DNV·GL

BULK CARRIER UPDATE

JUNE
01 2014

ALLSEAS MARINE

W MARINE INC

GREEN DOLPHIN

BUILD2DESIGN

CONTENT

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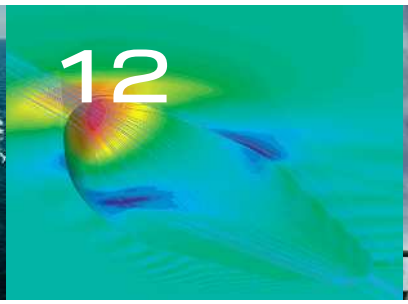

EDITORIAL

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Welcome to the new DNV GL Bulk Carrier Update
The outlook for our industry is today slightly better, but there are still many risks on the horizon. The supply/demand situation has improved and this has had a positive, although very volatile, impact on rates. Looking ahead, the fundamentals for the bulk carrier segment are strong. Steady growth in China, although at lower rates, is driving the demand for iron ore and coal imports. Environmental concerns, which are moving higher up on the agenda in China, are most likely positive for shipping, with higher-grade imported raw materials, such as coal and iron ore, becoming more competitive compared to the domestic alternatives. We are also seeing that the growth in China and the rest of the region has had the expected favourable impact on the inter-Asian trade, with positive effects on the rates.

However, there are many new risks, and opportunities, that we need to navigate through. Changing market conditions, as well as new regulations, are raising questions about new designs, unknown yards, new technologies, new fuel alternatives and new equipment on board - to name just a few. Some of the regulations are global and some are local, and the lack of predictability makes owning and operating ships even more challenging.

In the merged DNV GL, we have more resources than ever before. We have more specialists who can advise you when evaluating newbuilding projects or provide support to improve the performance of your existing fleet. We have experts within every field who can advise you on the status and impact of new regulations. We have surveyors in more ports than ever before to help you keep your ship trading. In short, we can assist you in navigating, so that the risks become opportunities to improve your overall performance.

BULK CARRIER UPDATE

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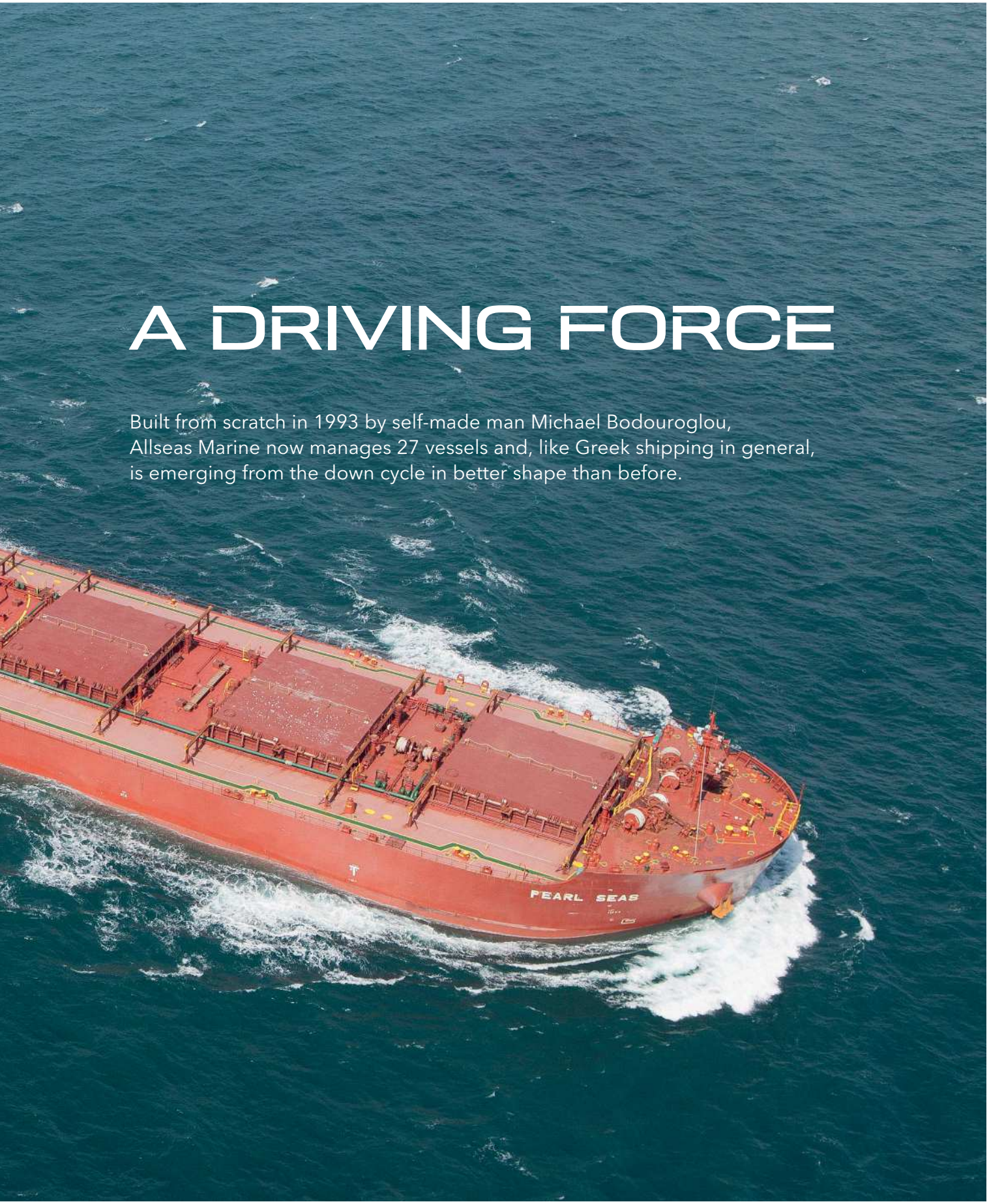
A DRIVING FORCE

Built from scratch in 1993 by self-made man Michael Bodouroglou, Allseas Marine now manages 27 vessels and, like Greek shipping in general, is emerging from the down cycle in better shape than before.



Text: Damien Devlin,Blue-C

Michael Bodouroglou on class
As signalled by his involvement in several class society committees, Bodouroglou is a great believer in the role of class in the maritime industry.

"Primarily, shipowners want class to provide a good quality service with quick response times. But there is also a growing appreciation for the value class societies can provide in an advisory capacity. They have a lot of knowledge and experience, so you'd be foolish to ignore that," he says.

Regarding the newly formed DNV GL, Bodouroglou says it is too soon to tell how it will affect the level of service the company can provide.

"While it takes a class option off the table, I appreciate that there are synergies between the two that may enable the new company to provide better services," he states.

"If you want something done, ask a busy person to do it," says Michael Bodouroglou, founder of Allseas Marine. And he should know. Bodouroglou is also founder, chairman and CEO of bulk carrier owner Paragon Shipping and container company Box Ships – both of which are independent companies that employ Allseas to manage their fleets.

As if that is not enough to have on one's plate, he is also on the board of numerous maritime and business committees and is president of the Hellenic-Australian Business Council (HABC), an organisation he is particularly enthusiastic about. Working with such organisations, says Bodouroglou, gives him a platform on which to communicate the positive side of the shipping industry.

"In the past, shipping has received a lot of negative publicity. But as well as being key to global prosperity, our industry has also raised its environmental and ethical standards. As one of the main players in the global maritime industry, I think the Greek shipping community has a responsibility to tell this story," he asserts.

Going his own way
Despite having no family background in shipping, Bodouroglou was attracted to the international nature of the industry from the age of 16. After completing a degree in naval architecture, he worked as a technical superintendent for Mamidakis, where he spent three years, and then joined Thenamaris, where he spent a decade. In 1993, Bodouroglou, together with a business partner, started his own operation, acquiring bulkers and later tankers. He says when starting a company you need to make the right decisions, but you also need some luck.

