

ClassNK

MAGAZINE

June 2018 - 83rd Edition

- ◆ *Developing for digital transformation*
- ◆ *Beyond traditional Class role*
- ◆ *ClassNK R&D Roadmap*



Expanding knowledge

Welcome to the 83rd edition of the ClassNK Magazine



Learning is an ongoing, lifelong process that is crucial to the growth and success of not only each individual, but also of each industry. This is especially relevant to the maritime industry in the middle of remarkable technological transition. In order to benefit the entire industry and society as a whole, ClassNK is conducting research and development in areas such as ma-

rine environmental protection and ship design and construction.

This edition outlines our five-year R&D Roadmap established in 2017 as part of our Mid-Term Plan. The roadmap illustrates the aims and focus areas of our R&D as well as each challenge ClassNK will work on. As the roadmap portrays the commitment for our continuous contribution to the industry, ClassNK can even accelerate respective R&D projects, should circumstances require it.

Articles in this edition cover so-called digitalization and detail how ClassNK envisages the future of the maritime industry in the context of digitalization or digital transformation. We are going to proactively adopt the digitalization to our classification service to revolutionize technology use for surveys and plan approvals. Fortunately, we will be assisted by many emerging technologies like hull or machinery monitoring, remote survey tools, and digitalized design data, and we are shaping the way they will be implemented in our field.

An informative interview with Senior Corporate Officer, Director of Innovation Development Division Mr. Hirofumi Takano provides valuable insights into the topics of Big Data, Internet of Things, cyber security and more. Meanwhile, another article provides a close-up look at how we are supporting the maritime community in Greece and the surrounding area through our office in Piraeus which has recently welcomed Corporate Officer, Regional Manager of East Mediterranean Sea and North Black Sea, Mr. Seiichi Gyobu, and other skilled managers.

In the era of unprecedented technological evolution, ClassNK is accumulating and expanding its experience and expertise to utilize them for the benefit of the maritime industry.

I hope you enjoy this edition of the ClassNK Magazine.

A handwritten signature in black ink, reading "Koichi Fujiwara". The signature is fluid and cursive.

Koichi Fujiwara, President & CEO

ClassNK

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ClassNKnews

Data Collection System support

8 February 2018 - ClassNK Consulting Service Co., Ltd launched a support service for setting up a Data Collection Plan in accordance with the Fuel Consumption Reporting system IMO DCS (Data Collection System) introduced by the IMO. According to the amendments to MARPOL Annex VI that made the data collection system for fuel oil consumption of ships mandatory as of 1 March 2018, data collecting and reporting for ships of 5,000 gross tons and above engaged in international voyages will be required beginning in 2019. According to this regulation, the gathering of data relating to fuel consumption amounts and a DCP outlining reporting procedures are required to be included in Part 2 of SEEMP (Ship's Energy Efficiency Management Plan).

Direct Load and Strength guidelines

19 March 2018 - ClassNK has released its Guidelines for Direct Load Analysis and Strength Assessment of hull structure. These guidelines incorporate the load and structural consistent analysis structural evaluation method. As the size of vessels being constructed continues to increase, 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. In order to help ensure the safety of this new generation of larger and more advanced vessels, ClassNK developed guidelines for direct load analysis and direct strength assessment methods as essential elements of class requirements.

Use of drones in class surveys

9 April 2018 - ClassNK released its Guidelines for Use of Drones in Class Surveys that incorporate the applicable range and procedures for use of drones in class surveys, the technical considerations for safe operation and the requirements for drone service suppliers. ClassNK established its R&D Roadmap in September 2017, which described efforts related to drones in the item "Survey Technology Innovation," one of its Four Focus Areas of R&D. In January 2017, the Society 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.

ClassNK wins Innovation Award

26 April 2018 - ClassNK received the Technical Innovation Award at the Seatrade Maritime Awards Asia 2018 held at the Marina Bay Sands, Singapore, on 25 April. The Seatrade Maritime Awards Asia judges awarded ClassNK the Technical Innovation Award for reducing the workload on board and ashore by minimizing potential handling errors and time-losses associated with paperwork, as well as making certificate information easier to retrieve through its "ClassNK e-Certificate". Launched in 2017, ClassNK e-Certificate 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 a total of 40 flag states.



ClassNK testing drones for use in class surveys

ClassNK R&D Roadmap

An insight into the overarching research and development program driving ClassNK forward

The “Advancement in R&D Activities” was detailed as one of the basic strategies of the ClassNK Mid-Term Plan (2017-2021) established in September 2016. Based on this policy, the ClassNK R&D Roadmap was established in July 2017 to set out the Society’s long-term vision on R&D activities, as well as to define the direction of these activities.

The R&D activities of the ClassNK Roadmap 2017 are based on two foundational elements, carried out in the context of a constantly changing environment. The first relates to R&D geared towards Core Technologies* and Integrated HR Development through R&D. The second is based on the use of damage information for Major Damage Prevention.

Based on these foundational activities, ClassNK is carrying out R&D based on the following four major themes:

- Rule Development (rationalization of existing rules, increased transparency/rationalization of new rule development)
- Survey Technology Innova-

tion (revolutionizing surveys through high level ICT technologies, development of remote survey technologies and survey robots)

- Marine Environmental Protection (investigation trends in environmental regulations, developing evaluation and verification techniques for environmental protection technology)
- Revolutionary Technology Development (innovation of marine technology through digitalization, developing evaluation and verification techniques for revolutionary technologies)

ClassNK will collaborate with universities, research institutions, and the industry to execute the R&D Roadmap together with contributions from the further development of human resources. Through this R&D, ClassNK aims to achieve innovation in maritime technology using the latest IT based on its mission to help ensure the safety of life and property at sea.

From 2018 until 2022, ClassNK will carry out a full review of Rules and Guidance for the Survey and Con-

struction of Steel Ships (Part C) in relation to hull structural strength over the course of five years. R&D will be conducted in the following areas:

- Quantitative evaluation of the effect of ship handling in actual seas under structural load evaluation loads
- Building tank test benchmark data for wave load analysis code verification
- Development of rationalized fatigue strength evaluation methods
- Advancement standards for fracture toughness of ultra-thick plate welding joints and brittle crack arrest designs.

ClassNK is also carrying out R&D into hull structural strength evaluations based on the reliability of methods as part of its efforts to take forward Goal Based Standards (GBS) in the IACS Common Structural Rules (CSR).

In the meantime, high level information and communication technologies such as IoT, Big Data and AI are advancing at a rapid pace.

ClassNK will utilize these technologies in the survey process to offer an even higher level of quality and rationality. Developments will focus specifically on:

- Investigation into the application of drone technology in vessel surveys
- Development of remote survey technologies
- Development of survey drones
- Advanced vessel surveys utilizing ICT (development of integrated survey system)

Guidelines for the use of drones in vessel surveys have already been released.

Considering the incoming SOx emission regulations in 2020, an investigation into the development and application of analysis methods for the combustibility of low sulphur fuels and a mechanism to prevent combustibility deterioration will also be carried out, with the results compiled into a new set of guidelines. ClassNK will act as an independent verifier for the performance evaluations and verification methods for the "Performance Evaluation Project for Ships in Actual Seas", a joint maritime cluster research project.

