

ClassNK

MAGAZINE

SEPTEMBER 2015 - 73RD EDITION

- ◆ *A new generation of wind power*
- ◆ *Natural choice for energy recovery*
- ◆ *Dynamic solutions for a diverse industry*
- ◆ *Industry partnership: Zodiac Maritime*



For ClassNK, No detail is too small.



ClassNK's unrivalled reputation for quality and technical excellence has made us the world leader in ship classification. With roughly 20% of the world's merchant fleet under class, we offer a complete range of survey, inspection, certification and technical services for every type of ship. To learn more about how our focus on quality has earned the trust of clients worldwide, visit us at www.classnk.com

Global Authority in Maritime Standards

ClassNK

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Supporting new opportunities



Welcome to the 73rd edition of ClassNK Magazine.

Over the past few years the industry has continued to see tremendous growth together with the development of innovative new technologies to facilitate that growth. This edition will introduce some of the activities that ClassNK is carrying out to support the industry.

An overview of our Natural Resources and Energy Department will give our readers some insight into exciting new joint R&D being carried out in the offshore sector by ClassNK and partners. Working with shipyards, shipowners, and research partners across the world, ClassNK is supporting the development of a number of revolutionary projects and providing its technical expertise and risk assessment services to ensure the safety of these new technologies. This edition also gives details of innovative new vessel and offshore projects being supported by ClassNK.

In line with our mission to ensure the safety of life and property at sea and protect the marine environment, another key area where ClassNK is providing support is the marine-based renewable energy sector. Our Renewable Energy Department offers a wide range of services from approval in principle to certification of new clean energy technologies such as floating offshore wind turbines and marine renewable energy fa-

cilities. An article on wind power will introduce some of the projects we are working on throughout the world.

As the development of new technologies is not just limited to the more specialized sectors of our industry, we are also helping shipyards and shipowners overcome present and upcoming challenges. To help the industry prepare for the Ballast Water Management Convention, we worked with software design company Armonicos to develop ClassNK PEERLESS, technology that uses 3D laser scanners to rapidly create 3D models of vessel interiors. Using this technology, a complete 3D model can be created in as little as 1-2 days compared to 7-10 days using conventional methods, helping to greatly streamline the entire retrofit process by removing the bottleneck in the design phase.

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This edition also includes an interview with one of our UK-based clients Zodiac Maritime Ltd. Renowned for its keen sense of the market and proactive business approach, Zodiac Maritime Ltd. identifies some of the key activities and services of an international ship management company.

I hope you enjoy reading about some of what we are doing to support the industry here at ClassNK.

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

Noboru Ueda
Chairman and President of ClassNK

ClassNK

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12TH INTERNATIONAL MARINE DESIGN CONFERENCE WRAPS UP IN TOKYO

15 May 2015 - The 12th International Marine Design Conference (IMDC) was held in Tokyo from 11 – 14 May, hosted by The Japan Society of Naval Architects and Ocean Engineers, and sponsored by The Shipbuilders' Association of Japan and ClassNK.

Roughly 170 participants from universities, research institutes, shipyards, and design companies from across the globe gathered at the 12th IMDC. The 4-day conference focused on what technical design areas will be the key for the future of maritime systems through nine keynote speeches and 87 general papers.

ClassNK Executive Vice President Yasushi Nakamura delivered the keynote speech at the Opening Ceremony and spoke at the Conference Dinner saying: "At ClassNK, our R&D activities provide the Industry-Academia platform to support the continuous development of our industry and we are honored to have joined forces with IMDC on this occasion."



CLASSNK RELEASES GUIDELINES FOR CNG CARRIERS

30 July 2015 - Utilizing its wealth of technical expertise and extensive experience in gas carrier R&D and ship classification, ClassNK has developed its Guidelines for Compressed Natural Gas Carriers which provide safety requirements for design and construction. The guidelines consist of safety requirements applicable to CNG carriers based on the IGC Code as well as additional requirements taking specific hazards arising from the handling of CNG into consideration.

The Guidelines for CNG Carriers are available on the ClassNK website for ClassNK "My Page" users.

CLASSNK RELEASES AMENDMENTS TO CLASS RULES

11 May 2015 - ClassNK announced that it released amendments to its Rules and Guidance for the Survey and Construction of Steel Ships.

The amendments, dated 8 May 2015, include the following:

- ◆ Requirements related to "Propeller Shaft Condition Monitoring Systems", in response to requests from the industry.
- ◆ Requirements related to "Material Factors of Rolled Stainless Steel and Stainless Clad Steel Plates", to reflect recent research and development results.
- ◆ Requirements related to "Means of Escape from Machinery Control Rooms and Main Workshops", to reflect changes made to relevant international conventions.
- ◆ Requirements related to "Installation Positions of Fixed Hydrocarbon Gas Detection Systems", to reflect recent changes made to relevant IACS Unified Requirements.

CLASSNK RELEASES NEW PRIMESHIP-HULL (HCSR) SOFTWARE

13 July 2015 - ClassNK released PrimeShip-HULL (HCSR) Ver. 2.5.0 in response to the new IACS Common Structural Rules for Bulk Carriers and Oil Tankers (CSR BC & OT).

The main features of PrimeShip-HULL (HCSR) Ver. 2.5.0 are as follows:

- ◆ Further strengthened data linkage with commercial CAD software for the prescriptive rule calculation software. In particular, the linkage to all members' data within the cargo areas of bulk carriers and product tankers with the widely used 3D ship design system "NAPA Steel" produced by NAPA has been achieved, making it possible to reduce the design work time required for each model significantly.
- ◆ To create better quality FE models, automatic idealization functions have been added to the direct strength assessment software. In addition, the automatic hot spot registration function for fatigue assessment has been added and the design support function has also been enhanced, improving the analysis process and shortening the required design work time.

Natural choice for energy recovery

The consequences of the land-based US shale gas phenomenon continue to work their way through World Energy markets, but fundamental trends driving growth in the Floating LNG sector remain intact. Offering design, technical and service support to this still-emerging market is high on the agenda for ClassNK's Natural Resources and Energy Department.

For decades, the number of large offshore resource discoveries has outstripped the onshore sector significantly. The Association of Asian Classification Societies recently pointed out that offshore discoveries increased from less than 10mn boepd (barrels of oil equivalent per day) in 1970 to 50mn in 2015, and projected a further 20% in growth by 2020.

A recent report by Sandler Research (Global Offshore Oil and Gas Market 2015-2019) predicted compound annual growth rates in recovered global offshore oil and gas of, respectively, 2.7% and 1.9%, between 2014 and 2019.

Within the offshore gas component, the significance of floating production and storage is recognized as a distinct growth opportunity. According to Clarkson's, by 2019 the global FLNG vessel capacity will amount to 44 million tonnes per year, about 7.5% of the industry's total capacity. The shipbroker expects 22 FLNG vessels to be in place, with another 22 possible by 2022.