"It doesn't take much to bring you down when you first start out," he states. "It wasn't a decision I took lightly, but I was prepared to take the risk. The experience I gained from Thenamaris was invaluable and I have tried to instil a similar culture and some of the same practices in my companies."

Resisting temptation
Despite his appetite for risk, Bodouroglou confesses to being "conservative in many ways." Caution paid off for him in early 2008 when he kept his cool and refused to get greedy at a time when bulk carrier rates were skyrocketing. "I just felt it was too good to be true." he recalls.

While others kept trading on the lucrative spot market, Allseas secured three-year contracts for four of Paragon's 12 vessels. This decision was vindicated when the market plunged later that year. The continued cash flow enabled Paragon to reduce its debt by a whopping USD 400 million at a time when many bulk operators were going under.

With the yards offering lower prices on newbuildings, Paragon went into expansion mode in 2011, placing orders for seven vessels to be delivered in 2014 and 2015. Bodouroglou says with modest debt and an expanded fleet now operating on the spot market, Paragon is poised to take advantage of an upturn in bulk rates, which he believes will come this year.

"The big picture is urbanisation. The need for raw materials to fuel infrastructure development in cities around the world will see demand for bulk carriers outgrow supply, leading to a much better earning environment for operators," he claims, adding that he hopes the lack of lending will continue to depress supply.

Greek entrepreneurship
If this is indeed how it pans out, Bodouroglou's timing will be a stroke of genius. But he says he will not be the only Greek shipowner to emerge from the downturn in a better position.

"The Greek shipping community has seen these cycles come and go, so during the good times they improve liquidity and secure long-term contracts. Over the last few years, we've seen many companies go under because they were too highly leveraged prior to the market crash."

According to Bodouroglou, this shrewd business sense exemplifies the entrepreneurial spirit in Greece.

"I hope other sectors in Greece can learn from what we've achieved. It also shows what businesses in this country would be capable of if they were given the chance to operate in a competitive and well-regulated environment."

Diversifying

In 2010, Bodouroglou saw an opportunity in the container business, bought nine vessels and established Box Ships. He says it is anyone's guess when the container market will pick up, but believes the current oversupply will balance out in the medium term. "It's a consumer-driven market and right now consumers are saving, so there continues to be a supply glut." he says. "However, we're seeing more scrappings and fewer new orders being placed, so I think the market will eventually find some equilibrium. "In the meantime," he summarises, "our strategy is to wait it out and remain liquid for as long as possible."

Despite his achievements, Bodouroglou comes across as a refreshingly unassuming character. And while Paragon managed to successfully ride the market cycles in recent years, he claims that his organisations' success has been based on more fundamental factors.

"Cycles will always come and go but, if you want to build a successful business, you have to get the fundamentals in place. At Allseas, we've worked hard for many years to build a reputation for quality, safety and efficiency. I always remind my staff that it takes years to build a good reputation and a split second to destroy it." ▮

Text: Damien Devlin,Blue-C

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FILLING A GAP IN THE BULK MARKET

Bulk owner W MARINE INC is convinced that its new 84K SDPP design will outperform both smaller and larger vessels, especially in shallower ports which it says are proliferating in the southern hemisphere.

W MARINE INC was established by its chairman, Yiannis Sarantitis, in 2003. It started its activities trading a single second-hand Panamax. The company sold the vessel in 2006 and the proceeds were invested in four post-Panamax newbuildings, the last of which was delivered in August 2011. It also added two Kamsarmaxes to the fleet in 2013. W MARINE INC has built up its reputation as a reputable and safe operator and this is reflected in its incident-free record, as well as in four of the vessels, and the managing company, having been awarded QUALSHIP21 status by the USCG.

The reputation the company has built over its short history, coupled with strong financing, enabled it to get through the bulk carrier down-cycle, which is a great achievement considering the pressure the downturn put on many small companies. However, Managing Director Nikolaos Triantafyllakis believes that the company's most exciting times are ahead of it. This is largely due to W MARINE INC's new 84K Shallow Draft Post Panamax (SDPP) design, (see article on the Green Dolphin 84S on page 12) which was developed based on feedback from charterers, a careful review of the company's current fleet trading records and a thorough analysis of future trading patterns in the dry bulk trades.

Don't forget the end user!

Like most good innovations, W MARINE INC struck upon the 84K SDPP concept by focusing on the end user, who Triantafyllakis believes the industry does not pay enough attention to.

"Our charterers started telling us about draft and beam restrictions at various ports, which got us thinking about how we could

Text: Damien Devlin,Blu-C

correct that and give our clients a more flexible and competitive product." he says.

When the team at W MARINE INC inspected further, they found that in fact nearly 90 per cent of the coal, iron ore and grain traded by the vessels in their fleet went through ports – either load or discharge – with dimensional restrictions. These ports were plotted on a map. New ports – and ports being expanded – with dimensional limitations were also added to the map. It then became apparent that the majority of ports with dimensional limitations were located in the southern hemisphere, primarily loading ports in Africa and Latin America.

"I started seeing the trend of trading patterns within the southern hemisphere. If you look at the demand for raw materials in Asia and the large deposits of them in Africa and Latin America, you start to realise that this trend will only become more pronounced."

Why is a Kamsarmax called a Kamsarmax?
The problem is that because many of the ports in Africa and South America are in waters shallower than 14 metres, existing vessels cannot load to full capacity when serving them.

"I have always wondered why a Kamsarmax is called a Kamsarmax when it isn't optimised for trade in the Port of Kamsar," Triantafyllakis says with a grin.

Another factor in his calculation was that the expansion of the Panama Canal would accommodate larger vessels, which would then offer charterers substantial economies of scale compared to current vessels using the canal, such as Supramaxes and Panamaxes.

Triantafyllakis says that a small organisation, like W MARINE INC, has to continually look for ways to adapt in order to survive. "All of these factors combined to create a great opportunity, so we set out to correct the deficiency of the larger vessels for trades where draft is a limitation," he says. "Our primary goal is to offer our clients a flexible, competitive, energy-efficient, operator-friendly vessel that will optimise the cargo lifting capacity within set dimensions."

Draft 13.5m, Beam 36m, Loa 230
The two most important dimensions Triantafyllakis and his team landed on were a draft of 13.5 metres and a beam of 36 metres. A 13.5-metre draft, combined with the wider beam, would enable the vessel to optimise its cargo-lifting capacity in shallow ports.

"These dimensions are the most important features," explains Triantafyllakis, although he acknowledges that the wide beam can be an issue at the moment in certain ports. "The extra width enables the vessel to deliver the carrying capacity we are after, and my gut feeling is that more ports are accommodating larger beams." he says. "With these dimensions, the 84K SDPP vessel can lift about 100,000 cbm, which translates into a net cargo intake of 82,500 mt, together with bunkers and constants, at a draft of 13.5 metres."

Proven efficiency
As well as maximising cargo loads, the design will also cut bunker costs. Technical Manager Kyriakos Koumparakis explains that the new design incorporates many of the newest eco-design features, including the latest generation MAN B&W 'G' type main engine, hull and propulsion optimisation – in cooperation with DNV GL – and a hybrid boiler, all resulting in demonstrably lower fuel consumption and an EEDI of 20 per cent lower than the baseline. In addition, it has many other features that aim to provide commercial flexibility – high tank-top strength, the ability to carry a wide range of cargoes and sufficient scantlings to ensure operational service for 25 years.

At this point in the process, W MARINE INC engaged Chinese designers Shanghai Merchant Ship Design & Research Institute (SDARI) to bring the idea to life. In recent years, many designers, as well as yards and technology suppliers, have touted "eco-designs" with dubiously high efficiency savings. However, as the vessels are largely untested, owners are not always sure how their vessel will perform in reality. In order to get more visibility on the 84K SDPP's performance, W MARINE INC employed DNV GL to model the design's hydrodynamics. Koumparakis, explains why: "It's a big investment, so you want to reduce the risk by assessing performance and operational dynamics before you place the order," he explains. "By evaluating the design, DNV GL gave us a better idea of what we should expect and this built up our confidence in the vessel's performance and capabilities."