Also as part of the ClassNK Roadmap, we are advancing with the development and provision of revolutionary technical services through the application of digital technology and other information and communication technologies, specifically:

- Digitalization (including data collection and copy) of design/construction, and related technical services
- Digitalization (including data collection and copy) of operations, maintenance/management, surveys, and related technical services
- Development of technical services for vessel Big Data utilizing IoS



ClassNK's subsidiary Ship Data Center Co. Ltd. will be used as a hub for Internet of Ships (IoS), providing an open platform as a foundation for the industry's vessels data. This is one example of our contribution to innovation in maritime technology.

With respect to autonomous and automated vessel technology, ClassNK will establish technical requirements for each level of automation and autonomy and plans to release relevant guidelines in May 2018.

In addition, ClassNK's R&D Roadmap looks beyond surface shipping, for example taking in investigative

research on foundational technology and developing safety evaluation technology for seafloor resources such as methane hydrate and hydrothermal deposits.

In summary, through its R&D activities, ClassNK strives to fulfill its obligations as a classification society to help ensure ship safety and protect the marine environment, as well as provide an even greater level of service to the industry.

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

Beyond traditional Class role

Interview: Mr. Takano, Senior Corporate Officer, Director of Innovation Development Division

Can you give a brief overview of your career with ClassNK, in different departments and functions?

In 1980, after my graduation from the School of Engineering of Osaka University, I joined ClassNK as a ship surveyor. In my 38 years with ClassNK, I have had the opportunity to work in various technical and managerial roles around the globe.

Personal highlights in my career at ClassNK prior to my current role are perhaps as the General Manager of the Istanbul Office from 1999 to 2002 where we established a hub for drawing approval activities close to our clients in southern Turkey and southern Europe. Then I took the role of General Manager in some

departments of the Head Office, including the Material and Equipment Department, the Practical R&D Promotion Division, and the Renewable Energy Department.

One of my recent roles worth mentioning is that of General Manager of the Renewable Energy Department. ClassNK has established unique expertise, especially in the innovative floating offshore wind sector to help our clients manage complex technical risks in this market.

From 2016, I have carried the responsibility of Director for the Innovation Development Division of ClassNK and assumed my current position in March of 2018.

Can you offer a summary of your role?

Our division is responsible for creating and expanding services which go beyond the traditional ship classification needs of our clients. Such services relate, for example, to digitalization in the maritime industry and to the certification of innovative technologies and management systems.

Being in charge of this division, it is also my responsibility to maintain close customer relationships and to ensure that our teams are highly motivated, well qualified, hard-working, open-minded and focused on the current and future needs of our customers.



One of the main trends in the industry today is digitalization. In this regard, we help the maritime industry maximize profitability and explore new business models by offering digital solutions and giving guidance on cyber security. ClassNK's "Ship Data Center" (ShipDC), for example – the first safe data platform for the maritime industry – is a solution that offers companies the ability to safely store and manage their data and make it available to authorized stakeholders.

Another trend which we respond to with dedicated services in our division is the increasing need to use environmentally-friendly technologies and systems. In response to climate change regulations we help maritime companies reach compliance with new requirements, such as EU-MRV, IMO-DCS, Ballast Water Management Systems, etc. I am also responsible for the organizational unit for Renewable Energy Certification which focuses on certifying compliance with floating offshore wind, wave, tidal and ocean energy technologies based on the highest industry standards. Furthermore, we also handle the certification process for energy efficient products, such as LED lights for ports.

ClassNK has previously stated that Big Data will play a big role in the future of shipping. When do you

think the industry can expect to reap the rewards of Big Data?

For us at ClassNK, collecting large amounts of data and making sense of it for the benefit of our clients has been a core process since our society was established more than a century ago. We have been collecting data to develop and to improve our industry leading technical rules and procedures, focusing on the safety and reliability of shipping. As times change, the means for collecting and analyzing data have changed and potential benefits have increased. That's why ClassNK established the ShipDC subsidiary in 2015.

Soon after, I observed a change in the mind-set of maritime leaders, especially amongst ship owners and ship operators, about the value which data collected from ships can provide to their organizations. Ships are now more often equipped with sensors which measure and transmit data and parameters from machinery and the vessel in real time. This data can be made valuable by applying intelligent analytics and drawing conclusions in order to optimize voyages and the efficiency of ships.

Keeping the trends of the industry in mind, ShipDC has served as the back bone for Big Data analytics. ShipDC users will be able to make

their data available to various stakeholders, such as shipping companies, shipbuilders, manufacturers, service providers and insurance companies. Without a common platform like ShipDC, multiple interfaces and exchanges could potentially be necessary to achieve the same results, while having to make comparably higher investments and being exposed to a potentially higher cyber security risk.

The usage of Big Data in shipping companies, e.g. for the optimization of voyages, condition monitoring, predictive maintenance and operational efficiency of machinery equipment on-board, is more commonly seen in recent months and years. The pace of digitalization in the industry is increasing rapidly along with the amount of data which is available for analytics and decision making.

Practical usage of Big Data as mentioned above has already begun. I believe the next five years will completely change the way we work and that digitalization will be the game changer!

You have referred to maritime IoT as Internet of Ships, IoS. Could you briefly describe IoS and its benefits?

While IoT (Internet of Things) is the network of physical devices which



Mr. Takano, Director of Innovation Development Division, ClassNK

Collecting large amounts of data and making sense of it for the benefit of our clients has been a core process since our society was established more than a century ago

enables us to connect and exchange data, I see IoS in a broader sense as the network of “things” on a ship, referring to connected materials, components and equipment on board, *and* as the network between ships and shore.

With IoS, ship owners can monitor the status of a vessel in real time in any location and apply analytics to historical and current data, to improve their decision-making and enable their vessels to run more efficiently.

IoS allows ships to generate more meaningful data, as well as connect and exchange data onshore. Enablers for IoS are intelligently applied sensors on board, generalized

satellite communication and improvements in telecommunication technologies which overall make the collection and exchange of data significantly easier and cheaper compared to previous years.

The benefits of the IoS can depend on how the data is managed and used by organizations. In general, with more meaningful data available and faster data transmission between the stakeholders of a vessel, decision-making ashore and onboard a vessel can be improved and thus made more effective. The task is to monitor all parameters relevant to the performance of a vessel in which early detection of events allows better decisions to be made and costs to be reduced or avoided.

By applying artificial intelligence and machine learning technologies to Big Data, potential benefits will increase further.

To make sense of the data, companies may need to involve experts and service suppliers. The question of how to make data efficiently available while keeping it safe and secure from cyber-attacks then arises. With ShipDC, we offer a safe platform for the industry to cope with this challenge.

With the introduction of internet and satellite broadband on ships, cyber security has become ever more important. What is ClassNK doing to help the industry mitigate its risk?

ClassNK has a unique position and responsibility to help the industry transition into the more digitalized and beneficial future

The risk of cyberattacks is high and is a relevant threat for the industry. The relevance of this topic will increase in the future as more and more organizations start to walk the path of digitalization.

