

ClassNK

MAGAZINE

JUNE 2015 - 72ND EDITION

- *Developments in the partnership with NAPA*
- *No distraction from LiquefAction*
- *A new way in Norway*



As maritime needs grow, ClassNK has solutions.

As the world's economy grows and changes, the maritime industry is faced with ever greater challenges. With roughly 20% of the world's merchant fleet under class, we understand the requirements for the future of safe shipping, and we're working to develop new tools and technologies to meet the changing needs of the maritime industry. Learn more about our efforts to advance maritime safety and protect the marine environment at www.classnk.com

Global Authority in Maritime Standards

ClassNK

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Success through support



Welcome to the 72nd edition of ClassNK Magazine.

This issue has been devised to take readers behind the scenes of some of ClassNK's cutting-edge development projects aiming to enhance ship safety, environmental performance and efficiency. These range from new software for ship design, to ground-breaking research of cargo behaviour during transit and state-of-the-art equipment performance monitoring.

In all of these initiatives, our focus is on developing ClassNK as a key partner supporting and shaping the future of the maritime industry through cooperation by building on relationships with our customers, industrial partners, academia, and government agencies across the world.

One key area for ClassNK is Norway, which is outlined in this issue with an introduction of our activities in the region. An interview with one of our key regional clients Stove Shipping also provides insight into the workings of a north European shipowner as well as an important look at our services from an end-user perspective.

We are also working with a wide range of international organizations to improve vessel safety. Readers will find a progress

report on LiquefAction, the pivotal research project that is bringing a completely new approach to one of the bulk shipping industry's greatest safety challenges.

This project, which involves the collaboration of research institutes in France and Germany, and leading bulk shipowner Oldendorff as well as ClassNK, looks to bring new engineering expertise to the explanations offered to account for a phenomenon that often has tragic consequences for shipping. These results are expected to greatly contribute to bulk carrier safety and influence the future of bulk ship designs.

Our role as a thought leader also demands attention to enhancing the performance of ships in service today. This requirement and our response to it provides the focus for CMAXS, the engine monitoring technology from ClassNK that at last envisages how the maritime industry can exploit big data to the same extent as players in onshore industries.

“ *In all of these initiatives, our focus is on developing ClassNK as a key partner supporting and shaping the future of the maritime sector* ”

Ensuring that the aspirations of regulators are reflected in the real world of shipping is a critical part of our work, which is outlined in a central feature of this publication. Here, we highlight a range of new initiatives that support common structural rules and compliance developed through ClassNK's subsidiary NAPA, as well as ClassNK's own solution for ship recycling.

As with everything we do at ClassNK, the aim is to offer innovative and practical solutions that will be of benefit to the wider maritime industry.

A handwritten signature in black ink, appearing to read 'N. Ueda'.

Noboru Ueda
Chairman and President of ClassNK

ClassNK

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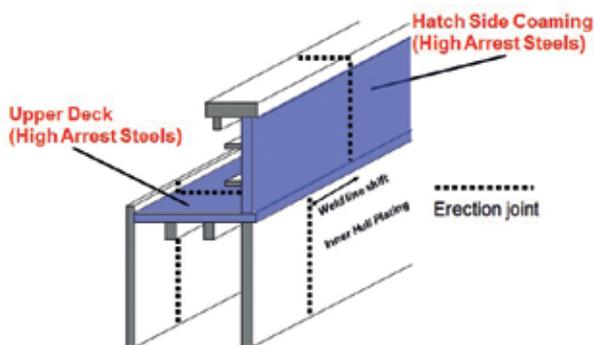


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NEW CORROSION RESISTANT STEEL OPTIONS

4 February 2015 - ClassNK issued approval for Nippon Steel & Sumitomo Metal Corporation's newly developed corrosion resistant steel (NSGP™-2) for use on the upper deck and/or inner bottom of crude oil tanker cargo oil tanks (COT). Following earlier approvals of steels for the inner bottom plating of COTs, this marks the first time that approval has been granted for corrosion resistant steels for both the top and bottom parts of the COT, providing owners and shipyards with a practical alternative to coating systems. The ClassNK approval confirms that Nippon Steel & Sumitomo Metal Corporation's NSGP™-2 corrosion resistant steel meets the requirements of the IMO Performance Standard for Alternative Means of Corrosive Protection for COT and can be safely used in the construction of crude oil tanker COTs. The innovative development is expected to significantly lessen the financial costs associated with applying protective coatings to conventional steel during ship construction and after going into commission.

RESEARCH PINPOINTS BRITTLE CRACK ARREST



Brittle crack arrest design steel for use on the upper deck and hatch side coaming

19 February 2015 - ClassNK announced it will carry out a joint research project aimed at improving safety standards for ultra-large container ships. With the introduction of 20,000 teu ultra-large container ships, the increased use of brittle crack arrest steel exceeding 80mm in thickness is ex-

pected. To ensure smooth adoption of thicker steel in the industry, ClassNK has embarked on a joint research project to develop technical standards in order to clarify the crack arrest parameter for steel plates exceeding 80mm in thickness. Through this joint research, ClassNK aims to establish clearer evaluation methods to form the proposal for unified IACS requirements for brittle crack arrest steel exceeding 80mm for the benefit of the entire maritime industry. The project will be carried out as part of the ClassNK Joint R&D for Industry Program in collaboration with the Japanese Welding Engineering Society (JWES), steel manufacturers, shipbuilders, and neutral research institutes, and is scheduled to be completed in mid-2016.

2015 RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

9 April 2015 - ClassNK announced the release of printed versions of its 2015 Rules and Guidance for the Survey and Construction of Steel Ships. The 2015 edition's amendments, made between 1 March 2014 and 31 December 2014, reflect the latest R&D findings, feedback from damage investigations, changes made to international regulations, as well as industry requests and include requirements related to:

- Guidance for Temperature Gradient ESSO Tests and Double Tension Tests
- Structure of Bilge Keels
- Dangerous Chemical Substances
- Strength Calculations for Gears
- Black-out Tests in Special Surveys

In addition to the above, printed versions of the newly established Common Structural Rules for Bulk Carriers and Oil Tankers, Part CSR-B&T as well as revised versions of both the Common Structural Rules for Bulk Carriers, Part CSR-B and the Common Structural Rules for Double Hull Oil Tankers, Part CSR-T (all dated 27 February 2015) are scheduled to be made available in late May.

NEW ERA FOR R&D WITH ESTABLISHMENT OF GRIC IN SINGAPORE



Left to right: Mr. Kurashiki (ClassNK), Mr. Kinoshita (ClassNK), Mr. Ravindran (ClassNK) and Dr. Thepsithar (NTU)

20 April 2015 - ClassNK held a press conference on 20 April in Singapore to promote the activities of its new Global Research and Innovation Center (GRIC). Joined by representatives from Nanyang Technological University, ClassNK Executive Vice President Tetsuya Kinoshita explained the rationale behind GRIC and the current goals for the center. The two main sectors that GRIC will cover are:

- Maritime technologies: Research and development of new technologies, improving existing technologies in the fields of safe/smart ships such as condition-based monitoring technology, eco-technology covering areas such as alternative fuel engine technologies, and emission control.
- Marine renewable energy: Establishing a marine energy test site for the tropics to support R&D in energy storage systems, biofouling materials, energy converters, prototype design testing and creating possibilities to provide energy for maritime industry usage like in ports and harbors.

