

ClassNK

Annual Report 2018

[English]





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Mission

The ClassNK Mission

ClassNK is dedicated to ensuring the safety of life and property as well as environmental protection and other related matters through various businesses related to classification, the establishment of various standards, inspection, registration, certification, and research and development, etc.

To achieve this mission ClassNK will:

- Deliver the highest quality services, by the highest quality personnel, while maintaining the fairness of our totally independent third party.
- Develop relevant rules, guidances, and procedures, and conduct technical research and development to positively contribute to the maritime industry.
- Maintain and develop our global operations in line with the needs of our clients.

Profile

Founded on 15 November 1899, Nippon Kaiji Kyokai, better known as ClassNK or simply NK, has been providing a full range of services as a third party organization such as ship surveys, in order to help ensure the safety of life and assets as well as protection of the environment. With approximately 130 branches around the world, ClassNK is widely known as a global classification society.

Regarding our main classification services, upon establishing technical rules relating to ship safety and marine pollution prevention, we inspect machinery, electric and automated equipment, safety equipment, cargo equipment, and material plans for individual ships based on the rules and classify them in line with standards. We are authorized by approximately 100 flag states to carry out ship inspections complying with international conventions on their behalf.

ClassNK makes the most of its long years of experience as a third party organization and is also involved with certification in the renewable energy field including ISO series inspection registrations and wind power.





Behavior Guidelines for Compliance

Basic Stance

In order to faithfully carry out the "Articles of Incorporation of ClassNK", "ClassNK Mid-Term Plan", and "Management Philosophy and Future Vision", each person who engages in work for ClassNK shall regard the "ethical decisions based upon one's conscience" as the root of compliance and the basis for all activities, and act accordingly to it during all business operations of ClassNK as well as in their private life. In this manual, "ethical decisions based upon one's conscience" means that the person examines the appropriateness of their own actions from the standpoint of an impartial third party by temporarily putting aside any personal, internal, or business interests.

"Each person who engages in work for ClassNK" refers to any person engaged in the business operations of ClassNK or any of its group companies.

Behavior Charter

ClassNK is constantly looking for ways to positively contribute to the safety of life and property as well as environmental protection and other related matters through its various business activities. This includes efforts to fulfill customer demand, provide high quality services, and support the global activities of its customers by providing various services such as classification, inspection, registration and certification as well as by establishing various technical standards and conducting various research and development projects, etc.

In order for ClassNK, an independent organization, to continuously and stably provide high quality, fair, transparent, and appropriate service, all executives and regular employees of ClassNK shall have a deep sense of ethics for gaining social trust and aim to practice fair and faithful behavior.

1. Vision (future image or goal)

- As a technical organization, we always pursue technical improvements and utilize our technical capabilities for sincere business, aiming to establish trust with our customers.
- We keep an organizational culture of openness with a free exchange of views and utilize various individual abilities to a maximum, aiming for an evolving organization.
- We open the way to the future with our technical capabilities, aiming to become a global leader.

2. Consistent fair and transparent activities

- We comply with laws and regulations for fair trade.
- We maintain healthy and normal relationships with political

and governmental organizations both domestically and internationally.

-We are firmly opposed to any antisocial activities, forces, and bodies that threaten social order, security, and stability, and never have any connection with them.

3. Promotion of corporate governance

- The management endeavors to show its leadership by thoroughly ensuring this charter is known throughout the entire organization and its group companies.
- It establishes, operates, and maintains an effective internal control system.
- It proactively discloses information to society and practices a highly transparent organizational operation.
- It respects improvements and other propositions, aiming for an organization open to society.

4. Respect for individuality

- We respect the personality and individuality of each other, ensure a safe and pleasant working environment, and achieve an affluent and wealthy life.
- Each of us willingly and voluntarily acts to self-manage our own tasks.

5. Response to globalization

- We respect laws and international norms, including human rights as well as the cultures and customs of other countries and regions to carry out our work and contribute to the development and prosperity of local economies and societies.
- We establish a global organizational operation system which is understood and accepted in harmony with local societies.

6. Social contribution and commitment to global environment

- We are aware of our responsibilities as a member of the international community and willingly support social contribution activities through our business.
- As a member of the international community, we voluntarily act for global environment issues which are common to all humanity and contribute to the protection of a healthy global environment.



Message from President & CEO

Message from President & CEO

Welcome to the 2018 ClassNK Annual Report. I would like to extend my deepest appreciation to all of our clients and stakeholders who supported our activities.

Looking back on 2018, it seems we have gotten out of the worst of times with the steady recovery of the world economy. This had a positive impact on the maritime industry with improved demand in dry bulkers and container ships along with signs of rising newbuilding stocks being seen. However, issues such as trade wars between major nations, a global sweep of populism, and BREXIT have negatively influenced the world economy and the future of the maritime industry is still uncertain.

In the maritime industry, the IMO adopted a greenhouse gas emissions (GHG) reduction strategy in April 2018 which aims to eliminate GHG emissions within the century. On the other hand, the deadline for the response to many other environmental challenges such as the SOx emission regulations, installation of ballast water treatment system, and the start of EU ship recycling regulations application is also approaching.

Further, with advancement in digital innovation like ICT and IoT, various other fields such as the construction of ships and their equipment, ship navigation, education/training of crew are beginning to noticeably change.

In this manner, 2018 can be said to have been a year in which the maritime industry carried out initiatives for technical innovation under the pressure of responding and preparing for environmental regulations in each sector of the industry.

Our Society constantly reviews its ways of business and supports

the industry to the best of its ability as a third party organization in order to help the ever-changing maritime industry smoothly transition to the next phase.

In 2018, in addition to revising the articles of incorporation which our Society relies on in order to respond to the changes of the era and clarify our scope of service, we also underwent organizational improvements to enhance our governance. Given the difficult times in the shipping/shipbuilding/marine manufacturing industries in recent years, with the help from every officer and employee in cutting costs and concentrating our investments into only the things we truly needed, we were able to obtain a financial basis to efficiently continue our business and expand it even further. 2018 was the year our Society established the foundation for future growth, and we will continue improving our service for the benefit of all stakeholders.

The current maritime industry is facing the two main challenges of environmental regulations and digital transformation.

Regarding environmental regulations, response to the 2020 SOx regulation is the urgent task at hand. In order to meet the long term GHG reduction goal established by the IMO, the use of carbon-neutral fuel and the reuse of CO₂ come to mind.

However, many of those technologies are still in development, leaving many hurdles left to overcome regarding their maturity and costs in order to realize their practical use. In light of the increased awareness of society as a whole in regards to environmental issues, it is becoming more and more essential to actively demonstrate our efforts and lead the industry in

responding to the challenges.

In addition to providing accurate and quick survey/inspection services in response to SOx, ballast water treatment, and ship recycling, our Society provides information and carries out the organization development so that the industry can smoothly respond to the regulations. We are constantly acknowledged for our 2018 initiatives in response to the urgent issues of the industry which include an update for our software related to fuel consumption reporting covering the allowed GHG emission amounts from vessels that begun globally in 2019, and for our analysis of the current retrofitting situation of ballast water treatment systems along with the suggestion to take early action. As a classification society, we are also working on a roadmap which will highlight a path and lead the industry in responding to the IMO's GHG reduction strategy goal that is likely to bring major changes in the long run to ships themselves and the ways they are operated.

Regarding digital transformation, we are focusing on the use of our Society's surveys/inspections and maintaining the infrastructure needed for the entire industry to use digital data while remaining compliant. Our society's main business of classification will be greatly influenced by the use of AI, condition monitoring and data analysis through big data,

remote conditioning, robotics, and keep changing. In order to address the changes and related challenges being brought by digital transformation, our Society has been advancing the projects described in the R&D roadmap developed in 2017 and has compiled the outcomes of research on the use of drones in class surveys and concept designs of automated operation/

autonomous operation of ships into various sets of guidelines throughout 2018. Further, we also worked on the entire revision of our Rules for the Survey and Construction of Steel Ships to be able to keep up with the accelerating technical innovation into the future. To promote digital transformation in the maritime industry, we have contributed to the construction and operation of a platform that enables the entire industry to utilize data through our active involvement with IoS-OP Consortium launched in 2018.

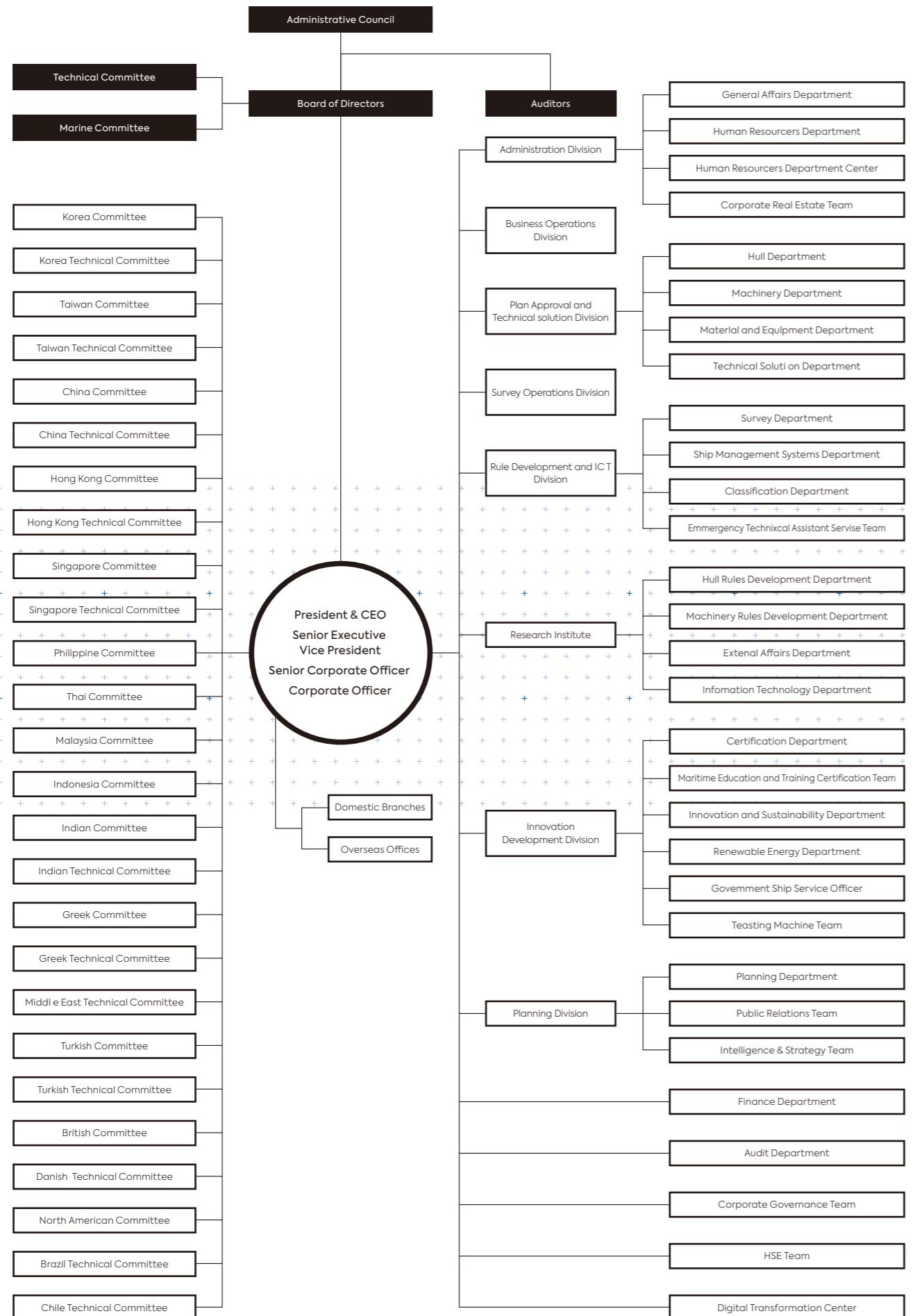
ClassNK will continue to deliver the very best technical services to our clients and continue to maintain and strengthen the relations of trust we share with the industry. In this annual report, we will introduce our recent initiatives and future plans to help you further understand more about ClassNK and we look forward to receiving your valued support for our activities.



