Internet of Ships Open Platform

Examples of Fair and Impartial Data Sharing and Data Utilization

Internet of Ships Open Platform Examples of Fair and Impartial Data Sharing and Data Utilization

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Forms of Value That IoS-OP Aims For

Reasons for the Existence of IoS-OP

Similar to other industries, there is a growing interest in the maritime industry as well in sustainability and decarbonization in particular for society as a whole in addition to digitalization which is proceeding at an unprecedented speed. Environmental changes such as these will significantly change the way business is carried out in various fields which make up the maritime industry such as shipbuilding, ship equipment manufacturing, ship operation, and crew education and development. However, there are limits to how much each company can respond to these changes, and we believe that collaboration is the key. The utilization and application of various types of data-centric digitalization and technologies will enable business improvements and the creation of new forms of innovation.

IoS-OP is a common platform for sharing ship operation data between relevant parties without harming the interests of shipping companies and other data providers and enabling data usage rights and various services to be provided to shipyards and manufacturers, etc. It consists of the shore data center for collecting and providing data operated by Ship Data Center Co., Ltd. (ShipDC) and the IoS-OP Terms of Use, which are the data distribution rules agreed upon within the industry. IoS-OP is a cooperative domain based on fair and impartial rules so that businesses involved in maritime affairs can take on the challenge of solving global social issues and aim for their own sustainable growth. It is operated by the IoS-OP Consortium, the ShipDC member organization for maintaining fairness, trust, and independence.

IoS-OP Consortium Activities

The IoS-OP Consortium was launched in 2018, subsequently developed an environment for the fair and impartial utilization and application of ship operation data, and provided value (see the "IoS-OP Utilization Examples") not only as a common platform for ship operation data but also provided the following forms of value to the companies participating in the IoS-OP Consortium. Moreover, while the IoS-OP Consortium is an initiative which originated from Japan, it has developed into a globally unprecedented initiative where even competitors in the same industry can meet as peers regardless of nationality in accordance with the reality of a single global market, which is a characteristic of international maritime transportation. Each company is utilizing IoS-OP to respond to changes in the management environment.

<Forms of Value That the IoS-OP Consortium Aims For>

- Ensures access to information about the latest technologies and regulatory compliance, etc. and experts in each area
- Builds networking with the maritime cluster, gathers advanced examples which become best practices, and searches for collaboration partners
- Develops human resources who utilize data and create innovation through participating in education programs hosted by the IoS-OP Consortium The following four working groups (WGs) were

created to realize these forms of value.

Rule Establishment and Data Governance WG

This WG takes the initiative to formulate and update data handling rules with the goal of creating sustainable businesses and data economy/ecosystem market by creating rules and systems through open consultation.

Regarding these rules, Yoshikazu Kawagoe, the first Chair of the IoS-OP Consortium (MOL Senior Managing Executive Officer, position as of March 2021), commented in an article of THE JAPAN MARITIME DAILY (March 3, 2021), "ShipDC spent time with experts to create extremely fair management rules to prevent unauthorized viewing, selling, buying or modification of data during handling. You can feel at ease entrusting data to ShipDC even if it is confidential. We are proud to have developed reasonable, user-driven rules." The rules have been highly rated by relevant parties and are being utilized as data sharing rules.

Moreover, rules for permitting data usage for AI development and accuracy improvement as well as rules for the provision of data to public institutions for public purposes, etc. were formulated in 2023 as a new initiative called the "ecosystem program for data transaction activation."

Solutions WG

The Solutions WG is made up of member engineers who carry out the following activities.

