

ClassNK

MAGAZINE

DECEMBER 2015 - 74TH EDITION

- ◆ *The Chinese Road*
- ◆ *Hand-in-hand with COSCO*
- ◆ *Emissions initiatives pay off*
- ◆ *In support of SINOPACIFIC*



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

ClassNK

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Global Authority in Maritime Standards

Responding to change with advancement



Welcome to the 74th edition of ClassNK Magazine.

The maritime industry serves consumers and employs people around the world. As such, we as an industry have a responsibility to improve our operations not only for our clients, but also for those working on the front line. Efforts come in many forms and from many directions, and in this edition we hope to give our readers insight into what ClassNK and our partners are doing to advance the industry.

One key area that has seen a range of new developments is the environment. The International Maritime Organization (IMO) and governments across the world have been introducing new environmental regulations at both local and international levels. New measures such as the incoming Tier III emission regulations and the introduction of Emission Control Areas bringing in stricter controls on emissions of nitrogen oxide (NOx), sulfur oxide (SOx) and particulate matter present new challenges.

While these measures provide clear limits and specifications, it is our responsibility to help owners and operators achieve

compliance. In this issue, an article on NOx and SOx regulations shows how ClassNK is developing new technologies in partnership with the industry under the Joint R&D for Industry Program to provide practical solutions for owners and operators.

Our commitment to supporting maritime professionals is highlighted in an article on ClassNK Academy. By providing the industry with access to low-cost, high-quality training around the world we are working to help organizations both improve their operations and ensure the safety of their personnel and property at sea.

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In terms of new regional developments, one country that has seen increased activity across the board is China. This edition includes a section on China and ClassNK's operations within the country as well as interviews with shipowner COSCO and shipbuilder SINOPACIFIC that give invaluable insight into how the essential operations of our industry are being carried out.

As always, I hope you find this edition of the ClassNK Magazine both interesting and informative.

Noboru Ueda
Chairman and President of ClassNK

ClassNK

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ClassNK

CLASSNK ISSUES ANNUAL REPORT ON PORT STATE CONTROL

12 August 2015 - ClassNK has released its annual report on Port State Control. The report aims to assist ship operators and management companies in maintaining compliant operations by providing information about ships detained by PSC as well as deficiencies that were found on board from many port states in 2014.

To help its customers improve safety management systems and overall fleet quality, ClassNK has included a breakdown of deficiencies which shows that lifeboats, emergency fire pumps, and fire-dampers continue to be the major items where most detainable deficiencies are found. The ClassNK report also provides detailed analyses of PSC detentions by flag state, port state, ship type, ship size, and ship's age as well as a summary of major amendments made to international conventions such as the SOLAS Convention. These amendments have further widened the scope of PSC inspections, a trend that will undoubtedly continue as the rules applied to ships increase and diversify.

CLASSNK OPENS NEW SURVEY OFFICE IN BRUNEI

17 August 2015 - ClassNK has opened a new exclusive survey office in Brunei. ClassNK has already established survey offices throughout the region including in Sibul, Miri, Kota Kinabalu (Malaysia), and Balikpapan (Indonesia) but through the opening of the Brunei office, the Society aims to provide the Southeast Asian region with even more convenient vessel survey services.



CLASSNK RELEASES WORLD-FIRST GUIDELINES ON COMPOSITE PROPELLERS

28 August 2015 - ClassNK released the world's first Guidelines on Composite Propellers (Part on Manufacturing/Product Inspection) on 31 August.

The strength and corrosion resistance of composite materials make them widely used in fields such as aerospace, automobiles, and wind power generation, and their scope of application has been further expanded due to their usefulness.

The substitute composite material carbon fiber reinforced plastic (CFRP) weighs in at around just 1/5 of aluminum-bronze. Despite its ultra-lightweight composition, CFRP exhibits the same or more strength compared to the aluminum-bronze composite materials used in conventional propellers. Due to its lightweight, CFRP propeller shafts can be manufactured with smaller diameters, reducing costs. In addition, by taking advantage of CFRP's strength, it is possible to produce thinner propellers with smaller blade areas, potentially increasing the propeller's efficiency.

In order to apply a composite propeller to ships, the material must have the required performance at least equal to existing aluminum-bronze composite materials, and it is necessary to confirm in advance that the composite propeller can be manufactured with uniform quality as an industrial product.

In May 2014, ClassNK granted approval for the design and manufacturing process of the CFRP propeller. The propeller was developed with support from the ClassNK Joint R&D for Industry Program and marked the world's first installation of a CFRP propeller on a merchant vessel.

Based on the knowledge obtained through this joint R&D project, ClassNK comprehensively summarized the requirements for the approval of the manufacturing process for composite propellers and the testing/inspection of the product in the form of guidelines to assist in the effective use of composite material propellers on ships.

EXHAUSTIVE CHECK FOR IINO MARINE SERVICE GHG EMISSIONS

28 August 2015 - ClassNK has carried out the independent third-party verification of Iino Marine Service's greenhouse gas (GHG) emissions inventory based on a reasonable level of assurance. ClassNK's verification was performed according to the requirements specified in ISO 14064 and under the observation of a registered accreditation body.

Iino Marine Service drew up an emissions report (from 01/04/2013 to 31/03/2014) based on ISO 14064-1 (Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals) which quantifies the total emissions from the 50 or so vessels it manages and the Iino Marine Service office. ClassNK then carried out the verification of this report in line with ISO 14064-3 (Specification with guidance for the validation and verification of greenhouse gas assertions).

The verification's 'reasonable level of assurance' means that ClassNK recognizes that the emissions as declared in the organization's GHG report were accurate, complete, and meet all of the relevant criteria. The verification certifies that an extremely stringent and comprehensive evaluation was carried out on Iino Marine Service's emissions report. In addition, the ClassNK verification process and verifiers' ability were approved by The Japan Accreditation Board (JAB), a world-leading accreditation body, and the verification based on ISO 14065 (Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition) was confirmed.



Mr. Koichi Fujiwara, ClassNK Executive Vice President, giving Mr. Hisahiro Oshima, Iino Marine Service President, the verification statement

CLASSNK AND TÜV RHEINLAND SIGN PARTNERSHIP AGREEMENT

15 September 2015 - ClassNK and TÜV Rheinland Group have concluded a worldwide partnership agreement to expand their testing and certification services portfolio and better serve their clients.

ClassNK, a leading non-profit classification society, has extensive experience in certifying materials and equipment for maritime use, while TÜV Rheinland is a world-renowned product testing and certification body. Both certification bodies operate globally, close to their clients.

Advances in technology and economic growth mean that more and more materials and equipment are being designed for both on-shore and maritime installations. Manufacturers of this dual-use equipment face lengthy and costly testing and certification processes before their products can be placed on the market.

CLASSNK STATEMENT OF COMPLIANCE TO TWO SHIP RECYCLING FACILITIES IN INDIA

29 September 2015 - ClassNK has issued Statements of Compliance (SoC) to two ship recycling facilities in Gujarat, India, R. L. Kalthia Ship Breaking Pvt. Ltd. and Priya Blue Industries Pvt. Ltd., verifying that the facilities are in line with the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009 (HKC).