ClassNK responds in many ways to the increasing need for cyber security in the maritime sector. Several years ago we initiated a research campaign together with specialized institutes and leading cyber security organizations to better understand the current and evolving maritime specific cyber threats. Such a campaign is currently ongoing.

We established, for example, collaboration with the United States Maritime Resource Center (USMRC) and have identified maritime-specific cyber threats and derived implications for safe and secure data exchange. The results were used for the development of our digitalized services and for guidance which we offer to our clients.

The aim of our research is to develop a cutting-edge system that pushes the industry forward and to consistently improve it. It is for these reasons that the solutions we provide can be used with absolute confidence.

Helping our clients protect themselves from cyber security risks, we assist with advice and guidelines on cyber security, with software like the ClassNK-NAPA Green solution and with special services as provided by ShipDC for example. ShipDC consists of a secured shipping operations database and has been especially built to keep data safe and secure.

You have also been active as the head of ClassNK's Ship Recycling Team. What current activities are you overseeing and does anything tie in with ClassNK's digitalization strategy?

Preparing for the coming enforcement of the Hong Kong Convention and the EU Ship Recycling Regu-

lation, ClassNK follows a policy to provide all necessary services to our clients along the entire life cycle of a ship. Based on this "from the cradle to the grave approach" we developed several solutions to support both ship recycling yards and ship-owners, covering for example, the development of Inventory of Hazardous Materials (IHM), Ship Recycling Facility Plans (SRFP), and Ship Recycling Plans (SRP). And yes, such services are linked with ClassNK's digitalization strategy.

ClassNK has been closely involved with relevant work groups at the IMO and has contributed to their initiatives. When regulations were set forth, it became necessary for our clients to transmit the necessary information for ship recycling through the use of standardized forms, Material Declarations (MD) & Supplier Declarations of Conformity. We realized that the process of information transfer for our clients was complicated and should be simplified. Ships consist



of thousands of products, which makes cataloging the material by hand and based on paper a very time-consuming task, with a higher risk of mistakes. The shipbuilder has to request the MD from hundreds of suppliers and monitor its collection status. Further, if the product contains hazardous materials, its location onboard and calculated mass by each location should be recorded to the IHM. The whole process of information gathering was not only long, but was also complicated.

To make this process more efficient to our clients, we developed a cloud-based software solution, called "PrimeShip-GREEN/SRM", enabling shipbuilders to collect MDs from suppliers electronically and generate the IHM simply by entering the product location. A steep increase in the number of clients who now want to use the software for preparing IHM for their ships is confirmation to us that our solution adds value to their organizations.

PrimeShip-GREEN/SRM became the "de facto" standard solution in the maritime industry for IHM development and maintenance.

Is there anything else that you would like to add?

Big Data has been called "the oil of 21st century" to emphasize the immense, untapped value it has. We are now in a digital economy where the value of data is higher than it ever was before. The maritime industry is rapidly waking up to the new digital age and it is an exciting responsibility for everyone who takes a role in shaping this new future of the industry.

Progress is being seen in the industry on data collection, condition-based maintenance, data analytics, forecasting, artificial intelligence and autonomous shipping, and I expect that this progress will accelerate quickly in the coming years. In this environment, I consider it to be strategically relevant for maritime lead-

ers to proactively shape the digital future of their organizations.

ClassNK, being one of the leading classification societies, has a unique position and responsibility to help the industry transition into the more digitalized and beneficial future.

While digitalization and new technologies will transform the way we work, the core of our work remains the same as it has always been, ever since ClassNK was established in 1899 which involves "contributing 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".

We need to realize that the transition to digitalization is inevitable. This transformation should be made as smooth as possible. Adapting to the change will be the key for success!

Developing for digital transformation

An introduction to ClassNK's aims as a classification society in the era of digitalization

On land, industrial internet consortiums and groups such as Germany's 'Industrie4.0' are leading the charge in improving the productivity of the Internet of Things (IoT) and spurring innovation, but digitalization is also having a dramatic impact on the maritime industry.

In terms of onboard vessel equipment, ICT technology such as shipboard networks and internet connectivity through satellite broadband are now the common standard. We are also seeing initiatives overlapping from other industries, such as the partnership between the maritime industry and other sectors.

In Japan, the i-Shipping initiative promoted by the Ministry of Land, Infrastructure, Transport and Tourism is the driving force behind the maritime productivity revolution, bringing about the creation of innovation and improvement of productivity in all phases of vessel design, construction, and operation. Meanwhile, the advancement of digitalization based on the Cyber Physical System(CPS) concept is strongly promoted by the Ministry of Economy, Trade and Industry's IoT advancement consortium, and by Society 5.0 via the Cabinet Office.

Taking a broad view, the economic growth driven by industrialization has seen a continuing shift from manual labor to more automated processes, with the overall effect

being more goods produced with less man power. With the further advancement of robotics and other high level ICT, new areas have become subject to the same trends, and one result has been a rise in productivity.

However, the medical, agricultural and financial industries, as well as areas such as management, education, and distribution/transportation still rely heavily on human resources, and this is also the case with the maritime industry. From the era when shipyards started to calculate and analyze strength using computers, ClassNK progressively introduced computers to undertake technical calculations and employed them as a classification database tool to manage classification vessels, in an effort to improve productivity and stay ahead of the curve.

In recent years, ClassNK has aimed not just at improving the productivity of our operations, but also at supporting our clients through the development of new software and services. The most recent major software and services developed from these efforts are as follows.

- **H-CSR software:** The world's first powerful advanced calculation software package for use with the IACS Common Structural Rules for Bulk Carriers and Oil Tankers (CSR BC & OT)
- **Hull Maintenance:** A specially designed information service created to organize and categorize information collected from classification surveys to provide owners and managers with hull maintenance information for individual ships.

In recent years, we have aimed not just at improving the productivity of our operations, but also at supporting our clients through the development of new software and services



- **Condition Based Maintenance:** “ClassNK CMAXS” analyzes ship data from onboard sensors using sophisticated algorithms to monitor ship machinery conditions
- **GBS-SCF onshore data center:** “ClassNK Archive Center (NKAC)” is the maritime industry’s first onshore digital archive center that fully complies with IMO Goal-Based Standards (GBS) and the related Industry Standard
- **Online solution for EU-MRV:** Service which helps lower costs associated with creating the Emission Reports (ER) required by the EU MRV regulations
- **Inventory of Hazardous Materials:** Service for smooth development and maintenance of the IHM, the list of the amount and location of hazardous substances onboard vessels
- **Electronic Certificate:** World’s first class-developed service to issue and provide Full-term (Final) certificate(s) of Class/Installations Registration and each Statutory with Secured Electronic file (PDF) in place of traditional paper certificates
- **Voyage Optimization:** A total solution for planning, monitoring and follow-up of ship operations, helping its users to realize operational savings through increased awareness, trim and voyage optimization and performance analysis
- **Big Data Platform:** ClassNK subsidiary “Ship Data Center Co., Ltd.” was established to provide a secure platform through which ship-related Big Data can be fully utilized

ClassNK has been proactive in developing leading-edge services in line with advances in ICT. However, to keep up with the rapid progress of digitalization in the industry, ClassNK has developed a vision for digitalization based on experience to date, the current technology landscape and expectations concerning future developments.