KEY SERVICES OFFERED BY THE NATURAL RESOURCES AND ENERGY DEPARTMENT

- ◆ Plan approval for newly built oil tankers, chemical tankers, and gas carriers
- ◆ Certification for tanker-related conventions including MARPOL, IBC Code, and the IGC Code
- ◆ Certification services for the loading of chemical cargo
- ◆ Plan approval for the conversion of oil tankers, chemical tankers, and gas carriers in service
- ◆ Concept Approval for new designs of liquefied natural gas (LNG) cargo tanks and LNG fuel tanks
- ◆ Plan approval for floating offshore facilities (FPSO/FSO) for the production and storage of oil
- ◆ Plan approval for floating offshore facilities (LNG-FPSO) for the production, storage, and offloading of LNG
- ◆ Comprehensive provision of technical development and services

Within these figures, Asia remains a key driver: according to the latest report by energy analysts Infield, Asia will account for 18% of forecast global offshore expenditure between 2015 and 2019. South East Asia in particular is seen as a hub for the LNG market. Here, floating LNG is expected to become a key feature of regional growth, with Malaysia retaining its leading regional share of offshore Capex. Capital intensive FLNG projects involving Petronas will deliver a considerable share of forecast growth, Infield predicts.

As of April 2015, the Petronas PFLNG-1 plant was 91% complete and expected to begin production in March 2016, whilst Shell's Prelude Project is set to enter service in 2017 and the Murphy/Petronas PFLNG-2 due to be operational in 2018.

Elsewhere, the Pacific Rubiales project of a Floating Liquefaction Regasification and Storage Unit (FLRSU) in Columbia should also enter into service next year. Again, based on recent agreements, Mitsui, MOL and Marubeni will invest in Tartaruga MV29 B.V. ("MV29"), a Dutch company established by MODEC for the deployment of the FPSO for Brazilian state oil company Petrobras, Petróleo Brasileiro S.A..

Given the growing need for clear technical guidelines for the construction and survey of offshore facilities, classification societies have increasingly been asked to participate in the early stages of design. In addition to identifying potential safety and environmental risks, Class itself is supporting the concrete development of the new technologies enabling the maritime transport and offshore production of LNG. Although continued low oil prices over the past year may slow down project development, ClassNK is working with the industry to create innovative solutions for the future.

ClassNK has long experience in LNG transportation, and currently has 59 LNG carriers on its register. ClassNK is also expanding its presence in the offshore sector through its support of new offshore projects. The development of deeper water FPSO (Floating Production, Storage and Offloading) and new concept FLNG and FSRU (Floating Storage and Regasification Unit) have posed new

technical challenges. These affect a large portion of the industry, including operators, shipyards, and equipment manufacturers, which means that addressing them requires careful support to strike a delicate balance between dedication and neutrality.

New focus was given to ClassNK's activities in the sector following the creation of a Natural Resources and Energy Department as a separate entity. The formal announcement builds on a gradual distillation of pan-Society expertise first initiated in 2009.

The scope of the department's activities covers the entire process, ranging from the support of joint R&D projects with offshore industry partners to the establishment of design guidelines, plan approvals, surveys, and operational support.

Based on the Project Team established in 2009, the department has been making strategic use of the Society's global network since it began operating in 2011. "This team is comprised of some of the top minds at ClassNK, both in Japan and overseas," says Hayato Suga, Operating Officer and General Manager of the Natural Resources and Energy Department. "Team members include not only LNG and offshore experts, but also machinery experts, material and equipment experts, senior researchers from our Research Institute, and top level management from our offices in Asia, the Middle East, and Europe. By bringing together staff from various fields, as well as from around the globe, we've created a team that will be able to respond rapidly and effectively to potential new projects anywhere in the world."

At the core of the new Natural Resources and Energy Development Team is ClassNK's previous Gas Carrier Team, which includes many of the Society's leading LNG experts. Around this core, ClassNK has added specialists from related fields to provide comprehensive support for the growing offshore energy sector.

It is this team which has overseen the updating of ClassNK's Guidelines for Floating Offshore Facilities for LNG/LPG Production, Storage, and Offloading, released in 2011, to include FSRUs as well as FPSOs.

The department taps into ClassNK's close relationship with Japan's National Maritime Research Institute (NMRI), which has conducted pioneering research on FPSOs and FLNG offloading systems. The team is also now acting as a point of contact on offshore projects within the comprehensive cooperation agreement reached with the Indonesian classification society PT. Biro Klasifikasi Indonesia (Persero) (BKI) in 2012. Building on a 40-year relationship between ClassNK and BKI, this agreement has brought closer ties in both the maritime and offshore sectors.

"In line with the more traditional classification activities, ClassNK is taking a comprehensive approach to supporting developments in the offshore sector," says Mr. Suga. "This means not only developing new rules and guidelines for FLNG installations, but also conducting joint R&D projects with the offshore industry to better support this growing sector.

"With the Natural Resources and Energy Department, we have the opportunity to combine our experience and expertise in the oil and gas sector with highly sophisticated and targeted R&D, and I'm confident that we will be able to contribute even further to the growth and development of the offshore sector."

A recent milestone has been reached with the Approval-In-Principle (AIP) of the world's first H₂/CO₂ FPSO design developed by MHI and Chiyoda Corporation, the first such facility to receive this acknowledgement.

The Society has also been involved in the development of a MODEC/TEC Micro-GTL (Gas to Liquid) plant on an FPSO, applicable to small to medium gas reserve development (Floating-GTL). The first demonstration unit was constructed in Brazil where various test operations of the unit have been completed.

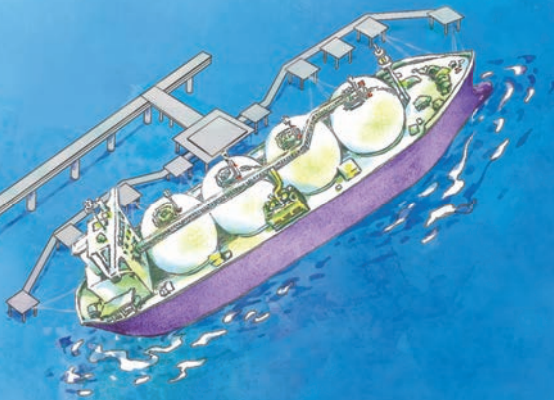
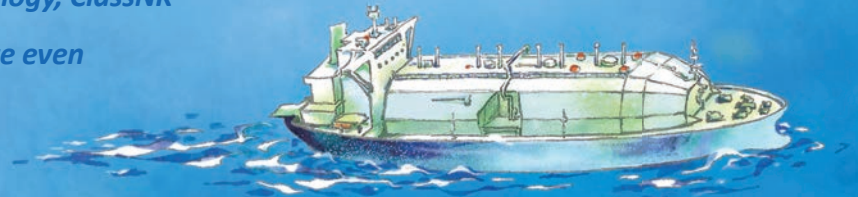
As part of a joint R&D project led by Tokyo-based MODEC and leading plant manufacturer Toyo Engineering, ClassNK contributed to the risk and safety assessment of the LiBro® FLNG system, a new floating system which has the potential to greatly increase the scope of offshore gas development, especially for small and mid-size fields.