ClassNK reviewed the SRFPs prepared by Kalthia and Priya Blue, which comply with requirements of the HKC, and confirmed that their ship recycling processes follow their respective SRFPs in addition to conducting on-site inspections before issuing the SoC. This marks the first time SoC have been issued to ship recycling facilities in South Asia.

The SoC are issued based on purely technical verifications of the facilities by ClassNK, which has so far done the same for ship recycling facilities around the world. ClassNK will continue encouraging safe and environmentally sound ship recycling in accordance with the HKC through its issuance of SoC to facilities that meet the HKC standards.

CLASSNK INNOVATION REWARDED AT THE LLOYD'S LIST ASIA AWARDS 2015

29 October 2015 - ClassNK picked up the Innovation Award for its 3D modeling software ClassNK-PEERLESS at the 18th Lloyd's List Asia Awards in Singapore.

The awards recognize the Asian maritime industry's successes, setting a benchmark for excellence while rewarding breakthrough ideas and concepts. The Innovation Award recognizes an innovative project or technology which has demonstrated or has verified potential to move shipping forward.

ClassNK-PEERLESS, the comprehensive and powerful design tool for 3D modeling, was developed using outcomes from joint R&D projects with the University of Tokyo, NYK Line, Mitsui O.S.K. Lines, "K" Line, Sasebo Heavy Industries, Sanwa Dock, MTI, S.E.A Systems, Armonicos, and ClassNK Consulting Service.

It provides a solution to the ballast water management (BWM) system retrofit bottleneck following the anticipated entry into force of the BWM Convention. Whereas before it was necessary to enter the engine room and measure every structure

manually, ClassNK-PEERLESS streamlines the process and eliminates the need for direct contact by using high-precision 3D laser scanners. Since its launch in 2014, ClassNK-PEERLESS has been used for retrofits on 27 vessels, saving roughly 8,000 man hours, translating into thousands of dollars in reduced labor costs.

Mr. Chris Jones, Director Asia Pacific, The Baltic Exchange presenting the award to Mr. Toshio Kurashiki, Operating Officer/Regional Manager of South Asia & Oceania, ClassNK



CLASSNK STARTS VERIFICATION TESTS OF CBM SYSTEM ON MAN B&W ENGINES

8 October 2015 - ClassNK has commenced actual verification tests of its next-generation condition-based monitoring (CBM) system ClassNK CMAXS e-GICSX for Mitsui's MAN B&W engines. The system is being jointly developed by ClassNK, Mitsui Engineering & Shipbuilding Co., Ltd., and MES Technoservice Co., Ltd. and the verification test is being conducted on a MOL-managed vessel with the cooperation of Mitsui O.S.K. Lines.

ClassNK CMAXS e-GICSX is unlike any other CBM system to date. Based on voyage data, including weather and sea condition, and machinery data collected from multiple sensors installed on the engine, ClassNK CMAXS e-GICSX can detect machinery abnormalities and, based on abnormality detection results, provide troubleshooting that can be accessed onboard even without an internet connection.

ClassNK CMAXS e-GICSX uses a sophisticated algorithm to analyze correlations between multiple sensing data. Through the use of this algorithm, precise abnormality detection is carried out based on voyage data and large amounts of data collected from the electronically controlled diesel engines. A total of three vessels from shipping companies including MOL

Group have been installed with ClassNK CMAXS e-GICSX and the effectiveness of the abnormality detection results and troubleshooting function will be verified. The verification test will go on until spring 2016.

ClassNK will provide a system to increase the reliability of machinery and support a reduction in lifecycle costs. The next-generation condition-based monitoring system (ClassNK CMAXS) uses big data analysis technology and includes ClassNK CMAXS e-GICSX for Mitsui's MAN B&W engines. ClassNK will also work together with machinery manufacturers to carry out a streamlined verification of the application of ClassNK CMAXS through vessel engine inspections.

CMAXS e-GICSX screenshot



Emissions initiatives pay off

The environmental objectives set out in ClassNK's Joint R&D for Industry Program continue to be realized through 2015, as long term projects to cut ship emissions through technical innovation reach fruition

Initiated in 2009, ClassNK's Joint R&D for Industry Program supports over 300 projects that address the key challenges facing shipping on safety and the environment. In line with the legislative timetable, the last 24 months have been particularly fruitful for initiatives involving vessel emissions.

The Program supports collaborative research with shipping companies, shipyards and marine equipment manufacturers, and has taken in everything from ship structures and hydrodynamics, to hull coating and voyage optimization. However, air emissions has been a major subject since the Program's inception, with technical innovation representing the route to compliance with shipping's environmental agenda.

ClassNK participates across a range of projects focused on developing technologies required to address the advancing restrictions of NOx and SOx emissions. These cover selective catalytic reduction and exhaust gas recirculation for NOx reduction, exhaust gas scrubbers for SOx reduction, and dual fuel engines that minimize both types of emissions when running on gas.

In recent months, results from NOx emissions projects within the Program's framework have been especially prominent in the two-stroke marine engine segment. One milestone was reached in August 2015, when a 34,000 dwt bulk carrier for owner Shikishima Kisen K.K. from The Hakodate Dock Co., Ltd. became the first ship to feature a new low pressure Exhaust Gas Recirculation (EGR) system.

The system, developed by Mitsubishi Heavy Industries Marine Machinery & Engine Co., Ltd. and Mitsubishi Kakoki Kaisha, Ltd., is believed to be the world's first low pressure EGR that recirculates the exhaust gas from a turbocharger using a two-stroke marine diesel engine. Initial and running costs for low pressure EGR are lower compared to high pressure EGR systems.

The low pressure EGR, installed in a Mitsubishi 6UEC45LSE Eco B2 engine, meets IMO's MARPOL Annex VI Tier III require-

ments to cut NOx from ships by 76% (compared to Tier II) in emission control areas for keels laid on or after 1 January 2016. The technology suppresses the NOx by changing the characteristics of engine combustion conditions. A decrease in oxygen in the scavenging air lowers the combustion temperature, in turn lowering NOx emissions. Part of the low pressure exhaust gas emitted is recirculated from the turbocharger outlet to a turbocharger intake, for after treatment by an EGR scrubber.

Subject to evaluation in commercial operations, this system is destined for uptake by NYK Bulk & Projects Carriers Ltd., and for deployment in the wider 'Tier III market'.

As far as wider two-stroke engine applications are concerned, MAN Diesel & Turbo is proceeding with EGR systems development with licensees. Kawasaki Heavy Industries, for example, is trialing a combined emission reduction system including EGR and water emulsified fuel system on a pure car truck carrier newbuilding for K-Line, as part of a development project involving shipbuilder Japan Marine United. Meanwhile, Mitsui Engineering and Shipbuilding is developing EGR technology for slow speed engine application as part of collaborative efforts with NYK Line and Monohakobi Technology Institute.

Given that only around 15 vessels driven by two-stroke engines are equipped to meet Tier III to date, with most operating on a trial basis, the efforts of ClassNK's Joint R&D for Industry Program on developing EGR are invaluable to helping owners and operators meet emissions requirements.

An alternative method of meeting Tier III emissions restrictions while sticking with diesel is selective catalytic reduction (SCR). SCR is an after-treatment solution, through which NH₃ derived from an injection of urea causes the NOx in the exhaust gas to react, forming H₂O and N₂ on the surface of the catalyst.