> "We set out to correct the deficiency of the larger vessels for trades where draft is a limitation."
> Nikolaos Triantafyllakis, Managing Director, W MARINE INC.

Greater loads, lower costs
Using this data, W MARINE INC compared the 84K SDPP with its current vessels and the results were impressive.

Compared to the traditional Kamsarmaxes, the new design, depending on port restrictions, could load up to 8.55 per cent more coal between Russia and Brazil, while saving USD 55,200 on intermediate fuel oil. Between the United States East Coast (USEC) and Europe, the design increased cargo capacity by up to 13.5 per cent while saving USD 12,300 on fuel.

Kyriakos Koumparakis,
Technical Manager, W MARINE INC

Nikolaos Triantafyllakis,
Managing Director, W MARINE INC

The results were just as stark when comparing the 84K SDPP to the 93,000 post-Panamaxes. For example, they showed that when carrying grain between the USEC and Europe, the new design could carry up to 4.87 per cent more cargo (due to its shallow draft) and achieve bunker savings of USD 80,000. In iron ore trades between Russia and China, the design could carry up to 5.20 per cent more cargo whilst saving USD 256,000 on fuel.

W MARINE INC discussed the design's specifications with a well-known charterer, which stated that the vessel could attract a premium of around 25 per cent above the Baltic Panamax Index (BPI), and that is without taking into consideration the advantages that the design will offer as a result of its ability to trade through the new, wider, Panama Canal - which Triantafyllakis thinks will be a big factor.

A fleet of 84K SDPPs?

If the vessel proves successful, something Triantafyllakis is confident of, then he says they would naturally order more. However, he is wary of growing too rapidly. "The aim of the company, in line with the wishes of its founder, Yiannis Sarantitis, is to build up a homogeneous fleet of vessels ranging in size between Panamax to post-Panamax. The addition of the 84K SDPP vessels will substantially enhance the commercial profile of our fleet and give us a competitive edge within that segment of the dry bulk market. We'll continue to monitor market characteristics and aim to adapt quickly to new trading circumstances." In addition to advantages reaped by smaller companies in being able to react quickly to news, Triantafyllakis sees many of the larger bulk-owning companies as inefficient and believes they often expose themselves to unnecessary risks. "Many rely too much on the charterer, without securing access to any cargoes. That's risky and short-sighted in such a capital-intensive industry. It is imperative to balance the commercial risks by securing access to cargoes. It's really something that some of those larger companies should consider," he declares.

The company will take delivery of the first vessel in the summer of 2016 from Sainty Marine shipyard. According to Triantafyllakis, it is mostly Chinese yards that can offer the flexibility needed to take on a new design and accommodate owners' requirements. "You need a good supervision team when building in China to make sure all of the design features are being implemented properly and that you end up with a well built ship, but it's money well spent," he states.

Optimistic about the market and design

Triantafyllakis' view of the market is entwined with the 84K SDPP design. He sees more trade being between the so-called developing world. "Demand for seaborne trade will continue to grow. We'll see increasing shifting of raw materials, mainly coming from Africa and Latin America towards the Far East. On the supply side, we have to remember that it's not just about boats on the water. It's about having enough of the right size of ships. The size of a vessel is a very critical element in dry bulk investment. My feeling is that supply will be restrained because there will be more scrappings as cargo stems increase and charterers take advantage of the efficiencies of larger vessels, rendering smaller and mid-sized vessels obsolete," he declares.

With such a compelling case for this new vessel type, many in the bulk segment will be watching with interest as it goes into operation in 2016. ▮

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GREEN DOLPHIN 84S

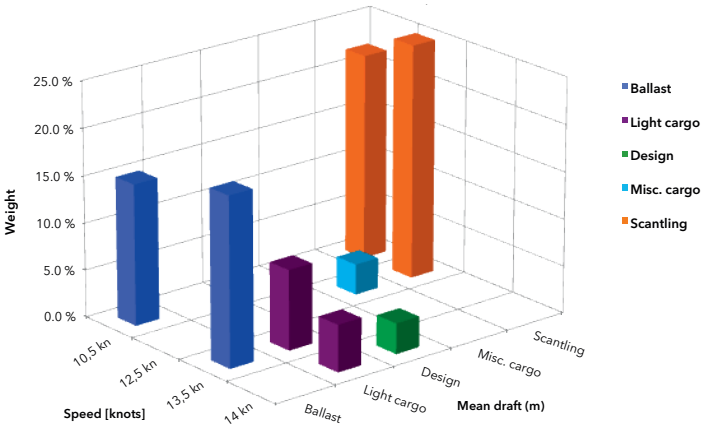
The main objective of DNV GL's assistance during the development of the Green Dolphin 84S was to help create confidence in the concept design proposed by SDARI for a wide-beam shallow-draft 84k vessel. DNV GL's scope included developing an expected operating profile, analysing the hydrodynamic performance of the hull shape, calculating the propulsion efficiency and estimating the fuel oil consumption.

The operating profile was determined based on the trade volume distribution for this bulk carrier segment - looking into trade volumes, voyage distances and the number of voyages for the various cargoes. Sample trades were studied to estimate average voyage speeds and data on draft limitations for a country/port and the relevant cargo-lifting restrictions were taken into consideration when developing the operating profile for the concept design.

SDARI had developed a candidate design and W MARINE INC asked DNV GL to assess the hull with regard to resistance and wake. The assessment focused on the design point in addition to four main operating points from the operating profile. The detailed flow characteristics were carefully studied for possible improvement potential.

The assessment concluded that the bare hull resistance and wake properties were as expected for a well optimised design with the required main dimensions and fullness, i.e. there was little or no room for improvement of the hull received from SDARI. It was noted that it might be worthwhile to implement trim guidance at light cargo drafts due to the typical transom flow behaviour. Further, the wake is considered good and again representative of a mature and fuel efficient design, but the high block design puts limits on the wake quality and the design may benefit from a wake equalising duct or propulsion improvement devices with a similar effect. W MARINE INC has hired DNV GL to assist in the further assessment of an optimal propulsion improvement device that would best match the design propulsion characteristics.

Several main engine and propeller options were also assessed in terms of propulsion efficiency to ensure a lowest possible fuel oil consumption.



