficiently complete design quickly, so that all relevant requirements can be checked against the design. Designing in 2D is the best option when faced with tight deadlines. Moreover, designing through sketching helps naval architects to understand proportions, scale, and relationships that are difficult to see in 3D. Therefore, manipulation in 2D gives the most freedom to quickly create and modify the plan at the basic design stage.

New functionality for fast design lets naval architects promptly generate a ship layout by selecting multiple drawing lines or a fixed value with step sizes. Sub-bulkheads and longitudinal bulkheads can be created by converting drawn lines at the floor or deck level to steel plates; the system builds the 3D model automatically and searches for the 3D boundaries of the steel plates to be created.



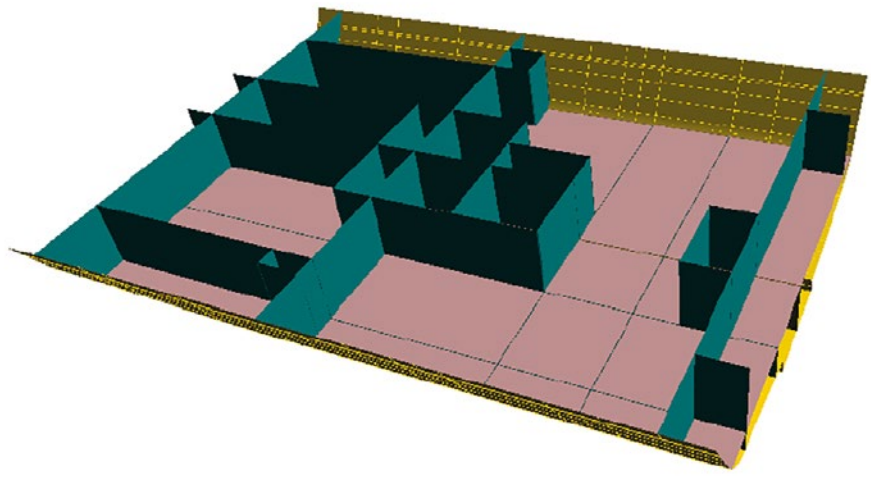


Fig.2 Each bulkhead (main or sub) can have assigned properties so that the material and stiffening structure will be available and visible in the views.

The newly created plates include construction properties; the topological behavior is essential since it allows the plates to be updated when the boundaries or the main dimensions are modified.

The generated 3D model is used directly in later stages of the design for complex changes. Because the 3D model is simultaneously created during sketching, there is a direct connection between the 3D model and the sectional views. When the 3D model is changed, these views are automatically updated, thereby saving time and avoiding errors.

Profiles as properties

After the main layout has been defined, the naval architect can speed up the design by stiffening the designed structure with automatic stiffening functions. The profiles as properties functionality enables the maritime architect to strengthen the bulkheads automatically in one go.

The software tool automatically places stiffeners on each grid position on the selected bulkheads. When a stiffened bulkhead size changes, the system automatically adds or removes stiffeners to it depending on the new size of the bulkhead.

Defining pillars in a matrix

The naval architect can define pillars in a matrix, after which the system automatically determines the end relations. For example, the maritime architect can establish a series of pillars in length and breadth on a deck level all in one go by providing the direction and distance. The system automatically searches for the end limitations, like the deck below. When a girder is present, the pillar is automatically connected to it.