Koichi Fujiwara

ClassNK
Representative Director,
President & CEO

ClassNK Organization Chart - as of 1 April 2019



Change in the Articles of Incorporation

In March of 2018, ClassNK revised its articles of incorporation and changed its goal to the following: "The purposes of the Society shall be to contribute to the safety of life and property as well as environmental protection and other related matters through various businesses related to classification, the establishment of various standards, inspection, registration, certification, and research and development, etc." In addition to emphasizing its continued dedication to its main business of classification, it has also set its sights on other fields to expand its services.

Introduction of a Corporate Officer System and Reorganization of the Head Office

In April 2018, ClassNK implemented a Corporate Officer system for structural enhancement as a general incorporated organization, highlighting supervising functions of the board of directors and management functions. The structure of the head office was also reorganized enabling ClassNK to go beyond its original scope of classification business.

Establishment of the Intelligence & Strategy Team

ClassNK established the Intelligence & Strategy Team in September 2018 in order to collect and organize more advanced business strategies and efficiently execute management measures in the midst of the rapidly changing external environment.

Signing of the "comprehensive cooperative treaty for technical support in ship and marine development" with Shipbuilding Research Centre of Japan

In December 2018, ClassNK signed the "comprehensive cooperative treaty for technical support in ship and marine development" with Shipbuilding Research Centre of Japan (Chairman: Shigeru Ito, referred to as "SRC" below). The treaty established the effective and efficient cooperative promotion of ship and marine development through the use of both parties' abilities and staff, sharing of information, planning and development of a consulting business, and exchange/training of staff etc.



Right: SRC Chairman Shigeru Ito
Left: ClassNK President & CEO Koichi Fujiwara



Executives

as of April 2019



Representative Director, President & CEO
Koichi Fujiwara



Senior Executive Vice President
Tetsuya Kinoshita



Senior Executive Vice President
Junichiro Iida



Senior Executive Vice President
Toshiyuki Shigemi



Senior Executive Vice President
Hiroaki Sakashita



Executive Auditor
Michio Takagi

Senior Corporate Officer, Director of
Innovation Development Division

Hirofumi Takano

Senior Corporate Officer, CFO

Masayuki Miyakura

Senior Corporate Officer, Director of
Planning Division

Taira Narisawa

Corporate Officer, Director of
Administrative Division

Katsuhide Kuno

Corporate Officer, Director of Survey
Operations Division

Yoshinori Kozeki

Corporate Officer, Director of Plan
Approval Division

Hayato Suga

Corporate Officer, Director of Rule
Development Division

Toshiro Arima

Corporate Officer, Director of Business
Operations Division

Takeshi Okamoto

Corporate Officer, Director
of Research Institute

Toshiyuki Matsumoto

Corporate Officer, Regional Manager of
Eastern Mediterranean Sea and Northern
Black Sea

Seiichi Gyobu





For Environmental Regulations

As environmental regulations become stricter, ClassNK advances its future initiatives and provides a variety of services in line with stakeholder needs in order to support the response of the industry.

2020 SOx Regulation

The regulations limiting the sulphur content of marine fuels for ships are specified in Regulation 14 (Sulphur Oxides (SOx) and Particulate Matter (PM)) of Annex VI of MARPOL 73/78. In addition to the emission control areas (ECAs) which already

require the use of low sulphur fuels that contain less than .10% sulphur, sulphur amounts in fuels being used in all parts of the ocean will need to be under 0.50% starting in January 2020. Compliant fuel oil is anticipated to include more low-sulphur blendstocks than ever before in addition to light distillates. ClassNK has identified five properties of compliant fuel oil that should be taken into consideration with its use: Compatibility, Low viscosity, Cold flow properties, Cat-fines, and Ignition/Combustion quality. ClassNK developed a guidance document which explains the basic characteristics of each property, and the potential safety implications associated with them. Released by the IMO in September of 2018, MEPC Circular "MEPC.1/Circ.878" recommends to create and keep onboard a "Ship Implementation Plan" that shows how ships can prepare for the 0.50% sulphur amounts from the regulation limit, and ClassNK has provided a sample entry of this for interested clients.

As an alternative to using low-sulphur fuel oil, it is also acceptable to use a SOx scrubber to clean gas emissions. ClassNK provides rapid and accurate inspections/surveys for SOx scrubber installations and in October 2018, we issued the third version Guidelines for Exhaust Gas Cleaning Systems to add the explanation of "2015 Guidelines for Exhaust Gas Cleaning Systems (resolution MEPC.259(68))", class requirements for Exhaust Gas Cleaning Systems (EGCS) and relevant equipment, class notations for EGCS and local/regional regulations for fuel oil sulphur content. During 2018, ClassNK issued 18 certificates/statements of compliance related to SOx scrubber (whole system: 15, gas emission monitoring equipment: 2, water emission monitoring equipment: 1) with its overall total reaching 27 at the end of 2018 (whole system: 19, gas emission monitoring equipment: 4, water emission monitoring equipment: 4).

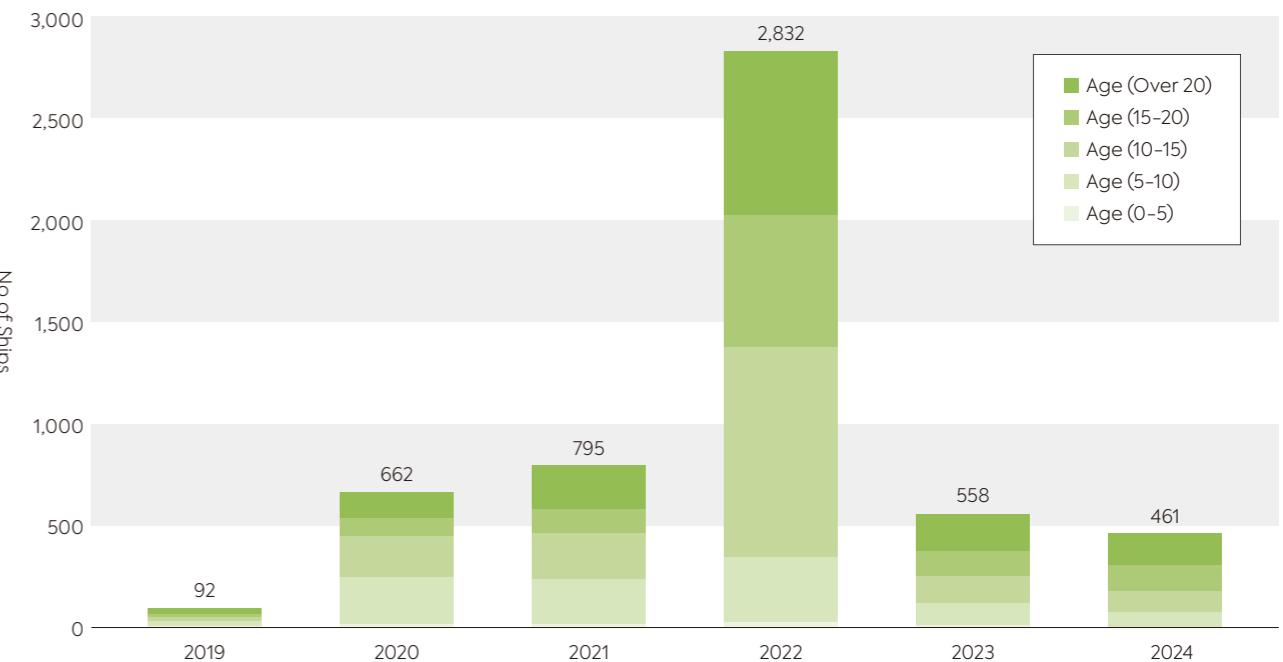


Ballast Water Management Convention

The Ballast Water Management (BWM) Convention which aims to control the transfer of harmful aquatic organisms and disease-causing bacteria in ballast water and deposits carried by ships entered into force in 2017. Targeted ships are required to install a ballast water management system (BWMS) by a fixed installation deadline. ClassNK analyzed the retrofitting status of BWMS on its registered ships and confirmed that installation deadlines based on the BWM Convention and announced its findings in September 2018. There were 7,315 ships on the ClassNK register obligated to install BWMS in compliance with the BWM

Convention and of this amount, 1,915 ships have completed the installation, leaving 5,400 ships that still require attention. The distribution of BWMS installation deadlines in line with the BWM Convention is as follows: 92 ships by 2019, 662 ships by 2020, 795 ships by 2021, 2,832 ships by 2022, 558 ships by 2023, and 461 ships by 2024, with the majority being highly concentrated in 2022 (refer to the graph below). The peak figure for 2022 may decrease due to the influence of ship recycling trends and response to USCG regulations. ClassNK recommends installing BWMS early, as difficulties are expected if the installations really do become concentrated around the world in 2022.

Distribution of BWMS Installation Dates for ClassNK Existing Ships





GHG Reduction

The goal of reducing GHG emissions to zero in the international shipping industry as early as possible within the century was agreed on at the MEPC held in April 2018. In light of this long-term goal, a short term goal of improving the carbon emission efficiency of all ships by at least 40% compared to 2008 levels before 2030, and a medium-term goal of improving them by 70% and reducing all GHG emissions in half by 2050 have been established.

ClassNK is aware that these goals are a grand challenge for the maritime industry. The 2030 goal is within reach through the expanded application of EEDI Phase 3 and gas fuels for newbuildings, however slow steaming and operational adjustments will be essential for existing ships.

No matter what the approach, in order to accomplish these goals it is essential to have an accurate grasp on ship GHG emission levels and to comply with the ship fuel consumption report system. Beginning in 2018, Europe has enforced the EU MRV (Monitoring, Reporting, Verification) regulation for ships operating in the area. For Reporting from 2019 ClassNK started the data collection based on the monitoring plan reviewed in 2017. Further, beginning in 2019, the IMO DCS (Data Collection System) requires the collection of data on fuel consumption amounts for ships weighing over 5,000GT engaging in

international voyages along with certification through submission of annual consumption reports to flag administrations or ROs. By the end of 2018, our Society had conducted 5,060 audits related to fuel consumption data collection and reporting procedures (SEEMP Part II).

