DNV·GL

TANKER UPDATE

No. **01 2015**

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Hull inspections

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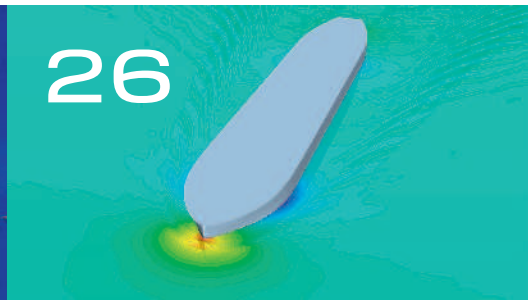

EDITORIAL

Catrine Vestereng
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Dear Reader,

The tanker market has undergone some incredible changes over the past twelve months. The major drop in the oil price triggered increased demand for tonnage as buyers of cheap oil took the opportunity to stockpile.

If the moderate oil-tanker newbuilding volumes during the past few years, and the low bunker prices are also taken into account, the market seems fairly healthy for the players involved.

Based on the above trends, it is not unlikely that we will experience an increase in the newbuilding market in addition to a high level of utilization of the existing fleet. We have therefore tried to focus on topics related to the forthcoming situation in this Update.

New statutory requirements focusing on inert gas, stability and ODME that is type approved for bio-fuel blends will enter into force on 1 January 2016 for newbuildings and also partly as retroactive requirements. Other newbuilding topics covered include the development of adequate specifications for NB, the new Common Structural Rules for Tankers and state-of-the-art software tools for technical calculations.

In the tanker trade, a successful SIRE vetting performance is seen as a ticket to trade and DNV GL has taken the initiative to help customers improve their vetting compliance performance. Our new initiative relates to both newbuildings and ships in operation that are covered by SIRE VIQ 6 and ExxonMobil's MESQAC.

I hope you find this edition of Tanker Update interesting. As the new DNV GL Segment Director for Tankers, I look forward to working with you in the tanker segment and supporting all of our customers worldwide.

TANKER UPDATE

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UPDATE ON NEW STATUTORY REQUIREMENTS

On 1 January 2016, we will see the entry into force of new requirements for inert gas, stability instruments and ODME, especially concerning tankers. The following is a recap of the new requirements and the implications they may have.

Inert gas

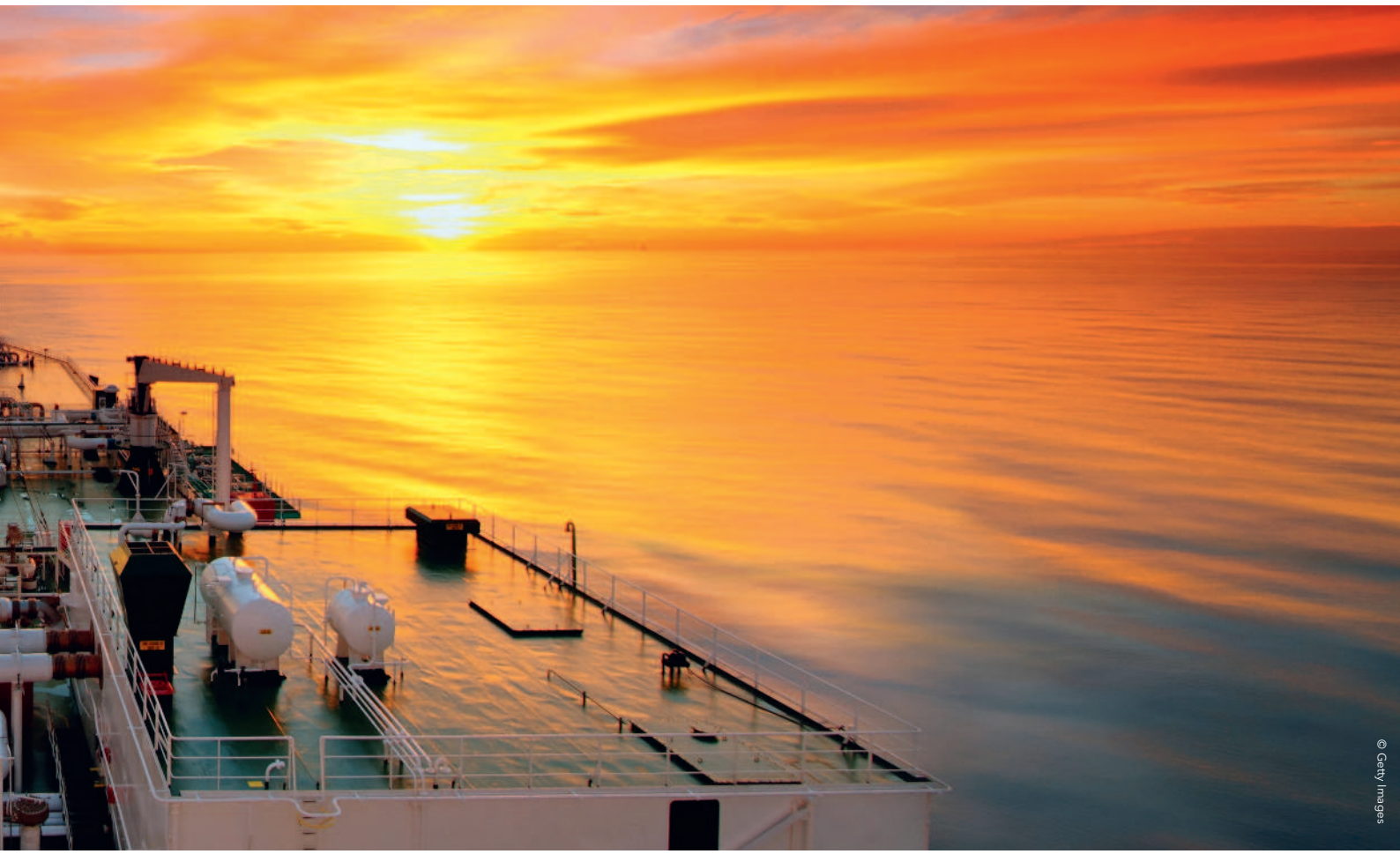
In recent years, there have been several incidents involving in-tank explosions on small oil and chemical tankers, many of which occurred in connection with gas-freeing and tank cleaning. The main reason is believed to be the lack of an inert atmosphere in the cargo tank, as these tankers are currently exempted from using inert gas. As a consequence, it has been decided to lower the SOLAS inert gas limit from 20,000dwt to 8,000dwt. In addition, chemical tankers' current exemption from inerting tanks of less than 3,000m^3 will be lifted for new ships. Since this is not a retro-active requirement, it will only apply to new tankers constructed on or after 1 January 2016.

In-tank inspections, a practice quite common prior to loading many chemicals, might cause logistical challenges and port congestion as new chemical tankers above 8,000dwt – irrespective of their tank size – will now have to purge their tanks alongside after the tank inspection when taking on low-flash products. As a means to avoid this, the revised SOLAS allows the application of inert gas to be postponed until after loading but before the commencement of unloading. It should be noted, however, that because of the risk of generating static electricity by using exhaust gas, only nitrogen is acceptable for this purpose. This further implies that, in order to utilize this option, an N_2 inert-gas plant should be installed on board, and of course this is something to bear in mind in connection with newbuilding specifications.

Consequential amendments have also been made to the FSS and IBC Codes. In the FSS Code, it is basically the oxygen limit for inert gas supplied to the tanks which has been reduced from 8% to 5%. The amendments made to the IBC Code include operational changes in the gas freeing and handling of inhibited products where the inhibitor is oxygen dependent and the products must at the same time be carried in an inert atmosphere.

The revised gas-freeing requirements are now more aligned with what is required for oil tankers under SOLAS, ie, that the tanks requiring inert gas should, after tank cleaning, be purged down to a certain limit of flammable vapours before gas freeing with fresh air may take place.

Products protected by an oxygen-dependent inhibitor are currently not to be carried in an inert atmosphere, in other words such products are today carried in tanks of less than 3,000m^3 on ships above 20,000dwt when the flashpoint is less than 60°C, the only exemption being for Styrene Monomer, which may be carried



under inert conditions subject to special provisions. In order to still be able to ship these products on new ships above 8,000dwt in future, the use of inert gas has been allowed provided it is not applied until discharging commences and the O_2 level is kept above that stated to be the minimum O_2 level on the inhibitor certificate. And, for the reasons previously mentioned, the postponed application of inert gas requires the inert-gas medium to be N_2 and an N_2 inert-gas plant to be fitted.

Stability

New requirements for onboard stability instruments will be applicable to all tankers effective from 1 January 2016. MARPOL Annex I, the IBC/BCH Code and the IGC Code have all been amended, requiring tankers to be fitted with a stability instrument capable of handling both intact and damage stability. The new requirement is retroactive and applies to both new and existing ships as follows:

- Ships constructed on or after 1 January 2016, at delivery.
- Ships constructed before 1 January 2016, at the first renewal survey on or after 1 January 2016 but no later than 1 January 2021. An instrument already installed, capable of verifying both intact and damage stability, may be accepted by the Flag Administration.

There are some openings for waiving the requirement, for example for ships operating only in a limited number of loading conditions.