Even looking conservatively at the speed of digitalization, it is easy to see how we could become a “data-utilizing” world. The shift towards this has already begun with policies such as the CPS in place.

We have entered an era where we can bring about even greater innovation through IoT, Big Data analysis, and AI, and by cooperating or collaborating with third-parties when necessary. The result of this innovation will almost certainly contribute to improved productivity and enhanced industrial infrastructure leading to higher resilience and competitiveness.

ClassNK is no exception to this. Using digitalization, we have been able to transform generally applied rules for the construction of steel ships as well as survey schemes into even more rational rules and survey requirements for individual ships as part of our aim to provide higher levels of safety and productivity. We are now in an era where we must think “digital first” and proceed with new survey schemes, rule development and innovative technical services.

For this reason, ClassNK decided to establish a foundation for utilizing ship data, in the shape of the Ship Data Center, running a database for operational data from ships such as hull monitoring and equipment condition monitoring.

- Ship Data Center Co. Ltd. is an independently operated database for Internet of Ships (IoS) initiatives
- Data entry and retrieval tests are carried out as a member of Japan Ship Machinery and Equipment Association (JSMEA) Smart Navigation Research Team (Design Testing Working Group)
- Processes are compatible with proposed standards of ISO19847 (Onboard Server Standard) ISO19848 (Data Standard)

The Society plans to innovate in its survey schemes by utilizing digitalization, remote inspection technology, inspection robot and others.

Current survey schemes are based on actual “greatest common divisor” surveys (survey items, survey intervals, etc.), and from the viewpoint of implementing the appropriate inspection according to the state of each ship. There is also a problem of diversification in examination items and massification of information examined due to segmentation.

Responding to these issues, ClassNK is aiming to develop a revolutionary survey scheme by using ICT, data analysis, AI, and other advanced technology.

For example, real-time condition monitoring and evaluations of ships in service may enable risk-based surveys depending on the condition of individual ships.

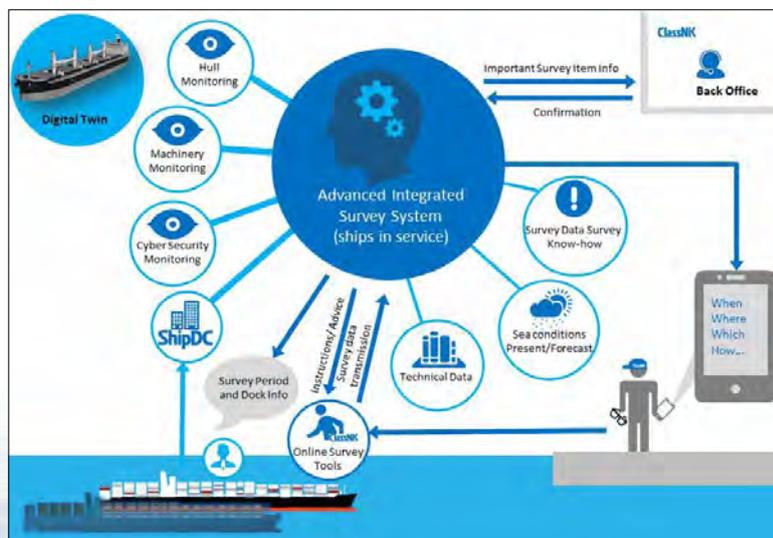


Fig. 1 Advanced Technical Services for Ships in Operation

Fig. 1 illustrates the implementation and advancement of elemental technology, and the shape of future survey technology based on monitoring data. The system will designate not only the necessary survey items for each ship, but also identify focal points automatically according to the specified risk.

Now let's consider aspects where further digitalization offers tangible benefits. Hull monitoring using sensors such as strain gauges

fitted in vessels is now common practice. Meanwhile, it may also be possible to ascertain the hull conditions of individual ships using minimal numbers of sensors in combination with stowage information, wave data and integrated load/structural analyses. Hull conditions can also be monitored in real-time onshore if there is a viable connection.

By monitoring the hull condition, users can identify structural components with the higher risk of each individual ship and carry out preventative maintenance to lower the risk of damage. Together with already widely available voyage monitoring, owners and operators will be able to perform a whole new level of hull monitoring with minimal additional investment.

Again, as already acknowledged, ClassNK offers ClassNK-CMAXS, an innovative machinery condition monitoring service. Already installed on ships in operation, the industry has begun to see the advantages of the preventative maintenance service in helping to extend machinery lifecycles.

By constructing a model of dependence from the correlation between values measured, it is possible to judge to what extent the measured value deviates from the normal state (deep learning), detecting and acting on that signal before the condition gets worse. This realizes the preventive maintenance and avoids secondary damage.

Meanwhile, the application of remote survey tools and survey robots not only increases the safety of surveys; it improves their efficiency. For example, drones can be used in confined spaces or high areas, making preparations such as scaffolding and filling survey areas with water unnecessary. To facilitate its utilization, ClassNK released “Guidelines for Use of Drones in Class Surveys” in April 2018.

ICT tools such as optical head mounted displays and wearable terminals allow users to see and communicate in real-time, which can be used to carry out surveys and offer technical support quickly and efficiently. This is especially useful in emergencies where trouble or an accident has occurred. It will also be useful as a data collection tool by enabling data to be collected from places where fixed sensors are difficult to reach or not present.

For survey technology during construction of newbuildings, Fig. 2 shows the prospects of the use of digitalization.

Analyzing and utilizing various types of Big Data (plans and drawings, previous construction data, construction process, operational data, etc.) helps the development of rational survey technology.

Together with the rule conformity judgment on digitalized design data, those technologies will contribute greatly to the productivity revolution and quality improvement at shipyards.

A closer look at design/construction, maintenance/management and operations indicates that attention is both necessary and beneficial in other areas.

For example, cyber risk management will now be covered during

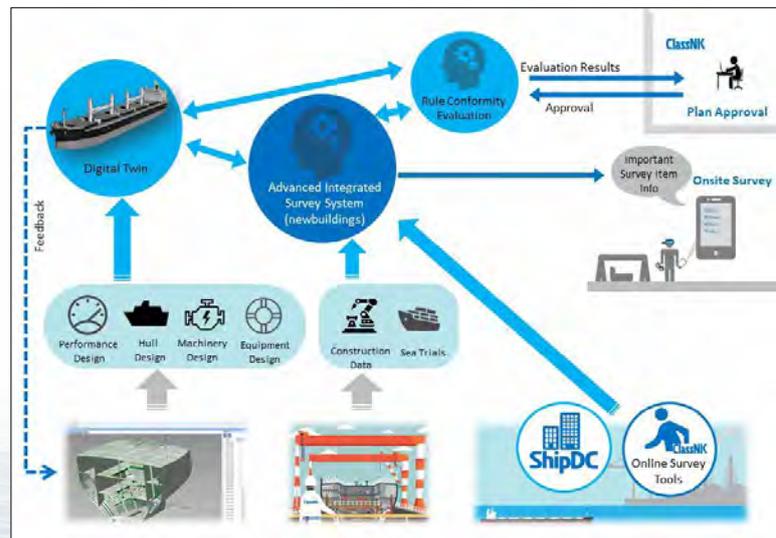


Fig. 2 Advanced Technical Services for Newbuildings



Fig. 3 Digital Twin

Document of Compliance (DOC) audits, according to IMO MSC98.