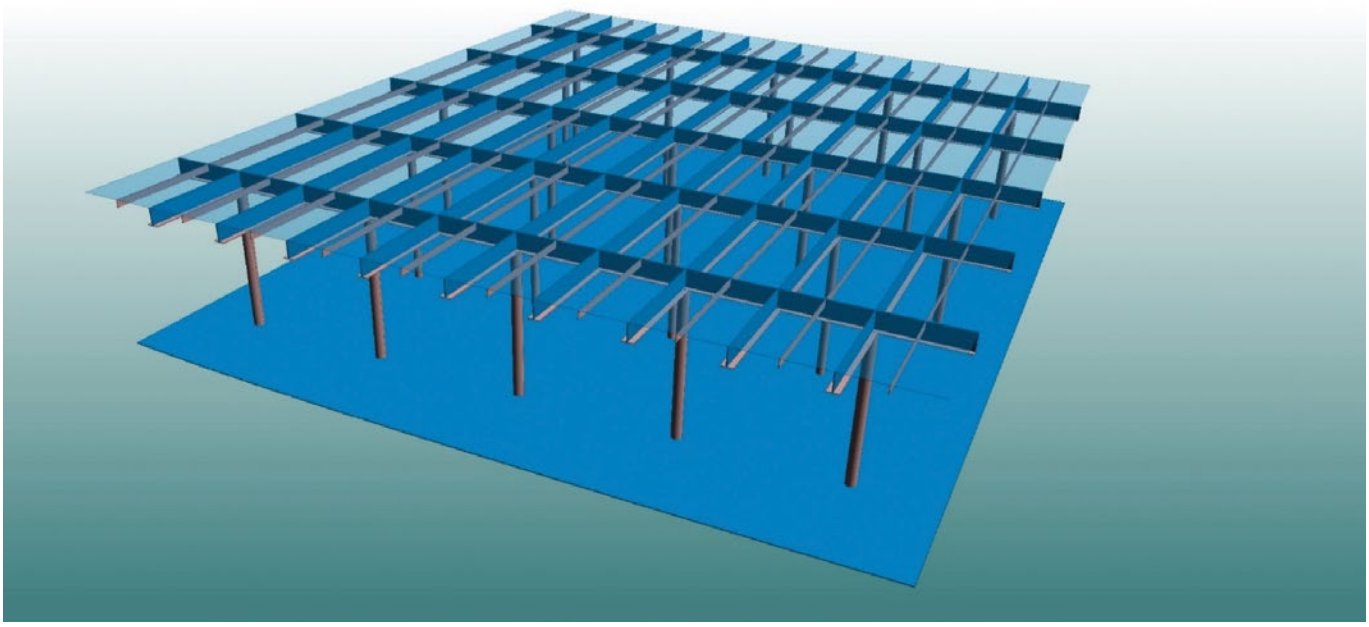
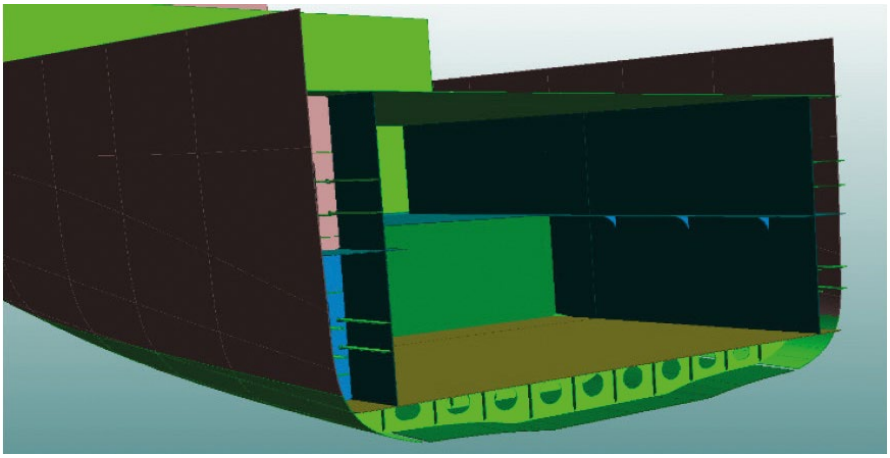
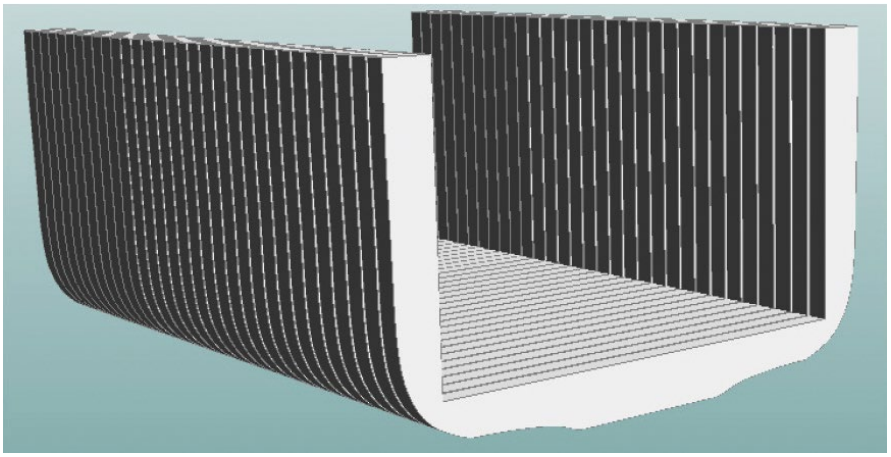


Fig. 3 Example of pillars in a matrix with automatic connections to girders and the deck below

Fig.4 Example of a mid-ship section (top) and the corresponding fully loaded 3D space (bottom)





Weight estimation

The midship section and the main layout are mandatory to define the basic design and general arrangement. With this information, the scantlings are determined so that the ship follows the rules. The solution for weight calculation has been extended not only to do the addition, but also to estimate the weight and center of gravity (COG) of the ship based on *"reference"* frames. After the naval architect has designed the mainframe, a parallel mid-ship section can be created as a fully loaded 3D space.