ODME type-approved for bio-fuel blends

Bio-fuel blends consist of a bio-fuel part, which is considered to be a chemical subject to MARPOL Annex II and the IBC Code, and a petroleum part, which is subject to MARPOL Annex I. One example is a mixture of ethanol and gasoline. For bio-fuel blends, a cut-off limit of 75% has been agreed on, determining the regime to which the blend is subject – MARPOL Annex I or Annex II, ie, if the petroleum part is 75% or more the blend is considered to be an oil governed by MARPOL Annex I. Up to now, bio-fuel blends have been allowed to be shipped under MARPOL Annex I without the ODME being type-approved for the specific blend. This has been considered all right as long as the resulting slop has been delivered ashore to a reception facility. However, as of 1 January 2016 this is no longer an option. From this date, in order to still ship a bio-fuel blend under Annex I, a non-compliant ODME has to be upgraded or replaced and the blend in question should be included in the new type-approval certificate. ▮

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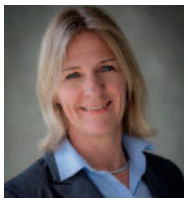
CSR BC & OT COMING INTO FORCE ON 1 JULY 2015

In January 2014, IACS published harmonized Common Structural Rules (CSR) for Bulk Carriers and Tankers. A large team of technical experts harmonized and further developed the two originally independent rule sets. The result is an improved, comprehensive and consistent rule set which will enter into force in July 2015.



Catrine Vestereng, DNV GL Segment Director, Tankers

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What is CSR BC & OT?

The IACS Common Structural Rules for Bulk Carriers and Oil Tankers (CSR BC & OT) enter into force on 1 July 2015, replacing the existing Common Structural Rules for Double Hull Oil Tankers (CSR-OT) and Common Structural Rules for Bulk Carriers (CSR-BC).

A large team of technical experts has from 2008 to 2014 harmonized and further developed the two originally independent rule sets – CSR-BC and CSR-OT. The result is an improved, comprehensive and consistent rule set which will set the standard for oil tankers and bulk carriers. The new rule set consists of two main parts. The first is a common part covering general hull requirements applicable to both ship types, such as wave loads, hull girder strength, buckling and fatigue requirements. The second part covers ship-type specific requirements only applicable to bulk carriers or oil tankers.

Some key features of CSR BC & OT compared with CSR-OT:

- Extended verification scope, with an FE analysis of all cargo holds including the transition to fore part and engine room
- More transparent and consistent requirements, including technical background
- Improved load model
- Vapour pressure added to the liquid cargo pressures for seagoing conditions
- Enhanced fatigue standard
- Hull girder buckling, also including lateral pressure and the combination with shear stress
- Hull girder ultimate limit state assessment, including damaged condition
- Compliance with IMO Goal Based Standards (GBS)

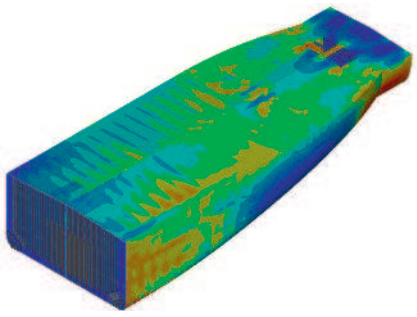

Fig 1. Finite element model of aftmost cargo tanks for an Aframax tanker

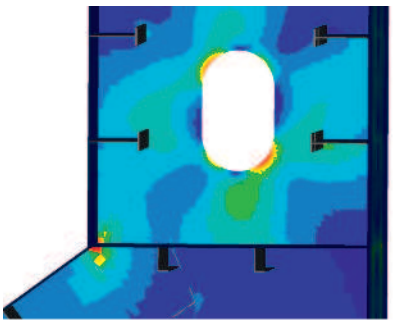

Fig 2. Local finite element model (fine mesh) of upper hopper knuckle and opening in transverse web for an Aframax tanker

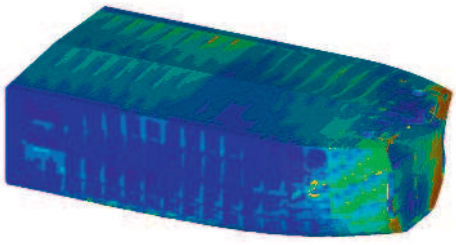

Fig 3. Finite element model of foremost cargo tanks for a VLCC

Consequences
The application of CSR BC & OT to existing designs shows that there will be some changes. Compared to CSR-OT designs, increases in the range of 1–3% may be expected. This is based on a simplified assessment without any redistribution of scantlings/design iterations. This means that, after iterations in a full design analysis, the actual impact may be reduced. The change in steel weight and scantlings also depends on the size of the vessel, structural arrangement, type of profiles used and amount of high tensile material used.

Prescriptive requirements will lead to scantling impact for some members, such as:

- Keel, sheer strake plating and non-watertight stringers in the double hull
- Plate thickness in way of tank boundaries
- Plating and stiffeners of strength deck and upper part of longitudinal bulkheads

In the midship area finite element analysis, the results show small changes. The vapour pressure addition to the liquid cargo pressure for seagoing conditions leads to some scantling impact for some members in the upper part of the transverse and longitudinal cargo tank boundaries.

Due to the increased scope of the FE analysis, a scantling increase is expected for primary supporting members, ie, web frames, stringers and girders, for the foremost and aftmost cargo tanks, including members connected to the collision bulkhead inside the forepeak tank as well as structures attached to the engine room bulkhead inside the engine room. Scantling increases have been found in local areas for the following:

- Aftmost cargo tank region
  - bottom shell and side shell
  - margin girder and lower side stringer
  - double bottom floors
- Foremost cargo tank region
  - middle and upper part of collision bulkhead and upper deck – in way of collision bulkhead
  - margin girder and lower side stringer

DNV GL support
DNV GL has expanded its activity worldwide to assist customers in implementing CSR BC & OT. An extensive training programme has been initiated for all approval units, enabling our staff to be well prepared to provide efficient and local support to the industry. We have also been running workshops for owners, yards and designers. Together with the yards, we have performed software training resulting in extensive consequence assessments of existing designs. We are there to ensure a smooth transition to CSR BC & OT for our customers. ▮

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VETTING COMPLIANCE SUPPORT

A DNV GL initiative to help our customers improve their vetting compliance performance

Håkon Skaret, Senior Principal Engineer

Erik Istad, Engineer

Richard Tao, Discipline Leader – Technical Operation

Successful SIRE vetting performance is seen as a ticket to trade for tanker operators. DNV GL has together with some owners developed vetting compliance services for newbuilds and ships in operation. The objective of this initiative is to use DNV GL's extensive experience of verification services and compliance support for class and statutory matters, including PSC compliance, and to offer the same support to ensure compliance with charterers' requirements.

Background

The tanker industry has seen a significant improvement in compliance performance over the past few decades and the introduction of the charterers' vetting schemes has been an important contributing factor here. But there are also concerns that severe accidents, such as explosions, groundings and collisions, still happen despite positive developments in the industry with a decreasing trend in vetting observations. Hence, a clean vetting inspection report is not always enough to be accepted by the charterer if the company's general performance is not satisfactory. Other concerns have been raised related to the increased inspection burden on the crew due to the numerous inspections that a tanker is subject to – such as port state, terminal, vetting and class inspections, and that more inspections will not improve quality or safety.

DNV GL's objective is to safeguard life, property and the environment and we would like to be seen as a partner in our customers' efforts to ensure compliant operations – and in doing so go beyond our traditional role as a regulatory body verifying compliance. The development of our vetting compliance services is an initiative intended not only to help our customers stay out of trouble but also to support continuous improvements so as to ensure compliant day-to-day operations.

Newbuilding vetting compliance support service

The OCIMF's SIRE VIQ contains defined, specific, prescriptive requirements for equipment and arrangements such as the cargo manifold layout and arrangements, towing and mooring arrangements, etc, going beyond the technical requirements in class rules and regulatory requirements. In addition, other charterers also have their specialties and ExxonMobil's MESQAC is the other main standard for tankers.

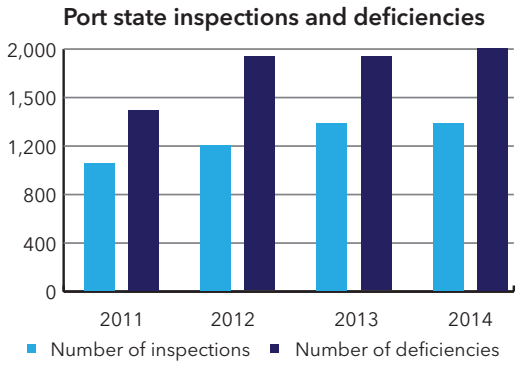
Vetting inspections have revealed that a number of ships delivered from yards have inconsistencies compared with these requirements which may result in observations, technical hold and costly modifications – a nightmare scenario for most tanker operators.

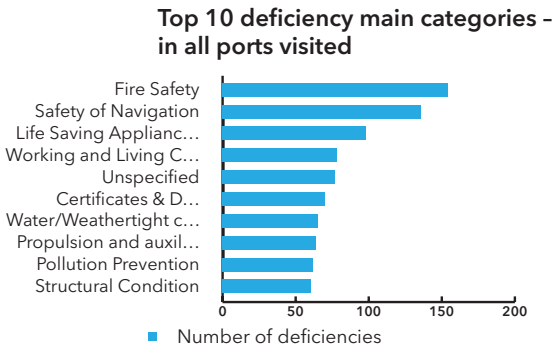
Providing a third-party verification service to ensure compliance is one of DNV GL's main activities and we are therefore launching a service addressing compliance with the SIRE VIQ and ExxonMobil's MESQAC standards.