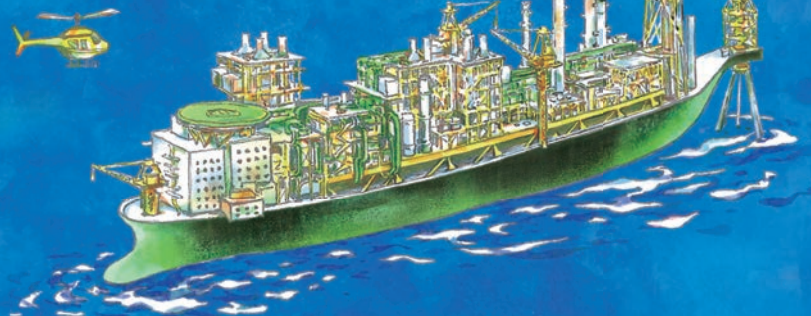
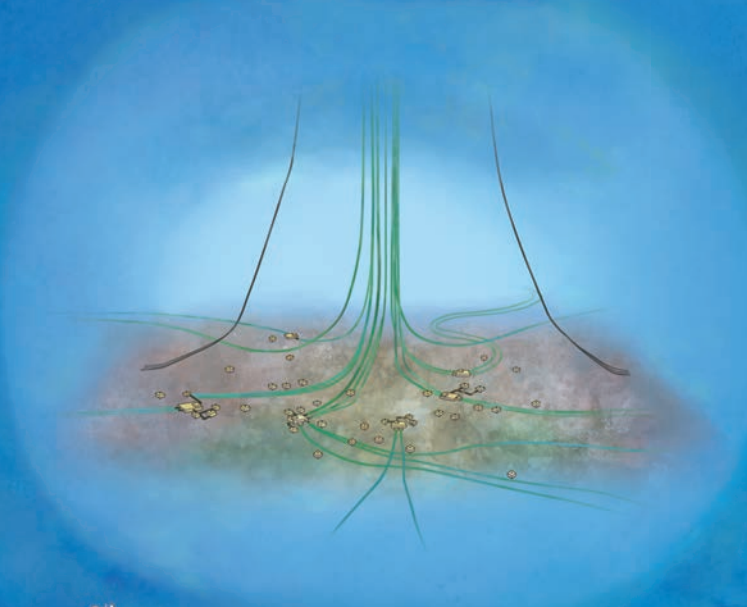
"Efforts to commercialize FLNG are gaining momentum, and the steps we have taken will ensure that ClassNK is at the heart of developments," says Mr. Suga. "Large-scale facilities located far offshore are justly given extensive coverage, but medium-scale and small-scale gas fields which have not previously been targets for development also offer substantial potential. FLNG promises to unlock those smaller, remote and environmentally sensitive fields, as well as being a time and cost saving solution – if executed well.

"In an era of unpredictable bunker prices and with increasingly stringent emissions regulations in ECAs, we also expect the use of LNG and other low flash point fuels like methanol as ships' fuel to increase. The Natural Resources and Energy Department positions ClassNK at the forefront when it comes to developing new technologies and service solutions for the industry."

Dynamic solutions for a diverse industry

With the discovery of new natural energy resources and given the growing demand for new technology, ClassNK is working with the industry to realize even more efficient and environmentally-responsible solutions for the offshore sector.





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Offshore oil & gas development technologies

LiBro FLNG (Floating Production Storage and Offloading for Liquefied Natural Gas)

Developed by MODEC, Inc. and TOYO Engineering Corporation, the LiBro® FLNG concept provides for safe and effective production, liquefying, storage and transfer of LNG from onshore or remote stranded offshore gas fields. LiBro® FLNG utilizes Lithium Bromide Absorption Refrigeration, a common energy saving technology of onshore centralized air conditioning units, to produce chilled water using waste heat from gas turbine exhaust. The chilled water produced by the LiBro® unit is used to pre-cool natural gas and cool N2 refrigerants for improved LNG train efficiency. The chilled water is also used to cool gas turbine in-take air to maximize gas turbine driver output.



The LiBro® FLNG concept is based on existing shipbuilding standards allowing it to be fitted topside of standard hull sizes. Fitted on a 300m x 50m vessel, the technology can produce up to 2 million tons of LNG annually, and store up to 160,000m³ of LNG and 20,000m³ of condensate. To enhance its early delivery and cost-effective features, LiBro® FLNG can be applied to both new built hull and existing hull conversions.

* LiBro is a trademark of MODEC, Inc.

H₂/CO₂ FPSO (Floating Production Storage and Offloading for H₂/CO₂)

The design of an innovative H₂ / CO₂ FPSO was conducted by Mitsubishi Heavy Industries, Ltd., and Chiyoda Corporation, being the first of its kind in the world. The FPSO is designed to convert associated gases of offshore oil fields into H₂ and CO₂.



In this design, H₂ is converted into methylcyclohexane (MCH) through Toluene hydrogenation and stored in a tank within the FPSO. MCH, a highly stable chemical product which stays in liquid state in ambient conditions, can be transported by standard chemical tankers. By dehydrogenating MCH into H₂ and Toluene, MCH can be used as an H₂ transportation carrier. Chiyoda, which recently completed R&D on a sophisticated dehydrogenation catalyst and process, named this unique method "SPERA" Hydrogen, and intends to initiate hydrogen supply business by sourcing H₂ from offshore oil wells that may need enhanced oil recovery (EOR).

The co-produced CO₂ can then be used for so-called CO₂-EOR. It is reported that, by forming miscible state, the injected CO₂ into oil wells can boost the oil recovery ratio very effectively. It is however difficult to find stable sources that can supply large volume of CO₂ economically.

By applying this H₂/CO₂ FPSO technology, offshore oil producers will not only obtain an effective solution for EOR, but also a viable method for monetizing associated gases.

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Micro-GTL (Gas to Liquid) FPSO

The Micro-GTL FPSO concept is based on the microchannel reactor based small-scale version of GTL module unit



which has been developed by a joint R&D venture between MODEC and TOYO. The GTL itself converts associated gases from oil fields into syncrude. Until now, producers would flare these associated gases or reinject into subsea reservoirs for safety reasons. However, the process is either harmful to the

environment or a waste of valuable resources. The Micro-GTL plant is also expected to be utilized for the small and medium sized gas reserve developments where FLNG technology is not considered suitable for economic reasons. The first demonstration unit was constructed in Brazil where various test operations of the unit have been completed.

Trading ships technologies

Sayaendo LNG Carrier

The revolutionary Sayaendo is a 155km³ MOSS-type (spherical tank-type) LNG carrier created by Mitsubishi Heavy



Industries. In contrast to conventional MOSS carriers, where the spherical cargo tanks are blanketed with separate hemispheric tank covers, the Sayaendo has a continuous tank cover across all cargo tanks. The continuous cover with spherical tanks underneath resemble 'peas in a pod', or sayaendo in Japanese. The configuration reinforces the ship's overall structural strength while reducing weight. The aerodynamic cover also substantially reduces longitudinal wind forces that create drag on vessels, contributing to reduced fuel consumption during actual operations at sea. Combined, hull form optimization, weight reduction and improvements in propulsion performance can achieve a reduction in fuel consumption of over 20% compared with conventional steam turbine-driven ships.