It is possible to calculate the actual steel weight and COG of the mid-ship section, the volume, and the weight of the fully loaded space. Based on this information, it is possible to extract the ship shape's weight per volume ratio [kg/m3]. This weight is used for other frames similar to the mid-ship.

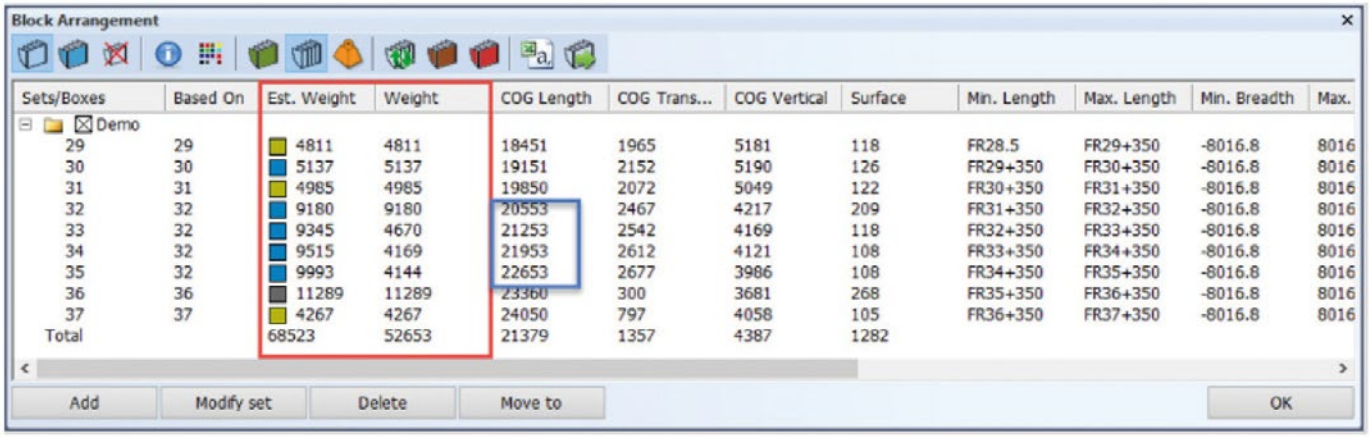


Fig.5 Example of weight and COG estimation based on mid-ship reference frames

The tool is not limited to the mid-ship section. Several reference frames can be utilized concurrently for weight estimation to achieve a more accurate estimation.

Topological equipment

During the basic design phase, heavy machinery layout significantly influences the ship's weight. Therefore, adaptability to new designs must be extended to outfitting elements.

With the elaborated *"Equipment Layout"* function in the hull application tool, the user can insert heavy machinery, for instance, by opening the component library and selecting equipment. The equipment is displayed in the hull view and can be positioned as required. Outfitting and piping disciplines can access the same model and make adjustments or changes according to machinery requirements.

Since topology is the main factor that speeds up and automates steel creation, this property is also added to the equipment via the *"Connect to view plane"* function. This ensures that the circle of automatic topological behavior triggered by the parameters is applied to close the loop.

Scantling analysis

To create sound and consistent structures to ensure safety and economic viability, the design must be checked against well-known rules and regulations. Several classification societies can calculate the feasibility of the design in terms of scantling choices, plate and panel thickness, and the spacing of internal frames, bulkheads, and longitudinal stringers.

Traditionally, scantling calculations are based on data from frame views. The primary data passed on to the scantling calculation software contains the description of the inner construction of the vessel and its variation along the ship, translated to the calculator's specific protocol.

OCX format: from classification to industry standard for data exchange

To enhance the classification process, a switch from a 2D drawing-based to a 3D model-based process has been researched and defined in the Open Class 3D Model Exchange (OCX).

This OCX format is intended to become an open industry standard for exchanging design information between designers/yards and classification societies. In addition to optimizing the calculation process by directly interfacing with the 3D design model, all parties involved in the vessel design have direct access to the model by directly interfacing with the 3D design model. This ensures transparency and reduces the amount of work by eliminating unnecessary drawings.

Cadmatic's Madalina Florean presenting the COMPIT paper in Siena, Italy, on 22 June 2022.