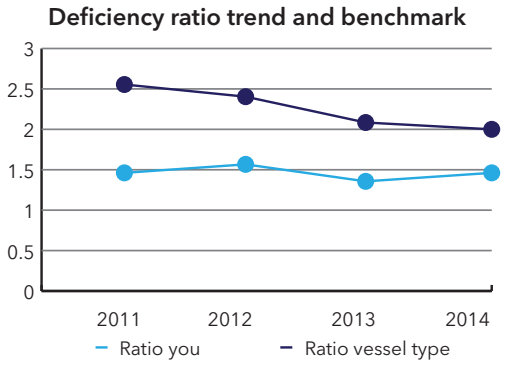
The service consists of a drawing examination part where our experienced approval engineers check the drawings for compliance. The next step is verification at the yard by DNV GL's project manager to ensure that the ship is built according to the specific requirements in these standards. Upon completion, a statement of compliance is

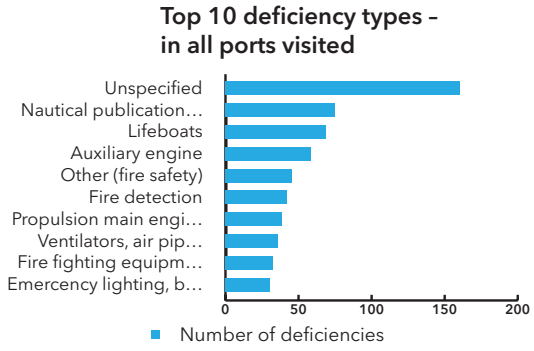
Newbuilding: in a newbuilding project, this service will consist of drawing verification and subsequent site supervision to document compliance with all the technical requirements defined by SIRE VIQ 6 and ExxonMobil's MESQAC. The deliverable will be a statement of compliance and a checklist documenting the same.

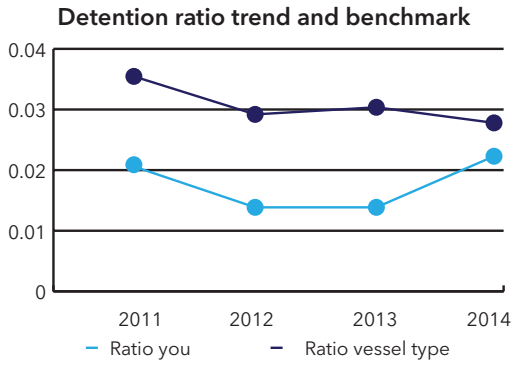
Ships in Operation: starting with a joint review of a company's improvement areas, DNV GL will offer specially trained surveyors/auditors to conduct a shipboard inspection/audit with the focus on compliance with SIRE VIQ 6 and how to improve compliance in the day-to-day operations.

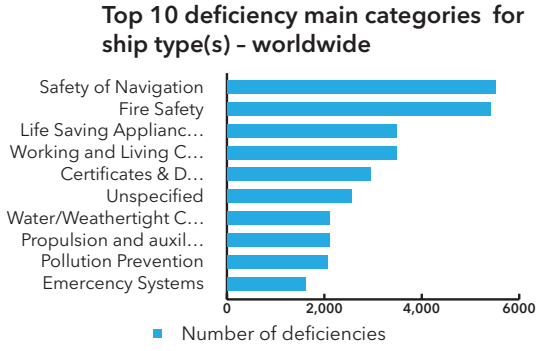












DNV GL has some 2,200 maritime surveyors who check compliance with rules and statutory requirements and carry out some 15,000 shipboard visits per year. Port State inspectors conduct around 80,000 inspections annually. Any deficiencies, observations and non-conformities are recorded and stored systematically. DNV GL has developed tools to analyse these data and extract key learning points related to operational and technical challenges. DNV GL wants to work closely with customers to improve compliance and safety and offers to share its observations with customers on a confidential, proprietary basis to supplement customers' own safety and compliance initiatives.

issued defining the scope of the verification and enclosing a check-list specifying.

This will reduce the risk of observations due to non-compliance with regard to the equipment and arrangement, relieve your New Building team of a significant job and give you credible documentation of compliance when securing your first cargo. This is a service offered to ships built to DNV GL class.

Vetting compliance support for ships in operation

A vetting compliance project will normally start with high-level discussions with top management to identify key focus areas where they are looking for an improved compliance level. Into this discussion, DNV GL will bring an analysis of the fleet's class and statutory performance based on our surveyors' and auditors' findings, together with the fleet's PSC performance during the past few years.

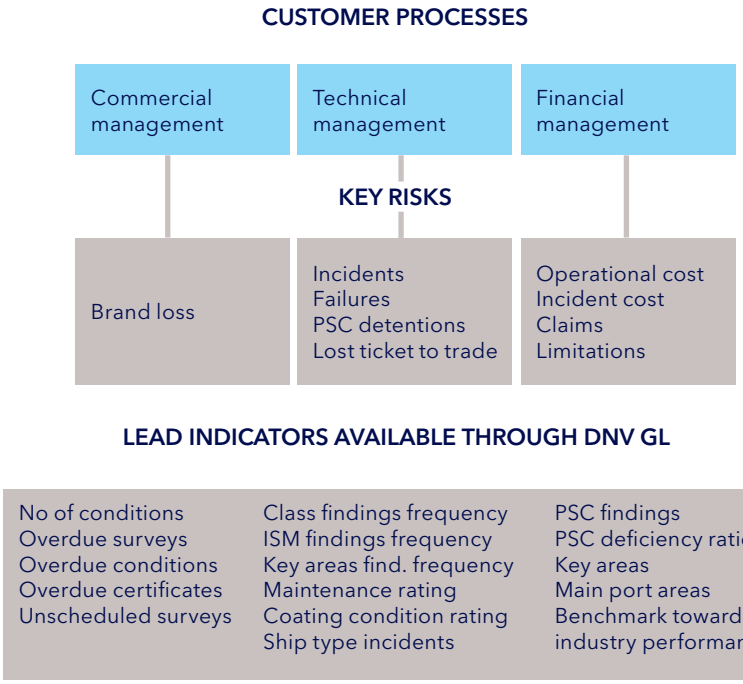
Through a dialogue, DNV GL and its customers will "compare notes" and agree on where the challenges are in the customer's shipboard operations (technical equipment failure, operational issues, record keeping, etc). It will be agreed which ships to focus on and a dialogue with the nominated surveyor/auditor will be established. DNV GL will deliver this service from Shanghai, Singapore, Fujairah, Rotterdam and Houston in the early phase of implementation. Further stations may be included later.

The duration of the visit will be agreed, normally one day, and the specially trained DNV GL surveyor will perform an audit/inspection where the scope of work is the SIRE VIQ 6, but with a focus on the areas of this extensive checklist agreed on with the company. The session on board will normally be a combination of inspection, training and coaching in how to ensure compliance in day-to-day operations and how to demonstrate competent handling of shipboard equipment and focus on continuous improvements rather than a pre-vetting clean-up exercise. The key to success is to not only identify observations but also explore what needs to be done to prevent these from happening again. In this, the surveyor's/auditor's broad experience from different ships can come in useful for providing input regarding best practice.

This can be done together with the company's own shipboard audit or in addition, and we recommend this to be done well in advance of a planned vetting inspection so as to enable the implementation of corrective and preventive measures.

After the visit on board, the surveyor will prepare an extensive report on the observations with reference to relevant SIRE VIQ codes, but equally important there will be a de-briefing telephone conference where the onboard observations will be shared with the company.

The findings gathered in the service will be entered into a centralized database. The plan is to provide benchmarking and perfor-



DNV GL's vetting compliance support is based on a structured approach.

DNV GL has access to data about:

- Customer fleet characteristics
- Class certificates, surveys and non-conformities
- Class survey findings and condition rating
- ISM audit findings
- Port state detention findings
- Owner vetting performance data

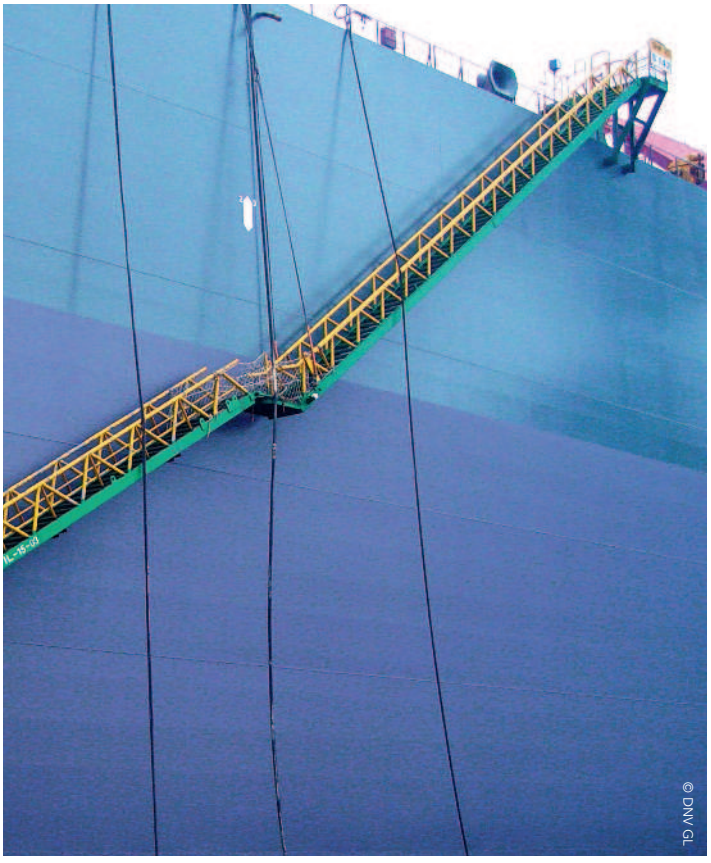
mance analysis for vetting-related findings in the same way as for class survey and PSC inspection findings in the future.