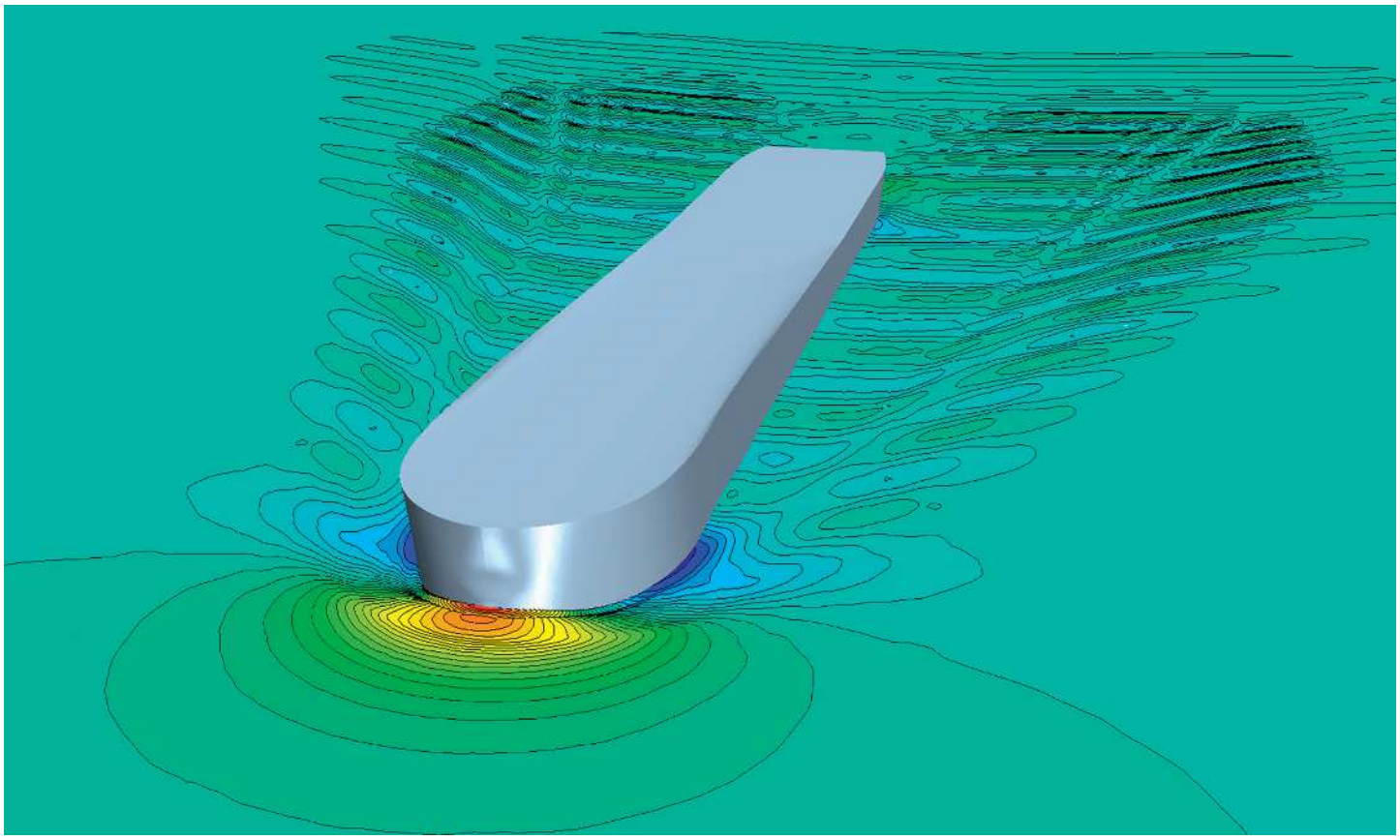
Operating profile
Draft-speed combinations and their relative occurrence

The DNV GL assessments provided a sound technical basis for W Marine during discussions with SDARI and gave the owner the necessary confidence to proceed with SDARI's proposed design.

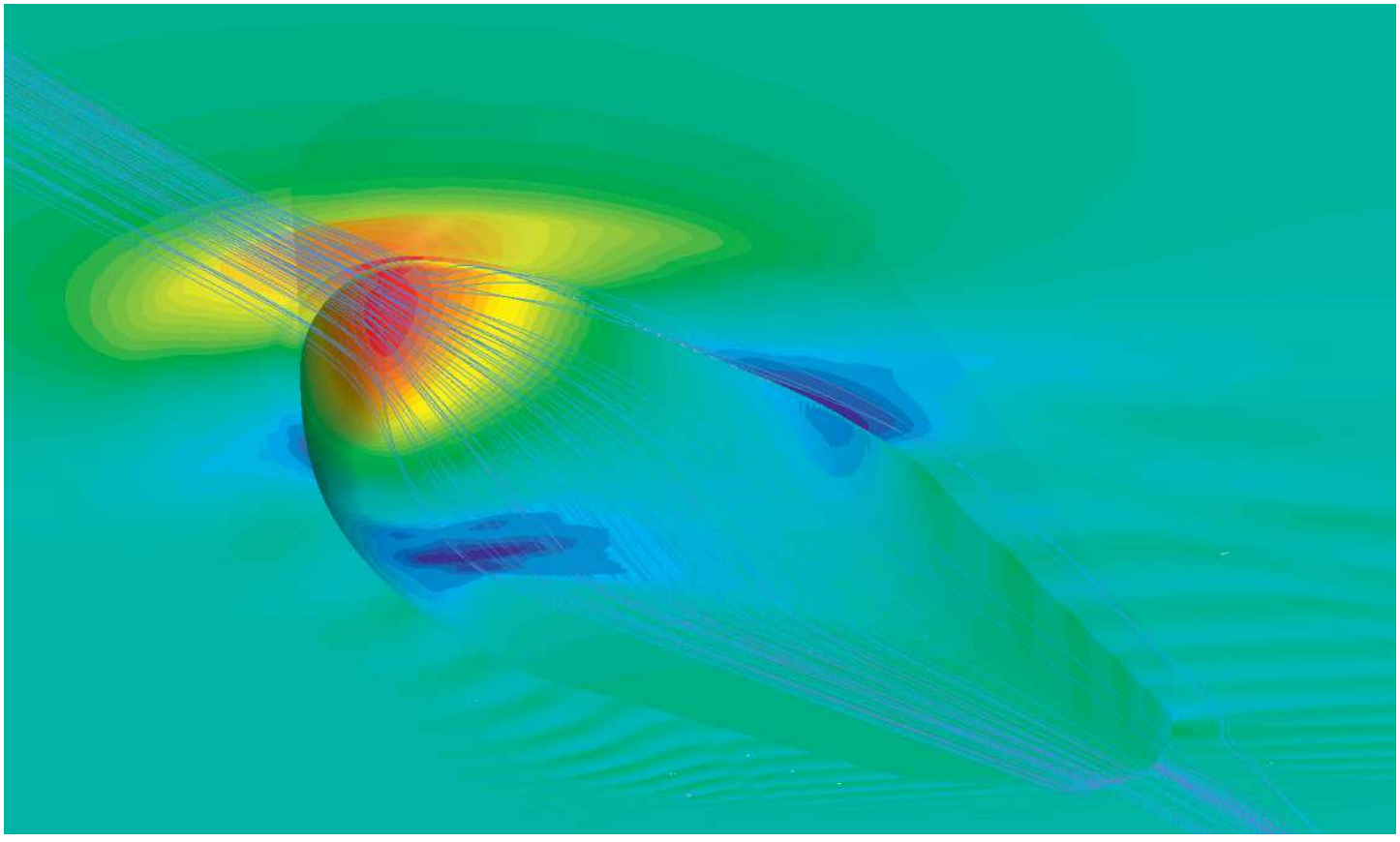
The next step is an evaluation of the cost benefit of different propulsion improvement devices. There are many viable options available and the existing detailed flow calculations provide a good basis for quantifying the savings potential.

Dr Olav Rognebakke, who has been in charge of DNV GL's team, gave credit to the work done by SDARI when he stated: "It is interesting to note that our scope of work has shifted from pure optimisation to verification," adding: "It's encouraging to see that our work has helped to reduce some of the risks involved in ordering a new design and that this design has already been ordered!" ▮

Wave pattern.



Flow lines and dynamic pressure distribution on the hull.



THE PORT OF NEWCASTLE, AUSTRALIA

Australia is the world's largest exporter of coal and Newcastle is one of the world's largest coal export ports. Other bulk cargoes include grains, vegetable oils, alumina, fertiliser and ore concentrates. The Port of Newcastle is the economic and trade centre for the resource rich Hunter Valley and for much of the north and northwest of NSW. It is Australia's oldest and one of the largest tonnage throughput ports, with coal exports representing more than 90% of total throughput tonnage.

Source: newportcorp.com.au

Text: Olav Rognebakke
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BUILD2DESIGN

DNV GL helps yards and owners to improve the fuel economy of their ships by focussing on the fabrication process. Build2Design is a new service offered by DNV GL to help ensure that the vessel hull is built to a reasonable standard to achieve minimum hull resistance. The fuel consumption promised by the design is negatively affected if the yard fails to pay sufficient attention to certain fabrication details. This may partly explain large variations in ship performance within a series of sister vessels.