Methanol powered vessel

Research into the development of methanol-powered vessels featuring the world's first dual-fueled low-speed diesel



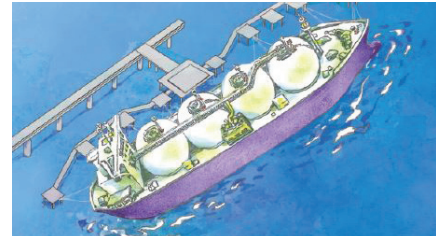
main engine is nearing completion. The vessels utilize both methanol and heavy fuel oil, allowing for greater flexibility in operations. Methanol as a fuel produces virtually zero SOx emissions, and the levels of NOx and CO₂ emissions are relatively lower than those generated by conventional diesel fuel oils. Construction of the vessel is scheduled for completion in early 2016, with various risk assessments including a HAZOP analysis already carried out by ClassNK as part of the project. The new technology is expected to prove beneficial in light of

tightening environmental regulations and the introduction of emission control areas.

Offshore receiving & logistic terminal technologies

FSRU (Floating Storage Regasification Unit)

Research into FSRU technology is gaining momentum at various gas and electric companies, as an innovative solution for



LNG receiving terminals. Regasification facilities fitted on LNG carriers can replace the role of onshore LNG storage tanks and regasification facilities, which require huge onshore construction work, as well as environmental assessments.

The conversion of older LNG carriers can make a strong contribution to lowering project costs and timely deliveries, a consideration that should bring LNG carriers with good service records under the spotlight for the conversion to FSRU. ClassNK provides technical advice for the smooth and safe implementation of FSRU technology based on its vast experience with LNG carriers and offshore engineering.

J-DeEP (Japan Offshore Design and Engineering Platform) Logistics Hub

The offshore logistics hub is a unique concept proposed by J-DeEP (Japan Offshore Design and Engineering Plat-



form), an "all Japan" association of shipbuilders and offshore engineering firms, shipowners and operators, marine research institutes and ClassNK, established in 2013 and authorized by Japan's Ministry of Land, Infrastructure, Transport and Tourism. Acting as both crew accommodation as well as a dispatch center, the facility could provide long-term accommodation at sea for crew members, and dispatch them to offshore rigs and production facilities by high-speed vessel or helicopter as appropriate. The hub could also facilitate the transportation of materials between onshore bases and offshore drilling/production sites. This offshore logistics hub is expected to provide substantial savings in offshore field development and operating costs when compared with traditional onshore logistics solutions.

A new generation of wind power

As offshore wind power is gaining attention as a promising energy option across the world, ClassNK continues to make multi-phase efforts to help expand the deployment of wind power generation.

Twin objectives of reducing greenhouse gas emissions and securing home-grown energy supplies have quickly driven forward developments in wind as a leading renewable energy source. Annual installations of wind power have increased significantly through the first part of this century, from 3.2 GW in 2000, to 11.8 GW in 2014 at a compound annual growth rate (CAGR) of 9.8%.

Offshore wind energy is by far the most developed offshore renewable energy resource, with 8,771 megawatts (MW) of electricity generated by global offshore wind resources in 2014 (*Global Wind Energy Council annual report, 2014*). However, since the first offshore wind farm was installed off the coast of Denmark in 1991, growth of offshore wind has been almost exclusively a European phenomenon: of the 8,771 MW of energy capacity from global offshore wind in 2014, 8,045 MW was generated in Europe, mostly in the North Sea.

Accounting for 55.9% of all European installations, the UK is leading the way. The London Array is currently the largest offshore wind farm in the world, comprising of 175 turbines covering an area of 100 sq. km with a capacity of 630 MW, or enough to power 500,000 UK homes a year. The Dogger Bank Creyke Beck project, approved by the UK's energy secretary earlier this year, is set to feature up to 400 turbines and could fulfill 2.5% of the UK's electricity needs.

Denmark is the next largest producer of offshore wind energy, followed by Germany (Denmark, the UK, and Germany comprise 84.7% of all European offshore wind capacity).

Outside of Europe, the remaining capacity exists in Southeast Asia, where China has made a huge commitment to offshore wind in the past year, adding 61 offshore wind units with a total capacity of 229.3 MW in 2014.

To date, wind power generation facilities in Japan have been established mainly onshore, with total capacity reaching approximately 2.6 GW by the end of 2012. However, the increased costs of establishing larger facilities onshore and land scarcity

have combined to drive wind energy recovery opportunities offshore and along the Japanese coast line.

With a strong push for renewables, a feed-in Tariff (FIT) incentive scheme for purchasing all renewable energies at a fixed price followed quickly in July 2012, with the equivalent of 2.08 GW being installed during the same fiscal year.

At the beginning of this year, Prime Minister Shinzo Abe announced that JPY 131 (\$1.1) billion – of the JPY 96.3 trillion 2015 budget – had been put aside for renewable technologies with 6% of the budget for offshore wind technology development.

Floating type and fixed-foundation type structures are used in the offshore installation of wind power generation facilities, with the fixed-foundation having a cost advantage of up to around 50 meters of water depth. However, as part of an initiative of the Japanese government, demonstration projects are being supported that aim to test the viability of fixed-foundation type and floating type structures, with main locations being off the coasts of Fukushima, Nagasaki Goto, Kitakyushu, and Choshi.

The incentives offered under the FIT system provide significant encouragement to classification societies in developing their role as arbiters of Japan's viable wind power generation facilities of the future. Their technical and regulatory expertise especially comes into its own in the case of floating structures, given Japan's Ship Safety Act applying to floating wind turbines constructed on or after April 2012.

Accordingly, since July 2011, ClassNK has offered certification services for large and small wind turbine systems and classification surveys for related offshore support structures through its Wind Turbine Division. Ever since the establishment of this division, the Society has been making multiple efforts to help facilitate the spread of offshore wind power generation in Japan, including conducting safety reviews of wind turbine support structures, wind turbine certification, research and development as well as examinations according to international standards.

*Fukushima Mirai
2MW Wind Turbine*



Floating offshore wind generation facilities

Conducting classification surveys as an “authorized organization” under the Ship Safety Act, ClassNK published the *Guidelines to Floating Offshore Wind Power Generation Facilities* in July 2012. These Guidelines apply mainly to floating offshore wind power generation facilities, including structures, mooring equipment, and towers. They cover design, inspection during manufacturing, and periodic inspection after the start of operation and are based on the ClassNK Rules for Offshore Structures and the IEC 61400-3.

Reflecting the growing Japanese engagement in the development of floating offshore wind power generation systems, ClassNK has already completed the survey and registration of two floating offshore wind power generation systems under construction in Fukushima and Nagasaki Goto.