"ClassNK MRV Portal" was launched in 2017 to facilitate compliance with EU MRV regulations, and has now been updated to support IMO DCS. The software consists of on-board data sending functions, an on-shore data management system, and

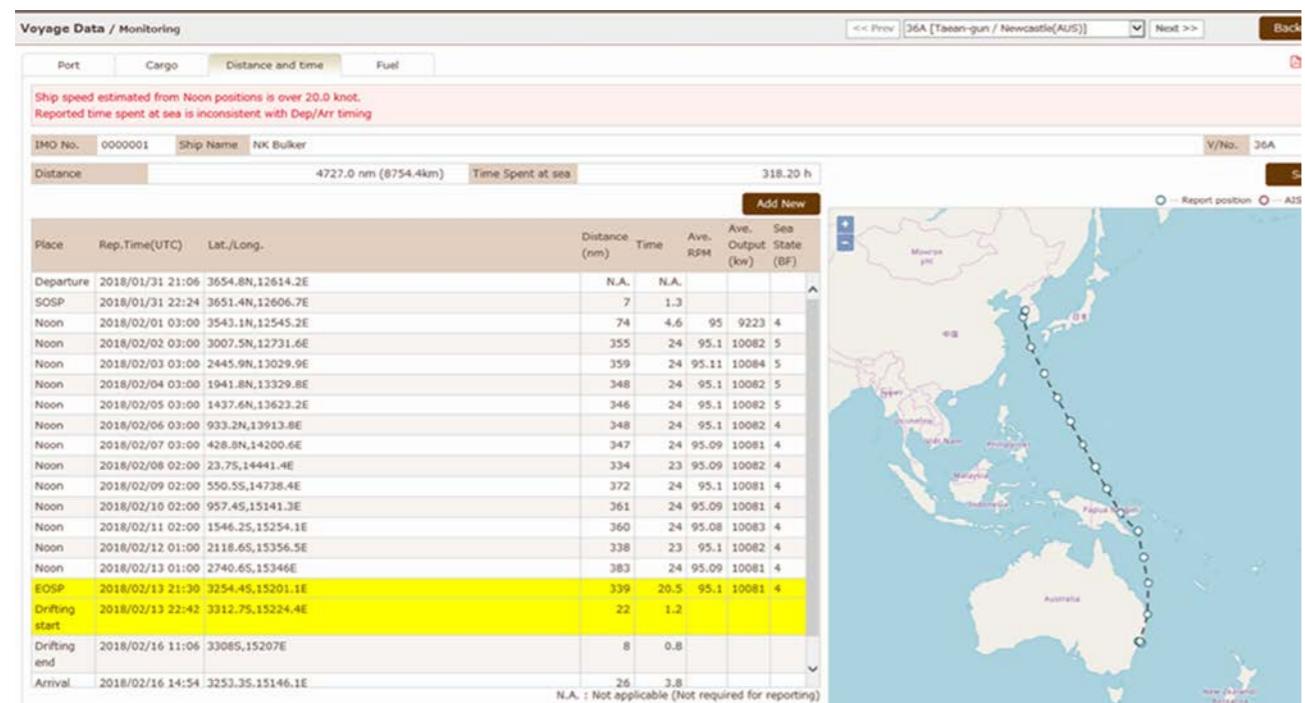


also a function for submitting an annual fuel consumption report. Moreover, the software is capable of efficiently connecting with third-party packages or in-house logbook software without any added on-board tasks and allows users to submit necessary data reports to ClassNK through the system.

ClassNK participates and provides support in meetings held by the Ministry of Land, Infrastructure, Transport and Tourism related to the GHG reduction strategy for achieving the 2050 goal. We

have contributed to the development of various energy-saving technologies and to address the IMO GHG reduction strategy as a classification society, we also consider technology scenarios for its achievement and outline them in our roadmap. Aware that developing and maintaining a suitable environment for the use of new technology is an essential role of classification, we will continue to contribute to R&D from the perspective of a third party organization utilizing our accumulated knowledge as a classification society.

In view of the increased momentum in the GHG reduction strategy of not only the shipping industry, but of the entire transportation sector, we also provide the necessary information on the latest trends and anticipated environmental constraints for sustainable business management to consulting firms, lawyers, and NGO speakers at environmental seminars (held in December 2018) in addition to the Ministry of the Environment, the Ministry of Land, Infrastructure, Transport and Tourism of Japan.



Ship Recycling

The Ship Recycling Convention was adopted by the IMO in 2009 to promote safe and environmentally sound ship recycling. Ahead of the convention's enforcement, ClassNK has implemented appraisal initiatives on the convention's requirements and contributes to safe ship recycling practices. Since issuing the world's first ship recycling Statement of Compliance to a ship recycling facility in 2012, ClassNK's purely technical verification methods have set the standard in terms of safety and environmental soundness and have been greatly

acknowledged for contributing to the improvement of many ship recycling facilities and procedures.

In 2018, ClassNK carried out appraisal services for 13 ship recycling facilities in India and Turkey (12 in India, 1 in Turkey). By the end of 2018, the total number of SoCs was 26 (23 in India, 1 in China, 2 in Turkey). Additionally, we carried out services as an Independent Verifier based on the EU regulations that went into effect in 2013 for 5 ship recycling facilities in India and Turkey, bringing that total to 7 as of the end of 2018 (4 in India, 2 in China, 1 in Turkey).

The number of SoCs issued during 2018 related to the IHM (Inventory of Hazardous Materials) required of ships was 368 (208 newbuilds, 160 ships in operation). This is the highest number seen on a yearly basis, demonstrating the increased needs of IHM. We continued providing support with IHM development to suppliers including shipyards, ship companies, and manufacturers, with our "PrimeShip-GREEN/SRM" software which significantly lessens the burden of creating/managing IHM.





Digital Transformation

In the midst of the digital transformation that is changing all of society, ClassNK is dedicated to improving its services and providing an infrastructure for the maritime industry to utilize to its maximum potential.

Data Platform

Technologies like Big Data and IoT are changing the business scene in every industry. This is reflected in the maritime industry with the collection and use of a variety of data such as ship operational information. Through its subsidiary Ship Data Center, ClassNK has engaged in many discussions with stakeholders in and out of the industry in order to provide an infrastructure for the many diverse players of the entire maritime industry to effectively and safely utilize data in addition to providing services for the storage of Ship IoT data. As a result of these efforts, we have achieved the goals of “1. Improving business and getting stronger independently” and “2. Embodying a new maritime cluster in the digital era of the whole industry by pursuing a new business model and connecting it to the next generation” through the sharing of ship IoT data and its efficient use from the perspective of the companies/

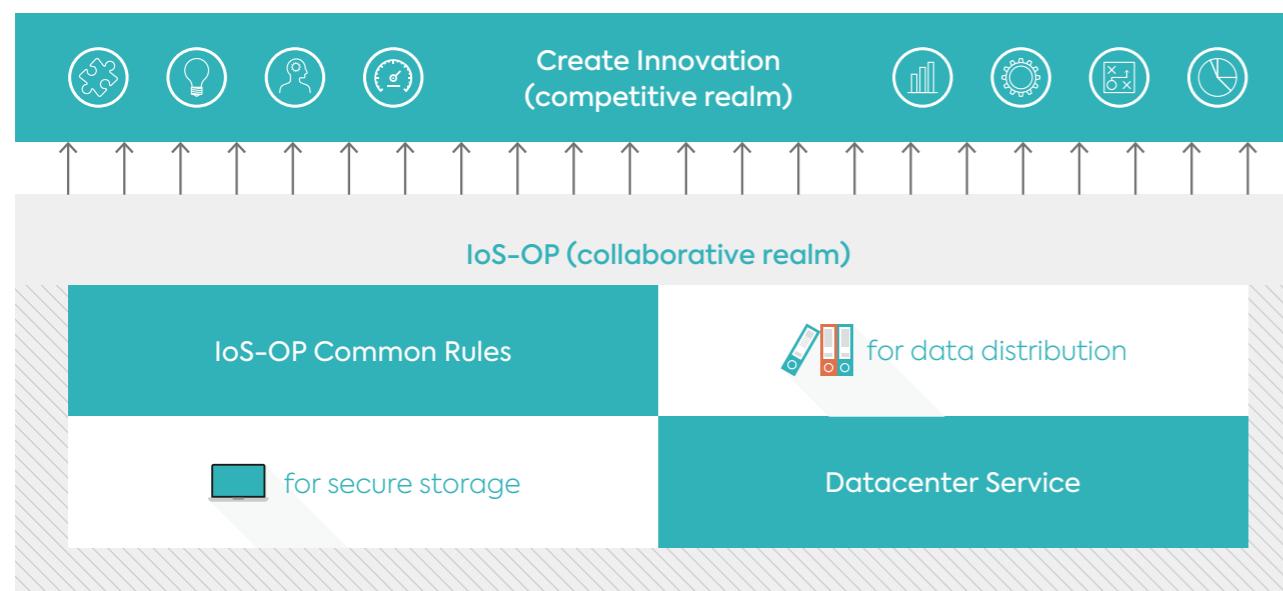
organizations/groups and their actual business that makes up the maritime industry.

To accomplish this goal, “IoS Open Platform (IoS-OP)” was launched in April 2018 as a ship IoT data platform. IoS-OP is a common platform that provides data usage rights and various services between stakeholders such as shipyards and manufacturers without harming the profits of data providers including ship companies. The platform consists of a data center for collecting and providing data, and the IoS-OP Terms of Use which are the rules on data distribution agreed on by the industry. It turns data distribution into a cooperative domain for stakeholders to contribute to the competitive domain through innovation and the development of new services that utilize data.

As activities of this type demand the utmost fairness, trust, and independence, the “IoS-OP Consortium” organization has been established consisting of member companies, allowing

sound and permanent management. IoS-OP launched with 46 organizations in the beginning made up of shipping companies, shipyards, ship machinery & equipment manufactures, and ICT companies. The entire industry acknowledges that this common platform for data usage is an unprecedented initiative.

In addition to providing data center service to ShipDC’s “IoS-OP” and as a participating member of the IoS-OP Consortium, ClassNK will continue further contributing to data use in the maritime industry.



IoS-OP Timeline

December 2015

Ship Data Center Co., Ltd. (ShipDC) established as a platform for the use of ship data. Participating Smart Ship Application Platform (SSAP) Project of Japan Ship Machinery and Equipment Association

May 2016

Ship data storage service trial begins. Japan Weather Association begins providing information on weather and sea conditions in the same month.

June 2016

Providing common data platform to Ministry of Land, Infrastructure, Transport and Tourism for their “Advanced and Safe Ship Technology Research & Development Support Project”

April 2017

“Open Platform for Ship IoT usage Forum” held

May 2017

“Ship IoT Open Platform Workshop” held

July 2017

“IoS (ship IoT) Open Platform Forum” held

September 2017 – February 2018

“IoS Open Platform Promotion Conference” established with 47 companies and 55 organizations participating. Discussed data usage scenarios, data sharing rules, new business models, and future plans.

March 2018

Member recruiting starts for IoS-OP

26 April 2018

IoS-OP Consortium launch announced

October 2018

“IoS Testbed” established, enabling connection tests between onshore data collection equipment and onboard applications, and onboard to onshore satellite broadband connectivity. “Ship IoT data use seminar for ship owners/ship management companies” and “IoT data use seminar for shipyards” held.



ClassNK receives “Data Science Award 2018”

ClassNK received the “Data Science Award 2018” hosted by the Japan Data Scientist Society on October 2018 for its practical initiatives involving ship IoT data use for data scientists. The Data Science Award is presented to projects and companies/organizations that make a strong contribution to domestic business development through data analysis/usage. The data Scientist Society has been hosting the award since 2015.

In the midst of the digital transformation sweeping across all industries, ClassNK was recognized for promoting the construction of an open platform that can be used not just in house, but by the entire industry, and for its practical initiatives with lectures and student internships for the training of data scientists.



Cyber Security

With the changes being brought by digital transformation, smooth response to cyber threats is an urgent matter. During 2018, ClassNK constructed its basic approach to ship cyber security based on international conventions and maritime bodies in order to support stakeholders in taking appropriate measures.



In November 2018, ClassNK also signed a cybersecurity partnership agreement with TÜV Rheinland. TÜV Rheinland is a global leader in testing, inspection and certification services providing digital services for safety, cybersecurity and privacy. With their partnership agreement, both parties agreed to comprehensively collaborate in jointly developing and delivering a cybersecurity certification scheme for the maritime industry. Utilizing the knowledge and strength from the services they each provide, both parties will continue to collaborate globally in the field of cybersecurity in order to further ensure the safety of vessels.

ClassNK collaborates with other professional bodies like TÜV Rheinland and has developed guidelines for the cybersecurity of ships in each of their ship design, construction, and operational stages.



Left: Mr. Tobias Schweinfurter, President and CEO, TÜV Rheinland Japan
Center: Dr. Michael Fübi, Chairman, TÜV Rheinland
Right: ClassNK President & CEO Koichi Fujiwara

ClassNK Archive Center

The IMO Goal Based Ship Construction Standards (GBS) were established by the IMO and aim to ensure safety and environmental protection through the lifetime of a ship. According to the SOLAS II-1/3-10 regulation, IMO's regulations are applicable to bulk carriers and oil tankers of 150m in length and above, with a building contract placed on or after 1 July 2016.

To ensure navigational safety, the regulation requires storage of Ship Construction Files (SCF) consisting of information on the ship's design and hull structure. As sensitive information including the high-level intellectual property drawings belonging to the shipyards and design companies is included in these files, they are allowed to be stored not only onboard but also onshore.