Joint R&D for Industry Program research projects covering SCR technology have included certification methodology

work, the performance of different types of catalysts, the influence of exhaust gas temperatures on SCR durability, sulfur content in fuel oil, trial NOx measurements, ammonia slip, installation and operations. In fact, as long ago as 2011, ClassNK provided the guidelines for the installation of SCR systems which summarize standard design specifications from safety aspects for using ammonia solutions or urea solutions as reductant agents. The Society has also issued several Statements of Compliance for SCR-fitted engines complying with the Tier III emission limits.

MHI-MME itself already has a low pressure SCR system for the upstream installation of two stroke turbochargers, developed within the “Super-clean Marine Diesel” research project by the Japan Ship Machinery & Equipment Association (JSMEA). Earlier this year, ClassNK also verified that the SCR system developed jointly by Mitsui O.S.K. Lines, Namura Shipbuilding and Yanmar meets Tier III NOx limits, for three power generators of a MOL-operated oceangoing freighter for a demonstration test scheduled for 2016.

Meanwhile, ClassNK issued a ‘statement of fact’ covering SCR-fitted two-stroke engines manufactured by Hitachi Zosen and developed jointly with engine licensor MAN Diesel & Turbo in 2011. A 6S46MC engine was initially installed on a 38,000 dwt general cargo ship for onboard trial. The Hitachi Zosen solution received the Marine Engineering of the Year 2014 from the Japan Institute of Marine Engineering on 27 July 2015.

Two-stroke marine engines running on LNG can also meet Tier III requirements, by introducing lean-burn combustion to reduce peak temperatures and NOx emissions – without needing either SCR or EGR. Dual fuel engines of this type have been developed by Wärtsilä. On the other hand, two-stroke dual fuel engines featuring high-pressure gas injection (GI) need a combination of SCR and EGR to comply because

they generate local high temperature peaks, increasing NOx emissions.

If recent product announcements have focused attention on NOx emissions from vessels running on two-stroke engines, this should not overshadow the four-stroke engine market, where ‘Tier III’ choices are already mature. More than 500 ships are estimated to already be operating to its provisions.

Here again, the options are EGR or SCR for marine diesel engines, or adopting the dual fuel/gas approach, although in this case it should be noted that Tier III-compliant DF four-strokes have been commercially available for many years.

Niigata Power Systems Co., Ltd., meanwhile, has a complete line of SCR systems for marine diesel engines ranging from 550 to 6,600 kW for main propulsion engines, with its first unit delivered nearly 20 years ago. ClassNK recently issued a ‘Statement

of Fact’ that the new and compact 28AHX medium-speed marine diesel engine combined with an SCR system from Niigata fully complied with IMO NOx Tier III Limits.

Developments at Niigata are now focusing on compact SCR design solutions as part of the “Super-clean Marine Diesel” research project overseen by JSMEA.

In light of the fast developing options, ClassNK is striking the critical balance between in-depth involvement in R&D and its neutrality as an advisor on the technical choices facing owners. In short, its pivotal role includes the ability to step back and base its advice on different vessel operating profiles, outlining the pros and cons of each option without fear or favor.

The Society note that SCR has a high NOx reduction rate of more than 90% with lower installation costs compared to EGR, except for large-sized engines such as main engines for VLOC, VLCC or large container carrier. However, they point out that SCR is a space-hungry option, and additional urea costs need to be factored in for the solution, which may cost more

“ *In summary, there is an initial cost issue on whether to select SCR or EGR to meet NOx restrictions, but the total cost effectiveness of systems depends on engine size, trade area, and the amount of time each individual ships spends operating within an ECA* ”

than the additional fuel consumed using EGR. SCR operation can also be limited by exhaust gas temperature, meaning that operation at low load may be difficult.

ClassNK also weighs SCR's need for performance spot-checking, intermittent maintenance or even replacement against the EGR's need to discharge wash water from the scrubber and to dispose of the residue generated by the washwater treatment system.

"In summary, there is an initial cost issue on whether to select SCR or EGR to meet NOx restrictions, but the total cost effectiveness of systems depends on engine size, trade area, and the amount of time each individual ship spends operating within an ECA," says Y. Shibata, General Manager of ClassNK's Machinery Department.

NOx emissions progress commanded the marine technology news agenda through 2015, and the SOx emissions issue rumbles on in the run up to regulatory review at IMO, set to be completed by 2018, which will decide whether stricter global controls should apply from 2020 or 2025. For the moment 3.5% sulfur content is permissible in fuel oil used outside ECAs, but this is limited to 0.1% within ECAs unless alternative abatement technology is used. The global limit is set to be reduced to 0.5%, either from 2020 or 2025.

Technical choices to meet these requirements are already clear, however, having been forced by the January 2015 deadline on SOx emissions within ECAs. The main body of owners operating within ECAs have chosen to run on more expensive fuel grades, although some have chosen the abatement technology that enables continued use of heavy fuel oil (HFO) via an Exhaust Gas Cleaning System (EGCS). A small number of operators have used the opportunity to construct newbuildings, making the more radical switch to gas.

Uptake decisions may change once wider restrictions are applied, and here too ClassNK has been preparing for any eventuality.

It released the third version of its Guidelines for Gas Fueled Ships at the start of 2015, with its updated expertise closely associated with developments within the Joint R&D for Industry Program. Niigata, for example, completed development of a smaller DF engine in 2012 under the Program, while Daihatsu finished developing a four stroke DF marine engine in 2014.

In terms of gas engines fit for incoming SOx emissions restrictions, ClassNK's expertise has also been deepened in the low-speed segment, where it has been supporting Diesel United Ltd., to develop a DF engine under license to Wärtsilä. Here, developments appear particularly exciting, given the growth potential offered by opportunities to import US shale gas into Japan. A full scale testing of a 6-cylinder (X72) Wärtsilä DF engine installed at DU's Aioi Works began in February 2015, envisaged as being applicable to large LNG carriers.

DU's interest in low-speed DF solutions is also expected to expand its sales activities to engines such as the X62 type, with a focus on conventional bulk carriers as well.

For shipping as a whole, however, the availability of sufficient quantities of low sulfur fuel is expected to remain an issue, with the uptake of exhaust gas scrubbers likely to become a mainstream solution. Accordingly, ClassNK released new Guidelines for Exhaust Gas Cleaning Systems (EGCS) in October of 2014, developed jointly with Japan's National Maritime Research Institute (NMRI) to offer comprehensive explanations of the contents of the IMO guidelines. These cover open and closed loop EGCS solutions, and the hybrid approach that takes in both solutions.

In this case, ClassNK is again at the forefront of technical developments as far as EGCS solutions for global shipping are concerned. Within the Joint R&D for Industry Program, Mitsubishi Heavy Industries, Ltd. and Mitsubishi Kakoiki Kaisha, Ltd. (MKK) are behind Japan's first hybrid SOx scrubber system, which features both freshwater and seawater exhaust gas scrubbing. The freshwater system can scrub fuel with 3.5% sulfur content to meet the 0.1% sulfur content limit, while the seawater system scrubs to a level of 0.5% sulfur content fuel oil to comply with anticipated global limits.

MHI and MKK are installing systems on a 7,500 unit Pure Car Truck Carrier in a joint project with ClassNK, Kawasaki Kisen Kaisha, Ltd. ("K" Line) and Japan Marine United Corporation as part of ClassNK's Joint R&D for Industry Program, with the ship's delivery due in 2016.