“The establishment of the Global Research and Innovation Center represents ClassNK’s commitment to developing innovative solutions,” said Mr. Kinoshita. “GRIC’s location in Singapore will make R&D projects accessible to international industry partners, and allow us to work with top academic institutions such as NTU and other sectors of the maritime cluster here in Singapore. We are excited to be building a smarter and greener future for the entire maritime industry from here in Singapore.”

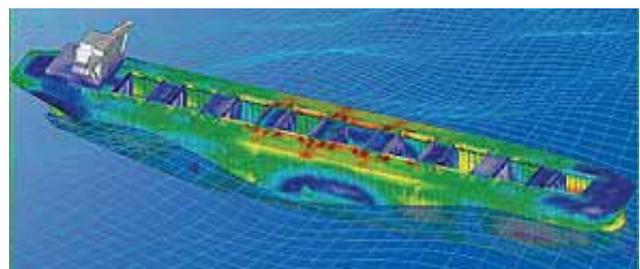
CLASSNK RELEASES PRIMESHIP-GREEN/PROSTA

30 April 2015 - ClassNK released PrimeShip-GREEN/ProSTA, making it the world’s first classification society to develop software which analyzes and calculates a ship’s speed trial results for EEDI calculation in compliance with the latest IMO Guidelines on 1 May 2015.

MARPOL AnnexVI states one parameter to calculate EEDI as the ship’s speed in calm sea conditions based on the speed trial results. To eliminate the effects of external factors during sea trial (wind, waves, current, water depth, sea temperature) and provide a way to analyze and calculate a ship’s speed in calm sea conditions, IMO assigned two methods in its Guidelines on survey and certification of the Energy Efficiency Design Index. Those were ISO 15016:2002 and the International Towing Tank Conference (ITTC) Recommended Procedures.

In response to requests from IMO to eliminate this dual standard, ISO and ITTC worked together to create the new harmonized international standard ISO 15016:2015 which was published on 1 April 2015. ISO 15016:2015 will be adopted at this month’s MEPC68 and is expected to apply to all sea trials from June 2015.

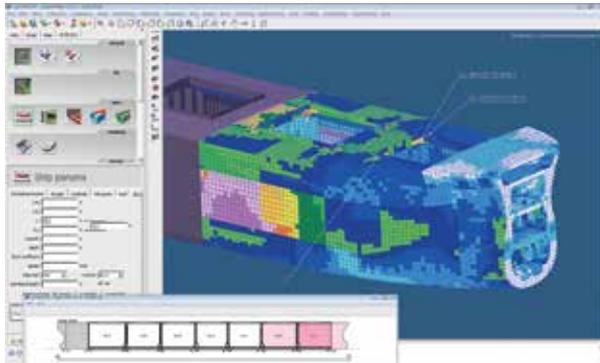
In addition to providing technical support for standard harmonization, ClassNK has also developed support tools such as PrimeShip-GREEN/ProSTA for shipyards, shipowners, and the greater maritime industry to enable smooth adoption of the amended standard. The software enables ship designers to calculate the ship’s speed in compliance with ISO15016:2015 and reduces the workload required for EEDI calculation. ClassNK will offer this software completely free of charge to all applicants.



PrimeShip-GREEN/ProSTA design software

CLASSNK LEADS ON HCSR SOFTWARE

9 February 2015 - ClassNK announced the release of Ver. 2.0.0 of its PrimeShip-HULL (HCSR) ship design support



PrimeShip-HULL(HCSR) design software

software. The new version is the world's first software system to fully reflect all rule amendments of the IACS Common Structural Rules (harmonized CSR) adopted in December 2014. Developed in response to industry demands, PrimeShip-HULL (HCSR) is a powerful total design support tool capable of far more than conventional software. The ship design support system helps to assist in the development of safer ships compliant with the harmonized CSR and is available completely free of charge to all ClassNK clients. The software's improved calculation and modelling features provide fast and continuous support to ensure more efficiency and quality in ship designs that are compliant with the harmonized CSR.

CLASSNK EXTENDS NET-BASED ENGINE SUPPORT

20 February 2015 - ClassNK and Makita agreed to bring the condition-based engine monitoring system ClassNK CMAXS e-GICSX to Mitsui-Makita MAN B&W main engines. The system assists in the early detection of abnormalities in electrically controlled diesel engines and is being developed in collaboration with Mitsui Engineering & Shipbuilding. ClassNK CMAXS e-GICSX incorporates e-GICS (electronic Global Internet Customer Support) technology developed by Mitsui, and ClassNK's advanced Big Data analysis technology to create a support system for preventative maintenance on ships. Data gathered from the engine sensor is automatically analyzed to provide performance diagnoses making it possible to conduct early countermeasures to prevent critical, time-consuming repairs and extend the frequency of overhaul intervals. The system aims to ensure safe operation of the ship and reduce lifecycle costs. Project completion is scheduled for March 2016.

EFFICIENT PROPELLERS PRESENTED IN HAMBURG

23 March 2015 - In order to introduce their latest technical skills and knowledge to the European maritime industry, Nakashima Propeller together with ClassNK held a joint technical seminar in Hamburg in March, which was attended by shipowners and a number of other industry professionals. The seminar focused on the theme of 'Eco Friendly and Efficient Vessel Operation by Modern Propulsion Systems and Software' and speakers discussed how they aim to spread the adoption of high efficiency propellers installed on newbuildings and for retrofit in addition to optimum operation support systems as solutions to the challenges currently faced by shipping companies.

CLASSNK UPDATES FLOATING OFFSHORE GUIDELINES

27 February 2015 - ClassNK announced the release of the latest version of its Guidelines for Floating Offshore Facilities for LNG/LPG Production, Storage, Offloading, and Regasification (Second Edition). Recent years have seen a rise in FSRU (Floating Storage and Regasification Unit) projects. These offshore gas facilities have been gaining popularity due to their low cost (less than half the cost of an equivalent onshore facility) and the advantage of being able to move wherever demand is the highest for regasification. In light of this industry trend ClassNK has clarified its guidelines to include FSRUs as well as FPSOs. As many of these facilities are often located close to shore, the amendments include design conditions which take into consideration the possibility and effects of tsunamis on offshore gas facilities. Tsunamis which occurred in the past at the specified operation site are to be investigated and the maximum tsunami which can occur at the site is to be taken into account during the design process.

CLASSNK OPENS NEW OFFICE IN CADIZ

14 April 2015 - ClassNK has opened a new exclusive survey office in Cadiz, Spain. Located in south-western Spain home to well-established shipyard facilities, the Cadiz Office joins an existing network of five survey offices throughout Spain in Bilbao, Algeciras, Barcelona, Ferrol, and Las Palmas. Through the opening of the Cadiz Office, ClassNK will respond swiftly to its clients in the region and provide shipowners with further improved services. With the establishment of the Cadiz Office, ClassNK now operates a global service network of 131 exclusive survey offices worldwide.

No distractions from LiquefAction

The LiquefAction project is expected to provide a better understanding of cargo liquefaction, and develop recommendations for ship design and operations that avert or mitigate future casualties.

Despite 75 large ship losses, leading marine insurer Allianz Global recently described 2014 as “the safest year in shipping for 10 years”, noting a 32% year on year decline in casualty numbers.