- · Review and documentation of technical requirements including the incorporation of standard technologies involving the connection of shipboard servers and application software
- Consultation and rule application regarding "secondary processing" and "anonymization," which are concerns when using data, and "statistical processing," which is one value of using big data
- · Data distribution security guidelines, provider registration requirements, and other revisions to achieve and maintain fair data usage
- Operation of a testbed to verify technologies regarding the connection of shipboard servers and application software via satellite communication and ShipDC In 2022, we started the "IoS-OP connection confirmation service" to ensure that both shipboard servers and application software can be sold and purchased with a sense of security. In 2023, we established a system for applying the results obtained through this service to the "Innovation Endorsement" certificate from ClassNK and also contributed to solving technical issues such as the visualization of data quality indicators in ship performance analysis and the confirmation of the utility of anonymity in statistical processing by ClassNK ZETA.



Business Promotion WG

To promote businesses that utilize data, we are introducing initiatives inside and outside of the industry which serve as hints toward data utilization and application as well as hosting seminars, etc. which introduce solutions offered by member companies of the IoS-OP Consortium to shipping companies and other customers in Japan and overseas.

The following seminars and monthly webinars were hosted in 2023.

<Seminars>

Name	No. of participants	Target	Hosting format (hosting city)
Coastal Shipping Digital Seminar	Approx. 230 ppl.	Coastal shipping personnel	Hybrid (Onomichi, Hiroshima Prefecture)
IoS-OP Symposium	Approx. 90 ppl.	Shipping companies and IoS-OP Consortium members	Hybrid (Chiyoda-ku, Tokyo)
IoS-OP Seminar for Domestic Shipping Companies	Approx. 80 ppl.	Ocean shipping companies	Local hosting (Imabari, Ehime Prefecture)
IoS-OP Singapore Seminar	Approx. 120 ppl.	Singaporean maritime personnel	Webinar
IoS-OP Taiwan Seminar	Approx. 60 ppl.	Taiwanese shipping companies	Local hosting (Taipei, Taiwan)

<Monthly webinar: IoS-OP Open Campus>

In 2023, we hosted the following nine lectures for the purpose of promoting mutual understanding and collaboration by broadly disseminating and explaining to society what kinds of initiatives the IoS-OP Consortium member companies are engaged in.

Month hosted	Lecturing companies, organizations	Theme
April	NIPPON KAIJI KYOKAI	Arrival of Full-scale Ship Cyber Security! -IACS Uniform Regulations and Their Operational Counterparts
May	Furuno Electric	Seeing What Is Not Visible - Integrated Ship-Shore Information Utilization for Operational DX
June	Akishima Laboratories	Learn How Examining Performance Improvement Measures Leads to Fuel Consumption Reduction Through the Utilization of Operational Data
July	MOL Techno- Trade	Best Adoption Track Record! Permanent PBCF Benefits with Convenient and Easy Maintenance + Rotor Sails in the Spotlight!
August	Nakashima Propeller	Concrete Initiatives for Energy and Labor Saving \sim From the Perspective of a Comprehensive Ship Propeller Manufacturer
September	Chugoku Marine Paints	Effective for CII Measures! Supporting Fuel Consumption Reduction Effects by High- performance Antifouling Paint with a Monitoring System
October	Planning and Design Center for Greener Ships	How to Reach Zero Emissions ~ Latest Trends in GHG Emission Reduction in International Maritime Transportation
November	MOL	Maritime Transportation Company Technology Development ~ Technology Innovation Headquarter Initiatives and Future Prospects ~
December	"K" LINE	Ship Data Utilization at "K" LINE and the Innovation Unleashed by K-IMS

Human Resource Development WG

To cultivate human resources that utilize data, we are hosting operational performance analysis study sessions for shipping companies so that they may understand the value of data (see Topic 3 "Initiatives to Improve Operational Performance").

Moreover, to cultivate human resources for the creation of innovation, we have hosted a total of five ideathons since 2020 with President Naotaka Ishizawa of the NYK Digital Academy serving as the lecturer. These ideathons aim to create solutions for social issues and ideas for new businesses by combining the technologies of the maritime industry with those of other industries. NYK Line, which is implementing a similar program, has already created several new businesses from this training program and reported that this

combining them?