Small wind turbine

The Society is also authorized to issue type certification for small wind turbines with an output of less than 20kW to confirm that these meet the standards required by FIT to be eligible for the scheme. The Society has already certified 11 small wind turbines across the country and started to issue certification to support structures for small wind turbines higher than 15m.

Building on IEC standards, in 2011 ClassNK introduced a certification service based on industry practice specified by the Japan Small Wind Turbine Association. The industry standards were created according to the JIS C 1400-2 (identical to IEC relevant standards), and with reference to the principles of other associations in the US and UK, paying particular attention to the wind conditions and installation environment in Japan.

Large wind turbine

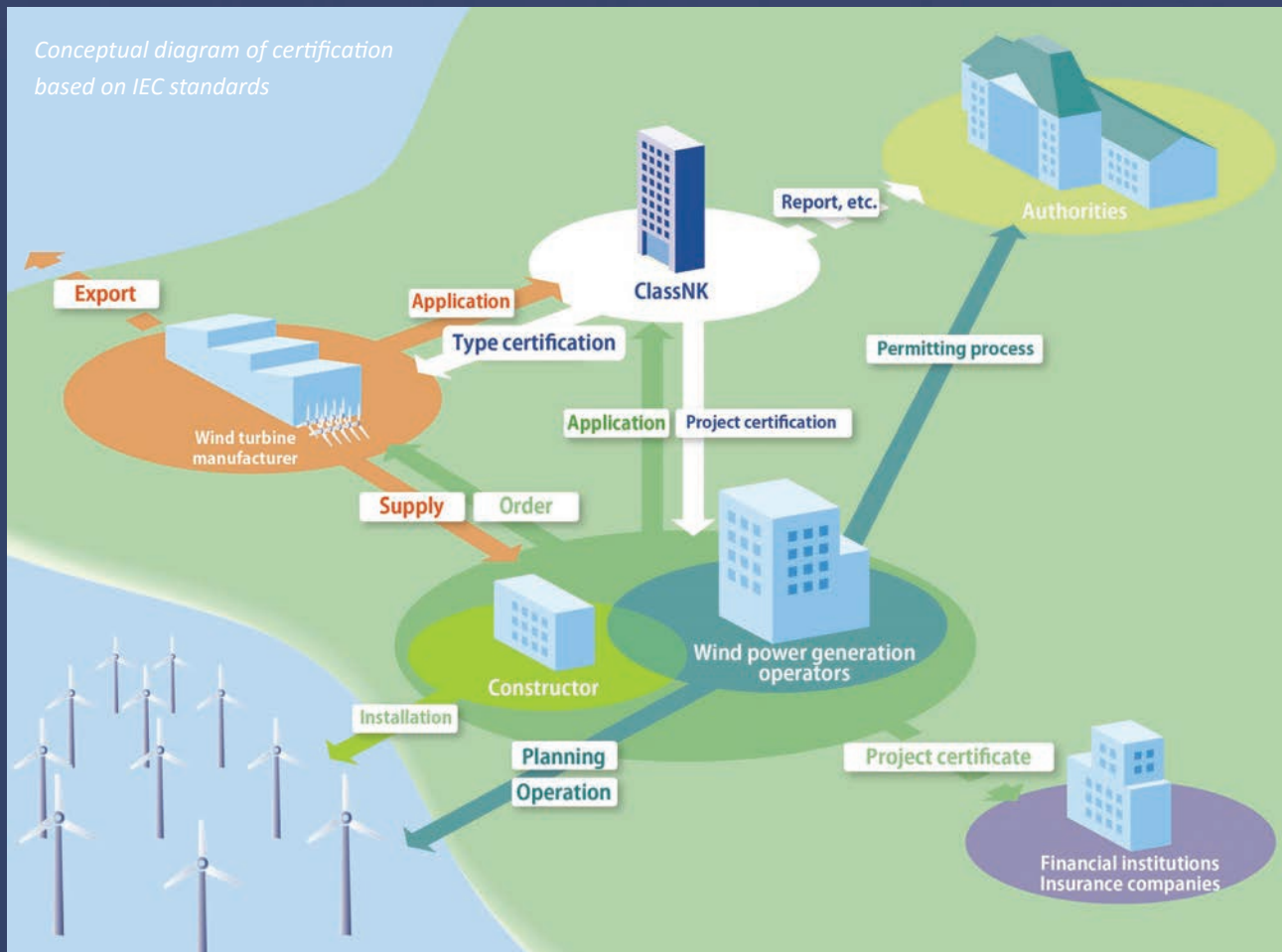
As part of its certification and design evaluation activities for large wind turbines, in accordance with IEC and JIS, ClassNK issued a “Design evaluation conformity statement” to Mitsubishi Heavy Industries covering a 2.4MW wind turbine. In addition, the Society issued a “Prototype Certification” to MHI for the 7MW and to Hitachi for the 5MW wind turbine, which will be installed on the Fukushima Floating Offshore Wind Turbine Projects.

Conducting site condition evaluation mainly for large wind turbines, ClassNK has concluded that the Large Wind Turbine meets the requirements of specific environmental con-

ditions in their installation location, such as typhoons and other conditions.

ClassNK is also responsible for the assessment of project site conditions (such as hydrography and wind conditions), to ensure that the safe transportation, installation, and testing of such structures are in accordance with international and national standards such as IEC and JIS.

Japan features many different landforms and weather patterns, including mountainous terrain which brings high winds, while the country is also exposed to typhoons, heavy thunderstorms, earthquakes, and tsunamis. Accordingly, ClassNK offers evaluation and certification specific to these conditions.



New developments

In a concerted response to the developing needs of the industry, in October 2014 ClassNK established a new Renewable Energy Department to oversee diverse activities related to renewable energy, which were previously the responsibility of its Wind Turbine Division.

The new department provides certification services for a wide range of renewable energy technologies, including wind turbine generation system verification and offshore farm installation, ensuring that ClassNK's high standards contribute to their safe development and practical application.

The department also takes responsibility for developments in wave power, tidal power, and ocean thermal energy conversion, where rapid technological advances are making the harnessing of other renewable energy sources a reality.

"Given the enormous potential of the ocean as an energy source and the ever-increasing demand for cleaner energy to mitigate climate change, there is a growing need for high-quality technical services to support practical developments in new technology", says Operating Officer Hirofumi Takano, who is heading the new department.



"ClassNK established the Renewable Energy Department to support these efforts and ensure the safe operation of renewable energy facilities offshore".

ClassNK is also part of a National R&D project overseen by the New Energy and Industrial Technology Development Organization (NEDO), Japan's largest public R&D management organization, and has joined the Condition Monitoring System (CMS) initiative for wind turbines to develop guidelines for the certification of CMS. The project aims to improve domestic wind power generation facilities from a current average output level of below 20% to over 23% by developing highly efficient maintenance techniques and conducting demonstration tests on actual wind turbines.

In addition, ClassNK strengthened its renewable energy activities by forming a capital alliance with the Wind Energy Institute of Tokyo Inc. (WEIT) at the beginning of 2015. This partnership will enable both parties to leverage their experience and knowledge to develop solutions to meet renewable energy industry challenges.