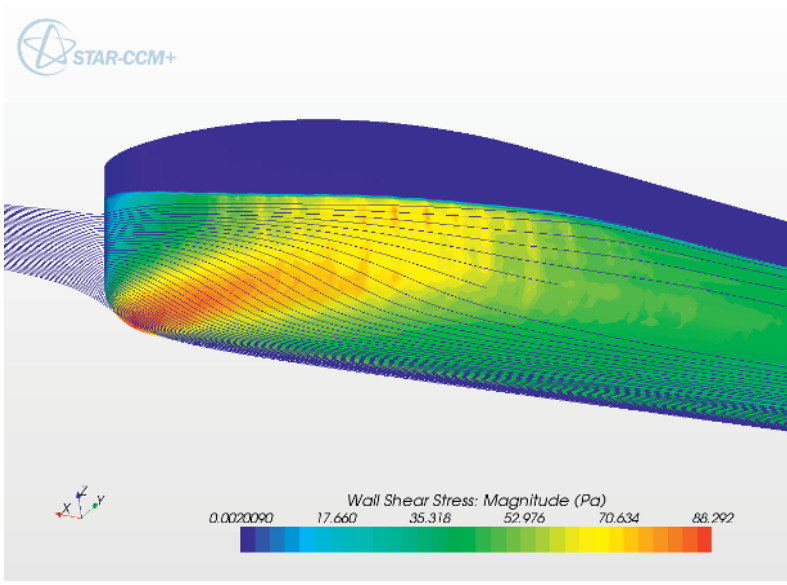
Going back 30-40 years, there was a huge focus on how to reduce hull resistance at a reasonable cost during building. This was achieved by, for instance, proper bilge keel alignment as well as reducing the drag from weld seams and other appendages. This focus was somewhat reduced during the recent boom, but the current challenging market and high fuel costs have led to renewed attention.

New analysis tools enable better assessment of cost-efficient fabrication. Quantification of the relative resistance resulting from different approaches should be balanced by the difference in effort and cost. DNV GL applies state-of-the-art computational fluid dynamics calculations to obtain ship-specific flow characteristics. This is the basis for our recommendation regarding areas of attention as well as quantified acceptance criteria.

One example in the placement of the bilge keel. The placement depends on the vessel's operational profile, as the flow around the bilge may change significantly depending on the vessel's draft and trim. This is considered in the DNV GL assessment. The traditional approach to align the bilge keel based on paint tests in a towing tank usually considers one draft only. The advanced Computational Fluid Dynamic calculations show that proper alignment of the bilge keel reduces the resistance and does not adversely affect the propeller wake. For the pilot project of the Green Dolphin 38 design, the total expected savings add up to about 2% which equales to an annual saving of about 50,000 USD. The corresponding amount for a capesize is approximently 120,000 USD per year.

The service is currently delivered for the Green Dolphin 38 pilot project for Goldenport and for Pioner Marine, and the first commercial project is based on a Seahorse 35 design for Graig Shipping.

Build2Design is offered for vessels being built to DNV GL class, and this service is carried out as a collaboration between the owner, yard and DNV GL. ∎

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GREEN DOLPHIN 38

A HANDYSIZE BULK CARRIER FOR COMPETITIVE ADVANTAGES AND A COOPERATION SUCCESS STORY

The Green Dolphin 38, the first in a series of Green Dolphin bulk carriers, is the result of a good long-term collaboration between Shanghai Merchant Ship Design & Research Institute (SDARI) and DNV GL. The ship was first developed by SDARI and DNV GL as a concept design. Introduced to the market at Posidonia in Greece in June 2012, it attracted a lot of attention and interest and a large number of orders have now been placed with Chinese shipyards.

With close to one hundred orders placed for the Green Dolphin 38, there is no doubt that the design is a success. The major share of the orders is to DNV GL class and the first ship is expected to be delivered in the first quarter of 2015.

The numerous orders prove that good decisions were made and that the right solutions were selected in the early development collaboration phase. In this phase, SDARI and DNV GL worked closely together to explore technical challenges in the following focus areas: fuel and energy efficiency; robustness and reliability; operational flexibility; and the ability to meet both current and future environmental regulations. Recognising that there is more to profitable shipping than just compliance, SDARI and DNV GL consulted widely with owners and yards to ensure that the Green Dolphin 38 can be tailored to suit individual operational needs. Emphasis was put on reducing the fuel consumption without compromising on strength and operational flexibility, while giving owners different options to meet future expected environmental regulations.

Since the ship was introduced at Posidonia in 2012, the good collaboration between SDARI and DNV GL has continued and several initiatives have been launched. For instance, the Green Dolphin 575 was developed and introduced to the market in 2013 as the second vessel in the Green Dolphin series, and earlier this year the DNV GL Build2Design service was launched with the Green Dolphin 38 as the pilot. Read more about both the Build2Design and Green Dolphin 575 on pages 16 and 20 of this magazine. ▮

FACTS
Length over all: 180.0 m
Breadth: 32.0 m
Design draught: 9.5 m
Scantling draught: 10.5 m
DWT design: 33,400 mt
DWT scantling: 38,800 mt
Service speed: 14.0 kn

Preparing for LNG tank installation.

Text: Adam Larsson
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GREEN DOLPHIN 575

A NEW HANDYMAX BULK CARRIER

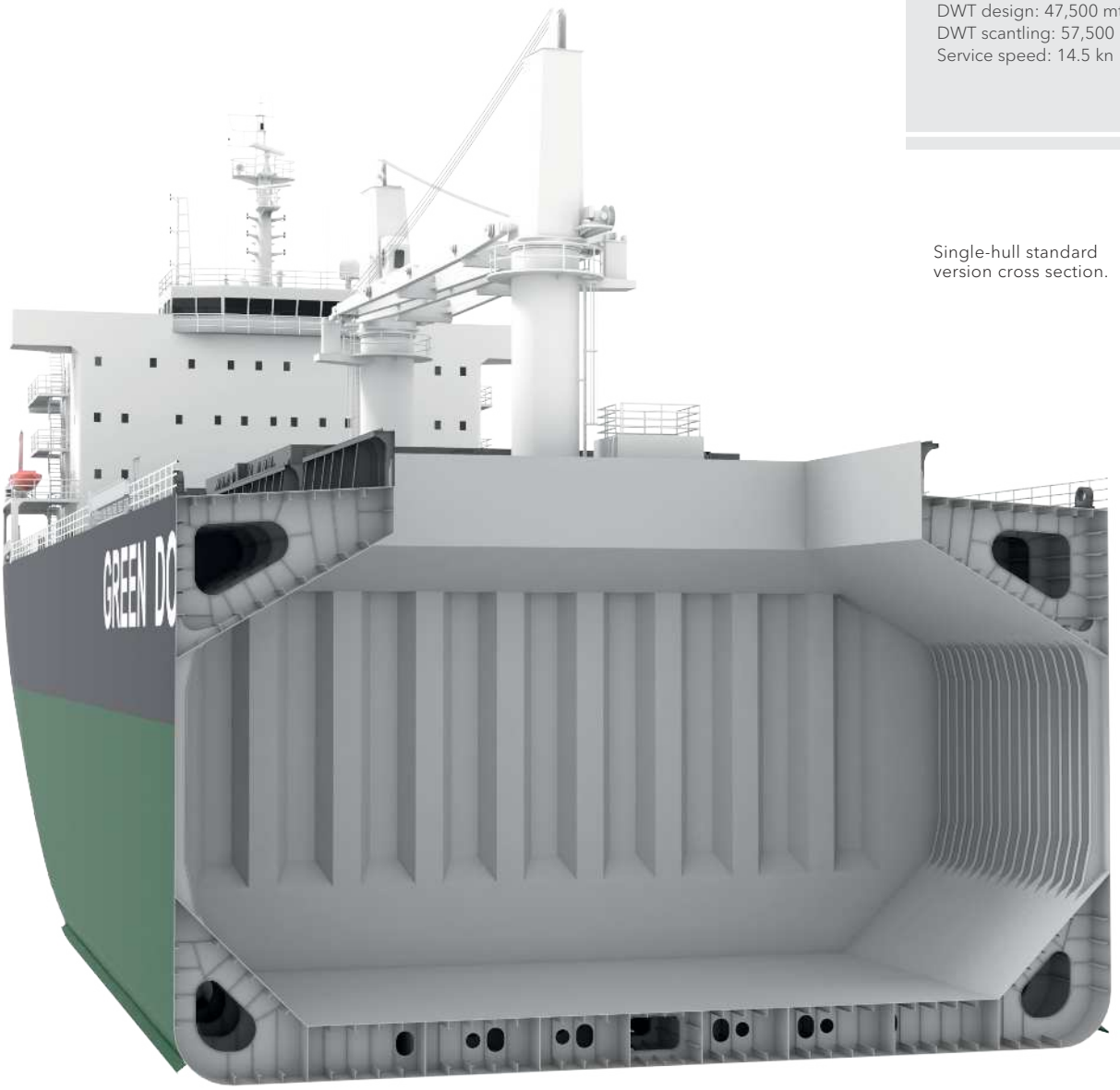
In December 2013 at Marintec in Shanghai, China, DNV GL and Shanghai Merchant Ship Design & Research Institute (SDARI) introduced the Green Dolphin 575 concept design for a Handymax bulk carrier. This is the second Green Dolphin design and builds on the success of the Handysize Green Dolphin 38. It uses technologies that are already available for commercial use, so it can meet ship owners' current needs in tight market conditions. The first order has already been placed with a Chinese shipyard.