However, liquefaction remains a live and present danger for the bulk carrier sector. Over the past decade liquefaction has been linked to the loss of more than a dozen bulk carriers and over 90 seafarers. The Allianz Global Safety and Shipping Review 2015 identifies the topic as one of the “key risks to the future safety of shipping”.

As the world’s leading classification society in the dry bulk sector, the topic is understandably high on the agenda at ClassNK. Its priority is clear through the Society’s participation in the joint industry R&D Project for Bulk Carrier Safety - LiquefAction.

Partners include Hamburgische Schiffbau-Versuchsanstalt (HSVA), Hamburg University of Technology (TUHH), Ecole Central de Nantes (ECN), and the Institute of Science and Technology for Transport, Development and Networks (IFSTTAR), with shipowner Oldendorff Carriers invited to participate.

The project’s outcomes are expected to benefit the bulk carrier sector as a whole, and are expected to feed into

relevant safety guidelines such as ClassNK’s Guidelines for the Safe Carriage of Nickel Ore.

INTERCARGO has termed nickel ore “the world’s most dangerous cargo”, but part of the liquefaction project examines the assumptions that lie unchallenged behind such statements. For example, ships go down quickly and catastrophically as a result of liquefaction, but do existing regulations really describe the conditions that cause cargoes to act under liquefaction? And would their full application avoid such circumstances?

These are complex questions; not all cargoes with the same name necessarily have the same mineralogy profile, for example. Cargo profiles may differ regionally and even from within the same mine. Sampling methods may also be due for review.

Again, empirical evidence suggests that Asian nickel ore is highly susceptible to liquefaction, whilst other sources are not. Meanwhile, most fatalities with nickel ore have occurred in relatively light sea states, often within similar timeframes after leaving the load port.

The condition of cargo on loading and the loading process itself therefore warrants close attention. Capt. Paul Jeffrey, of Oldendorff Carriers GmbH comments that the

typical geared vessel will see about 4,000-4,500 grab loads, dropping 10-15 tons of cargo from a height 10-15 meters above the cargo. This has the negative effect of imparting energy into the cargo, liberating water, and driving out air. For Oldendorff, to help mitigate these effects, best practices for loading such cargoes includes using a 'soft drop' method.

Further research may help define the real consequences of such compaction, and the safety benefit of implementing 'soft drop' loading techniques.

Explicit in the first and second editions of ClassNK's guidelines on nickel ore is the precondition that cargo should not be loaded with moisture content over the defined transportable moisture limit (TML). However, the guidelines also include warnings on measurement errors, environmental conditions during a voyage and other factors that could cause liquefaction even if the moisture content is less than the TML.

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Amendments to Section 4 of the International Maritime Solid Bulk Cargoes (IMSBC) Code, which became mandatory from 1 January 2015, require the shipper to provide a certificate, signed by a port state-recognized organization clearly stating the TML of a cargo provided that the cargo is categorized as Group A, , which is defined as cargoes that may liquefy.

Vessels can carry cargoes subject to liquefaction even if the moisture content is above the TML, as long as the ship is "specially constructed or fitted to carry the cargo, and if evidence of approval by the Administration is stored on board the ship".

The second edition of ClassNK's guidelines on nickel ore include the world's first hull structure and stability requirements for "Specially Constructed Cargo Vessels", released as part of revised guidelines in February 2012. The requirements have since been approved by Panama, Japan, the Marshall Islands and Liberia, have been recognized by INTERCARGO, and went on to secure the Seatrade Safety at Sea Award in 2013, building on the reputation of the first edition which was awarded the Lloyd's List Global Safety Award in 2012.

However, in the interest of safety, some in the industry have called for re-evaluation of "low risk" cargoes, such as bauxite, which remains a 'Category C' cargo as defined under the IMSBC Code – the least dangerous category from a liquefaction point of view. Allianz also raises the point "whether the list of cargoes in the A, B and C categories in the IMSBC Code needs to be reassessed."

Cargoes may have wide ranging properties, both physical and chemical. Cargoes should also be considered on their own merits, especially those that may substantially differ from that indicative in the IMSBC Code.

Action by regulators to sharpen definitions on or reclassify cargoes within the IMSBC Code will surely be welcome, but the LiquefAction project is based on the premise that they do not provide an exhaustive response to the root causes of the phenomenon. It is surely worthy of note that accidents have occurred with vessels carrying screened bauxite products, effectively outside the standard run-of-mill grade envisaged when bauxite was originally introduced into the BC Code – the predecessor

sor of the IMSBC Code. Screened products may or may not benefit from a 'new' classification. Carriers should certainly be prepared to question cargoes and trades they might be unfamiliar with.

"Despite the positive steps that have been taken towards prevention of shipping accidents, there is still much more to be done," says Yasushi Nakamura, Representative Director and Executive Vice President of ClassNK. "A greater level of support and guidance is needed across the board to ensure safety."

ClassNK points to a lack of empirical study focusing on the excitation effects on the cargoes caused by dynamic motions from waves and the vibrations from ship engines.

"The contribution from the ship and the sea conditions tend to be disregarded or addressed in a superficial manner, without taking into account the complexity of the problem," says Mr. Nakamura. "ClassNK is convinced there are issues that need to be addressed in a holistic and comprehensive manner."

Ship motions and the frequency range and amplitude that cause liquefaction of a given cargo with given moisture content over specific time periods are central areas of study within LiquefAction. Modelling the phenomenon's effect on stability by taking into account dynamic behaviour is also critical. Both factors will contribute to qualifying and quantifying preventive and mitigating measures in ship design and operation.

Capt. Jeffrey of Oldendorff comments: "We need to look at the puzzle from a forensic viewpoint, working backwards and involving not just academic science but also empirical science – to avoid assumptions. We know that large ore carriers have made frequent ocean passages safely with the presence of a 'wet base', the result

of natural moisture redistribution downward within the cargo column. Empirical evidence would therefore suggest there are factors at play not being considered in our general understanding of liquefaction."

"I'm hoping the ship and cargo modeling that the LiquefAction research will define can be used to help simulate and explain the empirical observations reported by survivors of real casualties."

Capt. Jeffrey says that the various mechanisms which can lead to cargo instability, which are currently "lumped together as liquefaction", may not necessarily be the same. Slope failure or free water, for example, have specific dynamics. "We cannot conclude necessarily that ores with moisture content below TML will not, in fact liquefy; there being other engineering principles to consider."

Other variables needing research are quantifying a cargo's liquefiable potential by mass and the location where it is most likely to occur within the cargo.

The phenomenon of 'expressed water' at the cargo's surface, whether it be from pore pressure alone and/or some other mechanism, has been reported since the 1960s, but is still not fully understood, Capt. Jeffrey says. "Should we be able to predict the propensity for expressed water over a wide range of cargoes, then perhaps we'd have a better understanding of the 'liquefaction' risks that may in turn help explain why we see variances."

According to HSVA, LiquefAction is addressing both design and operational vessel perspectives, "based on extensive experience and accident data, numerical modeling and simulation concerning the behaviour of granular cargoes in various modes of motion". The results of this research will also be employed in the dynamic stability assessment of bulk carriers and general cargo ships under sea conditions similar to those recorded in real accidents.

Capt. Jeffrey is also hopeful that the LiquefAction project might provide further insight into the consequence of a dense surface level slurry occurring with or without a substantial sea state.