ClassNK has been supporting the safe installation and operation of the system onboard, as well as making use of data and experience gained from the research to support its certification and emission verification activities.

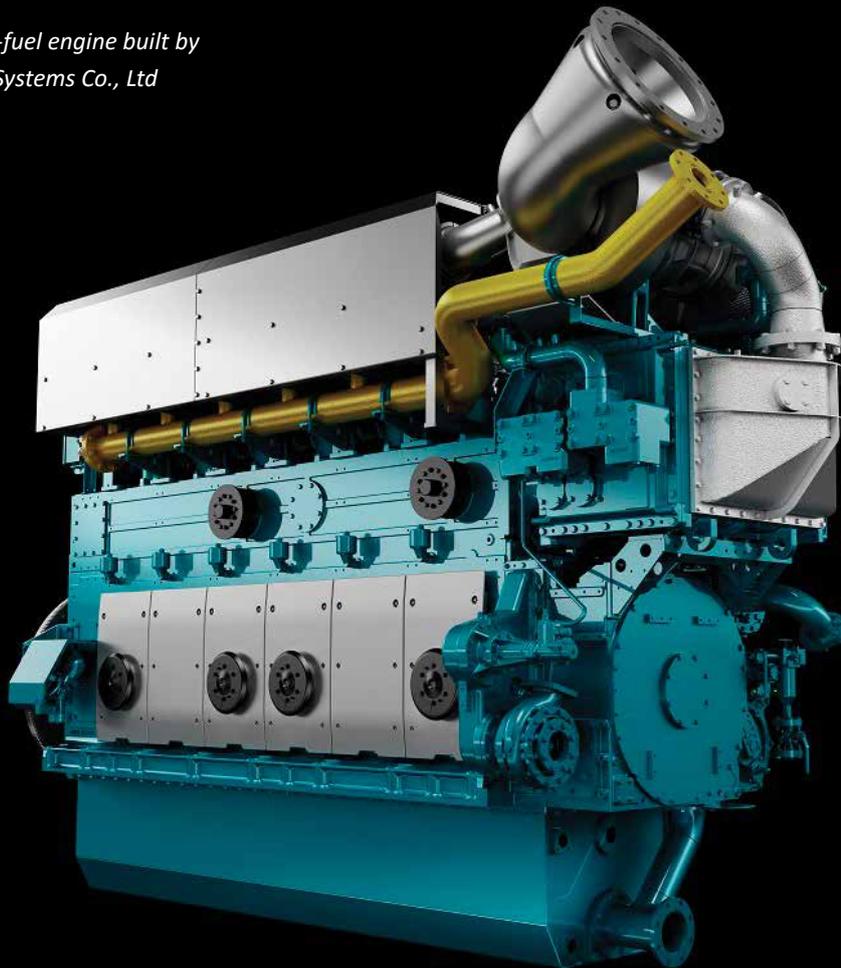
Here again, therefore, ClassNK has positioned itself to offer detailed advice on the costing of the EGCS option, taking into account initial outlay, estimated savings over time compared to a switch to lower sulfur content fuels, and the payback period. In late 2015, the Society notes that, while the decline in bunker pricing has challenged thinking on future investments across shipping, one of the interesting exceptions may be the EGCS. Although bunker prices have dropped, the difference in price between marine gas oil and heavy fuel oil has decreased though continue to exist, and so the principles of the EGCS case themselves remain unchanged.

The Society has also been involved in an interesting project on EGCS solutions as part of the Joint R&D for Industry Program that merits separate mention, through which Fuji Electric is looking to develop the world's smallest wet scrubber. The system features 'cyclone desulfurization', previously deployed in land-based exhaust gas cleaning, in a first marine application

and is reckoned to occupy less than half the volume of alternatives. The system has been tested onboard ship, applying a 1MW-class SOx scrubber for an auxiliary engine which satisfied prescribed specifications and performance.

If further evidence were needed of the priority given by ClassNK to the technical innovations required to limit pollution from ships, then it is worth noting that collaborative projects extend overseas. NYK Line, MTI, Alfa Laval and ClassNK have already teamed up with Singapore-based Nanyang Technological University and Sembcorp Marine Technology Pte. Ltd., to research EGCS technology. Moreover, emissions from ships were given priority in the MOU signed between ClassNK and the Maritime and Port Authority of Singapore early in 2015 covering joint R&D and technical innovation projects centered in the South East Asian hub. With regulations set to increase in scope, ClassNK will continue working with partners to help develop innovative solutions for the entire maritime industry.

*28AHX-DF dual-fuel engine built by
Niigata Power Systems Co., Ltd*



The Chinese Road

As China sets up a new strategy for more sustainable economic growth that is likely to be important for the shipping sector, ClassNK continues to expand its presence in the Chinese market

The last two decades have seen China playing a very large part in the development of the maritime industry, generating some 41% of the growth in global seaborne trade in the last 11 years alone. China's imports have reached 2 billion tons and exports of containerized goods are still a major driver of the container business.

However, after 15 years of sharp growth China's trade development is slowing down as industrial output increases at a more modest annual rate of 6% per annum through 2015, against a trend growth of 14% per annum.

The consequences have been felt across shipping, from container port throughput figures in North Europe and along the US West Coast to the wet and dry bulk trades. Concerns have been particularly keen in the dry bulk sector, given that around half of the trade takes place in China. Imports by the world's biggest coal consumer were 49.07m tons in the first quarter of the year, a fall of some 42% on the same period a year earlier according to data from the Chinese customs office.

To date, even economists of the highest standing are ready to take diametrically opposed views, with some believing that the Chinese economy is simply undergoing an overdue correction, and others already concluding that it should no longer be considered the world's engine for growth.