SDARI and DNV GL have once again in collaboration applied combined and complementary expertise to deliver a new design in the Green Dolphin series. The Green Dolphin 575 is a 190m-long Common Structural Rules (CSR) compliant handymax bulk carrier with five cargo holds. It is available in single-hull standard or double-hull (open hatch) configurations.

Backed up by SDARI and DNV GL's long history and experience within the bulk carrier segment, the choice of ship size is based on extensive market analysis together with input from many ship owners and ship operators. Ship-owner and ship-operator input has also been considered when selecting design characteristics and design options. Like the Green Dolphin 38, the Green Dolphin 575 aims to be fuel and energy efficient, robust and reliable, operationally flexible and able to meet current and future environmental regulations.

New for this project is that the hull's performance in waves has been addressed through model testing and numerical calculations of the added resistance in a given trade route. An operating

FACTS
Length over all: 189.9 m
Breadth: 32.26 m
Design draught: 11.3 m
Scantling draught: 13.0 m
DWT design: 47,500 mt
DWT scantling: 57,500 mt
Service speed: 14.5 kn



Single-hull standard version cross section.

profile consisting of full load and ballast conditions at service and slow-steaming speeds was evaluated. Read more about this work and the results on page 22 of this magazine.

The engine configuration and emission reduction technologies have been carefully evaluated. The Green Dolphin 575 is fitted with an efficient Tier II long-stroke low-speed main engine and a large-diameter slow-rotating propeller. It is further designed to comply with current and future expected local and global emission regulations, such as those relevant for IMO Tier III, Emission Control Areas (ECAs) and California and EU ports, through different alternatives: a switch to low-sulphur fuels, the installation of exhaust-gas cleaning systems or dual-fuel operation with LNG. ∎

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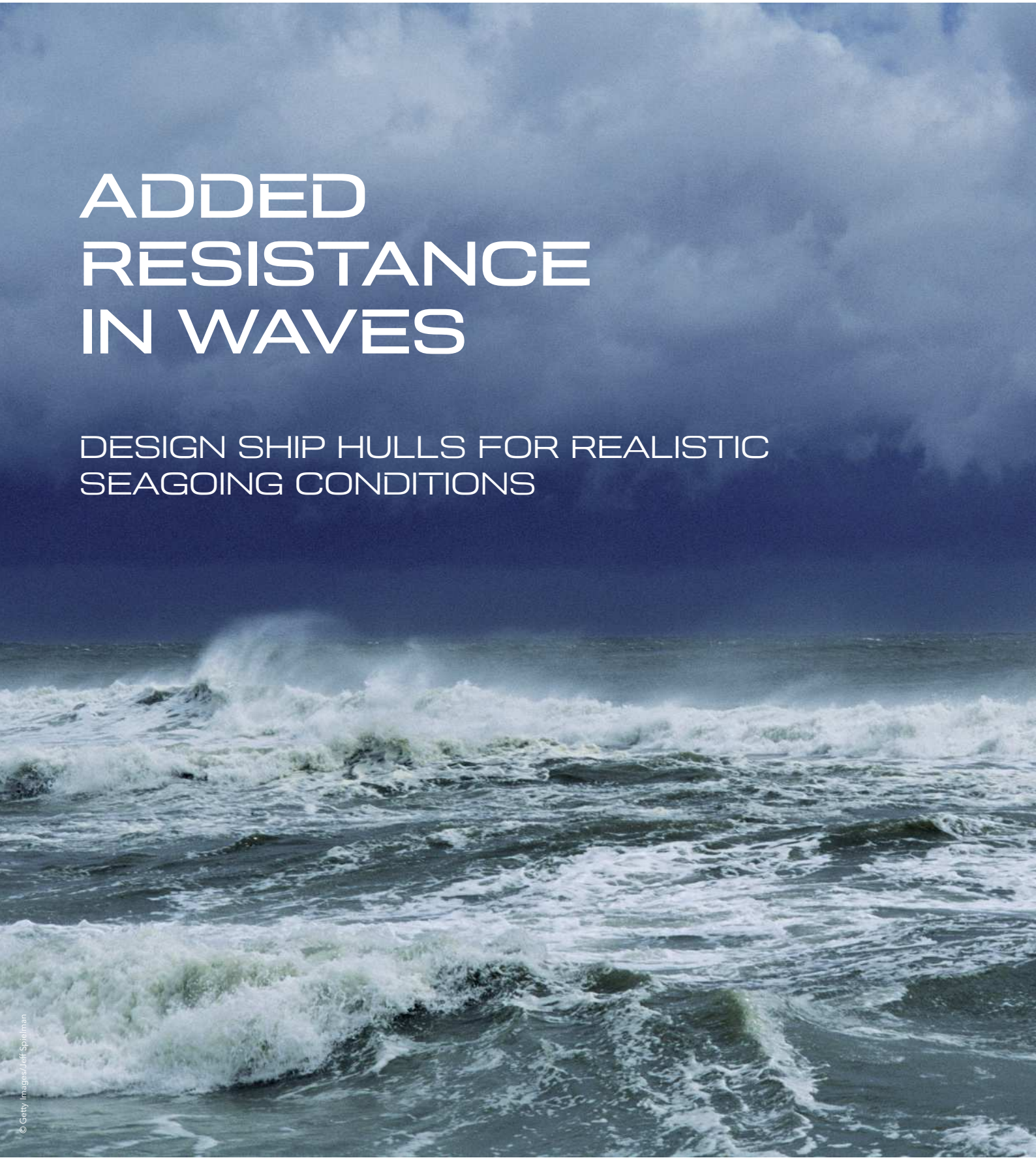
ADDED RESISTANCE IN WAVES