One plausible theory might suggest an instability that is initiated by a surface level slurry (liquefaction) sufficient to cause free surface and ensuing 'angle of loll' to be developed. The subsequent regaining of neutral or even positive stability at this large angle may be supported by observed accounts. At these large 'angles of loll' the free surface effect is significantly reduced with the slurry now finding itself nestled within the 'v' shaped wedge between the ship side boundary and the cargo's surface. The weight of the slurry is now to one side and although the free surface is drastically reduced, the resulting displaced weight maintains the permanent list. This

“ ClassNK is convinced that there are issues that need to be addressed in a holistic and comprehensive manner ”

comprises the first of a two-part rolling motion that may merit further study.

“Similarly, considering conventional models of liquefaction, we also need to investigate how a dense viscous medium may have sufficient mass and momentum to cause a large angle of list, the angle of loll, yet not enough to fully roll the vessel in one continuous motion,” says Capt. Jeffrey.

“Continuing this theory and its perceived 'two-motion roll scenario', is that the initial large 45 degree list subsequently will eventually cause the cargo to 'avalanche' at some point in time. This mass cargo movement is suspected of dealing the 'death blow', rapidly capsizing the vessel in mere seconds, seemingly corresponding with reports by survivors.” This secondary roll is known to occur within minutes or up to several hours after the initial instability.

“The proposition that cargo liquefies top-to-bottom or perhaps due to a wet base is itself questionable,” says Capt. Jeffrey. “The true value of the project will be seen when science based on empirical evidence questions the assumptions used in the standard liquefaction model. There's just simply a lot we don't understand as yet.”

The project team's innovative experiments and scientific modeling will expand upon the valuable framework already done by others, and help contribute to the collective knowledge so greatly needed.



Using big data to address big issues

A cloud-based, holistic approach to onboard machinery management, CMAXS is ClassNK's answer to the industry's pressing need for a coherent approach to utilize equipment monitoring, data analysis and maintenance work records.

In recent years, the use of sensor data to monitor onboard equipment condition and to prevent breakdowns has become widespread in shipping. Continuous monitoring and diagnostics based on collected sensing data are now key tools used to ensure the safety of operations and reduce the lifecycle cost of onboard machinery.

To address what is becoming an increasing need for systems that enhance safety and reduce machinery maintenance costs, ClassNK has teamed up with subsidiary ClassNK Consulting Service Co. Ltd. to provide ClassNK CMAXS, a highly reliable machinery maintenance system.

ClassNK CMAXS gathers data and information in the cloud database via two onboard applications; CMAXS PMS and CMAXS LC-A. Stakeholders can view their fleet data at any time, from anywhere in the world using the cloud-based database.

ClassNK CMAXS includes CMAXS PMS: an equipment maintenance planning and record management system which references the data and maintenance information input by crew members. CMAXS PMS maintenance management functions log maintenance work carried out on the ship, allowing crew members to carry out work during a voyage in accordance with a maintenance plan created on board, and develop a maintenance work report at the completion of maintenance work.

At the same time, the spare parts management functions of CMAXS PMS allow users to track parts consumed by onboard maintenance work, place orders with suppliers and log parts delivered to the ship. By optimizing the inventory process, the spare parts management functions help reduce dead stock and cut unnecessary costs.

Meanwhile, CMAXS LC-A is a condition monitoring system which uses sophisticated analysis software to achieve condition monitoring and automatic diagnosis of onboard



equipment to enable true “preventive maintenance”. The development of many existing systems focuses just on machinery diagnoses carried out shore side and manually. This is where the methodology of CMAXS LC-A differs from conventional systems. CMAXS LC-A is an onboard solution and covers everything from sensing to maintenance work support functions, without remote support.

CMAXS LC-A performs abnormality determination using the “mapping method” and “ANACONDA”. The mapping method enables engineers to develop maps of normal conditions based on their past experience and equipment characteristics. The second method involves the ANACONDA (Anomaly Analyzer for Correlational Data) technology developed by IBM, which uses correlations between measurements. ANACONDA draws on data collected by the sensors and analyzes the relationship between each sensor to uncover any abnormal values.

“
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Since the first method requires an in-depth knowledge of the equipment and extensive data analysis experience, the second method not only makes it comparatively easy to apply abnormality detection to measuring data but also makes it possible to detect previously overlooked dependencies.

CMAXS LC-A manages the monitoring and diagnostics functions of different types of shipboard equipment centrally, enabling crews to take quick and appropriate actions to address issues as they arise. That is why CMAXS LC-A can be used as an integrated platform for a wide range of onboard equipment.

“At ClassNK we are committed to using our extensive knowledge, obtained through years of surveying, to make machinery inspection more efficient. Our aim is to provide an even more advanced and reliable monitoring system capable of assessing a wide range of engine room equipment by enhancing the functions of CMAXS LC-A,” says General Manager Takashi Nagatome, ClassNK Consulting Service Co. Ltd.

The existence of this platform as an infrastructure will make it possible to deliver a high level of support easily, including abnormality detection, condition diagnosis, and troubleshooting by linking the necessary parameters and content. ClassNK believes CMAXS LC-A will help not only users but also equipment manufacturers to understand the condition of their equipment and allow them to reap huge benefits at minimum cost.



Staying green from start to finish

As European regulation of the ship recycling sector becomes a reality, ClassNK's early response to the issue at the international level proves its prescience.



Around 700 of the estimated 45,000 ocean-going ships in the world are taken out of service every year. Their valuable steel - over 80% of a ship's lightweight value - is an available resource that can be recycled. The machinery and equipment included in the lightweight value are also resources that can be reused.

The shipbreaking industry has grown to meet demand, and is now a profitable operation with business opportunities taken up most energetically in developing countries. However, their exploitation has come with both a human and environmental cost. The demolition of ships is sometimes associated with dangerous practices and pollution especially when issues such as lack of awareness make it difficult to ensure safety and manage hazardous materials, for example asbestos, oily sludge, and toxic paint chips.

For the past 20 years, the International Community has been campaigning for the improvement of safety and environmental standards in the ship recycling industry.

The IMO's response has been the "Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships", also known as "the Hong Kong Convention", adopted in 2009. Norway, whose delegation had been responsible for introducing the theme of ship recycling to the agenda of the IMO, became the first country to accede to the Convention on 26 June 2013.

Under the Hong Kong Convention scheme, ships over 500 gt engaging in international voyages must carry onboard an Inventory of Hazardous Materials (IHM) describing the location and the approximate quantity of the ship's hazardous materials. In principle, IHMs should be developed at the point of the ship's delivery and maintained until the end of its life.

Meanwhile, ship recycling facilities will be required to develop a Ship Recycling Facility Plan (SRP) by utilizing the IHM information to decide how to manage the types and amounts of hazardous materials expected.

As of today, however, only three countries (Norway, Republic of Congo and France) have ratified the Hong Kong Convention. To trigger entry into force, the instrument must be ratified by no fewer than 15 States, representing 40% of world merchant shipping by gross tonnage, with a maximum annual recycling volume of the signatories during the preceding 10 years constituting not less than 3% of their gross tonnage.

The European Union has subsequently looked to regulate the ship recycling sector more quickly. The EU Regulation on Ship Recycling entered into force on December 2013, specifically to speed up the adoption of the Hong Kong Convention. Its terms were immediately and uniformly handed down to Member States. The EU

Regulation imposes an obligation on ship recycling facilities wishing to undertake recycling activities on ships that exceed 500 gt and flying the flag of an EU Member State to be authorised and listed in the European List. In addition to incorporating much of the Hong Kong Convention without modification, it also imposes stakeholder requirements which are even tougher than the Hong Kong Convention in some areas. The industry should note that the IHM requirement is reinforced not only for ships flagged by EU Member States, but also for ships calling at ports in EU territory.