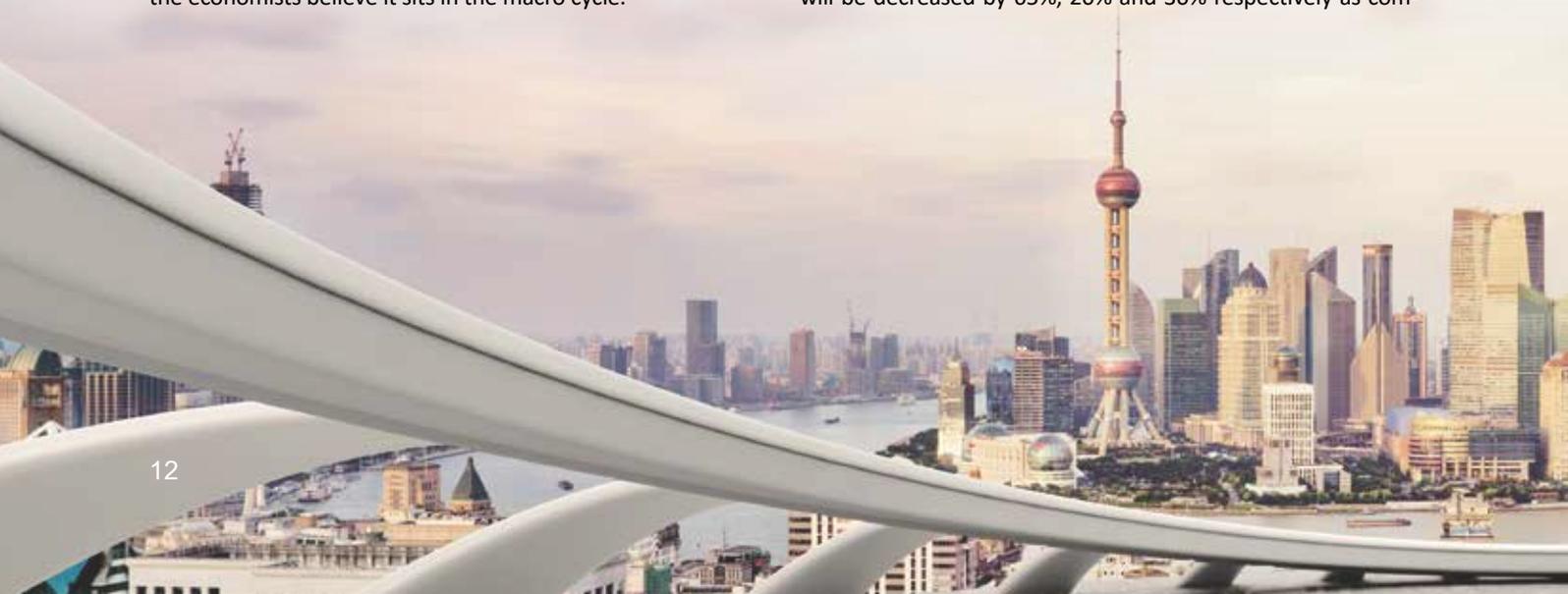
Whether either of these scenarios is accurate remains to be seen, but in the meantime China's mature economy retains significant growth opportunities for shipping activities, wherever the economists believe it sits in the macro cycle.

From within, China's economy is in an acknowledged transition, a transition that falls entirely within the 'one belt, one road' policies set out by Chinese president Xi Jinping. Planned as a network of overland road and rail routes, oil and natural gas pipelines, and other infrastructure projects the 'Belt' will stretch from Xi'an in central China, through Central Asia, and ultimately reach as far as Moscow, Rotterdam, and Venice.

The 'Road' is its maritime equivalent: a network of planned port and other coastal infrastructure projects that dot the map from South and Southeast Asia to East Africa and the northern Mediterranean Sea. This vast infrastructure concept is intended to help exploit China's enormous industrial overcapacity and ease the entry of Chinese goods into regional markets.

Set in the context of these ambitious plans, western pessimism over future growth from China may be misplaced. Certainly, raw numbers from the first half of 2015 should not be taken at face value. The rate of growth in coal consumption, for example, may well be at its lowest for 25 years, but part of the explanation lies in Chinese government efforts to curb use of domestic high sulfur coal production.

While not materially related, plans to develop ECAs in major Chinese port areas and the official release by China's Ministry of Transport of a scheme to control ship and port pollution for the next five years demonstrate comparable environmental intent in shipping as well as industry. According to the plan, by 2020 sulfur oxides and nitrogen oxides emissions in the regions of Pearl River Delta, Yangtze River Delta and Bohai Rim will be decreased by 65%, 20% and 30% respectively as com-



pared with 2015. About 90% of ships will use shore power at major ports while about 50% of container terminals, passenger terminals and cruise terminals will be capable of providing shore power.

By 2020 all the major coastal and river ports and shipyards will be capable of disposing of waste water from tanks and ship sewage, while all of the coal and iron ore dockyards at major ports will need to have wind and dust suppression facilities.

Opportunities also exist as a result of other government actions. A new five-year plan aimed at developing China's shipping industry has also been launched to help Chinese container lines and ports to become more competitive. The plan, which runs through 2020, includes tax and regulatory reforms while encouraging shipping companies to upgrade and modernize their fleets by retiring vessels early to reduce over-supply. The initiative also aims to improve port competitiveness.

Short term, traffic figures for the first half of 2015 and attendant ship utilization figures can hardly be considered encouraging for a shipping world driven by Chinese growth. However, the longer view sees China on track to play the key role in global shipping by 2030 as the emerging superpower of the maritime world.

With seven exclusive survey offices across mainland China alone, ClassNK is actively supporting the operations of each sector of the local maritime industry

With seven exclusive survey offices across mainland China alone, ClassNK is actively supporting the operations of each sector of the local maritime industry. Since its establishment in 1991, the Shanghai Office has been at the center of ClassNK's service network in China, working in cooperation with local offices to coordinate survey operations throughout the region.

The Shanghai Office is also home to one of six Plan Approval Centers located at major regional offices in the ClassNK global service network. As ClassNK Plan Approval Centers hold the same authority as Head Office in regards to the review and approval of ship drawings, the Shanghai Office can work directly with shipyards and owners on newbuilding projects. This allows for an even higher degree of efficiency in newbuilding projects.

This theme of close cooperation is echoed in the ClassNK China Committee and China Technical Committee. Established in 1994 and 1995 respectively, these committees bring together some of the key players on both the operational side and technical side of the Chinese maritime industry with the goal of exchanging information and discussing any challenges facing the industry.

ClassNK also regularly holds technical seminars throughout the region. Presentations are delivered by ClassNK experts on a range of technical topics covering new technologies as well as incoming regulations. Through these seminars, ClassNK is able to disseminate the latest technical information to technical managers and engineers working in all sectors of the Chinese maritime industry.

With this extensive infrastructure in place and many years of experience in the Chinese market, ClassNK is in prime position to support the further growth of the Chinese maritime industry over the years to come.

Industry Partnership: Hand-in-hand with COSCO

The partnership between COSCO and ClassNK extends back to the 1980s, taking in ships across the owner's fleet and wide-ranging 'touchpoints' say Mr. J. K. Shun, chairman of the ClassNK China Committee and deputy president of COSCO group

When did the partnership with ClassNK start and which vessel was the first registered with ClassNK?

We established our partnership with ClassNK in the early 1980s, at which time we were building a lot of small container ships in Japan and all of them were registered with ClassNK.

How many and what type of vessels operated by your company are registered with ClassNK?

Across the COSCO group as a whole, there are around one hundred ships registered with ClassNK. The types of ships are container ships, bulk carriers, general cargo ships and oil tankers.

What is ClassNK's biggest advantage and what is the most important benefit it brings to your business?

ClassNK is the leading classification society around the world and has more than 100 years of experience in the maritime industry, particularly in surveying newbuilding ships and ships in service. ClassNK has invested and is involved in many technical R&D projects in terms of new technology that improve ship safety and enhance pollution prevention. ClassNK responds quickly to customer inquiries and provides efficient and high-quality technical and training services. I believe ClassNK will support us in making a greater contribution to an ever-growing and greener maritime industry.

What are the company's values and what makes you popular in the Chinese market?

Our company's values can be summed up in the following statements: "The customer's need is always the first priority"; "Competent employees are fundamental to being competitive"; "Safety is fundamental to our survival"; "Responsibility and loyalty are central to our company culture"; and "Innovation is our spirit for the future".



Mr. J. K. Shun

We are committed to creating value for our customers and for society. We aim to provide the highest quality services with integrity and set targets to achieve continuous improvement and sustainable changes that accommodate shipping demands, improve cost competitiveness, deliver continuous innovation and offer leadership in the Chinese market.