Some general concerns have been raised, such as:

- DNV GL's surveyors do not have the competence necessary to cover the scope of the vetting inspections
  - We agree there is a competence gap between class/statutory work and the SIRE VIQ checklist so that the additional training of surveyors/auditors is necessary. We have entered into strategic agreements with some of the key vetting inspection firms, which have agreed to train specially appointed surveyors using personnel that have extensive experience of working with tankers and also have ISM Audit experience

- Vetting performance is business critical and far too important to subcontract to an external party
  - This service is built to help you improve your operations and should be seen as a supplement

- What's the added value?
  - For the newbuilding service, we will help you to ensure that the ships fulfil the charterers' requirements defined by the agreed scope and verify the same with a statement of compliance DNV GL offers a holistic view of your operations with regard to compliance and can share with you best practice from a fleet of more than 3,000 tankers ▮



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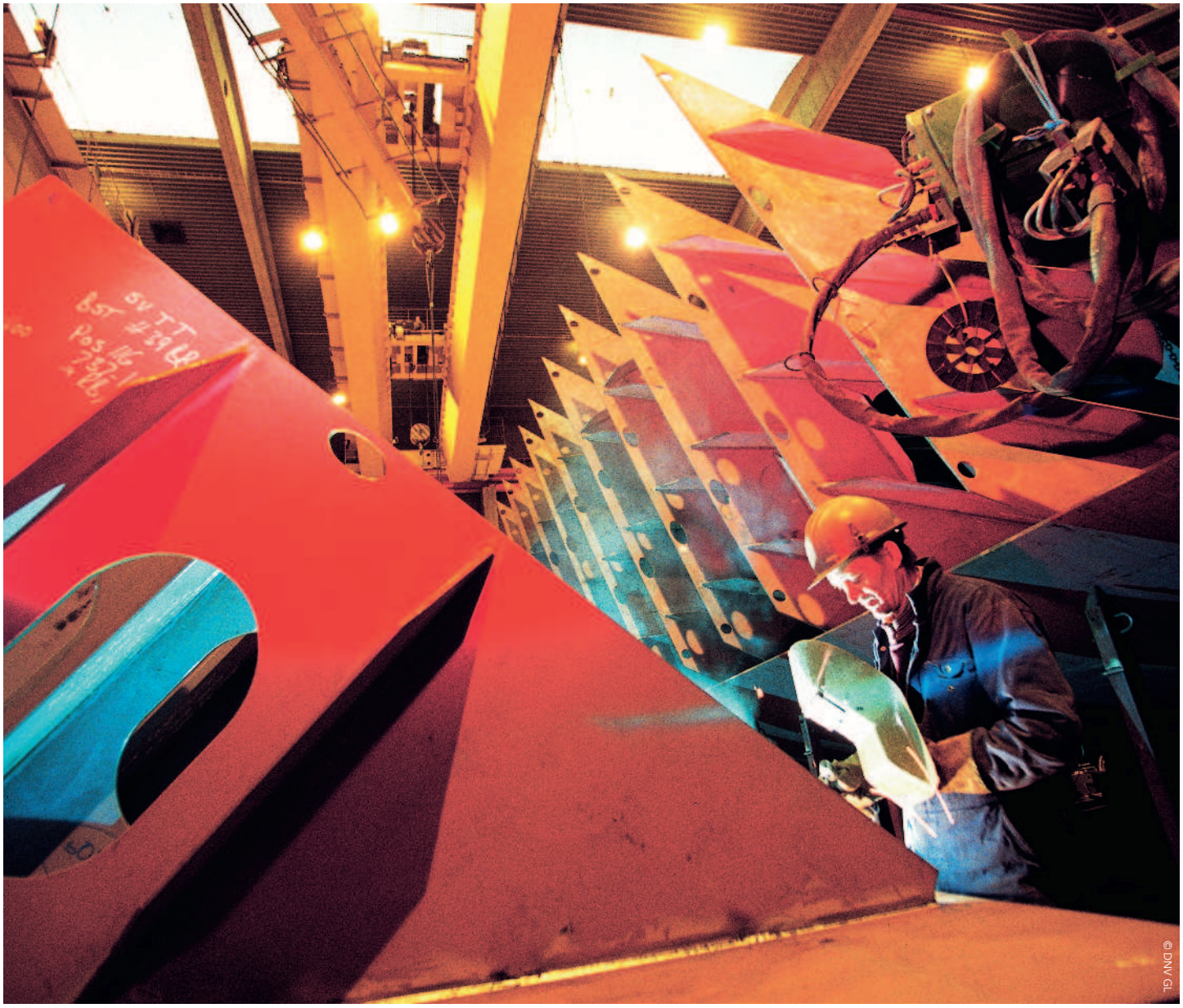
NEWBUILDING SPECIFICATION SERVICES



Regulatory and third-party requirements are constantly developing, resulting in the emergence of the term “future proofing” of tanker newbuildings. This implies that, for a tanker owner, it is essential that the newbuilding specifications cover regulatory and third-party requirements that enter into force in the course of the building period and in the foreseeable future after delivery.


Olav Tveit, Senior Principal Surveyor


Kristian Johnsen, Principal Engineer

Review of technical specifications
It is also useful for the owner to be informed of technical issues that have been found to cause difficulties in the newbuilding process or have resulted in operational limitations on previous projects. Lastly, it is useful for an owner to be informed of experiences related to, for example, the choice of technical solutions or materials which have proven to cause problems or limitations in operation, as well as possible solutions.

DNV GL can assist owners with the above through reviews of technical specifications. These can either be a review of the owner's outline specifications or a review of the shipyard's or designer's outline specifications or detailed technical specifications. The reviews go beyond checking compliance with class rules and statutory regulations and proposing class notations. Such reviews typically involve:

- Class and statutory requirements in force
- Future known statutory, regional and IACS requirements
- Potential cargoes
- Relevant regional requirements (EU & USCG)
- Oil major requirements (OCIMF & ExxonMobil)
- Feasibility of design and specifications based on experience from previous newbuilding project execution and in-service experience.
- New technology such as alternative fuels
- Equivalent levels of safety for novel designs.

Typical issues that have been addressed in reviews have been the implementation of the IACS Common Structural Rules, which enter into force for new ships constructed after 1 July 2015. Other hot topics have been related to air-emission legislation for SOx and NOx and associated technologies, as well as the future ballast water treatment requirements, where the choice of technology and location and USCG compliance issues are important.

Alternative fuel options
In terms of new technology, alternative fuels are of course an important issue. DNV GL has significant experience with gas-fuelled installations and can assist owners in assessing the feasibility of the proposed solutions and highlight potential challenges that need to be addressed in the specifications. For shuttle tankers operating on the Norwegian Continental Shelf, VOC legislation and associated requirements as to VOC recovery plants are a hot topic that DNV GL based on our experience can give advice about.

For tankers in general, experienced vetting issues will be considered, as well as oil major requirements. The same applies to main regional requirements, such as EU legislation and USCG requirements, as well as the impact of discharge prohibitions related to grey water and treated sewage in, for instance, the Black Sea region.

For oil product tankers, the issue of efficient tank cleaning is important, as are the ODME certification requirements for the carriage of bio-fuels. Another issue is the future inert gas requirements, which will apply to tankers of 8,000dwt and above and which enter into force on 1 January 2016.

Other requirements for review
For chemical tankers, the new inert gas requirements are of particular importance as failure to specify nitrogen systems may lead to operational limitations for the ship. As the cargo flexibility of a chemical tanker is specifically dependent on the features of each individual cargo tank, a thorough review of the specification is essential. As an example, a cargo tank located adjacent to a fuel tank cannot be utilized for the carriage of toxic cargo. This is thus the case for FAME, which also requires arrangements for the separation of all piping systems, as well as a P/V-valve setting of 0.2 bar. Similarly, a cargo tank located adjacent to a freshwater tank or a sea-chest cannot carry water-reactive cargoes.

Another important aspect is the choice of electrical equipment apparatus group, temperature class and the P/V-valve's maximum experimental safety gap. As indicated above, failure to specify the correct standard can result in restrictions on the cargoes that can be carried or limit cargo flexibility. As part of the specification review, DNV GL can tentatively assess the cargoes that the ship can carry.

Over the years, we have, based on experience and know-how, developed the necessary tools for comparing the carriage requirements for all products subject to the IBC Code with the limitations of any chemical tanker. This is actively used to assist ship owners and yards in determining the range of products which may be included in the final Certificate of Fitness, based on how the chemical tanker is designed and equipped. In addition, it enables us to preform gap analyses, advise on additional requirements for the inclusion of specific products and provide the specification required to meet our customer's needs.

In many cases, only minor improvements to a ship may result in a rather extensive addition to the List of Products that the ship is certified to carry. Further, during the vessel's operational phase, we strive to give cargo-related support often on very short notice. As an example, when the next revision of the IBC Code is agreed on – in which all products will be reassessed and new carriage requirements will be stated – we will easily be able to simulate the effect this will have on any DNV GL-classed chemical tankers, providing valuable information at an early stage for both new designs and existing vessels. ▮

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CARBON FUTURES

WHAT'S IN STORE FOR SHIPPING?

2015 will be a key year for international climate negotiations. What, if anything, does this mean for shipping?

Eirik Nyhus, Director, Environment

As we approach yet another round of international climate negotiations, this time in Paris in December, it is time to recap on the status quo for shipping regarding carbon dioxide (CO_2) emissions. Although the ballast water issue and tightened ECA requirements may have been the key focus areas for ship owners lately, regulators are also moving on CO_2 emissions.