Critically, the EU rules build on the Hong Kong Convention to put into law the notion of an approved list of recycling facilities permitted for ships flying EU flags, together with a list of prohibited materials for newbuildings. According to the European Commission: "The European List will be published in the Official Journal of the European Union and on the website of the Commission at the latest thirty-six months after the date of entry into force of this Regulation (i.e. at the latest by the end 2016). The Commission will be able to regularly update the European List in order to include or remove a ship recycling facility from the List."

For the first time, stakeholders are having to face up to the Hong Kong Convention in the context of implementation, rather than yet further discussion.

As an early mover in the development of work at IMO level, ClassNK has positioned itself in readiness for the entry-into-force of the Hong Kong Convention. As early as 2008, the Society established a cross-divisional project team to develop a complete solution for ship recycling, including the development of the necessary documentation.

Well before the adoption of the Hong Kong Convention at IMO in 2009, ClassNK worked with equipment manufacturers, shipyards and shipowners to develop IHMs for 20 new ships and 40 existing ships on a trial basis. This experience helped ClassNK to understand practical issues and build up technical expertise in this area.

According to the Hong Kong Convention, shipbuilders should collect hazardous material information related to machinery, equipment and other items installed onboard from equipment makers, trading companies and other suppliers. The information received should then be organised in the IHM, and the correspondence between the shipbuilder and supplier should be conducted in terms compatible with the prescribed forms, Materials Declaration (MD) and Supplier's Declaration of Conformity (SDoC).

To deal with both the proliferation of documents and the potential for errors in transferring information from MD to IHM, ClassNK launched a cloud-based system for IHM development and maintenance in 2011. The software, PrimeShip-GREEN/SRM, was devel-

oped in collaboration with IBM to assist with the easy exchange of MD/SDoC and generate the IHM automatically by managing information online.

The cloud-based system enables suppliers to consolidate the responses for shipbuilder requests to submit MD and SDoC. In addition, suppliers can upload their MD to the MD Library. Shipbuilders can develop IHMs in Excel format using the MD/SDoC uploaded by suppliers and set locations for MDs containing Hazardous Materials. PrimeShip-GREEN/SRM automatically calculates the amount of Hazardous Materials at each location. This information can then be approved by ClassNK and transferred directly to the shipowner.

"PrimeShip-Green/SRM is becoming the de facto standard for the development and management of IHMs around the world. Nearly 2,200 companies, mainly shipyards and equipment manufacturers in East Asia, have so far registered to use the system and are actually using it in the development of IHMs", says Hirofumi Takano, head of ClassNK's Ship Recycling Team.

"The system allows for all aspects of IHM development and management during a ship's entire lifecycle to be conducted online, from the input of MD and SDoC to the maintenance of IHMs onboard".

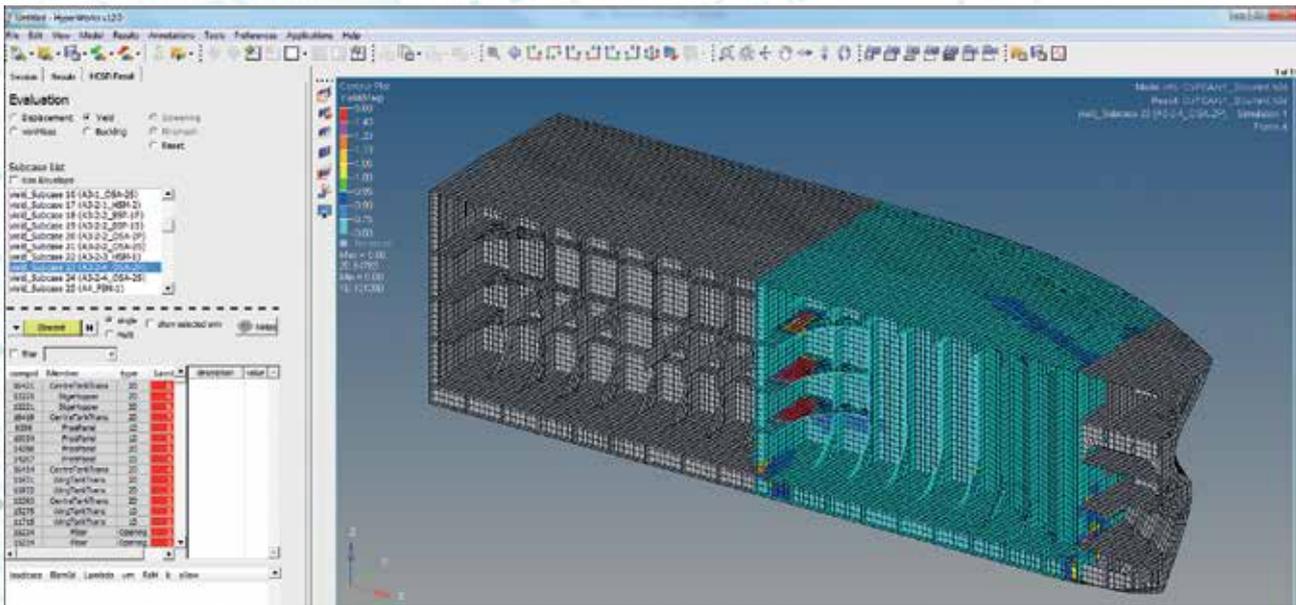
In its capacity as a classification society, ClassNK has already conducted and issued around 500 surveys and Statements for developed IHMs to certify their compliance with the Convention.

The Hong Kong Convention acknowledges difficulties when it comes to gathering information for aged ships, and therefore allows for the development of IHMs based on experts' drawings and onboard inspections. In order to facilitate this procedure, ClassNK's subsidiary company, ClassNK Consulting Service (NKCS), has built a team of experts to provide shipowners with an advanced solution for the IHM development process. NKCS also offers consulting services to breaking yards on how to prepare Ship Recycling Facility Plans (SRFP).

To date, ClassNK has certified five ship recycling facilities that have upgraded their management procedures to be in line with the Hong Kong Convention, including the world's first statement of compliance (SOC) to Zhongxin Shipbreaking & Steel Co. Ltd., in China. "Helping the industry comply smoothly with incoming international rules is the responsibility of classification societies. At ClassNK, we have worked to provide appropriate solutions to the issues faced by the stakeholders involved in the complex ship recycling process. With these solutions already in place, now it is just a matter of guiding the industry through the new regulations." says Mr. Takano.

Collaborative sound of CSR Harmony

The analysis capability of 3D modeling software NAPA Steel underpins the way PrimeShip-HULL(HCSR) is addressing harmonized tanker and bulk carrier Common Structural Rules.



The new (harmonized) Common Structural Rules for bulk carriers over 90m and oil tankers over 150m (CSR BC&OT) have introduced new classification requirements to mitigate the risks of major hull structural failure. New standards were developed to improve the safety of life and property at sea and protect the marine environment by contributing to the durability of the hull structure throughout a ship's design life.