To supplement the regulation, the Industry Standard was also developed by a cross-industry group including the Shipbuilders' Association of Japan (SAJ) and other organizations such as CANSI, CESA, KOSHIPA, SCA, ICS, INTERCARGO, INTERTANKO, BIMCO, OCIMF and IACS.

In 2016, ClassNK began operation of ClassNK Archive Center (NKAC) as the world's first archive center that satisfies the GBS at the same time the regulations came into effect. In line with the demands of the industry standards, NKAC obtained information security management system certification (ISMS, ISO/IEC 27001:2013) and uses a system that prevents unauthorized access and an advanced security system for remote data protection.

In October 2018, NKAC stored its first Ship Construction Files fully in line with IMO-GBS belonging to a VLCC constructed at NACKS managed by MOL Tankship Management (Asia) Pte. Ltd.

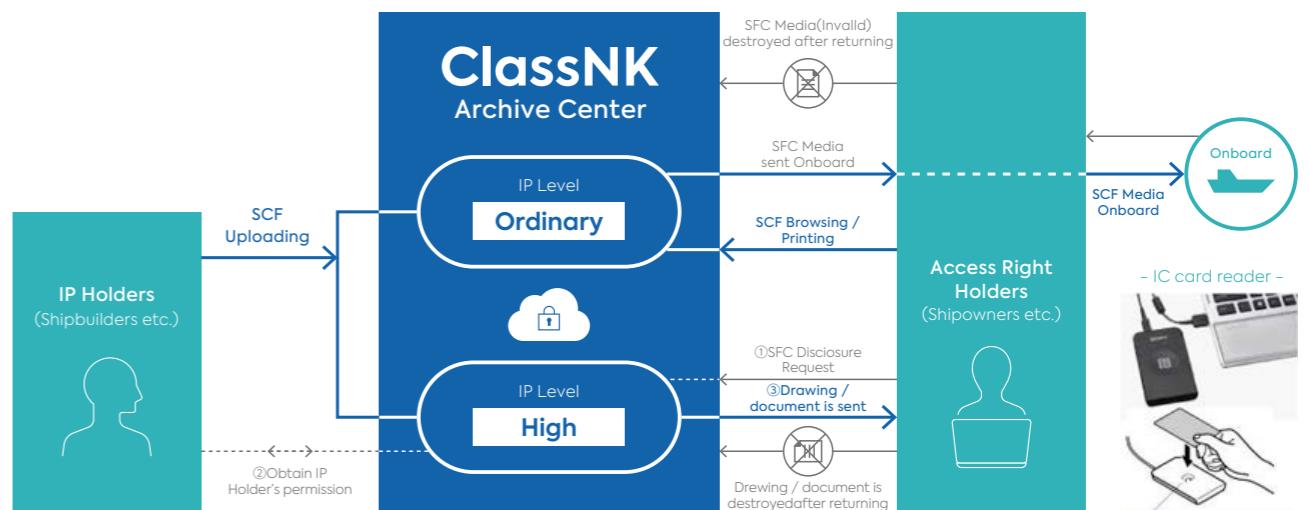
analyze the latest analysis technology and accurate evaluation methods is essential. ClassNK has developed and released “PrimeShip-HULL”, a structural strength analysis software based on the Society's experience with design drawing certification services and the latest information technology.

In order to be able to address not only revised regulations, but also contribute to the reduction of design process, we continuously update the software taking into consideration GUI improvements, the valid use of existing CAD data and user requests.

PrimeShip-HULL (HCSR) was released in February 2018 to support revisions in the Harmonised Common Structural Rules and upgrade its functions. In August and November, upgrades containing an optional position-detailed mesh construction function and a hatch cover evaluation function were also released.

Structural Strength Analysis Software

According to recent ship structure regulations, to conduct evaluations based on actual sea conditions, the implementation of a specialized software that can efficiently





R&D

In order to fulfill its mission of protecting life, property at sea and the maritime environment, and contribute to the maritime industry, ClassNK carries out R&D related to classification as well as activities based on our role as a member of the maritime community.



R&D Roadmap for R&D Promotion

The "ClassNK R&D Roadmap 2017", which was established in July 2017, aims to bring about the innovation of maritime technology using the latest IT as well as help ensure the safety of life and property at sea, with specific focus on development in the following four areas:

- Rule Development
- Survey Technology Innovation
- Marine Environmental Protection
- Revolutionary Technology Development

The R&D activities of the above are based on the following two major elements.

- Foundational R&D geared towards Core Technologies* and Integrated HR Development through R&D
- Utilization of Damage Information for Major Damage Prevention

*The five Core Technologies are: Structure; Motion, load; Material, welding; Information, control, communications, electronics; and Energy, environment.

2018 Initiatives

1. R&D directly related to classification

As part of our R&D results, we compiled and released the following 2 guidelines.

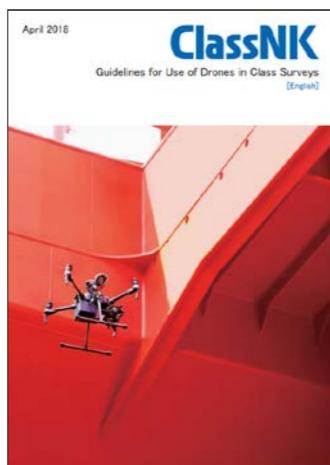
Guidelines for Use of Drones in Class Surveys

Drone-related technologies are improving at an extremely rapid pace and efforts aimed at utilization in the field of inspections and surveys are being carried out. The IACS also complies with related Unified Requirements.

When flying a drone in places such as the cargo hold or ballast tank of a ship, it is important to take into consideration the

possibility that the drone may not function properly due to being in a closed space surrounded by magnetic material which may interfere with some of the sensors of the drone (GPS and magnetic compass) which are closely related to flight stability. ClassNK began a full-scale study of the use of drones in class surveys and has conducted various types of verifications by carrying out basic performance experiments and experiments to test flight inside ship tanks and cargo holds.

Combining the technological knowledge in connection with drones accumulated by these efforts and the know-how in class surveys amassed by ClassNK over its long history to date, the applicable range and procedures for applying drones to class surveys along with the technical considerations for safe operation and the requirements for drone service suppliers were arranged in these Guidelines.



Guidelines for Concept Design of Automated Operation/Autonomous Operation of ships

In the automobile field, research and development on

automated driving systems is being conducted worldwide.

In the maritime industry, efforts towards the development of

automated operation systems for ships are being made aiming to improve navigation safety, working conditions onboard, ship operation, and more. This development of automated operation systems is expected to be achieved step by step for merchant ships in order to support their crews, except in some cases.



As the onboard operations and duties performed by ships' crews vary widely, design developments for automated ship operation are expected to be carried out under various conditions and concepts. It is essential to clarify the targeted operations/duties that would be automated, distinguish the division of roles between the crew (humans) and the automated operation systems (machines), and establish common understanding between everyone involved in the operation of the ship.

In light of the above, ClassNK developed these Guidelines with safety in mind in order to address the elements which must be considered in the concept design of automated ship operation systems. As there will likely be a variety of different design developments when it comes to the automated operation of ships, the Guidelines have been tentatively published as a "provisional version" which will be finalized through proper review

and revision after being applied for a certain period of time. ClassNK also plans to develop further guidelines for various stages on the automated operation of ships from development of design to actual operation.

2. Initiatives as a member of maritime society

Demonstration project utilizing ship maneuvering support functions and remote control

In August 2018, ClassNK was selected by Japan's Ministry of Land, Infrastructure, Transportation and Tourism (MLIT) to participate in a demonstration project utilizing ship maneuvering support functions and remote control. Japan is seeking to begin demonstrations for the practical implementation of autonomous ships by 2025, and this was the first demonstration project in Japan.

To date, the NYK Group has been working with nautical instrument manufacturers and partners to develop a manned remotely controlled system that can support the crew. Such a system would collect, integrate, and analyze information around the ship, prepare an action plan, and after the approval of operators at remote locations or on board, take action in accordance with the plan. After collecting data and developing a system using domestic coastal ships and tugboats, a demonstration test will be carried out on a tugboat in the latter half of 2019.

Participating in this demonstration project, ClassNK will be responsible for tasks including assessing the soundness of the system and conducting risk evaluations. Using the knowledge acquired from this demonstration project, the Society will contribute to the establishment of technology relating to autonomous ships such as in the revision of their Guidelines for Concept Design of Automated Operation/Autonomous Operation of ships.



National project on utilization of IoT for maritime industry

Japan's Ministry of Land, Infrastructure, Transport and Tourism is encouraging productivity revolution in the marine industry, called i-Shipping. As part of its actions, it has defined seven projects for the research and development of IoT-based technologies to help improve marine safety, to be subsidized under the Support Program for Research and Development of Advanced Safety Ship Technology.

ClassNK participates as a joint researcher in all seven projects and provides appropriate support from the standpoint of a third party ship classification society.

- A Study on the Determination of Ship Collision Risk and Autonomous Shipping
- Development of a system for the automated observation and transmission of marine weather data
- Improvement in analytical accuracy with the automatic correction of the ship characteristics model and application to safe operations
- Research and development of a technology supporting safety in LNG transport with the use of communication between ships and land
- Research and development concerning hull structure health monitoring for large container ships
- Development of a method of preventing accidents at ship engine plants with the use of Big Data for improving safety and economic efficiency
- Research and development for the introduction of IoT to deck machinery on cargo carriers and bulk carriers
- Automatic Reporting system of Weather Observations for Ships

Collaborative Research Project Involving Performance Evaluation of Actual Ocean Areas and Actual Ships

25 companies, organizations, and institutions participate and host the Collaborative Research Project Involving Performance Evaluation of Actual Ocean Areas and Actual Ships as collaborative R&D on common challenges in the maritime society. This project aims to develop methods to accurately evaluate the speed and fuel consumption etc. of ships in actual sea conditions with waves and wind. To promote the project,

ClassNK acts as secretariat together with National Institute of Maritime, Port and Aviation Technology National Maritime Research Institute.

Participation in endowed courses

ClassNK participated in the following endowed courses and promoted collaborative research to support basic research institutes.

University	Name of endowed courses
The University of Tokyo Graduate School Graduate School of Frontier Sciences	Marine Development System
The University of Tokyo Graduate School Graduate School of Engineering	Research and Development of Next-generation Floating Wind Turbine System

3. Enhancement of R&D Investigations/ Planning and Human Resource Training

We have carried out related investigations on trends in technical development etc. regarding the main themes outlined in the R&D Roadmap and reflected the acquired information and knowledge into related R&D plans. We have also continuously provided educational training to address the R&D issues handled by the employees who work on technical research.