Measures against cyber risk will be required in line with the increasing uptake of onboard LAN systems and satellite broadband connections. This is especially the case for “connected ships”, so-called for their constant internet connection, which requires the same level of security to be in place as on shore.

Generally, by monitoring both external transmissions and onboard LAN systems, security risk can be greatly reduced. However, this is difficult to complete onboard and specialist knowledge is required even on shore. This is an area that can directly benefit from digitalization, where if an onshore facility was established to carry out cyber security monitoring, risk management would become a much simpler process.

A “digital twin” is a digital reproduction of products and facilities which can simulate the movement and operational conditions of, and make predictions about, that asset (Fig. 3).

A “digital twin” is a digital reproduction of products and facilities which can simulate the movement and operational conditions of, and make predictions about, that asset

“Digital ship” of 3D models can be created based on the actual ship and added equipment and survey information as well.

This would allow users to consolidate design, construction, and operational data throughout the life of each individual ship which, when reproduced in 3D models greatly expands the possibilities for new innovative technologies. Outcomes would include the ability to:

- Share visualizations of vessel information through vessel/onshore transmissions in real time
- Create individual vessel maintenance/survey records for rational and efficient inspections and surveys
- Analyze at a high level based on operational data/ feedback for design and construction

- Provide continuous vessel condition monitoring/ accident and problem prevention

ClassNK also aims to carry out its plan approval directly on 3D or 2D CAD data, without having to refer to printed vessel drawings, in line with structural and installation requirements of the rules.

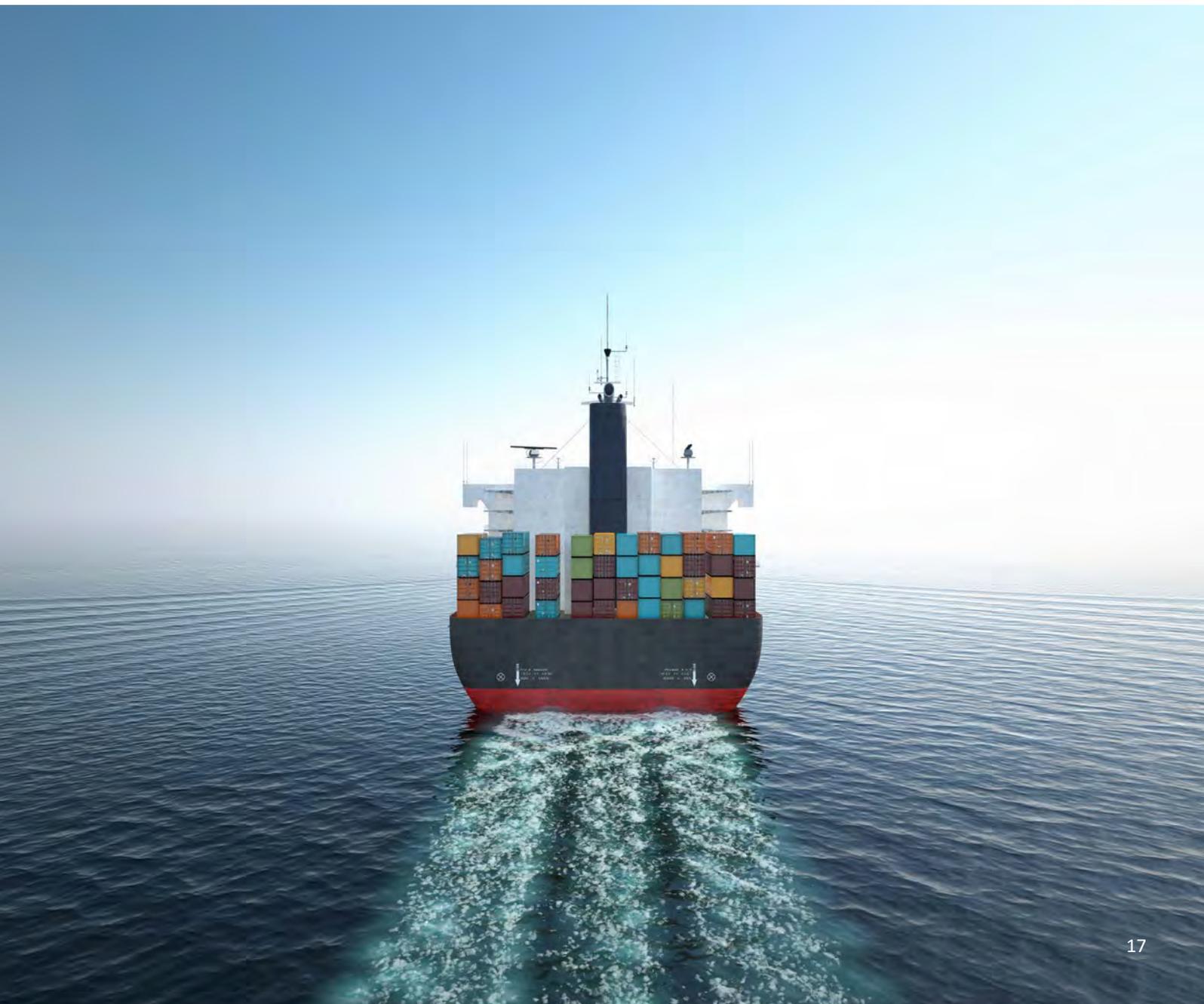
Using structural calculations employed by PrimeShip-HULL and others, for example, ClassNK is in the process of developing a system that can automatically carry out structural analyses of 3D models created from CAD data to determine rule

conformity. In addition, CAD ancillary data could be utilized when evaluating installation requirements. This means that plans could be approved electronically rather than by referring to printed drawings and plans, which would greatly improve the speed and efficiency of the plan approval service.

ClassNK is advancing the database of the rules that form the basis of these initiatives and is considering the use of a Q&A system capable of responding in natural language which combines the digitalized rules and AI. Furthermore, development is being promoted to provide digital

services such as creating a guide that extracts applicable requirements by specifying the type of ship, date of application, and others.

With every possibility that design proposals will be forthcoming that follow from various concepts for automated/autonomous ships, to carry out concept approvals (Approval in Principle), ClassNK is also carrying out investigative research aimed at the creation of functional requirements for automated and autonomous ship safety. ClassNK is also actively participating in the following three Research Groups (RG) of the Autonomous Marine Trans-



port System Research Committee (Secretariat: Japan Ship Technology Research Association)

- RG-1 Research on Business Model for Autonomous Seaborne Transportation Systems
- RG-2 Research on Development of Technical Concepts for Autonomous Seaborne Transportation Systems (Joint Research with Ministry of Land, Infrastructure, Transport and Tourism, Japan)
- RG-3 Research into Development/Implementation of Systems for Procedures for Automatic Ships

Specifically, ClassNK is going to issue guidelines on automated/autonomous operations, which formulate functional requirements for each level of automation/autonomy, formulate design approval procedures, and perform automated and autonomous ship risk assessments.