Having direct access to the 3D model also improves the understanding of the design.

The application of such a universal format goes beyond 3D scantling calculations. We are studying the possibility of using the model in the OCX format to perform FEM calculations.

The proposed adaptative general arrangement software ensures access to the 3D model and can read back information. When the classification society requires changes to the model, these changes must be made manually in traditional approaches. With a bidirectional connection, such modifications can be automatically done in the adaptative design tool by importing 3D models from an OCX file.

Connecting GA tool to optimization software – CAESES

Shape optimization is an important factor when optimizing a vessel due to its significant impact on hydrodynamic performance and structural behavior. Changes to the shape lead to changes in length and beam, which influence the weight and resistance. The intelligent hull general arrangement tool can be directly connected to any optimization software. CAESES software has conducted research that provides a new hull shape for every optimization variant, Harries and Abt (2019). In addition to the unique shape, the primary dimension parameters such as length and beam are updated, and the CAD system recalculates the 3D model. It is subsequently checked whether the scantlings are acceptable, and a new weight is provided based on the updated 3D model. The optimization software then calculates the resistance of the current hull form and the CAPEX and OPEX. The cycle continues until the optimization software finds the optimal parameters corresponding to an optimal vessel design, Harries et al. (2019).

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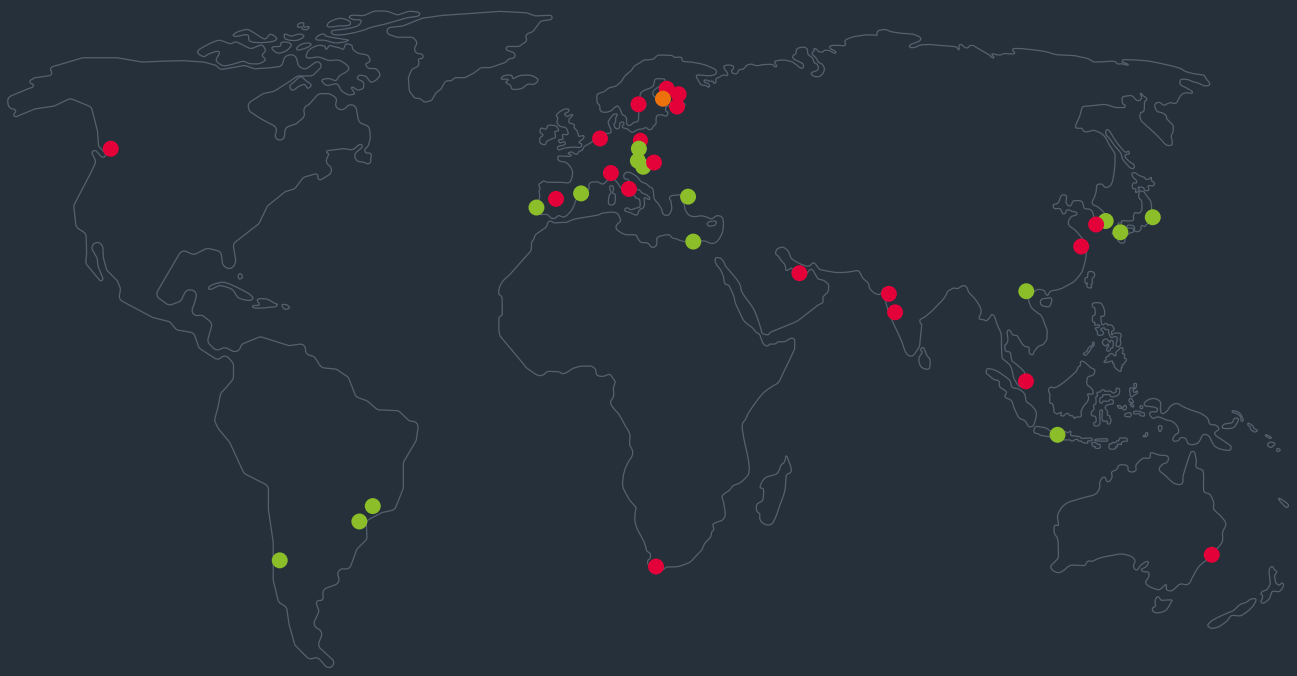
Cadmatic is a leading 3D design and information management software developer and supplier for the marine, process, energy and construction industries.

- Cadmatic's headquarters are located in Turku, Finland.
- We have staff in Australia, China, Estonia, Hungary, India, Italy, the Netherlands, Poland, Singapore, South Africa, South Korea, Spain, Sweden, the UAE, and Canada.
- 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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