From a shipowner's perspective, what are the major challenges that the industry is now posing and how are you facing them?



The shipping industry faces long-term stagnation at a time of over-tonnage in the market. We will have to restructure to accommodate wider industrial developments, based on current circumstances, to improve competitiveness and realize healthy development.

We have given priority to restructuring our fleet and playing to our strengths by focusing on the use of large-scale and specialized ships that are also energy-efficient and environmentally responsible, in line with market demand. Technical innovation is also key, as the Group strengthens the precise management of ship operation to continuously reduce oil consumption and CO₂ emissions.

What technologies are you using to improve the efficiency and sustainability of your fleet?

To achieve energy savings and emissions reductions, we use software to track the energy-saving effect of technologies and

make continuous improvements to improve the efficiency and sustainability of our fleet.

What are your plans for the future of the company? Which markets by geographical region and vessel type are offering you opportunities for new investments and why?

We try to adapt to the current market situation via deepening enterprise reform and focusing on continuous, healthy and green development. The rapidly increasing oil price over the past years and the big difference between oil and natural gas prices created great opportunities for the exploration, production and transportation of natural gas and shale gas. Although the international oil price has declined recently, we are of the opinion that there will still be a great opportunity for us to investigate the market for LNG ships; we think more measures towards environmental protection will lead to stricter and stricter emissions standards, and that the oil price in the future will create a different market dynamic.

What part does ClassNK play in the improvement of your safety management systems and how does Class help you achieve the goal of “zero-accident, zero-damage and zero-pollution”?

I definitely believe that ClassNK will be able to support us in further improving our safety management via providing high-quality technical services and training covering new amendments of international conventions in a timely manner with respect to new technology, new ship building and the management of ships in service.

I am informed that ClassNK is making progress in the development of a ‘Big Data System’. In case this system is successfully completed, I do believe that we, COSCO Group, can surely benefit a lot from it; it will help us to achieve our target “zero-accident, zero-damage and zero-pollution”.

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I believe ClassNK will support us in making a greater contribution to an ever-growing and greener maritime industry

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Industry Partnership: In support of SINOPACIFIC

SINOPACIFIC Chief Operating Officer Mr. Wang, Jianding explains how ClassNK support has been integral to the shipbuilding group's forceful progress

Wang Jianding, senior engineer, joined in Yangzhou Dayang Shipbuilding Co., Ltd. under SINOPACIFIC Shipbuilding Group (SINOPACIFIC) with a Master's Degree in October 2006 as a Deputy General Manager, and took over as the General Manager of Yangzhou Dayang Shipbuilding Co., Ltd. in March 2010. In October 2010,



he served as CPO of SINOPACIFIC and concurrently as General Manager of Yangzhou Dayang Shipbuilding Co., Ltd. and Zhejiang Shipbuilding Co., Ltd. He is now serving as COO of SINOPACIFIC cum General Manager of Yangzhou Dayang Shipbuilding Co., Ltd. and Zhejiang Shipbuilding Co., Ltd.

Can you give your own background and explain your role in the development of SINOPACIFIC Group?

Since joining SINOPACIFIC, I have been focused on the reengineering and improvement process of shipbuilding efficiency, as well as the creative implementation of "integrated management of production and technical transformation" in the Phase II technical transformation project of SINOPACIFIC. The Phase II technical transformation project took only 22 months from pile driving to the delivery of the first ship, a rapid return on investment in the technical transformation of SINOPACIFIC. This permits even more shipbuilding and deliveries in peak periods of demand, allowing us to respond to the market.

I have also focused on the standardization and enhancement of our enterprise management system. SINOPACIFIC Shipbuilding Group manages two production bases at Yangzhou Dayang Shipbuilding Co., Ltd. and Zhejiang Shipbuilding Co.,

Ltd. from its Shanghai headquarters. In order to maximize and optimize the use of the resources of the Group, we are actively promoting the integrated management model, and the comprehensive coordination of design, procurement, production and human resources. In September 2014, Dayang Shipbuilding and Zhejiang Shipbuilding was included in the first batch of qualified public show list of the Ship Industry Standard Conditions of the Ministry of Industry and Information Technology (MIIT) of the People's Republic of China.

I am a strong advocate of technological innovation and lean management. We are planning to establish a new leaner management team, and to set up a special reward fund for technological innovation. In 2009, Dayang Shipbuilding took the lead in the domestic market by delivering the first ship meeting new PSPC standards and, in 2012, Dayang Shipbuilding delivered the CROWN63 bulk carrier that obtained the world's first EEDI certificate issued by an IACS classification society. Zhejiang Shipbuilding successively delivered three series of the world's leading high-end offshore ships GPA696, PX105 and SX130 in 2011, and delivered the world's leading medium-sized anchor handling tug supply vessel (AHTS) SPA150 in 2015. Delivery of these ships consolidated SINOPACIFIC's reputation in the international market.

In order to respond to stagnation in the ship market, significant attention has been paid to the transformation and upgrading of products. Zhejiang Shipbuilding has focused on offshore support vessels (OSVs), highlighted personalized service, determined target clients, and opened up the markets of the Middle East, South Asia and Russia. In addition to the construction of high value-added OSVs, Dayang Shipbuilding has, on the basis of bulk carrier shipbuilding, opened up the production of gas



carriers, and has covered the whole field of LNG, LEG (liquid ethylene gas) and LPG ships currently. Through cooperation and inspection with TOTAL and SBM, the Company has improved the level of QHSE management, laid solid foundations for management step by step, developed an 'offshore culture', and tried hard to enter the offshore market.

Please offer a brief introduction about the development of SINOPACIFIC in general, as well as ships built in the initial stage of the group and the type of the ships built currently, explaining the group's phenomenal development. What is the outlook for the future?

SINOPACIFIC Shipbuilding Group is a shipbuilding enterprise integrating ship design, shipbuilding and trade. The Group's main products include bulk carriers, offshore auxiliary vessels, among others. The Group is dedicated to providing clients with personalized and comprehensive product solutions and professional technical support. As a technology-driven company, SINOPACIFIC currently offers 18 types of independently designed products. As of the end of September 2015, the Group has delivered a total of 449 ships.

SINOPACIFIC aims to become a continuous leader in targeted market segments. In the field of merchant ships, SINOPACIFIC adheres to the concept of 'making simple products very well',

constantly improves the level of fine management, and focuses on the construction of independently designed series bulk carriers. As the world's largest builder of offshore support vessels (OSV), SINOPACIFIC has delivered world-class ships such as PX105, SX130 and GPA696, cementing our position as a leader in that segment of the market. At present, all ship types delivered by the Group are in operation to the highest customer satisfaction.

As an example, initially Dayang Shipbuilding was mainly engaged in building bulk carriers of less than 80,000 dwt. Currently, in addition to its main product of 63,500 dwt bulk carriers, it also builds GPA696 and SPP35 series of OSVs as well as LPG, LEG and LNG series of gas carriers and other high value-added products. The change of focus has been in line with market demands, but also reflects the accumulation of technical expertise, advanced management practices and relation-building with quality customers. Currently, due to increased competition in the international ship market and the continued depression in ship prices, prospects are still not positive. SINOPACIFIC will continue to focus on technical innovation, optimizing and expanding in oil tankers, high-tech fishing boats and offshore construction vessels (OCV). At the same time, SINOPACIFIC will continue to strengthen its technical reforms at its shipyards, enhancing its lean manufacturing approach and concentrating on cost.