DESIGN SHIP HULLS FOR REALISTIC SEAGOING CONDITIONS

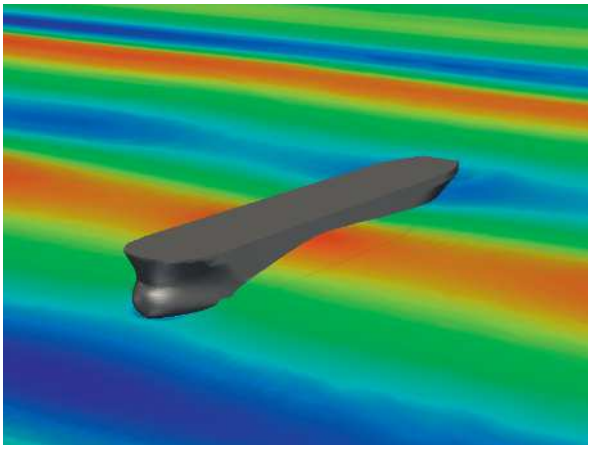


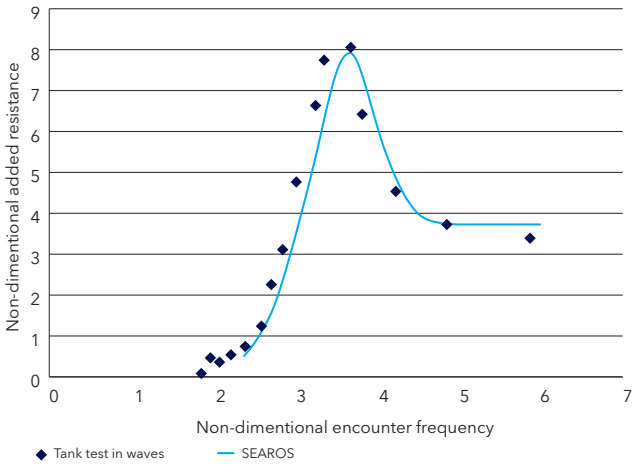
Ship hulls have traditionally been designed for optimal performance in calm waters. In a realistic seagoing condition, however, ships will be exposed to additional forces resulting in motions and added resistance that will influence the ship speed and fuel consumption. The magnitude of added resistance for a bulk carrier can typically be up to 20% of the calm water resistance on average. The aim should always be to design a hull that performs well in both calm waters and waves.

Driven by today's strong market competition, there is more and more interest in assessing the added resistance in waves. The numerical evaluation of added resistance is, however, still considered challenging in the industry. DNV GL is involved in many added resistance initiatives and has extensive experience of using different tools, including advanced Computational Fluid Dynamics (CFD). Recently, two DNV GL in-house potential codes for added resistance analysis, SEAROS and GL Rankine, have been developed and validated through research and development and commercial projects. Both SEAROS and GL Rankine are fully three-dimensional programs using state-of-the-art boundary-element methods.

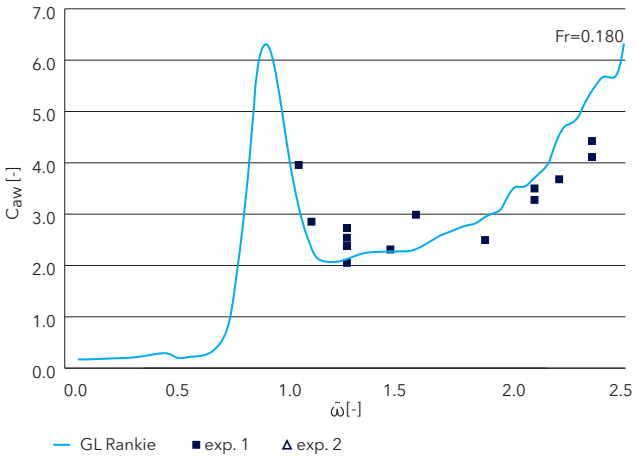
One project where added resistance in waves has been evaluated in the early design phase is the Green Dolphin 575 (see separate article on page 20 of this magazine). Here, the added resistance was calculated using SEAROS and the performance was compared to the existing SDARI Dolphin 57 design, which has similar main dimensions. An operating profile consisting of two loading conditions and two speeds was considered - full load and ballast conditions at service and slow-steaming speeds. The performances of the two designs were compared along a typical triangular Handymax trade route. The averaged added resistance was first calculated for any possible sea state, followed by a calculation for all three legs in the trade route by implementing tailor-made omni-directional scatter diagrams. For the entire trade route, the new Green Dolphin 575 was shown to have a 14-17% reduction in added resistance compared to the Dolphin 57 design.

The above procedure may easily be integrated into the hull design loop, enabling ship hulls to be optimised for more realistic conditions according to an intended trade route. ▮





Correlation between SEAROS calculations and tank test results for Green Dolphin 575



Correlation between GL Rankine and tank test results for a full-bodied vessel

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BALLAST WATER TREATMENT REQUIREMENTS

– HOW TO MANAGE THE CHALLENGES AND UNCERTAINTIES

Vessel ballast water serves to increase the vessel's draft, change the trim, regulate the stability and maintain stress loads within acceptable limits during voyages and loading and unloading operations. When discharged in ports of call, however, it may also release animals, plants, bacteria and pathogens from the vessel's previous areas of operation. If these organisms establish reproducing populations outside their native or historical range, they may become "invasive" and be considered an aquatic nuisance species.

The IMO International Convention for the Control and Management of Ships' Ballast Water and Sediments (referred to as the Ballast Water Management (BWM) Convention) addresses the potentially damaging effects of international shipping's use of ballast water. The BWM Convention will enter into force 12 months after ratification by 30 states representing 35% of world merchant shipping tonnage. As per May 2014, 38 countries have ratified the convention but there are still 4.6 percentage points lacking on the tonnage requirement. The dates for formal implementation are therefore still uncertain.

With the IMO BWM Convention lagging, the US government has introduced its own Ballast Water Management Program administered by the US Coast Guard (USCG) and US Environmental Protection Agency (EPA). The US regulations are already in force and this means that the US implementation schedule governs vessels operating in US waters. No ballast water treatment systems (BWTS) are per today approved by the USCG and an Alternative Management System (AMS) has been introduced as an interim measure to allow treatment systems approved by other bodies to be installed while awaiting USCG approval.

Challenges

With the introduction of the ballast water treatment requirements, international shipping is facing one of its most comprehensive challenges. The treatment systems are business critical for the vessel's operation. This, coupled with limited experience of their performance and a multitude of different technologies, all with their limitations and strong points, makes the ballast water treatment strategy one of the most important choices for years to come. Owners/operators will need to place significant trust in the supplier's data and information. The careful selection of a treatment system can mitigate specific feasibility requirements, such as space constraints, electrical load limitations and the integration of control systems, optimise operational performance and save costs. A treatment system that is optimal for one ship is unlikely to be the best solution for another ship.

Diversity of water

The diversity of water that the BWTS will have to deal with is important when selecting the right system for a given operational profile. To obtain type approval, tests have to be performed on standard quality water. However, these water qualities may differ substantially from the water the system is likely to experience throughout its operation. The turbidity, opacity, temperature and salinity of the intake water are some of the challenges facing the treatment system. Holding time requirements related to some systems may also be incompatible with the vessel's scheduled loading cycle. Some ballast water treatment systems may not be as efficient in brackish or fresh water, while other systems may need increased maintenance when operating in river water and certain filters may have a higher incidence of clogging in icy or muddy waters.

Cost and support

In a newbuilding project, the major selection factor is the equipment's cost. Apart from that, one of the most important considerations when selecting a system is the Operational Expenditure (OPEX), such as running and maintenance costs. For a new ship, a high Capital Expenditure (CAPEX) could be acceptable if the OPEX is low, but, for an older vessel, a low CAPEX is likely to be more favourable even though the OPEX could be high. Some systems require maintenance to be performed by a specialist from the maker, while other systems can be maintained by a trained crew. The maintenance requirements and support from the vendor worldwide should also be considered when selecting a BWTS.

US approval

The USCG Type Approval process is more stringent and rigorous than the IMO process. As a result, existing IMO Type Approved systems may not necessarily meet the USCG requirements and will require re-testing and possibly re-design. The USCG Type Approval process is still under development. To facilitate compliance, the USCG has created an Alternative Management System (AMS) process whereby foreign Type Approved systems may be used on a vessel for up to five years after the vessel is required to comply with US ballast water discharge standards.

How can DNV GL assist?

Taking advantage of our unique position as the leading classification society for approval of ballast water treatment systems, DNV GL has developed a systematic analysis procedure to find the optimal system for any given vessel/operation.

At the beginning of a feasibility assessment project with a customer, DNV GL will propose a set of selection criteria. DNV GL will then, together with the customer, agree on the weighting of the different criteria to be used in the analysis. The six main groups of assessment criteria are evaluated in detail for the selected treatment technologies. Each criterion is then broken down into sub-criteria, which are finally evaluated separately. The selection criteria are not necessarily equally important to different customers. DNV GL will therefore, together with the customer, agree on a weighting for each selection criterion. A risk-based approach will be used, in which the weight of each criterion is decided given the likelihood and consequences of a certain event happening or failing to happen.