4. Release of R&D outcomes

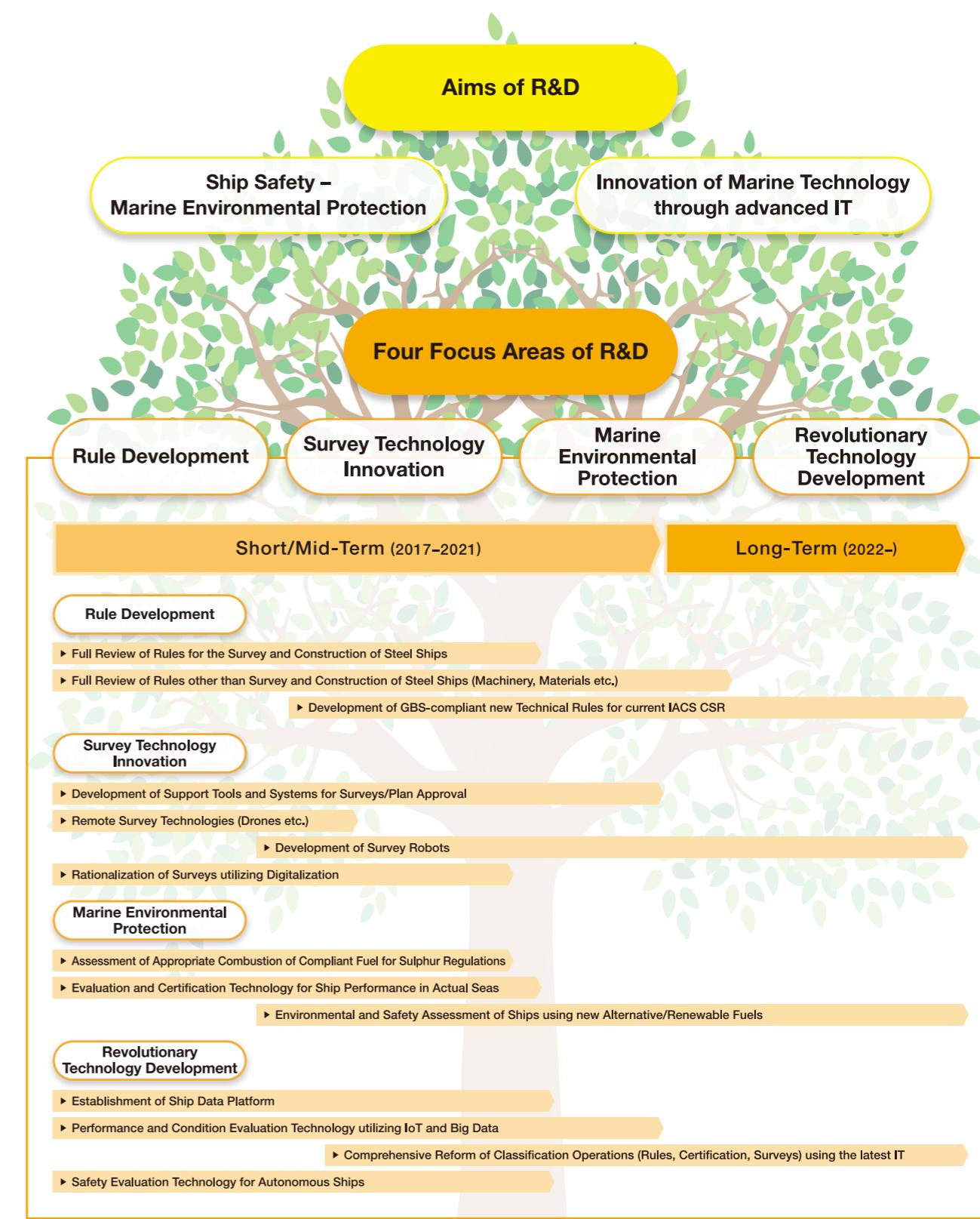
ClassNK carried out lectures and released papers on R&D findings globally. The main content presented was as follows:

- Safety of concept designs for automated operation/ autonomous operation of Ships
- Research on quantitative evaluation of ship handling influencers regarding weather conditions encountered by ships in actual sea areas (1st report)
- Use of drones in ship surveys
- Brittle fracture prevention and required amount of toughness for extra thick arrest steel plates in large container ships
- Latest trends in ship fuel oil environmental regulations and technical countermeasures

ClassNK R&D Roadmap

2017

ClassNK



Foundational R&D geared towards Core Technologies and Integrated HR Development through R&D

Utilization of Damage Information



Rules

ClassNK is constantly amending its Rules and Guidance in order to reflect the latest results from relevant research and development projects, feedback from damage investigations, requests from the industry, as well as changes made to relevant international conventions, IACS unified requirements, national regulations, etc.

Amendment of the technical rules

In 2018, a total of 119 technical rules were amended. The main amendments include the following.

Notation related to Sulphur Oxides Emission Control

With regard to regulation 13 of MARPOL Annex VI, the ClassNK Rules stipulate that "Nitrogen Oxides Emission-Tier III" (abbreviated as "NOx-III") is to be affixed to the classification characters of ships installed with diesel engines satisfying the NOx Tier III requirements and thus are permitted to operate in NOx emission control areas. ClassNK began implementing amendments to its Rules which added notation according to the equipment/engine installed to comply with the above-mentioned requirements from 1 January 2018. In a similar manner to notation related to NOx-III, all relevant requirements were amended in order to specify that the notation "Sulphur Oxides" (abbreviated as "SOx") is to be affixed to the classification characters of ships provided with arrangements for using low-flashpoint fuels (e.g., natural gas, methanol, etc.) complying with requirements related to sulphur content specified in regulation 14 of MARPOL Annex VI or arrangements which are at least equivalent to those complying with such requirements, and to list the notation related to the arrangements adopted by ships for compliance purposes.

Class Notations with respect to Structural Assessment based upon Direct Load Analysis

The ClassNK Rules and Guidelines specify requirements regarding structural strength assessments based upon direct strength calculations as one type of criteria for the structural strength assessments. Since these requirements specify loads estimated from the service records of existing ships, ships of new structural configurations or of a size lacking sufficient records of service may need to be evaluated on a case-by-case basis taking the ships' particular characteristics into account.

Therefore, ClassNK established its "Guidelines for Direct Load Analysis and Strength Assessment" which specifies a strength assessment method which considers the detailed characteristics of individual ships based upon load and structural consistent analysis. Accordingly, relevant requirements were amended to specify that where either yield strength assessments and buckling strength assessments, or fatigue strength assessments were carried out for the primary members in all cargo spaces in accordance with the "Guidelines for Direct Load Analysis and Strength Assessment", the class notation "PS-DA-DLA" or "PS-FA-DLA" was to be respectively affixed to the classification characters. In addition, the requirements regarding the fatigue strength assessments of longitudinals were applied to tankers, ore carriers, bulk carriers, container carriers and ships for which the class notation "PS-FA" was affixed to classification characters in accordance with the ClassNK Rules. The same requirements, however, were also often commonly applied to ships carrying liquefied gases in bulk, even when the class notation "PS-FA" was not affixed to the classification characters. Accordingly, relevant requirements were amended to add ships carrying liquefied gases in bulk and ships carrying dangerous chemicals in bulk as ships for which fatigue strength assessments of longitudinal were required because the former had sufficient records of application and the latter had a similar structural configuration to tankers.

Welding Procedure and Related Specifications

for Duplex Stainless Steels

In January 2014, ClassNK published its "Guidelines on Welding of Duplex Stainless Steels": a comprehensive summary of the Society's requirements related to welding procedure specifications and welding procedure qualification tests for duplex stainless steels. This guideline has been applied to the application for approval of welding procedure for the steels since its establishment. With respect to duplex stainless steels, a sufficient amount of operational result

related to the application of the aforementioned guideline has been accumulated, and it is assumed that its use on ships will continue to increase. Therefore, the Society has decided to incorporate this guideline into Part M of the Rules and Guidance for the Survey and Construction of Steel Ships as mandatory requirements.

Wind Turbine Installation Ships

In Chapter 11, Part O of the ClassNK Rules, provisions for ships used to install wind turbines (i.e., "wind turbine installation ships") are specified, and assume that such ships are capable of self-propulsion using their own propelling machinery. Recently, however, plans for constructing wind turbine installation ships which have no propelling machinery have been under consideration, so the aforementioned provisions need to be clarified regarding their application to such ships. ClassNK discussed the clarification of the application of its requirements as they pertain to wind turbine installation ships which have no propelling machinery, and comprehensively reviewed the related provisions to make clear which requirements need to be applied according to ship type. Stability requirements during lifting operations were also specified based upon the intact stability criteria for ships engaged in lifting operations (IMO resolution MSC.415(97)) adopted at MSC 97.

Structural Strength of Liquefied Gas Carriers

Steels for low temperature services which have minimum specified yield stresses greater than 235 N/mm² are used for certain parts of low-temperature-type liquefied gas carriers. Although the scantlings of hull structures in such cases were typically decided in accordance with the requirements for high tensile steel use, relevant requirements were amended to clarify the requirements in cases where steels for low temperature service whose minimum specified yield stresses were greater than 235 N/mm² are used. In addition, it is specified that the scantling requirements of cargo tanks of liquefied gas carriers with independent prismatic tanks are to be decided in accordance with requirements for "tanks primarily designed using classical ship-

structural analysis procedures" found in the IGC Code.

Remote Inspection Techniques for Surveys of Mobile Offshore Units, etc.

In recent years, the development of remote inspection techniques (RIT), such as the use of drones, etc. has led to increased industry demand for their application to hull structure surveys. IACS reviewed relevant requirements so as to take into account the application of RIT to classification surveys. ClassNK has established authority and survey requirements for remote technology, hull structures, and interior surveys of forced flood ducts and ventilation trunks based on the IACS Z series regulations.

Approval of Use of Computer Based Systems

Systems which depend upon software for their function (hereinafter referred to as "computer based systems") need to be provided with means against risks which are peculiar to such systems, e.g., computer viruses and malware. Requirements specified in IACS E22 (Rev.2) have been incorporated to the ClassNK Rules and the Rules assume that examinations and tests are carried out for each product as the principal method for approval.

Relevant requirements were amended in order to adopt approval of use as a new method for approving computer based systems according to requirements based upon UR E22 related to manufacturer quality control systems, computer based system designs, factory acceptance testing and so on so that they are compatible with the current method.



Guidelines Released in 2018

Guidelines for Direct Load Analysis and Strength Assessment

These guidelines incorporate the load and structural consistent analysis structural evaluation method. As vessels being constructed today continue increasing in size, structural strength assessments during the design stage are essential in helping ensure the safety and integrity of hull structures even in the harshest conditions of the ocean.

Direct strength calculations in structural strength assessments of hulls are one of the class requirements included in both ClassNK's "Rules and Guidance for the Survey and Construction of Steel Ships" and the IACS CSR. Simplified formulae, which calculate loads according to principle ship particulars and loading conditions, are used to carry out structural strength assessments. However, these simplified formulae were developed to cover load conditions estimated from actual ships, and have not yet been evaluated for increased sizes and configurations of vessels not yet constructed. Therefore in some cases, structural strength assessment that takes the loads of each individual vessel characteristics into account is essential.



Structural strength assessment methods based on "load and structural consistent analysis" take the influence of waves at sea into consideration when directly estimating loads, and are therefore able to closely replicate actual ship conditions. As a result, shipyards and design companies are widely implementing these assessment methods.

Guidelines for the Mandatory Code on Noise Levels on Board Ships (Third Edition)

ClassNK constantly updates its guidelines for the ship noise code enforced by the SOLAS amendments based on general noise prevention, representative Q&A's, collaborative research results, and IMO discussions. The 3rd edition outlines experiences with noise prevention acquired through collaborative research, the development of the simple SEA method for measuring ship noise, and examples of initiatives for improving the accuracy of ship ventilation noise measurements.



Guidelines for Use of Drones in Class Surveys

Guidelines for Concept Design of Automated Operation/Autonomous Operation of ships

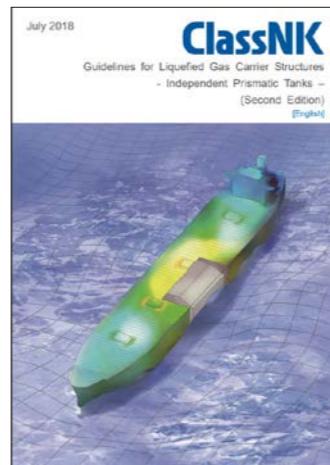
For these guidelines please refer to "R&D (p. 19-20)".



Guidelines for Liquefied Gas Carrier Structures –Independent Prismatic Tanks – (First Edition, Second Edition)

The two components of the Guidelines include the Guidelines for Direct Strength Analysis, and the Guidelines for Fatigue Strength Assessment.

The Guidelines for Fatigue Strength Assessment released in the 2nd edition outline strength assessment methods against fatigue cracks caused to vessels by prolonged and repeated loads. By implementing fatigue strength assessment methods that follow the guidelines, it becomes possible to carry out more reasonable fatigue designs for primary members of not only hull structures, but also of independent cargo tank structures and their support structures.



types. As its next step, ClassNK has decided to develop its own set of technical requirements related to strength assessments for bottom structures and fatigue strength assessments due to racking deformation.