The move towards CSR BC&OT reflects the fact that existing CSRs were initiated before the full implications of the IMO's Goal-Based Standards (GBS) became apparent. To address the objectives laid out by GBS, IACS and its member societies undertook 10 sub-projects, drawing on contributions from 70 specialists. IMO is now auditing the new rule version to verify its compliance with GBS, with entry into force due in July 2016.

The new rules require more in-depth analyses and new rules checks, in addition to the common standards for both ship types. Performing the design and verification analyses to meet CSR BC&OT has therefore demanded a significant software upgrade, to produce consistent and reliable results and ultimately common scantlings without increasing the time

spent on analysis. Achieving the seamless integration of rule checking and product model software has been a key priority in this process.

ClassNK's PrimeShip-HULL(HCSR) was the world's first multi-functional design and support software developed specifically to address the requirements set out in CSR BC&OT and reduce the man hours required for initial ship design work under the new rules. PrimeShip-HULL(HCSR) was released at the same time as the publication of CSR BC&OT draft in July 2012, followed by further developments of the software based on industry feedback and the latest rule changes.

The scale of the integration challenge posed by CSR BC&OT has been such, however, that work has involved very close collaboration between ClassNK and NAPA. Although ClassNK and NAPA already have software established in the maritime market, the task at hand has led to an initiative to harmonize aspects of ClassNK's PrimeShip-HULL(HCSR) and NAPA Steel.

That this collaborative approach has germinated around NAPA Steel is not surprising. Today 95% of the world's ves-

sels are built by yards which use NAPA's ship design software, including its integrated 3D model based design system NAPA Steel. Seamless integration with rule checking is built in to NAPA's 3D approach to design and construction software.

NAPA was acquired by ClassNK early in 2014, but both parties emphasize that NAPA continues to operate as an independent and neutral entity. As such, NAPA continues to collaborate separately with other class societies as an independent bridge across the legislative gap to CSR BC&OT. Indeed, based on the success of the initial initiatives NAPA has subsequently worked with other societies to develop the interfaces for CSR BC&OT prescriptive requirements assessments and others.

In developing the product model for CSR BC&OT, NAPA has shared tasks with PrimeShip-HULL(HCSR) in order to utilize the knowledge and strengths of both parties.

From ClassNK's perspective, the joint project expands the data linkage between ClassNK's PrimeShip-HULL(HCSR) design support software with NAPA's 3D model based integrated design software NAPA Steel. This greatly improves the efficiency of the ship design process and reduces the cost of designing vessels in accordance with the new rules.

According to ClassNK Representative Director and Executive Vice President Yasushi Nakamura: "With PrimeShip-HULL(HCSR) we have already succeeded in reducing the additional time needed for CSR BC&OT vessel design by roughly 50%, but our goal is to reduce the workload and in turn costs for ship designers and builders around the world. By improving the link to NAPA Steel and other design software we believe we can achieve even greater results."

NAPA President Juha Heikinheimo adds: "Many of the world's leading shipyards already use NAPA Steel to improve their design processes, and we see this improved data linkage as offering even greater benefits to NAPA Steel users. Improved linkage between NAPA Steel and ClassNK's PrimeShip-HULL(HCSR) and other software will allow yards building CSR applied vessels to even further streamline their design process, while also eliminating the need for designers to input duplicate data into multiple programs."

ClassNK has advanced the data linkage capabilities between PrimeShip-HULL(HCSR) and NAPA Steel. PrimeShip-HULL(HCSR) consists of two main components; a prescriptive rule function with quick rule calculation, easy-to-understand calculation results, and transparent reports for scantling calculations, and a function for direct stress assessments. In addition to shape and scantling information of longitudinal members, PrimeShip-HULL(HCSR) prescriptive rule data linkage features have been expanded to all structural members including transverse members from NAPA Steel product modeling. PrimeShip-HULL(HCSR) direct strength assessment data linkage features have also been expanded to include compartment information, member type information and opening information with FE models exported from NAPA Steel.

This enables designers to use 3D product models when the initial scantling checks are being submitted. This means that the cross-section geometry and initial scantlings as well as compartment information of an existing 3D model can be imported to a class rule check software.

For PrimeShip-HULL(HCSR) and for NAPA, the provision of prescriptive rule checks through the interface with NAPA Steel is by no means the end of the story. Functions for Direct Strength Assessment with Whole Ship Model will allow automatic analysis of all of the cargo holds together. Whole ship FE models created in NAPA Steel and other

design software will be automatically broken into hold models based on the requirements of CSR BC&OT.

Analyzing the cargo holds altogether rather than one by one will eliminate the need to input information and carry out individual analyses for each hold, greatly reducing the man hours required for the overall analyses.

Through collaboration over the last year and continued work as the deadline for CSR BC&OT approaches, class as a whole has been taking a practical approach to addressing the challenges, and offering a clear route towards strength assessments.

NAPA Steel together with ClassNK's PrimeShip-HULL(HCSR) is making the transition to strength assessments not only possible, but seamless.

“*Many of the world's leading shipyards already use NAPA Steel to improve their design processes, and we see this improved data linkage as offering even greater benefits to*

NAPA Steel users”

A balanced view on boil off

A new dimension has been added to ClassNK-NAPA GREEN software to optimize fuel use decisions to the benefit of all stakeholders.

The latest development in the performance monitoring and optimization software addresses the availability and utilization of the natural boil-off gas (BOG) that occurs during transit.

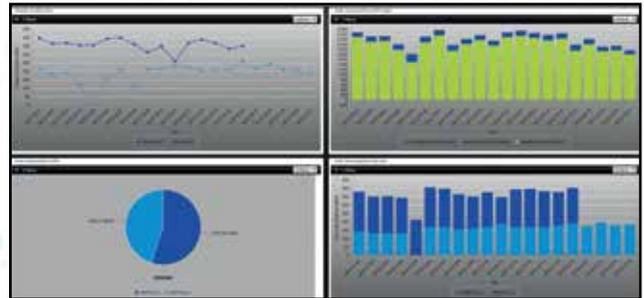
The new dimension has been added to ClassNK-NAPA GREEN, the software that is already a widely used voyage planning tool which assesses trim optimization, speed advice and vessel routing based on weather and sea state forecasts. It brings transparency to voyage planning decisions that may be taken on the basis of weather, but in the case of LNG carriers can actually involve a choice between increasing speed while burning conventional fuels and utilizing all available BOG.

This decision goes to the heart of a complicated issue between ship operators and charterers that is unique to the LNG sector. For the operator, BOG is often seen as a free source of fuel, while for the charterer, BOG is 'lost' cargo. Depending on the market, charterer may also instruct the operator to force more BOG should the required speed need so. On the other hand, unutilized BOG should be considered as waste, unless the vessel is equipped with re-liquefaction equipment.

As with other ClassNK-NAPA GREEN solutions, the LNG-specific software provides actionable analytics around fuel consumption, trim, route, speed, engine mode and operational efficiency. The new package is also entirely compatible with NAPA's widely adopted Gas Tanker Loading Computer for LNG carriers.

“**The integration of ClassNK-NAPA GREEN with the aspect of performance monitoring is the first of its kind**”

The extension allows users to choose whether it is most efficient to use BOG, forced BOG or bunker fuel (heavy fuel oil or marine gas oil), basing the decision on availability, price and calorific value, and in the context of the wider voyage plan. Options are considered in terms of their "Heavy Fuel Oil Equivalent" mass consumption so that the analysis is based on a like-for-like com-



parison. Finally the charterer has the tools to choose whether to force more boil-off or utilize conventional fuels.