The CO_2 issue is a complex one due to its multiplicity of stakeholders and its political rather than technical nature. While maritime regulations are traditionally moved forward by IMO, CO_2 is part of a complex tapestry of international, regional and domestic politics and negotiations. The crux of the matter is that political processes in which maritime interests have a negligible say may be instrumental in determining the direction of maritime CO_2 regulations.

International regulation by IMO

It is worth recollecting that a few years back there was a strong drive to develop a carbon pricing or trading mechanism for shipping. Heated discussions at IMO highlighted the split between developing and developed nations; the same split has so far proven to be an almost insurmountable barrier to a comprehensive international climate deal. Unable to reach consensus, IMO put market mechanisms for CO_2 regulation on hold and instead focused on energy efficiency. This resulted in broad agreement on the Energy Efficiency Design Index (EEDI) and Ship Energy Efficiency Management Plan (SEEMP). In practical terms, this is the first-ever international agreement on CO_2 emissions in any sector; quite an achievement for IMO.

Nevertheless, a number of countries hold the view that this achievement is not nearly sufficient if shipping is going to be able to contribute to actual reductions in CO_2 emissions and the well-known 2°C goal of the international climate negotiations. Several mechanisms to enhance ships' operational efficiency have therefore been proposed. Generally, these follow a three-stage approach; data collection, the development and testing of an

efficiency calculation methodology, and the eventual roll-out of the mechanism as a mandatory performance standard. Timelines have not been stipulated, only that each stage will take a number of years.

The proposals are strongly opposed by a number of parties who believe that developing operational efficiency regulations for ships is neither feasible nor appropriate. Presently, IMO is therefore limited to developing a framework for monitoring and reporting ship fuel consumption data only. As agreement on making even this limited scope mandatory appears to be out of reach, the development of mandatory regulations is expected to remain slow. In DNV GL's view, the earliest possible entry into force of mandatory international reporting requirements will be towards the end of this decade. Voluntary fuel consumption reporting may happen earlier, but IMO-agreed mandatory operational efficiency standards remain a distant prospect.

Regional regulations in the EU

The EU is presently in the lead on CO_2-emission-related regulations for shipping. After rolling back its proposal to include ships in the EU carbon trading system, Brussels decided to focus on developing a mechanism for a CO_2 Monitoring, Reporting and Verification (MRV) scheme for shipping. Political agreements have now been reached between various EU institutions and the MRV Regulation will become part of EU law on 1 July this year. Ship owners will have to prepare annual reports on a per-ship basis for all vessels above 5,000gt calling at a European port; the report must include information such as the annual data on the CO_2 emitted, distance sailed and cargo carried. The emission reports are to be verified by accredited verifiers, e.g. Class societies subject to accreditation in 2017. The technical details of the regulation are to be finalized by the end of 2016, ship owners must submit their monitoring plans by 1 September 2017 and monitoring starts on 1 January 2018.

This regulation will have a direct impact on ship owners in the form of mandatory data collection and reporting, but there is no CO_2 cost as such associated with it. Furthermore the regulation may have an indirect effect on the charter market and second-hand values of ships, as Brussels will make the collected data publicly available, including per-ship operational efficiency figures. The EU has stated its intention to leverage the MRV mechanism into a CO_2 pricing/trading mechanism at some point in the future, either in the EU or preferably at IMO. Finally, Brussels has also expressed its willingness to retire the EU MRV Regulation as soon as IMO develops a comparable international mechanism. DNV GL does not foresee EU CO_2 pricing happening this decade, but we do expect to see developments on this when moving into the 2020s.

Political negotiations at the UNFCCC

The international climate negotiations at COP21 in Paris in December this year have as a stated goal to reach a comprehensive international agreement that is to become effective in 2020. There is an outside possibility that shipping and aviation will be designated to provide funding, potentially as much as USD 100 billion annually, to the Green Climate Fund intended to facilitate climate change adaptation and mitigation in developing countries. Language proposing this has been kept alive and still exists in the present negotiating text. DNV GL considers it highly unlikely that there will be any agreement on this, indeed the outcome of COP21 itself remains in doubt given the present status of the negotiating text and associated political positions. However, if there is a surprise decision at COP21, the expectation is that IMO and the International Civil Aviation Organization (ICAO) would be tasked with the development of appropriate mechanisms. In such case, we do not anticipate that any such mechanism will enter into force before 2020 at the earliest.

In essence, we expect COP21 to have only a negligible impact on the shipping industry and even in the case of a surprise decision

Large oil tanker in an oil terminal in the port of Rotterdam in The Netherlands. Waterway in the foreground and huge oil tanks in the background

we foresee no tangible effects on the industry before the beginning of the next decade.

Where now?
Concern about CO_2 emissions from shipping will not disappear from the policymakers' agenda. However, we expect the EU MRV mechanism to be the key tangible regulation this decade.

There is a reasonable possibility that IMO will develop a monitoring and reporting mechanism for fuel consumption, but we predict that this will initially be voluntary, with possible mandatory application following some time later. If IMO moves quicker than anticipated and agrees on mandatory fuel-consumption reporting, this is nevertheless presumed to have a limited impact on the industry. IMO-mandated energy-efficiency reporting with associated minimum requirements is not expected this decade.

International climate negotiations are predicted to have a very limited direct impact on shipping, but if an agreement also covering shipping is reached at COP21, its impact is not foreseen to be significant before 2020.

It is important to realize that while the development of international regulations takes time, it is rarely given up. At DNV GL, we will therefore continue our efforts to shape regulations so that they are flag neutral, technically sound and preferably developed by IMO. ▮

Text: Rolf Buøen
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GETTING VALUE FROM YOUR HULL INSPECTIONS

With an increased focus on asset integrity, off-hire reduction and cost savings during a vessel's lifecycle, shipping companies now understand the necessity of regular and proactive maintenance of their ship hulls.

Rolf Buøen, Marketing and Communications Manager, Maritime Software, DNV GL - Software

With the advances in software systems for shipping in recent years, there is a vast trove of data that can provide business advantages if analysed correctly and communicated efficiently in real-time to decision makers, whether on shore or on board.

The lack of proper inspection regimes and systems can lead to a situation such as the following real case. During ballasting of a ship in port, a thin oil film appeared on the sea surface. Heavy fuel oil had leaked into a ballast tank through a corroded bulkhead. Port authorities required immediate action and the ship was detained for repair, incurring high costs. With proper follow-up of inspection regimes and well-implemented hull-integrity software solutions, the risk of such an incident is minimal. Inspections – including cross-fleet analysis – have the potential to provide significant savings, including in connection with dry-docking. An operational hull planned-maintenance system based on best-practice procedures will improve asset management and give more predictable maintenance costs. Regular, scheduled inspections following these practices allow potential problems to be discovered at an early stage. They also bring the benefits of immediate access, after one-time data entry, to status and repair data (ongoing and historical) supported by 3D ship-specific models. There is no need to collect information from various paper and multiple-data sources, a process which can be complicated and time-consuming.

Transparency and continuous control of a ship's hull condition create business advantages for ship operators and owners. Shipping companies can present a charterer or vetting inspectors with immediate documentation showing that proper technical and risk management systems are in place, supporting the securing of new contracts, not to mention helping to achieve a higher price when the ship is being sold.

Safety and profitability

Since the introduction of the ISM Code, owners are obliged to carry out regular inspections of their ship's hull and equipment. The crew is often responsible for this and it is crucial that they have the necessary knowledge and skills. The quality and value of any inspection scheme is highly dependent on the qualifications of the inspectors.

DNV GL has developed hull structure and inspection courses tailored to cover what is needed in order to carry out hull inspections. The courses have been developed by experienced naval architects and ship surveyors and take a basic, practical approach using the 3D Survey Simulator to illustrate hot spots and increase understanding of the structural configuration and response of ship structures. In addition, DNV GL provides ship-specific hull inspection manuals offering detailed guidance on critical areas and evaluation.

DNV GL hull-structure expertise

To identify the critical areas, DNV GL's broad general experience of ship classification is shared with owners by hull experts dedicated to looking after ships in operation. Furthermore, the level of detail regarding the rating of the coating condition, type of breakdown, how to report structural deficiencies, etc, is specifically tailored.

The hull inspection is not completed until the findings have been properly recorded, and the recordings are of little value unless

Illustrations of deck equipment from ShipManager Survey Simulator

used by both crew and onshore staff to control the condition of the vessel or fleet and prepare for repairs or dockings. To help do so in a structured, consistent and effective way, DNV GL offers a fleet maintenance system for hulls, ShipManager Hull.

Based on a tailored 3D structural model of the vessel available both on board and on shore, ShipManager Hull facilitates easy communication through a fully interactive 3D model which enables specific findings to be pinpointed using attached photos, drawings, etc. Cross-fleet analysis allows comparison between sister vessels. Thickness measurements can be visualized with measurement points that show the actual condition, supporting the planning of steel renewal. Steel weight calculations for repairs (including surface area and steel grade) based on an area marked on the model improve repair planning and the budgeting of dry-docking projects.

Smart management of dry-docking

The ShipManager Projects software system provides planning, tendering and project management help for dry-docking and other projects. It will enable you to manage a complete dry-docking project from work item collection via quotations management to the actual dry-dock work. You can easily re-use groups of work items or templates for types of work and build an electronic knowledge library for your dry-docking projects.

This system makes life easier for the crew, who can take advantage of graphical navigation aids, pre-defined inspection sheets that match the inspection manual and the automated transfer of inspection recordings to the central database on shore. The status of the inspection schedule and condition control can be seen immediately from colour-coded severity alarms that are also displayed graphically. This facilitates a proactive maintenance environment in which superintendents or fleet managers can act quickly, based on a full set of consistent condition data.