Having worked together for more than one decade, how do SINOPACIFIC and ClassNK maintain their good cooperation and partnership?

ClassNK and Dayang Shipbuilding have been working together since February 2004. From the first 53,500 dwt bulk carrier being registered to ClassNK, we have shared a friendly cooperative relationship. At the time when Dayang Shipbuilding had just set up operations, ClassNK was there to provide guidance and assistance with shipbuilding production and quality management. The people of Dayang Shipbuilding always keep this friendship in mind.

It is clear that ClassNK has a technological advantage in the field of bulk carriers, and SINOPACIFIC is committed to creating the world's most efficient carrier building base, with priority given to building of bulk carriers at Dayang Shipbuilding. In respect of 53,500 dwt, 53,100 dwt, 63,500 dwt and 82,000 dwt products, the two sides have a strong cooperation concerning almost every activity such as market, consulting, early support, training, audit, and surveys.

What types of and how many ships are built by SINOPACIFIC? What are the advantages of technology and market of the core ship type?

At present, SINOPACIFIC has more than 90 orders in hand, with bulk carriers including 63,500 dwt, 82,000 dwt and 121,000 dwt; gas carriers including 27,500 m³ LNG ships and 36,000 m³ LEG ships and 22,000 m³ LEG; SP series of OSV products including SPP35, SPA150, SPA60, SPP17A, SPA80A and SPA85L, etc.; stone dumpers and fishery research vessels and so on.

The core ship types of SINOPACIFIC include OSV series, our CROWN series of bulk carriers and gas carriers, with independent intellectual property rights and strong competitiveness in the market. As for OSV products, platform supply vessels (PSV) have a load capacity ranging from 1,500 to 5,000 tons, which may accommodate the existing market demands. The capacity

of our anchor handling tug supply vessels (AHTS) range from 60 to 150 tons, covering the small and medium-sized AHTS market. Our CROWN series of bulk carriers include Super-Max and Ultra-Max (63,500 dwt super handy-size), KamsarMax (82,000 dwt Kamsa type), and Mini-Cap (121,000 dwt small Capesize). Gas carriers cover all the C-shaped tank ship types from 5,000 to 36,000 m³, including LPG, LEG and LNG.

These core ship types are technologically unique, with independent intellectual property rights. SINOPACIFIC's OSV designs are flexible enough to accommodate electric propulsion, dynamic positioning DP2, DP3, environmental protection and comfort, and other forward-looking attributes. Its bulk carriers offer superior cargo capacity, high speed and low energy consumption indicators. These indicators support the CROWN brand's strong reputation in the market, which has already resulted in orders for over 100 CROWN63 ships. SINOPACIFIC has its own research

and development team to make continuous improvement and innovation of the core ship types to meet the market demands, which is why our designs have always been in a leading position. Recently, SINOPACIFIC has successfully won the bidding in nine SPA80A AHTSs of SPA80A again on the basis of the successful building of twenty SPA80 AHTSs.

What advantages does ClassNK have on technology and service?

ClassNK conducts deeper research and is exhaustive in its application of rules, codes and new technologies, especially for early market tracking and the application of IMO and new rules and regulations. ClassNK is timely in informing on the corresponding technical information and responding to customers.

SINOPACIFIC has maintained a close cooperation with ClassNK. In recent years, technical risk and the cost of constructing shipyards have increased in response to continuous upgrades of international conventions, codes, rules, and relevant standards, whether from the early stage of the market development or subsequent technical design and shipbuilding. ClassNK is con-

“ **In the future, ClassNK will still be an important partner in the field of bulk carriers, as well as tankers researched and developed subsequently** ”



stantly focused on the demands of its customers with respect to helping raise the level of construction technology for shipyards, solving major technical problems due to the change of codes and rules, providing shipbuilding survey training, interpretation of new technologies and new codes, and helping the promotion and improvement of the major technologies of shipyards.

What are the most important technical problems and challenges you may come up against? How do you solve them? What types of assistance can the Society provide for you?

The most important technical problems and challenges encountered by SINOPACIFIC mainly come from frequent upgrades and changes to the international conventions, rules, codes and related standards in recent years, such as ballast water management, EEDI, Tier III and other new requirements. The adjustment and modification can be led and driven by international political factors which are often difficult due to their timetables, which can leave shipyards unprepared in terms of the market and technology. This can lead to a negative impact in new ship designs, preparation of new building techniques, selection of new devices, and sometimes even impact the overall effective implementation of production and the operation plan at shipyards.

ClassNK's study and understanding of the new requirements, as well as tracking and control of new technology application have more advantage than those of the shipbuilding enterprises. The upgrade, early warning, propagation and implementation and training for new rules and regulations, synchronous technical support to the research and development of new type of ships, combined with the effective coordination of drawing review, on-site inspection and issuance of certificate in the process of building of new type of ships are of great benefit.

Can participation of ClassNK bring more abundant experiences and opportunities to you?

ClassNK's participation not only provides support and experience in sharing design and building technology with the shipyard, but also, based on its professional knowledge and related information of the industry, actively assists the shipyard in market development. Sharing knowledge can bring more new opportunities for SINOPACIFIC.

For example, after learning that SINOPACIFIC was developing new KamsarMax bulk carriers, ClassNK acted as a bridge for promoting cooperation between Chinese ship companies and MHI, which has good technical reserves in this area, eventually leading to the successful cooperation between the two sides. CROWN MHI 82, jointly researched and developed by SINOPACIFIC and MHI, has not only successfully received orders of ten ships, but has also won a good reputation in the industry due to the first-class performance indicators of its design, resulting in a successful adoption by a shipyard in Japan which once again confirms the success of bilateral cooperation. ClassNK has definitely made great contributions.

Recently, you have signed a few batches of ships registered to ClassNK. Do you plan to register more ships with ClassNK in the future?

SINOPACIFIC maintains a close cooperation with ClassNK on all ship types. In the future, ClassNK will still be an important partner in the field of bulk carriers, as well as tankers researched and developed subsequently.

Previous cooperation between ClassNK and SINOPACIFIC covers a wide range of activities including market, consulting, early support, training, audits, and surveys. We hope that the two sides should, as always, keep close cooperation.

How do you expect ClassNK to support your research and development activities?

In order to adapt to the current downturn situation of shipping and shipbuilding, SINOPACIFIC is also considering entering the field of large and medium-sized oil carriers and other products in addition to traditional bulk carriers and liquefied gas carriers. ClassNK has excellent experience and customers in the field of oil carriers and we hope to receive their continued support.

What other information do you hope ClassNK Magazine will communicate to the industry?

ClassNK has always been a friendly partner to SINOPACIFIC. We hope that ClassNK Magazine continues promoting Chinese brands, the competitive advantages of SINOPACIFIC, and the development of new ship types and technical advantages in the future.

ClassNK Academy: A global mission

The ever-growing requirement for better maritime training, against a dearth of suitably trained personnel, has dominated the industry agenda for years and will continue to do so

ClassNK's mission is to ensure the safety of lives and property at sea and protect the marine environment. As part of this mission, ClassNK set up the ClassNK Academy to help provide the maritime community with reasonable cost high quality training all over the world for a safer and greener maritime industry.