Building on WEIT's analytical expertise and its position as a leading technical institute, ClassNK will focus on service development, including independent third-party Marine Warranty Surveys (MWS). This service evaluates potential operational risks in the design, transportation, and installation of renewable energy projects established offshore and is required in securing insurance for new projects. The survey focuses on key factors such as sea fastening and cable laying and will be provided through the newly established ClassNK Renewable Energy Department.

As the use of offshore wind power as a valid renewable energy source is rapidly increasing worldwide and specifically in Japan, the certification of floating-type offshore wind turbines will become more and more essential. By actively participating in the creation of international standards and rules as well as developing R&D projects for floating-type offshore wind turbines, ClassNK has taken the necessary steps to ensure that its support is both coordinated and specific.

'PEERLESS' Ballast Water Management System installation

As enforcement of the Ballast Water Management Convention once more looms large, cutting edge 'ClassNK-PEERLESS' software eases time and cost burdens on shipyards and owners by enabling 3D laser scanning in retrofitting projects.

The need to retrofit new technologies on board ships is more extensive today than ever, whether driven by regulation or the promise of greater vessel efficiency.

Over the last decade, the implementation of new international regulations has required owners to introduce a range of new and costly measures such as coating systems, water ingress technology, electronic charts and alternative fuel types, to name just a few. Meanwhile, the pursuit of lower fuel bills has spawned an array of eco-efficient technologies utilizing monitoring and big data to capitalize on latent efficiencies in vessel operations.

11 years after it was agreed at IMO Council, the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) finally seems to be on the verge of ratification. If ratified, the requirement to invest in the installation of ballast water management systems will become a costly imperative for owners and operators.

At time of writing, the share of world tonnage commanded by ratifying states teetered 2.14% short of the 35% that would trigger the Convention's entry into force 12 months later. However, previous arguments against ratification – in particular, concerns from the International Chamber of Shipping (ICS) over the G8 guidelines on type-approval

testing – evaporated at IMO's 2015 Marine Environment Protection Committee (MEPC). And, while higher and critical US standards are yet to result in a single BWMS achieving USCG type-approval, Argentina, Indonesia, and Italy have already declared that they are in the process of ratifying IMO's legislation.

After ratification, owners will need to install ballast water management systems onboard all new and existing ships in accordance with regulation B-3 of the convention.

MEPC agreed a "Roadmap for the implementation of the BWM Convention", which emphasizes that early movers, i.e. ships which install ballast water management systems approved in accordance with the G8 Guidelines, should not be penalized later on. The Committee also developed draft amendments to provide an appropriate timeline for ships to comply with the ballast water performance standard.



Accordingly, mapping out an effective BWMS installation procedure quickly moved up the priority list at the midpoint in 2015.

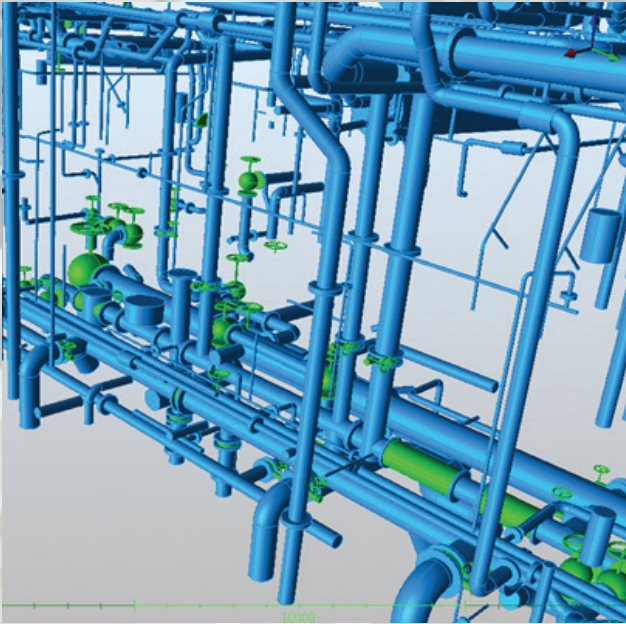
ClassNK announced that work on 'ClassNK-PEERLESS', a software which aims to enable installation of such systems in existing ships more efficiently by exploiting 3D laser scanning, was complete and available by January of 2015. The software's development draws on a research project first acknowledged in May 2012, involving the University of Tokyo, Monohakobi Technology Institute, NYK, MOL, "K" Line, Sasebo Heavy Industries, Sanwa Dock, and SEA Systems. Software development on the project was led by ClassNK, working with Japanese 3D software solution provider Armonicos.

The principal installation issues faced in retrofitting new ballast water systems are that existing ships have not been built to accommodate space-hungry BWMS, especially in their engine rooms. The systems required feature large diameter piping and are complex, while space for settling tanks presents another particular challenge.

All this adds up to a situation that would usually require repeatedly sending in engineers to take and check measurements manually. Such an approach would mean the creation of 2D drawings to be cross-referenced with the vessel's general arrangement plan. This long and tedious process takes time and costs money.

ClassNK's Executive Vice President, Mr. Yasushi Nakamura outlines the scale of the issue. "The convention means that some 40,000 vessels will need to be retrofitted with BWMS and the process is both time-consuming and costly," he says. "Deploying commercially viable 3D scanners will ease the burden on owners, operators, shipyards, and designers."

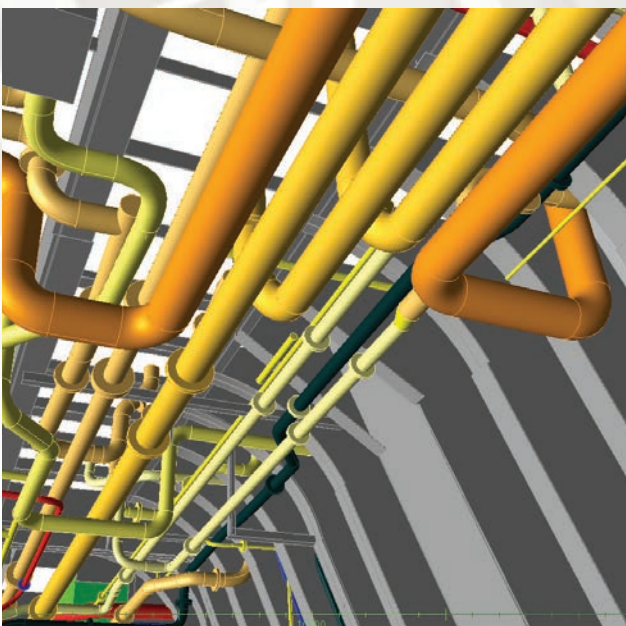




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In developing ClassNK-PEERLESS, the objective was to minimize design lead times and disturbance during the retrofit process

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ClassNK-PEERLESS uses 3D laser scanning to accurately measure available space automatically, without the time-consuming manual work.

Scanning, as opposed to physical inspection inside ship spaces, is inherently straightforward and safe. It is also quick, involving just 10-20 two minute scans from different angles on each deck, and the whole process onboard takes less than a day. For an owner going into a BWMS retrofit, if the equipment to be installed is already decided on, on-board scanning is required only once.