As the development of technology requirements for strength assessments completed in 2018, ClassNK has included the latest knowledge acquired through R&D into the guidelines and renamed them as "Guidelines for Vehicles Carrier Structures". The guidelines consist of "Guidelines for Direct Strength Analysis" which specify requirements related to the use of direct strength analysis to evaluate the structural arrangements and scantlings of the primary structural members of bottom structures in cargo hold areas, as well as "Guidelines for Racking Strength Assessment—Evaluation of Yielding Strength—" which outline requirements related to the use of direct strength analysis to evaluate the structural arrangements and scantlings of primary support members that support racking deformation in cargo hold areas.

Guidelines for Exhaust Gas Cleaning Systems (Ver. 3)

In addition to interpretations of updated IMO guidelines, the 3rd edition of the Guidelines incorporates standards for installation of exhaust gas cleaning systems (EGCS) based on findings of joint research projects which included trial testing of EGCS on actual ships and design trials. The Guidelines also include requirements for obtaining class notations signifying that a ship fulfills requirements for the installation and preparation of EGCS. In 2018, in addition to amendments in the appendix for classification notation, information on regional regulations was also added to the content of the guidelines.



Guidelines for Vehicles Carrier Structures

Vehicles carriers are designed with a minimum number of transverse bulkheads and partial bulkheads in order to increase cargo handling efficiency as well as to permit more vehicles to be loaded on board; this, however, means that the structures of such ships are fairly susceptible to racking deformation. In recent years, new types of vehicles carriers, such as post-panamax and bulkheadless, with structural designs different from that of a conventional vehicles carriers have been entering service in increasing numbers. In consideration of such circumstances, ClassNK released its Guidelines for Racking Strength Assessment of Vehicles Carriers—Guidelines for Evaluation of Yielding Strength—in November 2016 in order to clarify unified evaluation procedures for vehicles carriers with various structural design



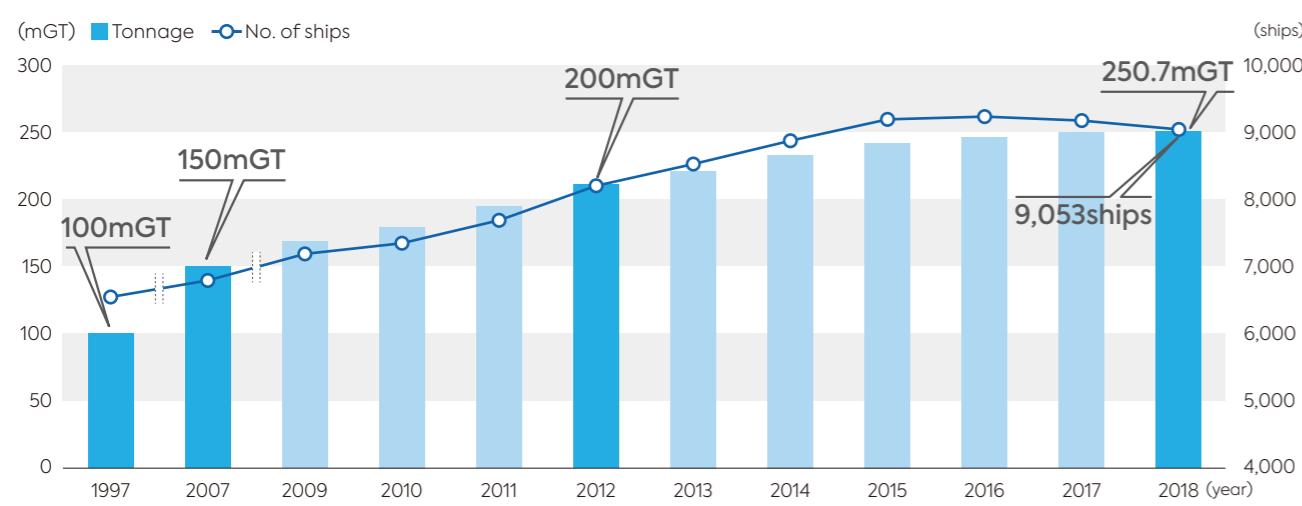


Class & Statutory Services

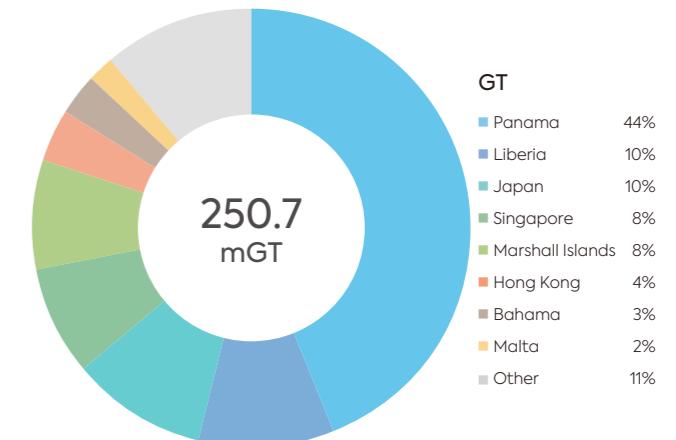
As its main business, ClassNK carries out surveys in line with classification rules and international conventions, and is dedicated to ensuring high quality and prompt technical service. In 2018, the ClassNK register surpassed 250 million gross tons for the first time.

Ships classed by ClassNK

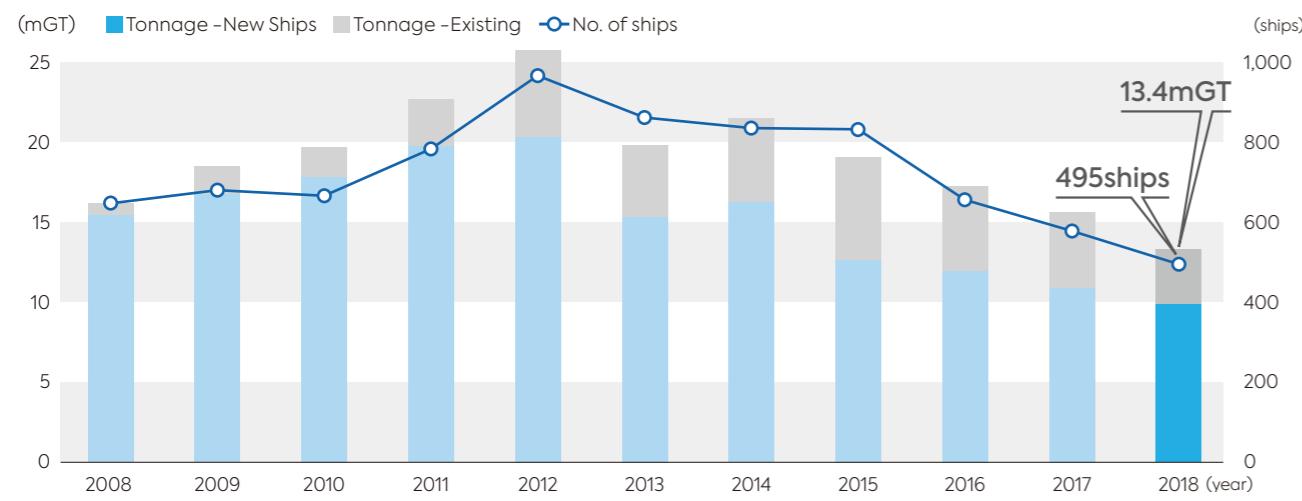
Growth in total amount of classed ships



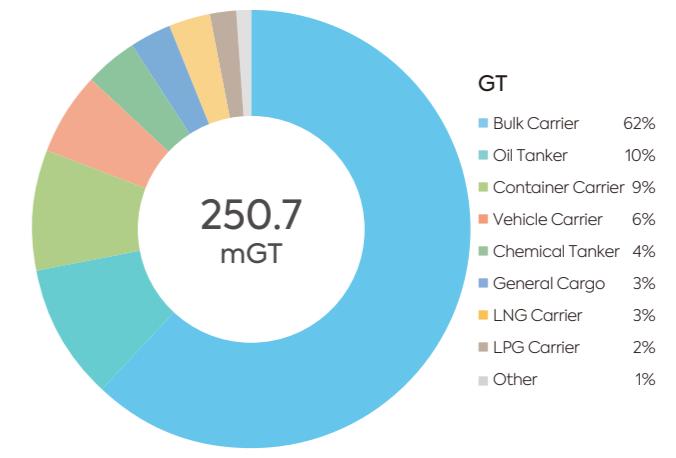
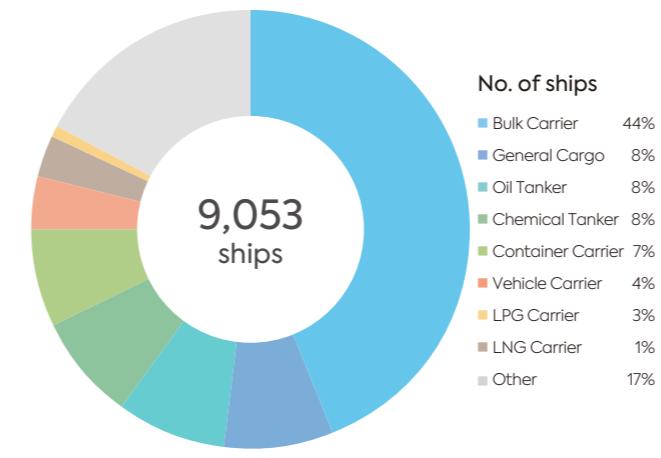
Classed Ships by Flag



Growth in newly classed ships



Classed Ships by Ship Type





Class Surveys

ClassNK carried out 495 classification surveys and 15,271 class maintenance surveys around the world.

Statutory Surveys, ISM/ISPS Audits and MLC Inspections

As of the end of 2018, ClassNK is authorized to carry out surveys and statutory services in accordance with the International Convention for the Safety of Life at Sea and the International Convention for the Prevention of Pollution from Ships by more than 100 flag administrations around the world.

Safety Management System - ISM Code

In accordance with ISM Code requirements, 31 companies and 714 ships were newly registered in 2018, and at the end of 2018 there were 733 companies and 5,862 companies registered.

Ship Security Management System - ISPS Code

In accordance with ISPS requirements, 709 ships were newly registered in 2018, and at the end of 2018 there were 5,308 ships registered.

Maritime Labor Convention - MLC

In accordance with MLC requirements, 663 ships were newly registered in 2018, and at the end of 2018 there were 5,208 ships registered.

Statutory Certificates

Authorized by various flag states, ClassNK issued the following certificates (excluding interim and short-term certificates) in 2018.

Certificate type		No. issued
SOLAS related	International Load Line	LL 3,353
	SC	2,293
	SE	7,562
	SR	3,915
	DOC	421
	SMC	2,225
	ISSC	1,024
	OTHER	1,533
MARPOL related	OPP	3,853
	NLS	66
	CHM CODE	332
	SPP	1,818
	APP	3,528
	EE	343
	GAS CODE	145
	(*) indicates total number of companies at year end.	