The software satisfies the demands of different stakeholders by optimizing operations for the owner, for example from a safety perspective, while at the same time providing a performance optimization and automatic reporting tool for the charterer for verification purposes.

In addition to the standard signals ClassNK-NAPA GREEN collects, the LNG-specific phenomena are accounted for by 200-400 extra signals, mostly focusing on the cargo characteristics and cargo handling equipment. Due to the flexible nature of the ClassNK-NAPA GREEN platform, this only required a configuration change plus the removal of unnecessary user interface dialogues for ship personnel.

Jouni Salo, Product Manager, Shipping Solutions at NAPA says: "By developing this specialist performance monitoring solution, NAPA and ClassNK are making it possible for transparent and easily understood information to be automatically shared between crews, vessel owners, operators, charterers and cargo owners. This provides the assurance that the vessel is operating at the most economically viable profile."

Data on cool down requirements and natural BOG estimations are also available for use in the context of ClassNK-NAPA GREEN's analytic services. Therefore, it is useful not only for vessel routing selection, but for vessel deployment optimization, and ultimately vessel design optimization.

“The integration of ClassNK-NAPA GREEN with the aspect of performance monitoring is the first of its kind and will enable all those involved to ensure safe, efficient and optimum end-to-end operations,” says Yasushi Nakamura, Representative Director and Executive Vice President, ClassNK. “However, it will also provide important feedback for those shipbuilders which specialize in LNG carriers, contributing to their product development. After all, NAPA is the most widely used design software in shipbuilding.”

Statutory compliance made easy

Wider uptake is expected of NAPA Statutory Compliance Manager, an advanced software analysis tool developed jointly by ClassNK and NAPA to handle calculations and reports creation for stability and longitudinal strength.

ClassNK and NAPA initially developed the innovative calculation tool to enable statutory compliance calculations to be easier and automatic, as well as enhancing workflow in the approval of design process in 2008. NAPA statutory compliance software has been widely adopted by designers, yards, classification societies and maritime administrations, but to date use of the jointly-developed calculation and reporting tool has been controlled through ClassNK licensing.

Up until now, the tool has been identifiable as 'ClassNK Manager' within PrimeShip-NAPA Manager - the NAPA-based application created to improve the efficiency of ship design and speed up the classification approval process.

PrimeShip-NAPA Manager allows users to perform statutory compliance calculations such as stability and longitudinal strength calculations easily using NAPA 3D models. PrimeShip-NAPA Manager also delivers a workflow requiring minimum input and is so intuitive and easy-to-use that no training is needed to use the software.

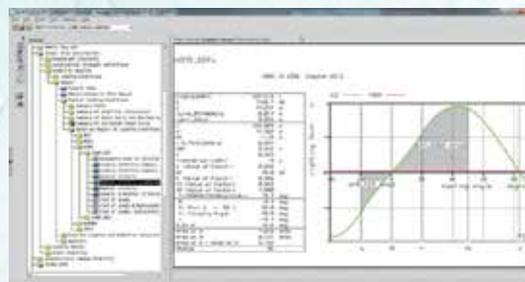
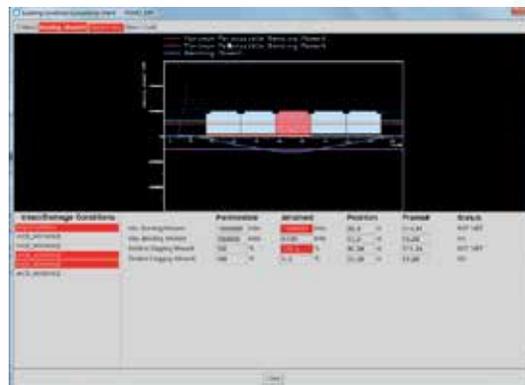
From early 2015, the calculation application was made available to all NAPA users, including other classification societies, under the name NAPA Statutory Compliance Manager as part of NAPA's full range of software solutions.

The application provides a logical workflow for assessment of necessary rules for bulk carriers, tankers and container ships, taking account of intact stability, deterministic and probabilistic rules and regulations set out at the International Maritime Organization. These include, but are not limited to, the Intact Stability Code 2008, SOLAS 2009, the tanker-specific MARPOL Reg. 27 and the bulker-specific SOLAS XII.

The application is designed to work on top of existing geometry. While the geometry model needs to be pre-defined, NAPA Statutory Compliance Manager contains intuitive functionality that can accommodate domain-specific definitions such as openings, deck load arrangements, loading conditions and damage conditions. The same flexibility applies to working with existing analysis tools, subdivision and database securing. Among its wide range of functions, NAPA Statutory Compliance Manager also enables longitudinal strength analysis including shear force corrections, and grain stability.

In making NAPA Statutory Compliance Manager functionality more widely available, NAPA and ClassNK also paid special attention to report presentation; one result

has been a new set of standard layouts, reflected in the clarity of supporting intact and damage stability booklets. With the solution now available to an even wider audience, the industry has greater opportunities for innovation.



Compliance Check, Openings and Report

A new way in Norway

ClassNK's Oslo Office has been adding some well-known Norwegian names to its roster of regional shipowners under class. Oslo Office General Manager Nore Nilsen puts the regional upturn in ships registered down to availability and responsiveness of services.

Long established in the Norwegian market, ClassNK opened an exclusive survey office in Oslo in 1995, offering classification services as well as shipboard equipment certification for local manufacturers. The Oslo Office subsequently saw an increase in activity over the years, offering more class surveys, audits, inspections, and business promotion for owners and operators in the region.

Helping shape these activities is Nore Nilsen, General Manager of the ClassNK Oslo Office. Qualified as both a naval architect and as a marine engineer, Mr. Nilsen brought with him 30 years of industry experience, with a CV including 13 years with another class society, 14 years with four different shipowners and a period in the offshore sector.

Over time, the arrival of the International Safety Management Code and the International Ship and Port Facility Security Code naturally broadened expectations for the work done by ClassNK in Norway, he explains, with each of ClassNK's locally-based surveyors qualified to offer a complete range of services.

"Since I joined in 2004, we have seen a continuous increase in our workload in the region, based on satisfying existing contacts and building new ones step by step," he says. "It's fair to say that ClassNK is now widely accepted as integral to the Norwegian maritime industry as a service provider, and that acceptance extends to shipowners, ship managers and equipment suppliers."

Full authorization as a Recognized Organization from the Government of Norway followed in 2011, granting ClassNK the authority to perform surveys and issue certificates for Norwegian-flagged vessels on behalf of the state. The scope of the agreement covers Norway's two ship registers, the Norwegian Ordinary Ship Register (NOR) and Norwegian International Ship Register (NIS). ClassNK registered its first Norwegian flagged vessel (NIS) in 2012, in the shape of the *Star Norita*, a bulk car-

rier owned by Ugland Shipping AS, of Grimstad.

"Before 2011, we had no ships flying the Norwegian flag that were classed with ClassNK; now we have over 20 NIS vessels with us, owned by some of the best known names in Norwegian shipping, and that does not happen by coincidence."



ClassNK's concerted response to the implementation of the newly revised Maritime Labour Convention has proved particularly attractive to Norwegian owners, Mr. Nilsen says. "MLC compliance is a significant challenge and owners need to be sure of their class partners when it comes to the entire auditing process, including the training element. Our Norwegian customers have been exacting in this regard, and we as class partners have welcomed that attention to detail."