This commitment to global maritime training has seen the Society invest significant human resources in assisting companies to address the growing experience gap in their staff and the difficulty of training new employees.

Since its inception in 2009, the ClassNK Academy has expanded each year to better serve the growing needs of the maritime community where the program is regarded as a leading maritime training institution in the region.

By Q4 of 2015, just six years after inception, the ClassNK Academy program had been held roughly 400 times in over 40 locations across the world.

The ClassNK Academy has roughly 90 lecturers stationed at ClassNK offices around the world. Academy lecturers are full-time ClassNK staff who have undergone special training to teach Academy courses. Lecturers are experts in their re-



spective fields, holding advanced technical degrees in either mechanical engineering or naval architecture and an average of over 18 years' hands-on experience as ship surveyors and/or auditors.

The majority of Academy lecturers are management level personnel who are able to address technical matters from the perspective of both line staff and management. Academy lecturers span 18 different nationalities and, wherever possible, ClassNK Academy courses are taught by lecturers based at local offices. This eliminates language barriers and makes it possible to provide clear understanding of contents.

All Academy lecturers receive extensive training in Japan to ensure they are not only experts in course content, but also experts in teaching that content to students of a variety of levels and nationalities.

Academy courses are now available in 25 countries around the world. In terms of graduates, a cumulative total of more than 23,000 individuals have participated in ClassNK Academy courses since the program's inception.

ClassNK currently offers 10 courses in three separate training packages with the focus on newbuildings, existing ships and ship management. The newbuilding and existing ship packages are geared towards newcomers to the industry with a working knowledge of shipping and shipbuilding, and include courses on classification surveys and statutory issues as well as hull and machinery damage, safety equipment and Port State Control. The ship management package is directed towards ship and shore-based staff with working knowledge of ISM audits. It includes courses on risk management among others and fulfils Tanker Management Self Assessment (TMSA) requirements.

Course content is primarily aimed at providing new employees and those with limited practical experience at various companies with basic technical knowledge about shipbuilding and shipping, and also includes the latest technical information. Academy lecturers span many different nationalities, and wherever possible ClassNK Academy courses are taught by lecturers based at local offices. This not only eliminates language barriers, it also makes it possible to provide local context to course materials. Whether in Shanghai, Dubai, or New York, this gives the Academy courses an almost tailored approach rather than a "one-size fits all" style program.

ClassNK is able to provide comprehensive and focused training programs for maritime professionals in a short but intensive period. Each comprehensive package lasts from 1-2 days, allowing attendees to absorb the information quickly, and put that knowledge into use for their daily work almost immediately.

Another key aspect of the ClassNK Academy is ClassNK's low-cost, asset-light approach to training and education. Rather than invest in expensive specialized facilities, ClassNK offers the Academy program through its survey offices, seminar facilities in major maritime cities, and also on-demand at the offices of maritime companies. This format allows ClassNK to offer the Academy at low cost to attendees, providing education and training to maritime companies without negatively affecting their bottom lines.

ClassNK's mission is to ensure the safety of lives and property at sea and to protect the marine environment and, through the ClassNK Academy, the Society provides the maritime community with low-cost high-quality training all over the world for a safer and greener maritime industry



The 10 courses available are:

Classification Surveys during Construction (Hull)

The one-day course, aimed at superintendents, shipbuilders and repair yard personnel, with up to roughly two years' experience, provides an overview of the various design and construction-related tests and surveys a newbuilding undergoes between the vessel's order and delivery.

Classification Society and Statutory Issues

This one-day course, aimed at superintendents, shipbuilders and repair yard personnel etc., with up to roughly two years' experience, serves as a primer on classification societies, including their role in the maritime industry, history and core duties. It also covers outlines of ship inspections (class surveys, statutory surveys, etc.) and the major international conventions applicable to ships.

Damage (Hull)

This one-day course is directed at superintendents, ship officers, shipbuilders and repair yard personnel etc. with up to roughly five years' experience. It offers easy-to-understand explanations of how hull damage occurs as well as how it is dealt with using representative examples of damage to different ship categories. It also includes an introduction to the preparations that classification surveys require.

Port State Control (PSC)

This half-day course is directed at superintendents, ship officers, shipbuilders and repair yard personnel with up to five years' experience. It introduces participants to subjects including the international conventions relating to Port State Control (PSC) detainment statistics and the primary matters that receive PSC attention.

ISM Internal Audits

This two-day course is aimed at QM managers for ship owners, management companies, ship officers and superintendents with more than two years' experience. It provides general instructions for internal audits of a safety management system and outlines the International Safety Management (ISM) Code for internal auditors, both essential elements for the implementation and continuous improvement of systems.

Materials and Welding

This one-day course, aimed at superintendents, shipbuilders' personnel, steel manufacturers etc., with up to roughly two years' experience, covers the fabrication of steel used for ship construction, including easy-to-understand explanations of topics such as welding techniques, common errors and what inspections entail.

Classification Surveys during Construction (Machinery & Electrical Installations)

This one-day course aimed at superintendents, shipbuilders personnel etc., with up to roughly two years' experience, covers all the inspections of machinery and electrical equipment that take place over a new vessel's construction from the order being placed to the completion of construction. It also provides easily understandable explanations of each type of test and how they are carried out.

Damage (Machinery)

This one-day course is directed at superintendents, ship engineers, shipbuilders and repair yard personnel etc. with up to roughly five years' experience. It offers easy-to-understand information on how damage to machinery and electrical equipment occurs and how it is dealt with, using representative examples of damage to different types of machinery.

Safety Equipment

This half-day course is directed at superintendents, ship officers, shipbuilders and repair yard personnel etc. with up to roughly five years' experience. In addition to an overview of safety equipment (fire fighting, lifesaving and navigation), this course also introduces applicable international treaties and examples of failures.

Incident Investigation and Analysis and Risk Management

This two-day course is directed at QM managers for ship owners, management companies, ship officers and superintendents with more than two years' experience. Incident investigation and analysis is performed in various fields including transportation, manufacturing and medicine. Risk management is applied to fields including business management, finance, medicine, information security and occupational safety.

ClassNK events

◆ **INTERNATIONAL WORKBOAT SHOW, NEW ORLEANS, USA, 1ST - 3RD DECEMBER 2015**

Please visit ClassNK at booth 3711

◆ **MARINTEC CHINA, SHANGHAI, CHINA, 1ST - 4TH DECEMBER 2015**

Please visit ClassNK at booth N1D31 in the Japanese Pavilion

◆ **VIETSHIP, HANOI, VIETNAM, 24TH - 26TH FEBRUARY 2016**

Please visit ClassNK at booth A92 & A93

◆ **ASIA PACIFIC MARITIME, SINGAPORE, 16TH - 18TH MARCH 2016**

Please visit ClassNK at booth B-L16

◆ **CMA SHIPPING, STAMFORD, USA, 21ST - 23RD MARCH 2016**

Please visit ClassNK at booth 101 & 102

◆ **OTC ASIA, KUALA LUMPUR, MALAYSIA, 22ND - 25TH MARCH 2016**

Please visit ClassNK at booth D702

◆ **SEA JAPAN, TOKYO, 13TH - 15TH APRIL 2016**

Please visit ClassNK in the Japanese Pavilion

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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

www.classnk.com