ClassNK strives to achieve a higher level of safety and productivity in shipbuilding through the digital innovation of maritime technology

Additional information

Terminology relating to digitalization is listed below for additional reference.

IoT (Internet of Things)

A structure in which various “things” connect to the internet and become mutually controlled through the exchange of information. IoT refers not only to things, but to people and data connected to the internet. It is an internet reform of “everything” included in IoT. Distinguishing itself from the general IoT, Ship Data Center Co., Ltd. replaces the “things” portion with “ships” and conducts system building of the data flow market as an Internet of Ships(IoS).

Big Data

A giant data group that is difficult to record, store, and analyze with traditional database management systems. It does not have a precise definition, and is a marketing term frequently used among information system companies. In many cases, Big Data does not only refer to a large amount of data, but often to something which contains various types of nonstructural/atypical data, forming and getting recorded live at a daily rate. By recording, storing, and instantly analyzing data

groups which would have previously been lost, it is considered beneficial to business and society by creating new structures and systems which were once unimaginable.

AI (Artificial Intelligence)

AI refers to a software or system that imitates the mental work of the human brain on a computer. Specifically, this includes computer programs which comprehend natural human language, perform logical reasoning and learn from experience. Examples of the uses of AI include expert

The word digitalization is sometimes used quite freely, although internationally its definition breaks down into a three-stage process, shown in Fig. 4.

By realizing continuous digitization, ClassNK will work to revolutionize survey technology, advance technical services, and strive to become

“digital first”, all to achieve a higher level of safety and productivity in shipbuilding through the digital innovation of maritime technology.

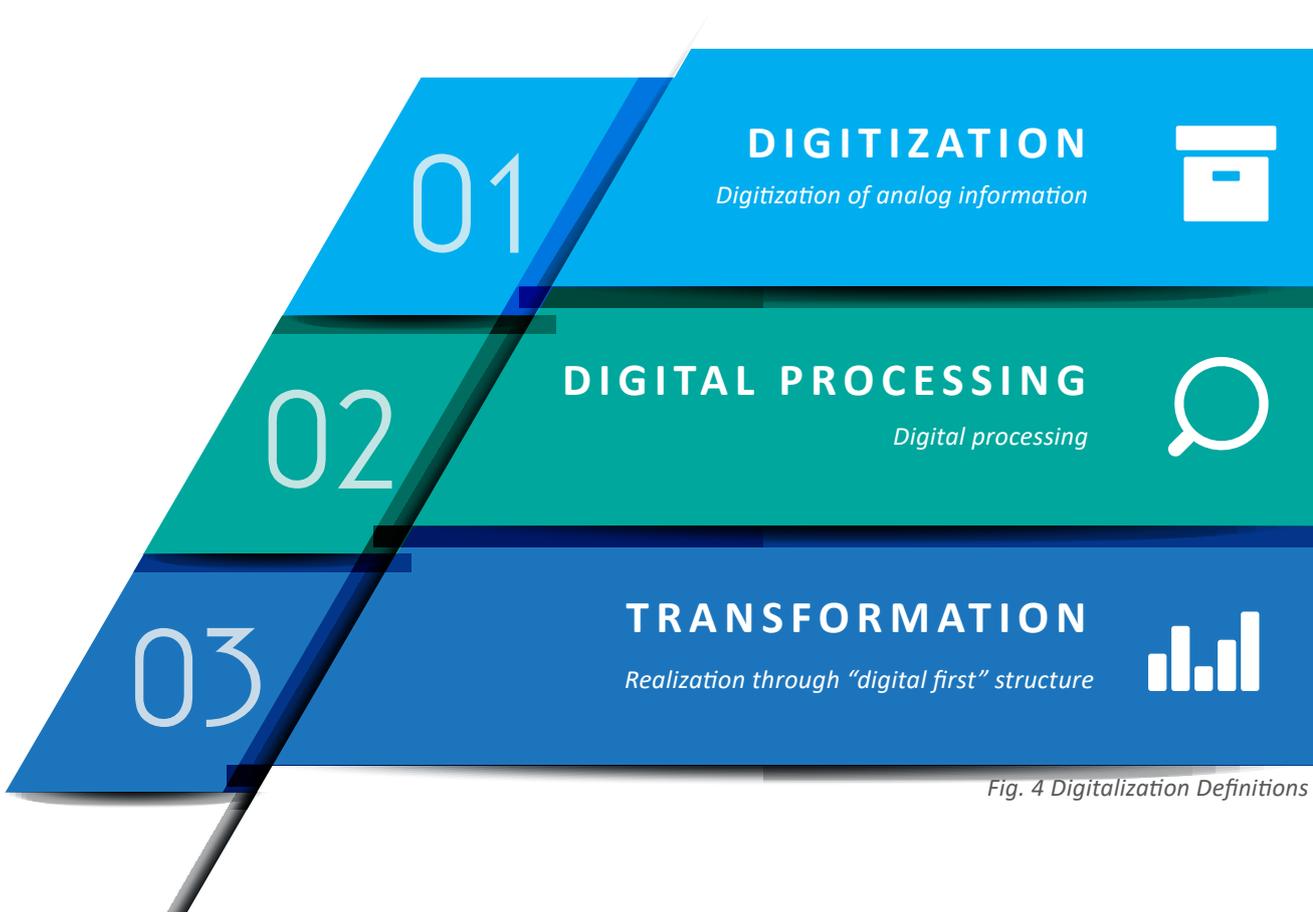


Fig. 4 Digitalization Definitions

systems which imitate the problem-solving methods of specialists, machine systems which automatically perform translation, systems which comprehend images and sound, and speech recognition systems.

Cyber Physical System (CPS)

CPS refers to the idea of improving physical systems with computing power by closely linking the high computing ability of cyber space (Cyber System) and the real world (Physical System) through sensor networks.

Industrie4.0

The High-Tech Strategy 2020 Action Plan which the German

government has been promoting since 2011. Many companies and organizations of industry, government and academia including Germany’s major firms are involved. It strives for the realization of a “smart factory” using CPS.

Society 5.0

“Realization of Society 5.0 through Connected Industries” was presented as the top priority among other strategic policies of the Japan’s Ministry of Economy, Trade and Industry for 2018. It strives to encourage innovation by utilizing ICT to its potential, accelerating data application, developing a diverse workforce, encouraging activity, and connecting businesses with each other.

R&D Support of Shipbuilding Technologies (i-Shipping)

A system put in place by the Japan’s Ministry of Land, Infrastructure, Transport and Tourism that aids with a portion of R&D expenses to promote i-Shipping which strives for the improvement of innovation productivity using ICT in all phases including the design, construction, and operation of vessels. I-Shipping Production is the production facility/system R&D and for improving productivity of shipbuilding that uses IoT technologies and AI. I-Shipping Operation is for R&D involving ship operations which use advanced technology such as IoT and Big Data.