Well-known Norwegian names that have joined the ClassNK register include family-owned Stove Rederi AS, which prides itself for the quality of the ships it commissions for the handy-max and supramax dry bulk carrier markets and its association with the industry's most forward-looking shipbuilders. The company transferred five geared, semi-open box design bulk carriers to the ClassNK register in 2013. Other large players in terms of fleet size have also proved open to the ClassNK offer, including Spar Shipping, which is again focused on the geared dry bulk carrier segment.

As the society with the largest share of the world's bulk carriers under class, it is not surprising that ClassNK has been particularly persuasive among Norwegian owners in this vessel category. However, Mr. Nilsen says the impact being made in

a market which is, after all, home to one of its International Association of Class Societies peers is starting to extend across the full range of vessel types.

Also among the many newcomers to the ClassNK register, for example, is Bergen-based Hansa Tankers, which has become a significant player in the stainless steel chemical tanker sector since it began operating in 2010, and newly established TRF Ship Management based in Oslo.

BW Fleet Management, BW Group's internal provider of ship management and newbuilding services focusing on gas and tanker operations, also recently became a ClassNK client when ordering several chemical vessels, Mr. Nilsen says.

"I think the key element in all this is the services we provide, and the positive attitude ClassNK brings to its engagement with owners. Norwegian owners have welcomed the fact that they now have the opportunity to make a choice based on services delivered."

The very fact that the Oslo Office works in a different time-zone than the head office is advantageous to ClassNK as a provider of services within the Norwegian market, Mr. Nilsen suggests. "We are on-call here, but if there is an issue customers know that our London and Hamburg staff, including a representative for our Survey Operations Headquarters also stationed at the Hamburg Office, are available as back-up and that the support available from ClassNK Tokyo during Europe's out-of-hours periods is unrivalled.

"We know that owners judge the services we provide based on availability and on our willingness to respond in a timely way. Staff in Tokyo work long hours anyway, and that means that outside European office hours, I can be assured that our operations in Norway are getting the kind of global support network every owner has the right to expect from Class in the 21st century."

Engaging with the industry's needs at a global level requires a holistic approach, on top of a commitment at ground level, Mr. Nilsen explains. He highlights ClassNK's proactive attitude to improving its services, citing the recent initiative to streamline its classification certificates by re-engineering its registration system as an example. Until recently, ClassNK would issue

“
*It's fair to say that ClassNK
is now widely accepted as
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maritime industry*
”



provisional classification certificates at the completion of class entry surveys onboard before delivering the final certificates once the registration had been completed at head office.

"As part of ClassNK's goal to continuously improve its 24/7, 365 days a year service policy, classification certificates reach the ship simultaneously with conventional certificates, considerably cutting down on waiting time for ship owners."

The willingness to anticipate industry needs through continuous research and development as part of a non-profit commitment to the shipping and offshore sectors is also highly valued in Norway, Mr. Nilsen says, where investing in future technologies is a way of life.

He predicts demand for ClassNK services will continue to grow in Norway, confiding that the Society is not only looking to recruit a further surveyor in the months ahead, but is also testing the appetite among Norwegian owners for a second office in Norway, this time with a particular focus on Bergen.

"Owners located around Bergen have said they would certainly value a local presence from ClassNK, and we are certainly prepared to set up there within a short space of time, so it may only be a question of timing," Mr. Nilsen says.

Industry partnership: Stove Shipping

With a long-established tradition in the geared bulk carriers sector extending back to the 19th century, Norwegian company Stove Shipping has built its fleet at leading Japanese shipyards. Lars Christian Skarsgård, Head of Shipowning of Stove explains why the partnership with ClassNK was a natural decision to support its business.

What is the history behind Stove Shipping?

Stove shipping was originally founded in 1959 and is a private shipowning company controlled by the 3rd generation of the Tidemand family. We manage our fleet from our office outside Oslo together with our sister company Eastern Bulk Carriers which is a worldwide operating company.

In 2013 your company transferred its entire fleet to the ClassNK register. What were the requirements involved in that decision?

We transferred our eight ships to ClassNK in 2013: five geared, semi-open box design vessels and a further three geared bulk carriers. For decades our company has been committed to having vessels built to the highest standards and therefore our entire fleet has been constructed at Japanese shipyards, ever since our first order dating back to 1980. As such, a decision to partner with ClassNK seemed natural to further strengthen our business in Japan.

What is the Society's biggest benefit to your business?

Having a classification society considered to be first-class is a prerequisite to trade in our business. We rely on certifications but, as issues arise, equally important is the collaboration in solving problems. ClassNK has welcomed us warmly and we look forward to continuing our good relationship with the Society.

Are you planning to register other vessels with the Society in the next few years?

As a modernization process is ongoing, with new vessels set to join the fleet over the next couple of years, it is likely that these vessels will be registered with ClassNK.

Can you share your latest news on new deliveries, second hand vessel acquisitions and further plans for 2015? Can you expand on your design and operations?

We have had three vessels coming into ClassNK since 2013 as replacements for vessels sold and we will announce acquisitions as they arrive. Nevertheless, the strategy remains focused on the geared bulk carrier segment, including semi-open box designs. I think we have all seen a gradual improvement in the efficiency of ship designs. However, when dealing with first-class shipyards this is more an evolution process rather than a revolution, as some others might declare. Acquiring tonnage is a long term commitment for us and we follow with interest the new efficiency developments in terms of energy saving, cargo handling and environmental impact.

Could you identify any switch in your trading patterns/products carried over the last 12-18 months, and if so, can you give us an explanation?

The dry bulk sector is already fragmented especially in the minor bulk trades where we tend to focus; however, we see that as a positive sign. Interestingly, some new trades have developed, such as the export of steel products, but our vessels continue to trade between all continents.

ClassNK events in 2015

- ◆ **NOR-SHIPPING, OSLO, NORWAY, 2ND - 5TH JUNE**
Please visit ClassNK at booth B03-08
- ◆ **INLAND MARINE EXPO, ST. LOUIS, USA, 15TH - 17TH JUNE**
Please visit ClassNK at booth 240
- ◆ **NAVALSHORE, RIO DE JANEIRO, BRAZIL, 11TH - 13TH AUGUST**
Please visit ClassNK at booth G-499
- ◆ **PHAROS, CAIRO, EGYPT, 1ST - 3RD SEPTEMBER**
Please visit ClassNK at booth H026
- ◆ **OFFSHORE EUROPE, ABERDEEN, UK, 8TH - 11TH SEPTEMBER**
Please visit ClassNK at booth 4D155
- ◆ **INMEX INDIA, MUMBAI, INDIA, 23RD - 25TH SEPTEMBER**
Please visit ClassNK at booth J20
- ◆ **SEATRADE OFFSHORE MARINE & WORKBOATS, ABU DHABI, UAE, 28TH - 30TH SEPTEMBER**
Please visit ClassNK at booth A8

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24/7 Worldwide Full Support

As the world's leading classification society, ClassNK maintains a global service network of over 130 exclusive surveyor offices. ClassNK's surveyors work in shipyards and ports around the world, wherever they may be called upon to assess the condition of a ship, to ensure that all of our services are available to clients 24/7, worldwide. To learn more about how our commitment to service has earned the trust of clients worldwide, visit us at www.classnk.com

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