Certificate type	No. issued
International Ballast Water Management	BWM 332
Anti-Fouling Systems	AFS 909
Maritime Labor Convention	MLC 4,246
Tonnage	TM69 981 Suex Canal 457 Panama Canal 448
Total	39,784

Approval of manufacturers and service suppliers

ClassNK also carries out surveys and approvals for companies who provide testing and measurement services related to class and installation maintenance surveys. As part of these activities, ClassNK certified the following number of firms in 2018:

Thickness measurements on ships	23 (256)
In-water survey of ships	41 (297)
Radio inspection services	18 (387)
Voyage Data Recorders (VDR)	15 (298)
Maintenance of firefighting systems and equipment	50 (349)
Maintenance of life saving equipment and appliances	19 (164)
Tightness testing of hatches with ultrasonic equipment	4 (22)
Testing of coating systems	0 (9)
Services of lifeboats, launching appliances and on-load release gear	45 (259)
Measurements of noise level	0 (2)

Port State Control (PSC)

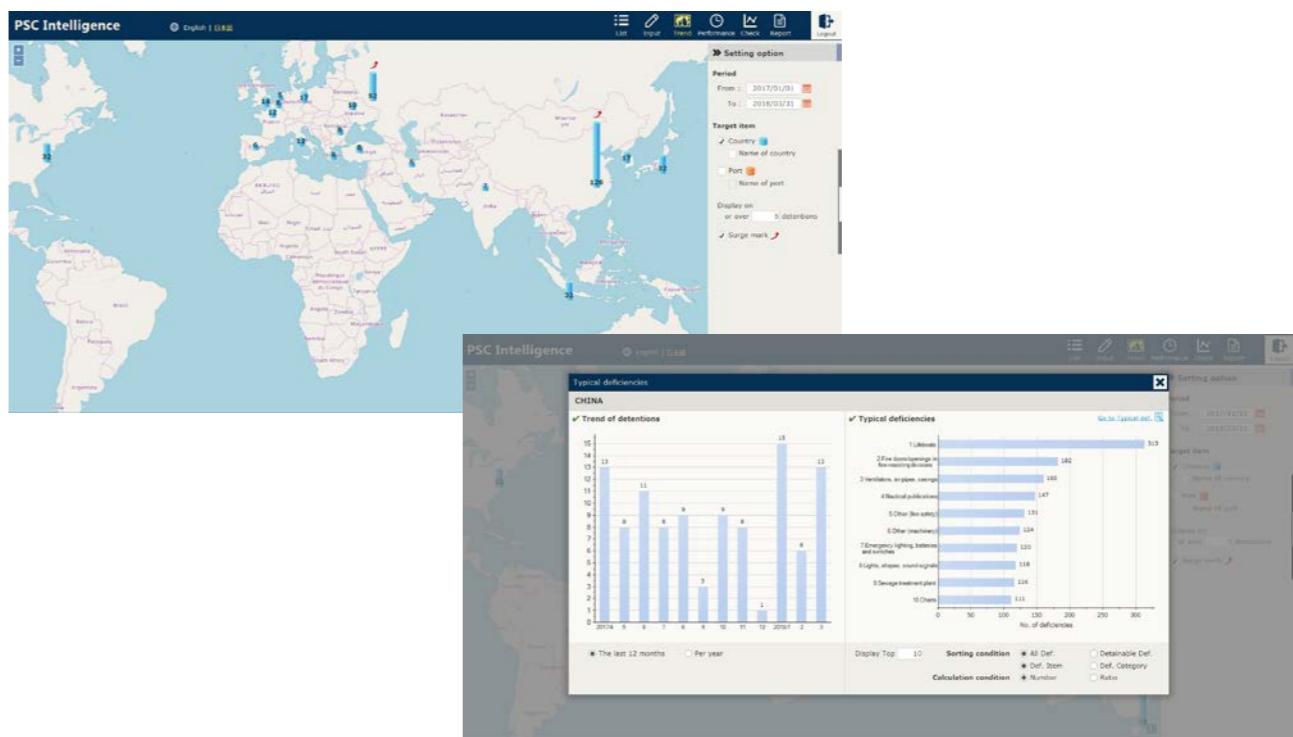
ClassNK continues to work with ship management companies of detained vessels to help improve ship conditions and increase safety awareness. ClassNK published its "Port State Control Annual Report 2018", a compilation and analysis of PSC related statistics for the previous year, and distributed it to ship owners, ship managers and other stakeholders.

In addition, ClassNK visited key PSC authorities around the world in 2018 to discuss PSC and future initiatives, including the China Maritime Safety Administration, Australian Maritime Safety Authority (AMSA), PSC Jakarta in Indonesia, United States Coast Guard (USCG) and PSC Novorossiysk in Russia.



ClassNK releases "PrimeShip-PSC Intelligence", software for improving PSC performance

ClassNK released "PrimeShip-PSC Intelligence" to assist the improvement of PSC performance of shipping companies, provided free of charge in September 2018. Based on the



database of PSC reports inputted by ship managers, shipowners, and ClassNK, the software enables users to comprehend trends of the PSC findings pointed out by each country or port, and output the tailor-made checklist in line with the trends. Furthermore, the software also provides the various functions which assist improving the ship management system of respective shipping companies as well as PSC performance, such as a function to grasp trends of the deficiencies that PSC have pointed out on managing fleet.

Other technical services

Condition Assessment Program (CAP)

During 2018, ClassNK issued Statements of Compliance to 69 vessels under its Condition Assessment Program (CAP). As of the end of 2018, the total number of Statements of Compliance issued by the Society for CAP stood at 537.

Emergency Technical Assistance Service : ETAS

ClassNK's Emergency Technical Assistance Service (ETAS) is on call 24/7 to support the owners and operators of ships registered for this service in ensuring the safety of their vessels and minimizing the environmental impact if disaster should strike. In 2018, 168 vessels newly registered for the ETAS service, bringing the total number of vessels registered for the service to 1,450. In 2018, this team was called into action for 4 incidents related to maritime casualties to provide technical support.



ClassNK Electronic Certificate System wins Technical Innovation Award at Seatrade Maritime Awards Asia 2018

ClassNK received the Technical Innovation Award at Seatrade Maritime Awards Asia 2018 held at Marina Bay Sands, of Singapore in April for developing and introducing its electronic certificate system to the industry.

ClassNK e-Certificate launched in 2017 is the world-first comprehensive electronic certificate service for classification



and statutory certificates. Based on the standards stipulated in IMO's GUIDELINES FOR THE USE OF ELECTRONIC CERTIFICATES (FAL.5/Circ.39/Rev.2) released in 2016, the system enables secure transmission of certificates from ship to shore and vice versa.

Most importantly, the system includes an online function to determine the validity of certificates and that they have not been falsified or tampered with. Currently, the use of ClassNK e-Certificate is approved by total of 40 flag states.

The Seatrade Maritime Awards Asia distinguished panel of judges awarded ClassNK with the Technical Innovation Award for the reduction of the workload on board and at shore by minimizing potential handling errors and time-loss associated with paper burden, as well as making certificate information easier to retrieve through its "ClassNK e-Certificate".

ClassNK grants AIP to NYK Line and Japan Marine United for their joint research on an LNG-fuelled 200K DWT bulk carrier design

ClassNK granted an Approval in Principle (AIP) based on its Rule Part GF which adopts IGF Code (regulation for ships using low-flashpoint fuels) to NYK Line and Japan Marine United (JMU) for their joint project on the concept design of an LNG-fueled 200K DWT bulk carrier.

The design is based on a 200K DWT bulk carrier developed by JMU. Despite its added weight due to the increased amount of equipment such as its LNG-fuelled tank and LNG fuel supply system, it provides more cargo hold capacity. By running on LNG,

in addition to reducing NOx, SOx, and PM emissions, this vessel is expected to satisfy Phase 3 (30% less than Phase 0) of the EEDI (Energy Efficient Design Index) defined by the IMO for ship GHG emissions.



Right: NYK Corporate Officer Taizo Yoshida
Center: JMU Senior Managing Officer Takayuki Sasaki
Left: ClassNK Senior Executive Vice President Toshiyuki Shigemi

ClassNK Releases "PrimeShip-GREEN/ProSTA ver.ITTC"

ClassNK released "PrimeShip-GREEN/ProSTA ver.ITTC" in November 2018. It is the world's first software that calculates and analyzes a ship's speed for Energy Efficiency Design Index (EEDI) calculation in compliance with the latest International Towing Tank Conference (ITTC) 2017 Guidelines (ITTC Recommended Procedures and Guidelines 7.5-04-01-01.1, Preparation, Conduct and Analysis of Speed/Power Trials; 2017) for EEDI verification.

ClassNK PrimeShip-GREEN/ProSTA ver.ITTC

This screenshot shows the software interface for ClassNK PrimeShip-GREEN/ProSTA ver.ITTC. The main window displays various input tables and calculated results. Key sections include:

- Date of Sea Trial:** 2015/04/12
- Hull:** Dimensions (L_{OA}, L_P, L_{BWL}, B_{imposture}, T_A, T_M, T_{F-trail}, V_{on trail}, V_{at low load}, C_B, K_{V/L}, A_M, K_S, A_W) and Wind parameters.
- Propulsion:** Seawater on trial, Air on trial, Propeller type, Shaft modulus.
- Measured or observed data during ship's speed-power trial:** Includes columns for Main engine output setting, Run number, Start time, Time elapsed, Mid time, Ship's heading, and Ship's speed over the ground.

The software interface is designed for ease of use, with tabs for InputTable, OutputTable, Figure, ResultSummary, Beaufort Scale, ITTC Dataset F2, and Flow Diagram.

MARPOL Annex VI states one parameter for calculating the EEDI of a ship's speed in calm sea conditions based on speed trial results. To eliminate the effects of external factors during a sea trial (wind, waves, current, water depth, sea temperature) and provide a way to calculate and analyze a ship's speed in calm sea conditions, the IMO assigned two methods in its Guidelines (2014 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)); those were ISO 15016:2015 and ITTC 2014 Guidelines.

However, at MEPC 73 (October 2018), the IMO Guidelines were revised to require compliance with either ISO 15016:2015 or the ITTC 2017 Guidelines.

ClassNK has provided shipyards, and the greater maritime industry with "PrimeShip-GREEN/ProSTA" as a support tool since 2015 for calculating a ship's speed in compliance with ISO 15016:2015.

To further contribute and provide technical support regarding ITTC 2017 Guidelines, ClassNK has newly developed "PrimeShip-GREEN/ProSTA ver.ITTC" which has the same user-friendly interface as the former "PrimeShip-GREEN/ProSTA" and calculates a ship's speed in accordance with ITTC 2017 Guidelines. In addition, to continue providing technical support regarding ISO 15016:2015, the Society also released "PrimeShip-GREEN/ProSTA ver.ISO" which adds more functions to the former "PrimeShip-GREEN/ProSTA".

(*1): ITTC Recommended Procedures and Guidelines 7.5-04-01-01.1, Preparation, Conduct and Analysis of Speed/Power Trials; 2017

(*2): 2014 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)



Certification Services

Utilizing its accumulated knowledge as a classification society, ClassNK provides a broad range of third-party certification services for quality, environmental, occupational health & safety, energy management systems, and maritime crew training in addition to verification for greenhouse gas (GHG) emission inventories.

Quality Management Systems - ISO 9001

In 2018, ClassNK certified a total of 23 organizations in line with ISO 9001, bringing the total number of organizations registered with the Society to 501.

Business field	Number registered
Fabric, textiles	4
Pulp, paper, paper products	1
Pharmaceuticals and textiles	4
Rubber products, plastic products	10
Concrete, cement, lime, gypsum etc.	1
Basic metal, Processed metal products	112
Machinery, equipment	100
Battery-powered/electrical equipment	38
Shipbuilding	72
Other transportation equipment	1
Construction works, civil engineering	15
Wholesale, retail	16
Shipping, storage, communications	92
Real estate	2
Engineering, R&D	23
Other specialty services	116
Crew education, training	27
Medical and social work	15
Other social/individual services	1

(*) Some may fall under multiple fields.

Environmental Management Systems - ISO 14001

In 2018, ClassNK certified a total of 2 organizations in line with ISO 14001, bringing the total number of organizations registered with the Society to 133.

Business field	Number registered
Pharmaceuticals and textiles	1
Rubber products, plastic products	1
Basic metal, Processed metal products	27
Machinery, equipment	32
Battery-powered/electrical equipment	7
Shipbuilding	27
Construction works, civil engineering	5
Shipping, storage, communications	50
Real estate	2
Other specialty services	2
Other social/individual services	2

(*) Some may fall under multiple fields.



July 2018, Registered Ocean Network Express Pte. Ltd. (ONE) ISO14001:2015 (EMS, environmental management system)
Right: Mr. Jeremy Nixon / Chief Executive Officer, ONE
Left: ClassNK CEO & President Koichi Fujiwara

Occupational Health & Safety Management Systems - OHSAS 18001/ISO45001

In 2018, ClassNK certified a total of 2 organizations in line with the management systems, bringing the total number of organizations registered with the Society to 34.