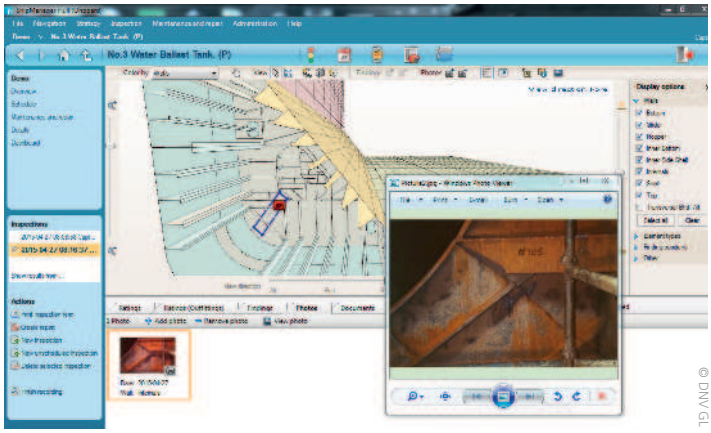
Hull integrity challenges

DNV GL has extensive experience of providing hull integrity software and services for all types of vessels. One example is oil tankers, where cracks, corrosion and other elements of structural integrity are main areas of attention. The lack of satisfactory hull integrity may lead to oil ingress in ballast tanks, pollution of the sea, port state detentions, fines, unscheduled ship repairs and, in the worst cases, major accidents due to structural failure. This is also the reason why hull integrity receives such a lot of attention from charterers in connection with vetting. TMSA compliance is necessary in order to obtain acceptance by charterers.

The main hazards for liquefied gas (LNG/LPG) transport are high pressure, low temperature, flammability, toxicity and reactivity. Cracks, corrosion and other structural integrity elements are also main areas of attention. Regarding the cargo-containment system itself, gas carriers have a good record in terms of safety. However, damage statistics clearly show that gas carriers suffer from the same challenges as other tankers when it comes to the structural integrity of the hull itself. Coating breakdown, eg, in welding connections, can cause a dramatic reduction in fatigue life. It is important to discover and monitor coating breakdown at an early stage.

In FPSOs, signs of ageing with a potential impact on normal operations (eg, corrosion, buckling and fatigue) lead to a need for systematic hull integrity management activities such as inspection, monitoring, maintenance and repair work. With hull integrity systems in place, owners are able to focus on life extension, preventing any negative impact on the environment, minimizing operational downtime and maximizing asset value. ▮

For more information:
www.dnvgl.com/shipmanagerhull
www.dnvgl.com/surveysimulator



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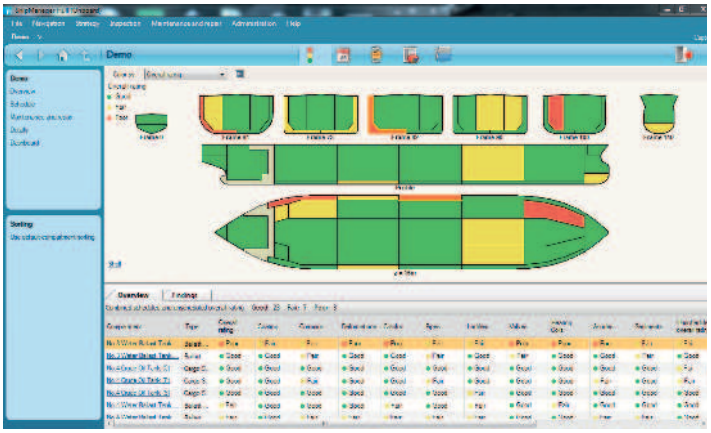
Location of finding incl. photo reported in ShipManager Hull



Overall coating condition overview from ShipManager Hull

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DNV GL CALCULATION TOOLS SUPPORTING CSR FOR BULK CARRIERS AND TANKERS

DNV GL has further developed our own calculation tools, in order to provide efficient support and ease of the implementation of the new Common Structural Rules.

Vebjørn Guttormsen, Head of Section

The harmonized Common Structural Rules are based on the first principles of physics instead of on empirically based models. This will provide a better answer to the conditions the ship will experience in reality. However, it also means a shift towards more computerization of the rule formulations and structural assessments and good support from rule calculation tools will be essential in the structural design process.

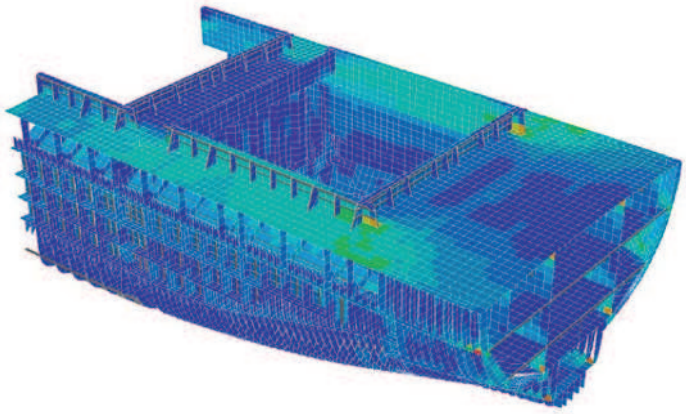
In response to this, DNV GL has invested heavily in its rule calculation tools to provide efficient support for the new rules. Both Nauticus Hull and GeniE have been updated to support the latest version of the CSR for prescriptive and Finite Element Method calculations. The main priorities during this work were to improve efficiency and quality by introducing better modelling and FE meshing capabilities, automated calculation tasks and improved reporting functionalities. In addition, it has been important to improve the interface with other yard design and FE systems for the exchange of models.

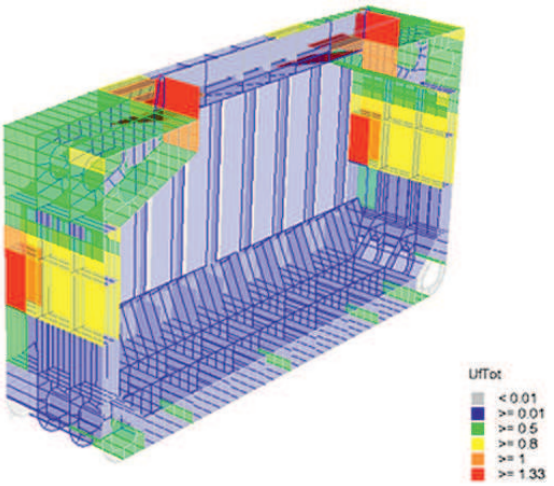
The changes in Nauticus Hull and GeniE address the needs of the designer, who will be working with new demands for an increased number of models and load cases. For prescriptive calculations, Nauticus Hull Cross Section Analysis has been updated to support the CSR, including buckling, yield, fatigue and hull girder ultimate state analysis. In addition, a new rule calculator has been introduced for local scantling checks of primary supporting members and individual assessments of plates and stiffeners.

On the FEM side, there are improvements to the functionality for modelling the non-parallel fore and aft part of the cargo area, including the import of the hull shape from stability software. Ship-specific modelling features, such as adding longitudinals to the outer shell, have been significantly improved. It is also possible to reuse finite element models from other software systems. GeniE includes powerful algorithms to automatically generate mesh according to various requirements. For further improved mesh control, the software has been updated with functionality for partial meshing and state-of-the-art tools for manual mesh adjustments.

Based on the GeniE model, the user can automatically apply corrosion additions, loads and boundary conditions in accordance with the CSR. In addition, the software has been updated to include tools for doing automatic yield and buckling checks in accordance with the rules. Acceptance criteria for different structural components are automatically accounted for.

The new rules also require a number of local models for assessment of critical details. GeniE has new functionality for screening the model to identify critical areas as well as improved efficiency for generating local fine mesh FE models and conducting local fatigue assessments. ▮





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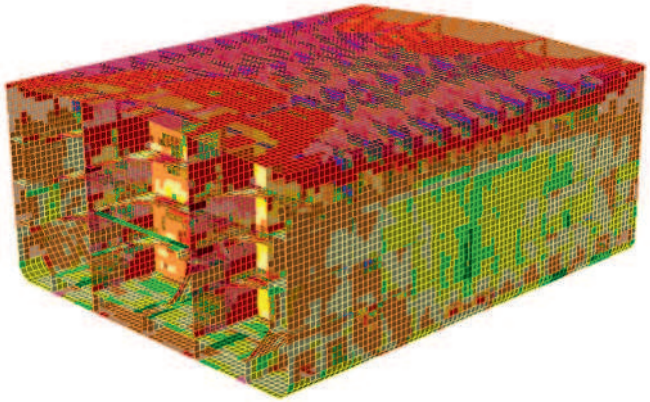

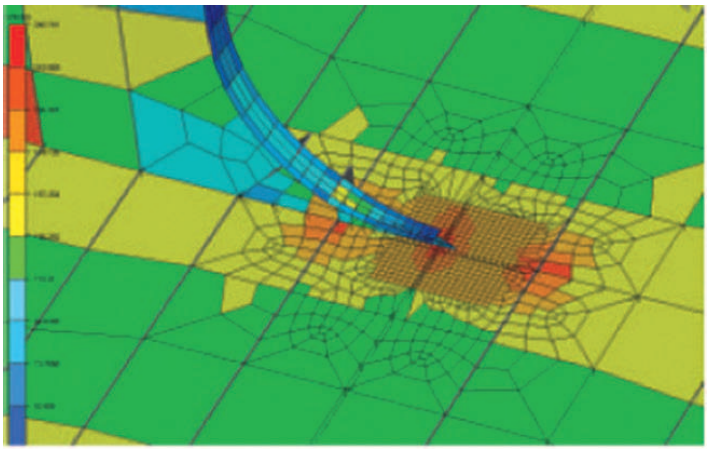

1. Aftermost cargo hold model of bulk carrier
2. Buckling check in GeniE according to the CSR
3. Yield assessment of VLCC in GeniE
4. Automatically generated local fine mesh model of bracket toe for detailed stress assessment