Newer and stronger

ClassNK has further reinforced its organization in Greece

For many in the shipping world, Greece is the spiritual home of modern shipping. The Greeks have played a prominent role in international shipping since time immemorial, and over the years have developed a strong reputation as leaders in the maritime industry.

ClassNK is a world-leading classification society that has been serving the Greek maritime community for many years. The Society dramatically strengthened its services with the opening of the Piraeus office in 1975 and its operations in Greece have steadily expanded to serve all major ports throughout the Aegean archipelago. In 2014, ClassNK increased its commitment to the Greek maritime industry even further through the establishment of the Greek-registered corporation, Nippon Kaiji Kyokai (Greece) S.A.

The office now oversees a total of more than 1,000 Greek-owned ves-

sels. This achievement is a testament to ClassNK Piraeus' outstanding service and the trust it shares with Greek shipping clients.

In April 2018, Mr. Seiichi Gyobu, who is one of the 14 corporate officers of ClassNK, was appointed to serve Nippon Kaiji Kyokai (Greece) S.A and took up the role of Regional Manager of the Eastern Mediterranean Sea & Northern Black Sea.

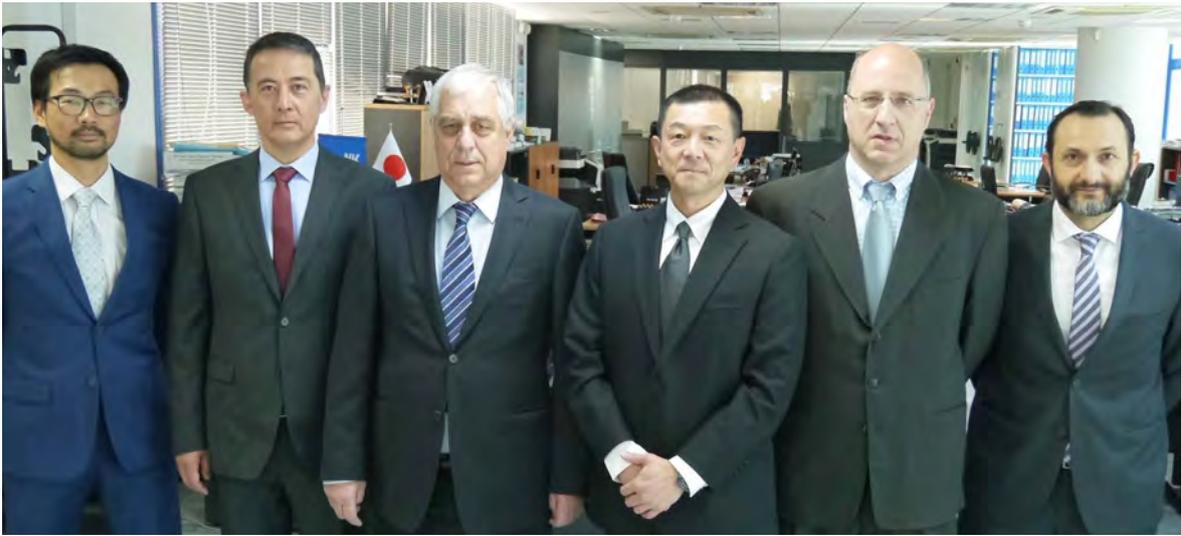
Mr. Gyobu joined ClassNK in 1983 and has since taken on various tasks in the Head Office including plan approval, rule development, and control of ClassNK survey activities. Having spent more than 15 years at ClassNK survey stations in Japan, Australia and the US, his long experience and excellent insight makes him one of the most admired surveyors in the Society. Furthermore, he has demonstrated his extensive organization management skills through his previous position as Regional Manager of

North, Central and South America, responsible for all ClassNK activities across two continents.

Upon assuming the new role, Mr. Gyobu commented "It is a distinct honor for me to come to Greece and work together with our Greek customers. Needless to say, Greece has historically been and will continue to be one of the most important regions to our Society. The ClassNK staff and I will do our best to maintain strong relationships with all of our Greek clients and make our services as convenient as possible."

Mr. Gyobu's mission is to further improve ClassNK's service level and customer satisfaction together with Mr. Aristidis Dalakas who has kept his vital role in client relations as Executive Advisor. Mr. Dalakas has served ClassNK for 30 years and has been the leading figure in expanding ClassNK's presence in Greece. He continues representing





From left to right: Mr. Naruchika Kozuma, Mr. Dimitrios Kakouris, Mr. Aristidis Dalakas, Mr. Seiichi Gyobu, Mr. Konstantinos Th. Markou, Mr. Ioannis Vrontorinakis

ClassNK's swift, client-oriented, and reliable attitude.

Another ClassNK veteran, Mr. Konstantinos Th. Markou has been promoted to General Manager of Surveys. Mr. Markou is in charge of handling surveys and audits in Greece and the surrounding area, and also provides necessary assistance to Greek clients, applying ClassNK service all over the world. His team is also supported by newly-appointed managers Mr. Ioannis Vrontorinakis and Mr. Dimitrios Kakouris.

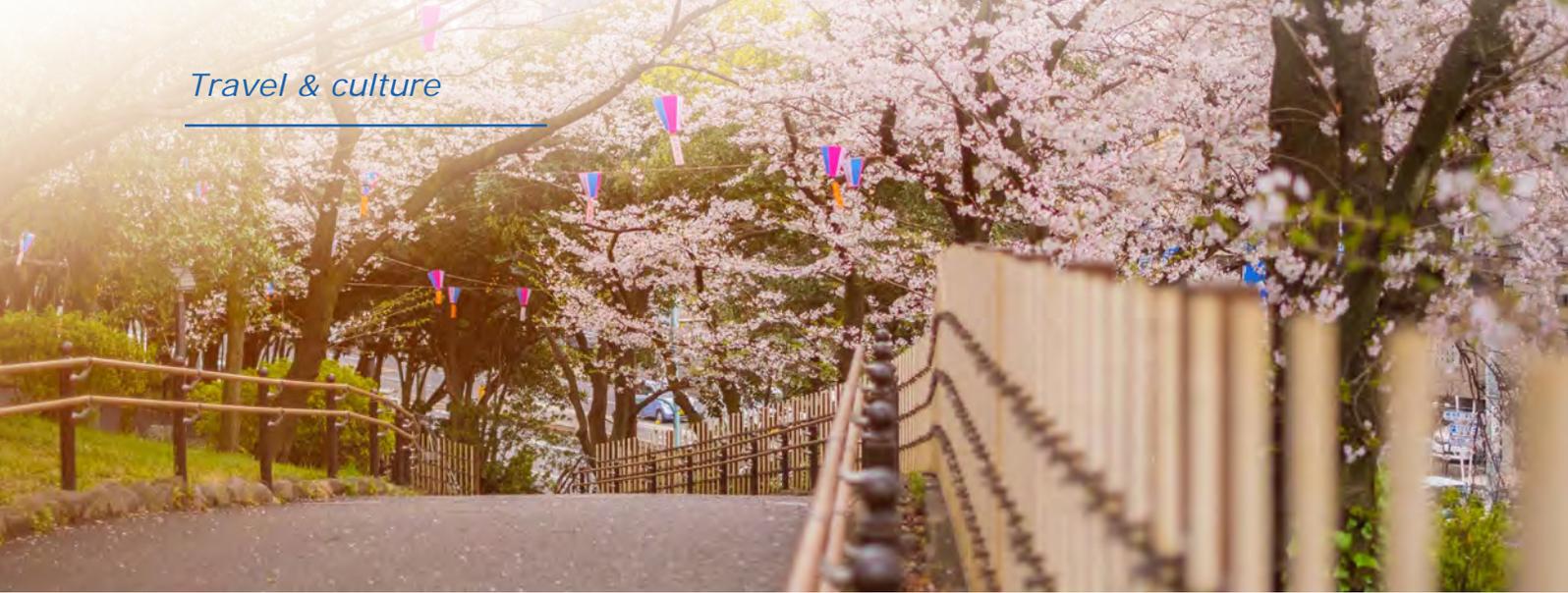
Furthermore, Mr. Naruchika Kozuma, a manager dispatched from Japan, adds his function as Representative of the Survey Department, holding the authority to make technical decisions on behalf of the Head Office. This enables him to take quicker and more definitive actions in response to customer needs.