Business field	Number registered
Pharmaceuticals and textiles	1
Basic metal, Processed metal products	3
Machinery, equipment	4
Shipbuilding	13
Construction works, civil engineering	1
Shipping, storage, communications	14
Crew education, training	1

(*) Some may fall under multiple fields.

HSE (Health, Safety & Environment) Management Systems

In 2018, ClassNK certified a total of 2 organizations in line with HSE management systems, bringing the total number of organizations registered with the Society to 4.

Business field	Number registered
Shipbuilding	4

Energy Management Systems - ISO 50001

In 2018, ClassNK certified a total of 4 organizations in line with ISO 50001.

Business field	Number registered
Shipping, storage, communications	4

Maritime Education and Training

In 2018, ClassNK certified a total of 2 maritime education and training organizations and 8 courses, bringing the total number of organizations and courses registered with the Society to 42 and 145 respectively.



Maritime Labor Convention Certification for Manning Organizations

In 2018, ClassNK certified a total of 7 organizations in line with Maritime Labor Conventions for Manning organizations, bringing the total number of organizations registered with the Society to 112.

Assessment and Verification based on EU MRV

ClassNK continued to provide services to assess Monitoring Plans based on the EU MRV Regulation for fuel consumption reports. In addition, it carried out software development and formulated procedures ahead of the start of its emission report verification services.

Other Certification Services

ClassNK also provides certification services for the following fields:

- Clean Shipping Index verification
- Road Traffic Safety Management Systems (ISO 39001)
- Verification of GHG emission
- Environmental performance verification
- Clean cargo working groups verification



Renewable Energy

ClassNK provides certification and third party verification services to meet various client needs involving the increasing adoption of renewable energy. Through these services, ClassNK contributes to the formation of a sustainable, low-carbon society.

Wind power energy

ClassNK provides certification services for wind power generator manufacturers and owners in accordance with the IEC61400 series global standards for wind turbines. ClassNK's certifications are used in inspections based on Japan's "Electricity Business Act", "Ship Safety Act", and other related regulations.

Wind turbine certification

ClassNK provides certification and classification for wind power generation systems such as large and small wind turbines.

System registered	Registered in 2018	Total
Large wind turbine	1	7
Small wind turbine	0	17



Wind farm certification

ClassNK certifies the safety of wind turbines and their supporting structures in addition to their construction sites onshore or offshore. This certification is expected to be utilized for obtaining license and approval as specified in Electricity Business Act of Japan.

System registered	Registered in 2018	Total
Wind farm	22	55
Supporting structure (tower/foundation)	0	9

Floating offshore wind power generation system certification

While floating offshore wind power generation systems must comply with the Electricity Business Act of Japan, towers, floating structures, and mooring equipment must comply with the Ship Safety Law. ClassNK provides classification surveys as an organization that abides by the Ship Safety Law based on its "Guidelines for Floating Offshore Wind Power Generation Systems".



Periodical Safety Management Inspections in accordance with the Electricity Business Act

In Japan, installation personnel of wind power generation systems with an output of over 500kW must independently check the inspection status of such equipment every 3 or 6 years and get it inspected by a nationally approved safety management inspection body, as defined by the Electricity Business Law. ClassNK became a nationally approved safety management inspection body in January 2018 and now offers periodical safety management inspection services.

R&D

ClassNK has begun research (2018-2020) to establish criteria regarding the use of drones in power generation system surveys for the smooth implementation of marine wind power technology. ClassNK is carrying out experiments aimed at achieving maneuverability in strong wind and practical and efficient inspection methods with long flight times in collaboration with the National Institute of Maritime, Port and Aviation Technology.

Marine Renewable Energy Technologies

ClassNK provides a variety of certification services for marine renewable energy power generation systems that utilize wave, tidal, ocean current and ocean thermal energy including test platforms, prototype certification, project certification for verifying installation sites of power generation systems and their supporting structures, and component certification etc.

Marine Warranty Survey

A Marine Warranty Survey (MWS) is the third party surveillance of marine operations which is often requested by re-insurance underwriters in order to ensure that offshore marine operations (such as the installation and transportation of offshore sea structures, and the laying of cables etc.) are being carried out safely and reliably.

In 2018, ClassNK completed 1 MWS. We became authorized as an MWS body by another major re-insurance company, making us authorized as an MWS body by a total of 4 companies.



Human Resource Development

As human resources form the base of ClassNK's business, we strive to provide sufficient education and training for high quality and prompt service. Sharing our accumulated knowledge and experience, we contribute to providing the entire industry with human resource training.

ClassNK Academy

ClassNK Academy was established in 2009 to provide the necessary basic knowledge to those involved in the shipbuilding, maintenance and transport industries. ClassNK Academy has been held actively since then and 1463 participants in Japan and 843 overseas took part in courses in 2018.

To better address client needs, in 2018 we offered design engineer training packages that consist of group training and E-learning Courses, as well as maritime data scientist training courses as follows:

Basic ship survey package

- Classification societies and statutory issues
- Classification surveys (hull)
- Classification surveys (machinery & electrical installations)
- Materials and welding
- Basics of painting/coating

Basic Statutory package

- TM69, LL, SOLAS (SC)
- MARPOL etc.
- SOLAS (SE, SR)
- ISM, ISPS, and MLC

Ship management package

- Incident investigation & analysis
- Risk management
- Internal audits

Design engineer training package

- Structure design
- Outfitting (steel) design
- Outfitting (pipe) design
- Machinery design
- Electrical design

Worker course

- DP training course
- Coating surveyor assistant course

Maritime data scientist education lecture

- Equipment measurement data analysis
- Performance analysis based on ISO19030



ClassNK Seminar

An essential task of ClassNK is to provide the industry with technical information. To do so, we hold technical seminars around the world designed to provide the shipping/shipbuilding industry with the latest information.

The following are some of the presentations held by ClassNK at Technical Seminars in 2018.

2018 ClassNK Technical Seminar

- ClassNK initiatives with advanced structural strength analysis methods and rule development
- Use of drones in ship surveys
- IMO GHG emission reduction strategy
- Guidelines for Concept Design of Automated Operation/ Autonomous Operation of ships
- Latest trends on international conventions
- Explanation of revised rules
 - Outline of establishment, revision and abolition of rules
 - Amendments to Class Rules and Guidance for the Survey and Construction of Steel Ships
 - Engine and Electrical Installations

- Equipment
- Hull and Materials
- Recent Topics on IACS Environmental Issues/ Machinery/ Safety/Survey/Hull/Cyber systems panel
- Global Sulphur Cap from 2020 and Technical Measures
- The importance of cyber security: trends in the industry and ClassNK initiatives

Data usage and data scientists seminar

Hopes are high for data scientists who analyze big data to discover new knowledge, but the supply of these scientists is currently limited. ClassNK held a seminar in which we invited Professor Kaoru Kawamoto of the Data Science Department at Shiga University, a data scientist who represents Japan and also serves as ClassNK technical advisor, and other specialists who work in the front lines to assist with the training and hiring of data scientists in the industry.

Overseas Technical Seminars

ClassNK holds regular technical seminars around the world to provide in-depth information on incoming regulations, and introduce the latest technologies and technical findings to its clients and maritime stakeholders. The seminars aim to deliver practical information on a wide range of topics in line with the needs of each country. In 2018, seminars were held in China, Malaysia, The Philippines, Singapore, Vietnam, Hong Kong, Taiwan, USA, Thailand, Indonesia, Cyprus, Greece, India, UAE, Lebanon, Oman, Kuwait, and Egypt. The following are some of the presentations that were carried out in 2018.

- Recent Topics at IMO
- LNG Fuelled Ship - Current Situation & Activities of ClassNK
- SOx and NOx Regulations and Current Status
- Cybersecurity on Board
- Measures on PSC issues
- PrimeShip-PSC Intelligence

- Global Sulphur Cap from 2020
- Maritime Innovation using digital technology

Training for crew education and training instructors

In line with crew education and training certification, ClassNK holds training for improving the abilities of instructors involved with crew education and training. In 2018, we held training for 45 participants based on the IMO model course and issued certificates of completion.

ClassNK Data Science Camp

The first ClassNK Data Science Camp was held to contribute to the training of data scientists in the maritime industry. 20 graduate students specializing in maritime issues were provided with the opportunity to participate in data science lectures and actual data analysis projects.



Training for ClassNK Surveyors/inspectors

ClassNK implements a training program for ensuring that all surveyors and inspectors have sufficient knowledge and ability to carry out their work. In 2018, the following training sessions were held.

- Surveyor training
- Maritime Management Systems Auditor training
- Maritime Labor Inspector training
- ISO Auditor training



Service Network

138 Locations

Exclusive Survey Offices

ClassNK provides a broad range of services via its extensive worldwide survey network, with the number of exclusive survey offices totaling 132 locations around the world at the end of 2017. In addition to these offices, ClassNK also maintains six Plan Approval Centers located in the major shipbuilding regions of the world.

Plan Approval Centers

● Offices with Plan Approval Center ● Overseas Offices ● Offices in Japan

Japan	Tokyo Head Office Technical Division (Hull Department, Machinery Department, Material and Equipment Department, Technical Solutions Department)	China	Shanghai Office
Korea	Busan Office	Singapore	Singapore Office
		Turkey	Istanbul Office
		India	Mumbai Office





Corporate Governance

As a third party organization, we carry out our services from a fair and just perspective in accordance with laws and without deviation from societal norms. Additionally, we strive to contribute to the development of society through our services and to establish a fair workplace with healthy business relations.

Establishment of an Internal Control System

The Society prepares an Internal Control System in order to ensure that the director carries out duties that conform to laws and Society's Articles of Incorporation and that all other conducted business practices are appropriate. In 2018 especially, we conducted risk management for risk factors which may have a large impact on operation, and verified that remaining risks were within an acceptable range

Health, Safety and Environmental Policy (HSE)

As an international classification society providing services to ensure the safety of life and property at sea and to promote the protection of the marine environment, ClassNK considers health, safety and environment to be of the utmost importance. We have established the "Health, Safety and Environmental Policy" designed to ensure the health and safety of all employees and to protect the marine environment. In order to implement this policy effectively, we have established the Occupational Health and Safety (OH&S) Manual, began operating it in Japan in 2017, and have continued to manage and improve our occupational health and safety performance.

In 2018, we continued to promote our health and safety performance by operating the OH&S Manual in all survey offices. We provided HSE training to all staff responsible for HSE at each office, lectures on health and safety law and personal protective equipment, and safety education for the enforced safety of surveyors, and continue to inform staff about labor incidents etc.



Health, Safety & Environmental Policy

General Policy

Nippon Kaiji Kyokai (ClassNK) is committed to placing utmost priority on ensuring the health and safety at work of all employees, and managing and continually improving our health and safety performance with the overall goal of no injury and ill health. We also contribute to social development through the protection of the marine environment as an international classification society.

Strategies

To fulfill this policy, we will

- give our consideration to health, safety and environment aspects in preference to our other activities,
- comply with all applicable legislation and any other requirements we subscribe to which relate to occupational health and safety (OHS), and its own rules, statutory, regulatory requirements and the requirements of the flag administration which relate to the protection of the environment,
- conduct surveys strictly and fairly to promote the protection of the marine environment,
- utilize a systematic approach to managing health and safety to achieve continual improvement of OHS performance by establishing OHS objectives and targets and, performing regular reviews,
- promote prevention of accidents and ill health through hazard identification and risk assessment of the work and workplace,
- give all employees the right and responsibility to refuse to conduct work they consider to present an unacceptable risk,
- increase awareness and improve knowledge of all employees related to health and safety by providing adequate OHS training and/or education,
- actively support industries to promote renewable energy use,
- contribute to Joint research and development (R&D) on emissions-reduction technologies with industries and academic partners.

Koichi Fujiwara

Chairman and President, Representative Director

NIPPON KAIJI KYOKAI

1st September 2017

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