Text: Jakub Walenkiewicz
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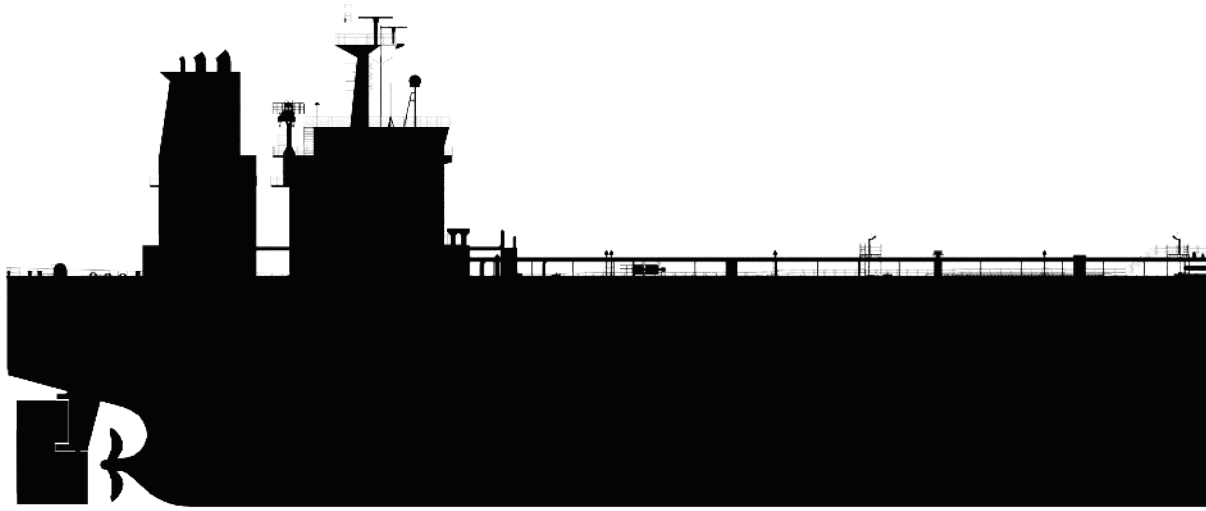
THE CRUDE OIL MARKET

It is hard to believe, but less than one year ago, oil prices were hovering around USD 110 bbl. Little did we know that within six months prices would plummet to some USD 45 bbl at the lowest point. The increased production of unconventional oil in the US, combined with high OPEC production, resulted in a glut of oil in the international markets, subsequently bringing prices to a level last seen in 2009. Needless to say, for ship owners paying USD 300/t for bunkers instead of USD 700/t, every day feels like a birthday!

Jakub Walenkiewicz, Principal Market Analyst



While the entire merchant shipping industry benefits from the reduced fuel expenses, crude oil tankers seem to have hit the jackpot! Besides the savings made on bunkers, they have also been blessed with substantial growth in the demand for tonnage. Cheap oil triggered an intensive stockpiling (particularly in Asia), which resulted in an increased number of fixtures for crude oil tankers. As a result, the freight rates have gone up substantially. Average one-year TC rates are at least twice as high as they were a year ago. A strong spot market is keeping oil tankers busy and owners are reluctant to offer their ships for storage.

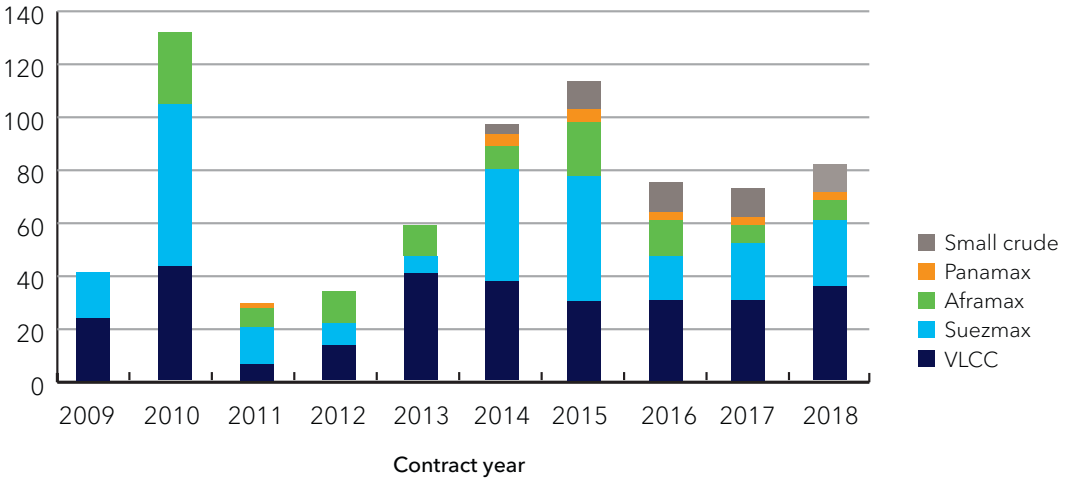
Interestingly enough, it is not the end of the good news for crude oil tankers. Increased cargo volumes coincide with a very tight fleet supply. Due to the low number of contracts placed in 2011 and 2012, very few ships are being delivered nowadays. The tight supply/demand balance is helping owners to push the rates even higher. Although the current orderbook contains 79 Suezmaxes and 89 VLCCs, deliveries in 2015 are limited to only 16 Suezmaxes and 25 VLCCs. With such low fleet growth, the rate is very likely to remain strong throughout the next 12 months.

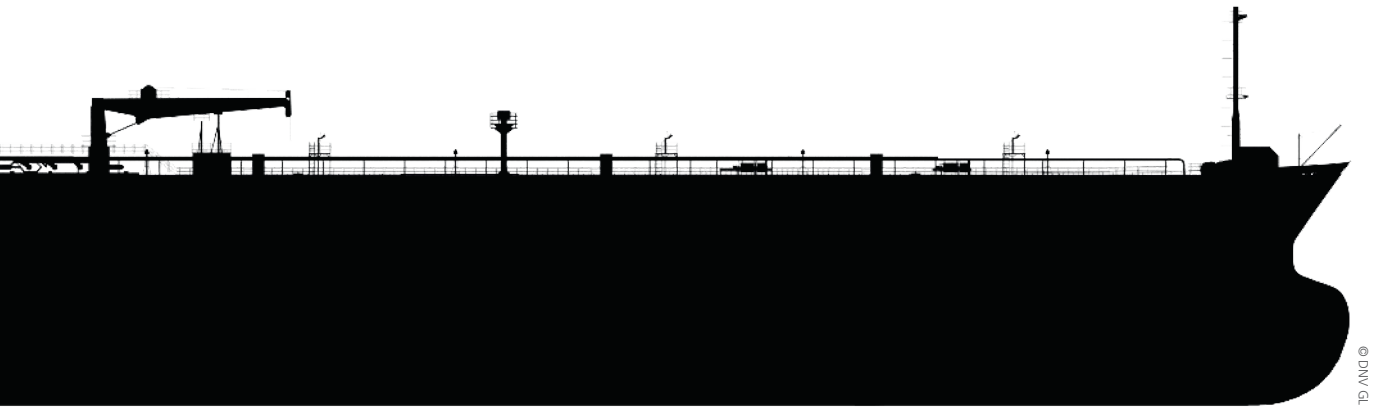
Despite strong fundamentals supporting the market, there are also several factors which need to be addressed. First of all, the robust growth of shipments was triggered almost entirely by stockpiling. As the storage reaches its limit, the crude oil must be moved and used eventually. Although it is believed that lower prices will cause higher consumption, we are yet to see the magnitude of that effect. Until that happens, it is impossible to tell how much longer the strong demand will continue.

Secondly, as we expect a substantial number of deliveries for 2016 and 2017, strong rates are going to gradually come under pressure. Since there is only limited potential for scrapping (or conversions), the crude oil fleet growth will accelerate, thus increasing the supply of tonnage.

Another interesting development which may influence crude oil movements is the rapid increase in refinery capacity in the Middle East and India. As more products are generated in that region, it is reasonable to expect this to lead to reduced exports of crude oil. This will be of particular importance to Europe, where the refining capacity is constantly declining. In such a case, we may expect a growing trade in products (carried by LR tankers), subsequently reducing crude oil exports from the Middle East.

Crude oil tankers – annual contracting including forecast





On the other hand, significant changes are taking place in the traditional trade patterns, offering new opportunities for crude oil tankers. Diminishing transatlantic trade, due to lower US imports, has redirected most of the West African crude oil, which now goes to China. As the new trade offers a longer voyage, it benefits the VLCC fleet. Another example is the unstable situation in Libya. Due to the ongoing conflict, crude oil exports out of the country, mostly to Europe, have decreased and need to be compensated by West African crude oil which has similar properties. This increases the tonne-mile demand for Suezmaxes. Although we can call it a short-term disturbance, it is likely to remain for some time in the future. As the crisis deepens, it may take several years for the country to restore its previous export capacity.