The combined score and weighting add up to a table where the different overall systems' performance may be compared.
All in all, the solution lies in leveraging the necessary competence and available information and consequently reducing the ultimate risk when selecting a treatment solution for the vessel. This is exactly the kind of services DNV GL offers in its BWM evaluation process. ▮

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NEXT-GENERATION ENVIRONMENTAL REQUIREMENTS

Managing the impact of environmental regulations now entering into force is one of the most challenging tasks facing shipping this decade. Nevertheless, the shipping community should start thinking about the potential business impact of emerging regulations.

Eirik Nyhus, Director Environment

Regulations take time – but are as inevitable as death and taxes
One of the key characteristics of developing international maritime regulations is obvious; it takes time. The timeline for a regulation is normally long, with a number of complex and time-consuming steps. There are of course exceptions. The post-9/11 International Ship and Port Facility Security Code was fast-tracked for obvious reasons, and the EEDI and SEEMP were a showcase of rapid action, taking "only" five years from inception to entry into force.

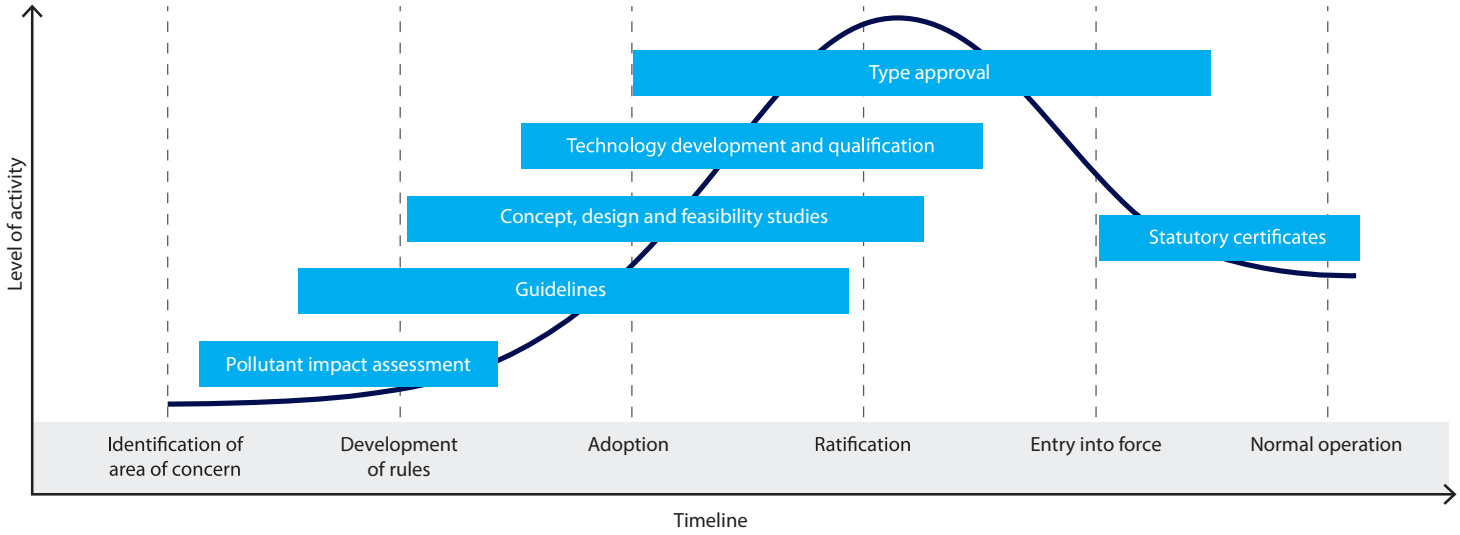
"Industry needs to engage strongly now, not later! Doing otherwise will make business needlessly difficult ten years down the road."

SOx, NOx, PM, BWMS, AMS, EEDI, SEEMP, MRV, IHM; the list of abbreviations is long and growing. What they all have in common is that they embody key pieces of environmental regulations that have recently entered into force or are likely to do so in the near future. However, it is crucial to realise that new environmental regulations entering the development pipeline will be just as challenging to respond to as anything we see today.

What are these emerging issues? The short answer is hull biofouling, soot emissions and underwater noise. While the work is still at an early stage, IMO has recognised all three as significant environmental issues and put them on the formal regulatory agenda. The time for the maritime industry to have its say is now.

The normal state of affairs is different; it is not unusual to see 10-15 years elapse from the date when an issue is introduced until the resulting regulation enters into force, see figure next page. The flip-side of this is that once an issue has entered the regulatory pipeline it rarely gets dropped. In practical terms, the implication is that the issues that will have developed into regulations in a decade or so are the ones that are presently recognised as concerns.

Clean hulls, smokeless exhaust and quiet ships?
That is where we see hull biofouling, underwater noise and soot right now. The confluence of factors focusing attention on these three issues leads us to believe that we will see mandatory



regulations addressing all of them. While the timing remains unpredictable, we would not be surprised to see regulations agreed on towards the end of this decade and entering into force in 2020 – 2025.

The work on biofouling has so far led to the development of early-stage voluntary guidelines. Research indicates that biofouling is a significant mechanism for species transfer by vessels which is not sufficiently covered by the anti-fouling or ballast water management conventions. Draft guidelines were agreed by IMO in 2011. The US has also developed and implemented national regulations which could influence IMO, and the EU may be moving in the same direction.

The US raised the issue of underwater noise with IMO in 2008 as a matter of increasing public concern, with a focus on its possible impact on cetaceans. Whales have a special place in the public consciousness in a number of countries and the US has for example established a 10-knot speed limit in whale breeding grounds as a general protection measure. Underwater noise, primarily from propeller cavitation and machinery, is thought to have a detrimental effect on both whale breeding and navigation. In response, IMO has worked on the issue for a number of years and concluded by adopting guidelines in April 2014. It can be expected that these guidelines will form the basis for regulatory initiatives as experience is accumulated

The work on soot, or black carbon (BC) as it is more precisely known in technical jargon, is less mature, but is attracting a great deal of attention, including from outside IMO. Black carbon can be described as "*a strongly light-absorbing carbonaceous aerosol produced by the incomplete combustion of fuel oil*". It is recognised as contributing significantly to both global warming and accelerated Arctic ice melting, and as such is deemed to be a significant problem. Shipping's contribution to it remains unclear, but IMO is presently working on appropriate definitions and measurement methods and is likely to eventually consider potential control measures and regulations.

All three issues, hull biofouling, underwater noise and soot, could be subject to regulation as early as in 2020. The regulatory response and attendant mandatory measures are obviously not clear at this time. However, educated guessing nevertheless points towards soot being handled by either fuel change or smoke-stack particle filters, biofouling by mandatory hull cleaning under controlled circumstances, and underwater noise by changes in propeller design and acoustically insulating noisy equipment from the hull. It goes without saying that all of these will represent significant operational and technical challenges for the shipping industry.

The price of silence

The shipping community is presently struggling to cope with what is perceived as a veritable "tsunami of regulation", while also keeping their ships running in a highly challenging business environment. Needless to say, lifting their eyes from the day-to-day concerns and trying to think strategically about what is going to happen in ten years' time can seem like a waste of time and energy. As a result, the general industry response tends towards an "I'll deal with it when I see it" attitude. Obviously, as most influence on regulations can be wielded at the early stages, this is not the best response when it comes to either shaping the final outcome or preparing for its business impact.

Industry needs to engage strongly and constructively now, not later, if it wants to ensure that what emerges from the regulatory pipeline has the desired environmental effect, is operationally practicable, technically feasible, reasonable from a cost/benefit perspective and safe. Owners and operators need to start thinking strategically about the potential business impact. Doing otherwise will make business needlessly difficult ten years down the road. ▮

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