These organizational reinforcements demonstrate ClassNK's strong commitment to better serve the Greek Maritime industry's

growth through its highest technical services.

ClassNK's contribution to the Greek shipping industry stretches far beyond traditional classification services. In addition to providing the best in class surveys, audits, and inspections, Nippon Kaiji Kyokai (Greece) S.A. works to reflect ClassNK's cutting-edge approaches to digitalization, emissions, and all of its other initiatives for tackling the challenges of the industry alongside its ever-expanding Greek fleet.





A stroll in the park

The beauty of Asukayama Park is as fascinating as its history

Busy city life can mean that the slow and quiet change of seasons sometimes goes unnoticed. But taking time to see the sights is as simple as a walk in the park.

Located in Oji on the JR Keihin Tohoku Line, the de facto capital of Tokyo's northern Kita Ward, Asukayama Park is one of Japan's most historic national parks. The park began with the planting of cherry blossom, or *sakura*, trees in 1720 by Tokugawa Yoshimune, Japan's eighth shogun, and was first opened to the residents of Edo (modern day Tokyo) in 1737. Now, over 600 sakura trees, along with 15,000 rhododendrons and 1,300 hydrangea bushes are dotted throughout the area. Incidentally, standing at an elevation of 25.4m at its highest point, it is officially recognized as Tokyo's smallest mountain.

Spring is arguably the best time for a visit. As one of the few sakura tree areas that allowed the consumption of *sake*, Japanese rice wine, residents of Edo flocked to Asukayama in late March to sit under the trees and en-

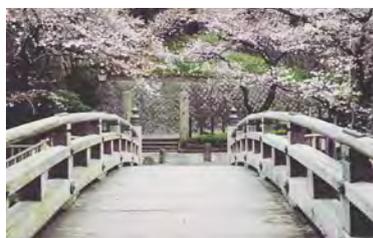
joy picnics while watching the cherry blossom petals fall from the trees like pale pink snow. Even now, groups of families, young people, and seniors alike gather around the trees to have fun and unwind.

Before becoming one of Japan's first officially designated national parks in 1873, Asukayama was immortalized in a set of famous *ukiyo*e wood prints some 30 years earlier by renowned artist Utagawa Hiroshige in 1843. These prints depict beautiful seasonal landscapes and scenes of kimono clad nobles watching the cherry blossoms fall from the trees. Other prints show mysterious gatherings of foxes on a dark New Year's Eve, symbolic of the Inari shrines that can be found throughout Japan. While many of these prints are now in museums around the world, traditions such as the New Year's Eve *Kitsune no Gyoret-su*, a 'fox parade' of over 100 mask-clad locals, are still held in nearby to this day.

Even outside of the New Year celebrations and the cherry blossom season,

the park has many other attractions on offer. Asukayama Park is home to three museums. The Paper Museum includes exhibits of traditional Japanese *washi* paper and the early production of Japan's modern paper, which was largely carried out in the area from the late 1800's until 1949. The Kita City Asukayama Museum has exhibits on the art, nature, and history of the area from ancient times to present. The Shibusawa Memorial Museum is a tribute to Eiichi Shibusawa, one of the driving forces behind Japan's modernization from the beginning of the Meiji period in 1868 until his death in 1931. This museum details the life and works of Shibusawa, whose residence was built on the grounds of the park, and exhibits collections of historical artefacts from the period including letters from samurai in pre-Meiji period Japan.

And of course, there is a vast playground which every weekend is filled with the sounds of children at play. The beauty of Asukayama runs as deep as its history, and is surely worth the walk.



ClassNK events:

- ◆ **POSIDONIA, ATHENS, GREECE, 4TH - 8TH JUNE**
Please visit ClassNK at stand 4.101/O
- ◆ **SMM, HAMBURG, GERMANY, 4TH - 7TH SEPTEMBER**
Please visit ClassNK at stand B2.EG.212
- ◆ **GASTECH, BARCELONA, SPAIN, 17TH-20TH SEPTEMBER**
Please visit ClassNK at stand A235
- ◆ **SHIPTEC CHINA, DALIAN, CHINA, 24TH-26TH OCTOBER**
Please visit ClassNK at stand 2F06
- ◆ **SEATRADE MIDDLE EAST MARITIME, DUBAI, UAE, 29TH-31ST OCTOBER**

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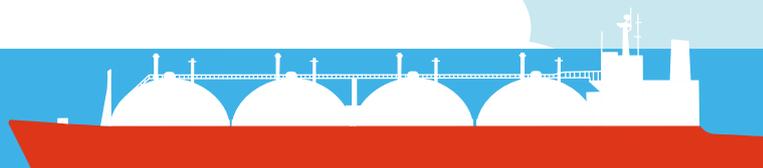
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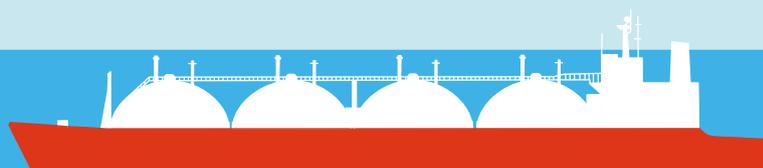
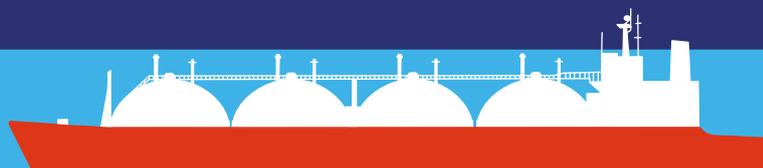
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