“In developing ClassNK-PEERLESS, the objective was to minimize design lead times and disturbance during the retrofit process,” says Mr. Nakamura. “As part of the project, we helped develop 3D laser scanners to collect high-density 3D data to create digital models of engine rooms and other structures, which can be used directly in the creation of 3D CAD blueprints.”

The software package converts the information gathered into cloud point data to create highly accurate 3D models of structure interiors within ClassNK-PEERLESS that can be imported into individual client 3D CAD applications, where machinery room arrangements can be conceived in a familiar format.

A complete 3D model can be built in 1-2 days, compared to the 7-10 days it can take to build the same model by drawing on conventional inputs. Shortening the modelling time in this way delivers a substantial cost reduction. In fact, the cost of ClassNK-PEERLESS depends on the area of installed software, so designers also only have to pay for what they use.

“Owners and operators will be under pressure to retrofit their vessels with BWMS, and the resulting urgency could lead to a backlog at shipyards,” says Mr. Nakamura. “This would be exacerbated by long design lead times when creating 3D vessel models using a conventional approach.

“Using 3D scanners and ClassNK-PEERLESS to create three dimensional images of the entire engine room allows the shipyard to plan and troubleshoot the installation process, and carry out retrofits as efficiently as possible. Streamlining this work will have a direct and immediate impact on alle-

viating the pressure on shipyards and designers, as well as speed up the entire process.”

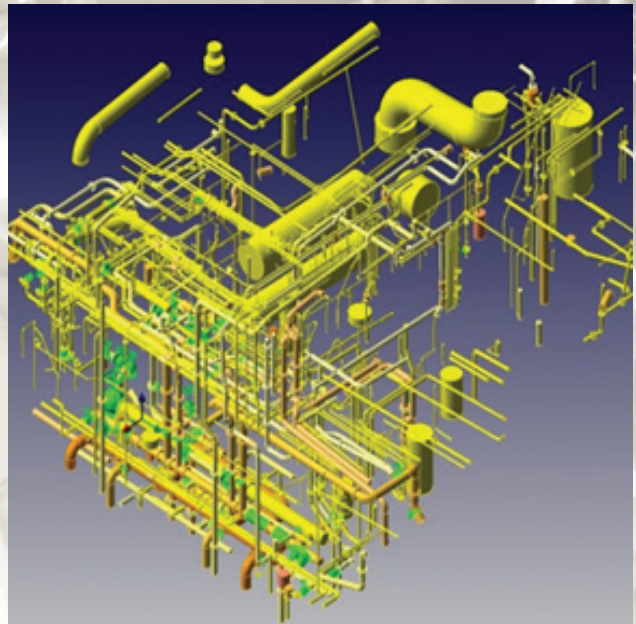
Mr. Shigeki Morikawa, CEO at Armonicos, adds: “Retrofitting BWMS will become unavoidable in the near future, however the modelling of existing vessels is a bottleneck that could slow down the entire process. Working together with ClassNK, we have brought this innovative new solution to market. By streamlining the modelling process, shipbuilders across the world can be prepared for the BWMS treaty and provide a highly efficient retrofit process for the entire maritime industry.”

If ballast water management is at last becoming an imperative, ClassNK notes that usefulness of the 3D scanning option is not limited to regulatory needs. ClassNK-PEERLESS could equally well be deployed for any retrofitting project involving installation of new equipment within existing available space – for example ship conversions for marine gas oil use as a fuel.

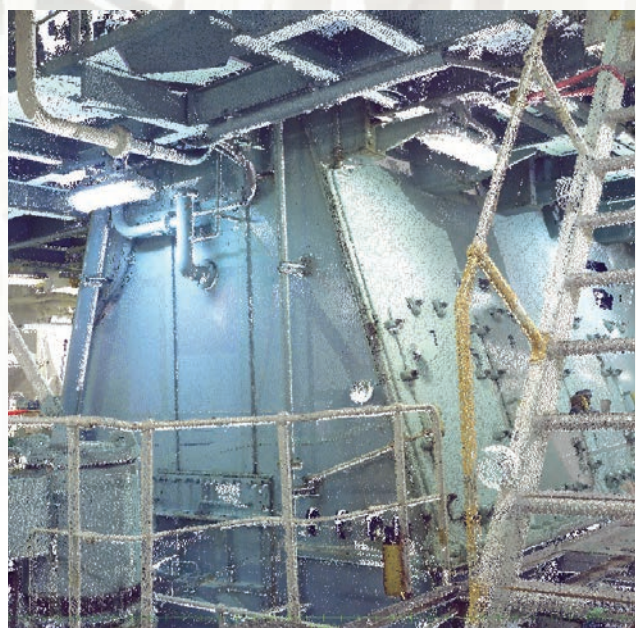
Supplied under license through subsidiary ClassNK Consulting Service Co., Ltd., ClassNK-PEERLESS automatically applies standard rules for various ship components, such as pipes, valves, and other fixtures when processing point data of a space such as the engine room to create the 3D models. As the technology can be applied where precise interior measurements are required, ClassNK-PEERLESS can be used to streamline a wide range of projects from vessels to offshore modules.

“ClassNK-PEERLESS offers tangible benefits not only to the shipyards and designers carrying out retrofits, but also to the owners and operators who have ordered the retrofits,” Mr. Nakamura concludes. “Where previously vessel measurements were taken manually, streamlining the entire retrofit design process will greatly reduce vessel off hire downtime and costs.

“Carrying out highly accurate measurements in advance with 3D scanners makes it possible for shipyards to develop better, quicker methods for repair and retrofit work. In older vessels, especially, plans are often not available, and the 3D scanners allow us to not only bridge that gap, but leapfrog from 2D drawings to highly detailed and accurate 3D CAD data, which is perfect for the advanced engineering work required for retrofits.”



“*ClassNK-PEERLESS offers tangible benefits not only to the shipyards and designers carrying out retrofits, but also to the owners and operators who have ordered the retrofits*”



Industry partnership: Zodiac Maritime

With over 20 years' experience, Zodiac Maritime Ltd. continues to provide the best possible service to its international clients. Mr. George Cowan, Technical Director, Zodiac Maritime, identifies some of the key activities and services that distinguish a global ship management company.

Can you tell us about the history of Zodiac Maritime?

Zodiac Maritime Ltd. is an international ship management company, established in the 1970's and headquartered in London with representative offices in Shanghai, Tokyo and Mumbai. In its early days Zodiac Maritime Ltd. started with general cargo and dry bulk vessels. Over the subsequent decades the fleet grew organically and today comprises of over 100 vessels diversified over VLOCs, Capesize, Panamax, Handymax and Handysize Bulk Carriers, Container Ships, Crude Tankers, Product Tankers, Chemical Tankers, LPG Tankers and Pure Car (Truck) Carriers.

Zodiac prides itself on providing a complete package of management services to its clients (from the building and purchase of a vessel through to crewing, operating, maintenance, and many others). Which are the most successful services that make you a leading ship management company among other competitors?