Last but perhaps not least is the expansion of Chinese refineries, which are coming online as early as in 2015. This will certainly reduce the product tanker trade, but crude oil imports are expected to increase in order to supply the new refineries.

There are, of course, many more factors which may be discussed. We have only discussed those which in our eyes are the most significant nowadays. All the conclusions leave us with somewhat mixed feelings. We definitely believe that the market will remain vibrant in the short term, but at the same time we are aware of possible threats in the longer term. Oil prices remain a key factor when considering the well-being of the oil tanker market. Although we are currently experiencing a significant overproduction of oil, it may be difficult to keep oil prices low in the long run. It is worth mentioning that the depressed oil price environment has significantly reduced the investment in exploration, production and maintenance. In a few years, this may have severe consequences for the oil industry and as a result may reduce the future production capacity. It may then lead to reduced demand for tankers, particularly if the oil price starts to recover again.

All of this has led us to come up with a contracting forecast which is still very optimistic for the current year. Positive sentiment continues to draw attention to this sector, fuelling the order book with new contracts. Nevertheless, as a result of high deliveries, we anticipate a gradual reduction in orders for crude oil tankers, with an expected average level of 75 ships per annum. ▮

Text: Adam Larsson
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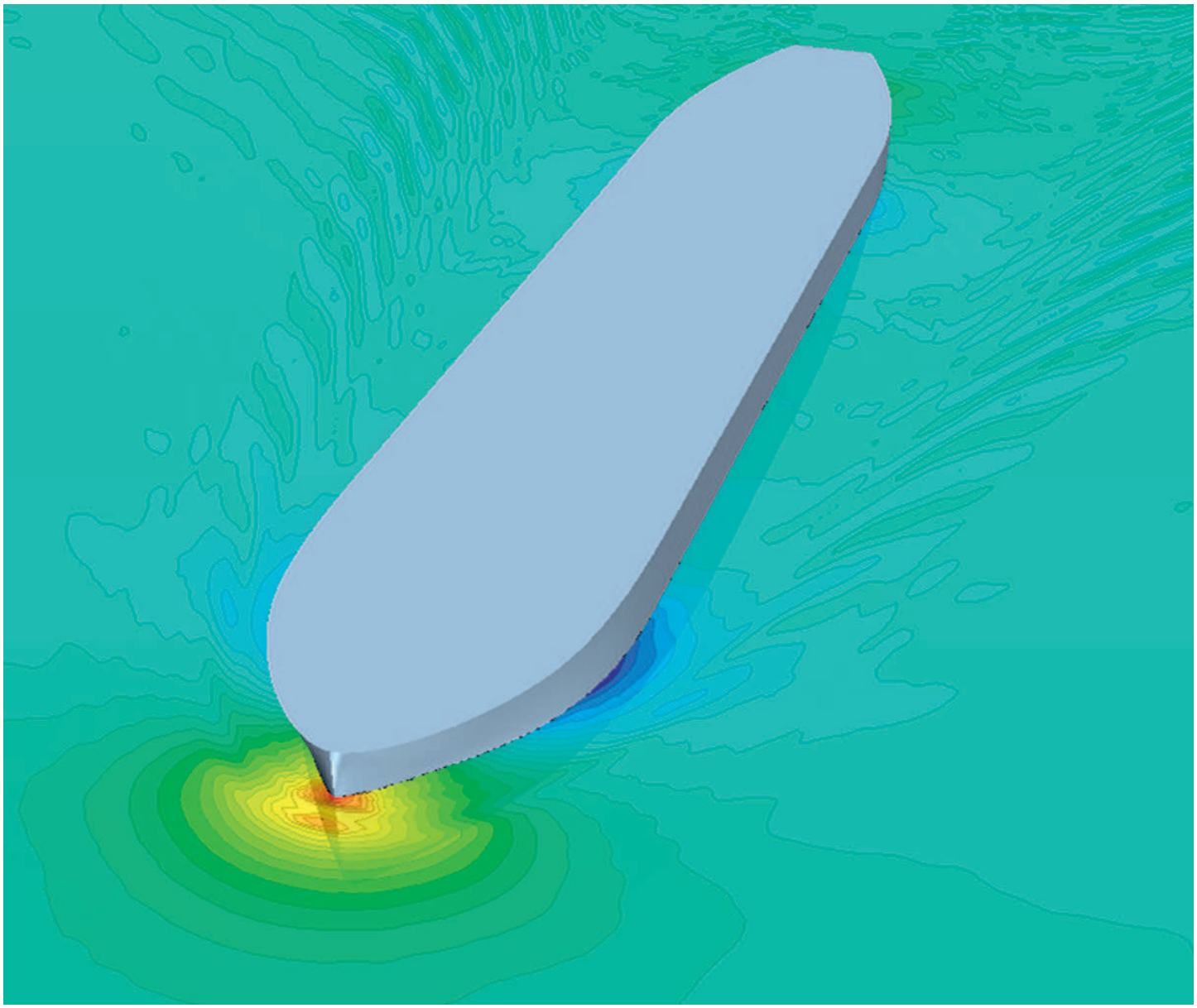
DNV GL MARITIME ADVISORY PROVIDES DECISION SUPPORT FOR

NEW IMPROVED VLCC DESIGN



Hull assessed by CFD analyses – wave pattern and pressure distribution on the hull (design draft at 15 knots)

The verification of hull performance, and thus fuel consumption, is a highly relevant subject in times when owners and operators are requiring low operating expenses. Questions have also been raised about the actual performance of many new and unproven ship designs in the market.

Adam Larsson,
Group Leader

In 2014, DNV GL's Maritime Advisory was asked by a Singapore-based commercial ship operator to undertake an independent assessment of a new VLCC hull design by a Chinese designer. Within a critical time frame, the objective was to verify the new hull's performance and make the operator more confident that the predicted performance would be achieved before the order was placed and the building process started at a Chinese shipyard.

Maritime Advisory tackled this complex challenge by checking that the hull design performance was satisfactory for the operator's intended operating profile, ie, the combination of drafts, trims, and speeds the vessel is expected to operate at. In addition, the hull improvement potential was assessed and recommendations were made regarding possible modifications that could lead to a reduction in hull resistance.

In the project, we worked closely with the operator, designer and shipyard – in total four different stakeholders in three different geographical locations. The advisory project team received valuable help from our local staff to manage the communication between all these stakeholders.

The project concluded that the new VLCC hull design is very competitive and that its performance fits the operator's operating profile. This conclusion was drawn based on a limited improvement potential identified in the project combined with a sound and trustworthy performance prediction prepared by the designer.

In summary, the operator was very happy to have been given technical insight into, and confidence in, the vessel's performance as this provided valuable decision support in the ordering process. In addition, the designer also became more confident that its new VLCC is a good design and received input on how the design could be further improved. Finally, the shipyard became more confident that the vessel it will deliver in future is likely to meet the operator's expectations.

Maritime Advisory's approach to meet a project's objectives:

- Work in close collaboration with the operator, establish a realistic and sound operating profile based on historical voyage data for similar ships in the fleet combined with the operator's strategy for future trades and operation.
- Review existing design documentation; vessel specifications, hull lines and model test reports.
- Perform independent hull-resistance and propeller-wake analyses using Computational Fluid Dynamics (CFD) RANS simulations in full-scale and a virtual towing tank, based on the conditions in the operating profile.
- Independently predict the performance in the contractual condition using the results from the CFD analyses combined with the results from the model tests.
- Assess the current hull performance based on the calculation results.
- Identify hull improvement potential areas based on the calculation results together with visual observations. The CFD simulations provided valuable information on the flow characteristics along the hull.
- Qualitatively and quantitatively estimate the savings potential. This was done by modifying the hull lines and preparing a number of new hull shapes that were tested by CFD analyses for the conditions in the operating profile. A close dialogue with the designer and yard is required in this situation to respect design constraints and building requirements.
- Conclude on the findings and recommendations for further work
  - Is the design prediction sound and performed in accordance with recognised procedures?
  - Does the existing hull meet the expectations (resistance, speed-power, fuel consumption)?
  - Is there any improvement potential? ▮

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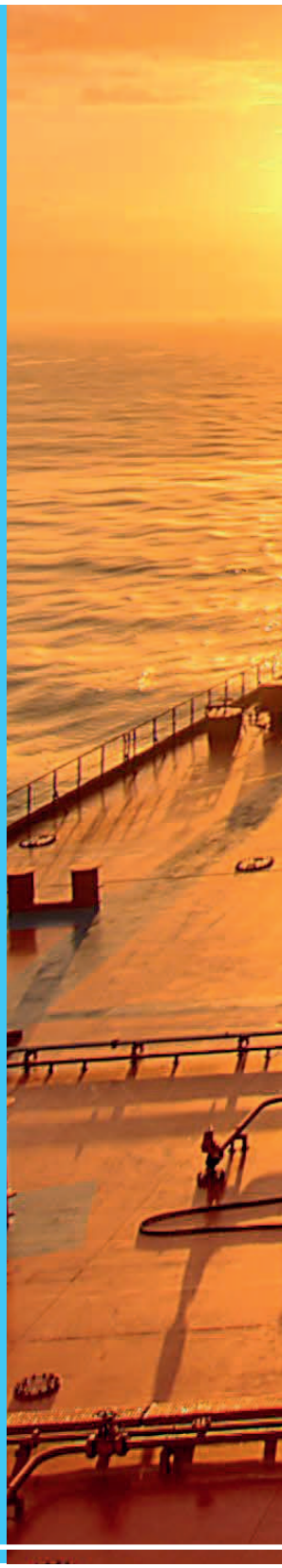

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