Zodiac Maritime sets the same expectations and standards for all of the different types of ships whether for newbuilding or second-hand tonnage. Our aim is to simplify the management structure and make it easier for the ship and shore staff to work together. The day to day running of the ships is centralised and all concerned departments sit alongside each other so there is a strong interaction in dealing with any ship

matters arising whether routine or urgent. The most successful part of Zodiac's service is this strong integration.

Which areas of your activities are you currently investing in and why?

By Vessel Type: The fleet is well balanced across all sectors and there is a continual process of replacing older ships with more modern tonnage. The average age of the fleet being 8.8 years. We have a healthy new building programme of 20 vessels covering all sectors and are generally well placed to invest should a suitable venture arise. A suitable business opportunity determines the type of the ship that we will invest in and operate.

In Manning and Training: When one considers that we trust an individual to manage an asset worth millions, which carries cargoes worth many millions more, then continuous ongoing training is essential to make that individual the best they can be.

We have our own manning offices around the world that recruit for the fleet and always bring senior officers through



head office to meet the teams and learn our systems before joining a ship. We also select certain officers for extended training periods in our office so they can learn shipping from this side and through our eyes so they will have greater understanding of the organisation built around a ship and that will make them better managers on board.

There are audit teams and IT support teams circulating throughout the fleet and our manning offices host regular training seminars and we install computer-based learning aids for specific training such as the recent ECDIS requirements and also for onboard drills and safety procedures.

By Geographic Location: Class well knows the need to have a global network that can provide service to the shipowner quickly and efficiently. As we are also a service provider to the ship employer, it also makes sense for us to position representatives in strategic places. This may be a sole representative or a full representation office when it makes economic sense to do so. For troubleshooting the inevitable problems that arise when operating ships, it is beneficial to have someone in the same time zone and therefore we do have local representation in areas of high ship activity who can alert the right person, initiate local support and assist the ship.

By Service Provision: Ship efficiency has been a major topic for several years and in order to improve the service to our charterer we initiated a programme to clearly show that all fuel delivered on board our vessel is being used efficiently and is fully accountable on a daily basis.

The data collected allows us to determine the engine efficiency and hull efficiency and monitor the need for intervention.

This in house program gives individual, voyage and fleet comparisons with selected KPI's to ensure the ship's performance matches expectations of the charterer.

The expansion of ECA zones and the use of LSMGO was complicated recently by the introduction of LSHFO. All ships were prepared and plans approved in order to allow the charterer the choice of which LS fuel he may wish to supply.

As part of a bunker initiative, to date we have trained 40 chief engineers to a professional bunker surveyor standard and we rotate one person in Singapore, one in China, one in Europe and one in the Americas to attend our ships when they bunker and to ensure the operation is correctly carried out.

The measurement forms are computerised so correct quantities are immediately calculated and armed with the right equipment, correct procedures and confidence in their own abilities. Our disputes with our suppliers have been fearsome but have saved us and our charterers from paying for several thousand tons of missing fuel.

In between bunker operations our surveyors go around the fleet carrying out fuel ROB audits and teach the ship crew the correct methods.

When did the partnership with ClassNK begin and how did it develop over the course of the years?

Japan used shipbuilding in the 50's and 60's to rebuild and develop its industrial base and in fact dominated world shipbuilding up to as recently as 2004, so most ships were in fact Japanese-built and classed by NK initially; shipowners active in building and buying of 2nd hand vessels were quick to note the high quality of the vessels they were taking over.

My personal relationship started in the 70's when I sailed with a Japanese shipping company and subsequently worked ashore for them as a superintendent. I have always appreciated the support, integrity and industry shown to me from that time until the present day.



What benefits does ClassNK offer to your business? How can class in general/ClassNK help or support you?

ClassNK is a close and reliable partner that keeps up to date with legislation and regulation and is the interface, ensuring that ships can comply with requirements.

They actively maintain a dialogue between the lawmakers and shipowners to influence the fair and practical additional burden of ever-increasing legislation.

This affords an owner time to consider, source and implement change in a fairly controlled manner.

For the record, how many and what type of vessels operated by Zodiac are registered with ClassNK?

- 38 vessels:
- 13 container
- 8 dry bulk
- 6 tankers
- 7 chemical tankers
- 1 LPG
- 3 PCTC

Can you expand on the major fleet renewal and expansion program that your Oil Product Fleet is currently going through?

Presently this is a vibrant sector, which affords the opportunity to grow the business in a sustainable way. For new tonnage the focus is built around the expectations of the oil majors

and the extensive vetting schemes they operate so that Zodiac can be considered as a reliable partner.

In your opinion, what are the main challenges the industry is now posing to ship owners and management companies and what are your views on the global market? Are there ways in which Class can help you to face these challenges, and how?

Of course too many ships in most sectors and the fragile global economy are of great concern. The uncertainty that it brings, as economic or political shocks cause ripples of a magnitude previously unimaginable, mean it is difficult to foresee any stable long term prospects. However, being optimistic there should be a slow but steady increase in trade flows and a softer oil price will help to keep inflation and interest payments low so there should be opportunities for the better companies to build on the improvements – those being driven by market requirements for fuel saving and environmental needs.

Ship design, hull form, simulation of sea-keeping performance are all areas where class can help a shipowner evaluate a new building and provide the ship master with an informative document to help with navigational choices.

Anything you would like to add?

This is a family-run business that cares about the ships and personnel onboard and ashore so it has been a privilege to witness the passing of the business through the generations from founder to sons and grandsons and still see the same ethos and business dynamic to grow the company.



ClassNK events in 2015

- ◆ **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
- ◆ **NAVEGISTIC, ASUNSION, PARAGUAY, 30TH SEPTEMBER - 2ND OCTOBER**
Please visit ClassNK at booth 05
- ◆ **SEATRADE OFFSHORE MARINE & WORKBOATS, ABU DHABI, UAE, 5TH - 7TH OCTOBER**
Please visit ClassNK at booth 101
- ◆ **INDONESIA MARITIME EXPO, JAKARTA, INDONESIA, 7TH - 9TH OCTOBER**
Please visit ClassNK at booth D02
- ◆ **KORMARINE, BUSAN, KOREA, 20TH - 23RD OCTOBER**
- ◆ **OTC BRAZIL, RIO DE JANEIRO, BRAZIL, 27TH - 29TH OCTOBER**
Please visit ClassNK at booth C1
- ◆ **GASTECH, SINGAPORE, 27TH - 30TH OCTOBER**
Please visit ClassNK at booth A380
- ◆ **WORLD MARITIME DAY, KUALA LUMPUR, MALAYSIA, 30TH -31ST OCTOBER**
Please visit ClassNK at booth 17
- ◆ **INTERNATIONAL WORKBOAT SHOW, NEW ORLEANS, USA, 1ST - 3RD DECEMBER**
Please visit ClassNK at booth 3711
- ◆ **MARINTEC CHINA, SHANGHAI, CHINA, 1ST - 4TH DECEMBER**
Please visit ClassNK at booth N1D31 in Japan Pavilion

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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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