About the IoS-OP Consortium

The IoS-OP Consortium is composed of the following organizations.

[General Meeting]

Revises member terms and conditions and approves business and budget plans. Held four times a year and allows all companies participating in the Consortium to attend.

[Steering Committee]

Engages in the operation principles of the IoS-OP Consortium, matters concerning sub-committee operation, the establishment, operation and appointment of leaders of the WGs, and the amendment or abolition of IoS-OP Terms of Use, etc. IoS-OP Consortium composition

General Meeting	=	Rule Establishment Data Governance V
ecides the most important matters (such as evision of member terms and conditions, approval f business and budget plans, and other important natters) through voting	E)	Solutions WC
Steering Committee		Solutions WG
oncerning the operation of the sub-committee, stablishment, operation and appointment of eaders of the WGs, and the amendment or bolition of IoS-OP Terms of Use, etc.	* **	Business Promotio
Sub-committee		
iscussion and proposal of consortium operation rinciples, adjustments between each WG and olicy formulation, etc.	Å	Human Resource Development WG

ideathon changed the thinking and behavior of the participants, which demonstrates its effectiveness in fostering innovation-creating human resources.

Held twice a year and can be attended by responsible parties from platinum members (mainly the officer class) and elected members.

[Sub-committee]

Discusses and proposes IoS-OP Consortium operation principles, makes adjustments between each WG and formulates policies. Held four times a year and can be attended by persons in charge from platinum members (mainly the section chief class), elected members, and WG leaders.



IoS-OP Utilization Examples

It has been six years since the IoS-OP began full-scale operation. The role of IoS-OP is becoming increasingly important and includes the sharing of operational data by shipowners, ship management companies, charterers, and shipyards as well as the examining of performance improvements utilizing data, etc.

ONE: Centralizing the data of three separate companies with IoS-OP

The General Meeting to establish the IoS-OP Consortium was held in May 2018. The first large-scale business case utilizing this sharing platform after the full-scale operation of IoS-OP was the container shipping company Ocean Network Express (ONE).

ONE was launched in April 2018 when "K" LINE, MOL, and NYK Line spun out and integrated each of their regular container ship business divisions. One issue with this integration was how to handle the ship data from each company. Within the maritime shipping companies, container ships are one type of ship which utilized operational data from the earliest stages. Due to their high daily fuel consumption and the significant impact of operational efficiency improvements, each company built voyage data collection systems from around 2010 to support fuel-saving operation, and they promoted the utilization of such systems in container ships. Container ships were equipped with monitoring equipment to collect data concerning fuel consumption performance such as the RPM, speed, fuel consumption, wind speed and direction, and the companies advanced initiatives which led to operational improvements and ship handling support through the verification of this measurement data. The utilization of ship data is



Provided by: Ocean Network Express

absolutely essential in the business management of container ships. However, each of the three companies individually operated their own ship data platforms and utilized data with different standards, and the question of how to share data became a major theme with the integration of their container ship businesses. Accordingly, IoS-OP came to play a major role as it began full-scale operation around the same time as the launch of ONE.

First, with respect to the question of how to share operational data on different platforms, IoS-OP was the appropriate solution as a fair and impartial sharing platform for handling the data of the three companies. In addition, IoS-OP also had arrangements regarding the handling of data, which was a major issue in the data sharing between the companies. The three companies participated in the promotion conference before the launch of the IoS-OP Consortium and discussed data collection and utilization. The data ownership approach and data usage rules were completed in February 2018 (see "Data Handling Rules"). IoS-OP provided contractual provisions indicating the obligations and rights of data users, which enabled the smooth facilitation of the contract procedure for data use within ONE.

As a result, "K" LINE, MOL, and NYK Line were able to start sharing the operational data acquired from each of their container ships with the charterer ONE through IoS-OP in the year following the launch of ONE.

The effect of IoS-OP utilization is not limited to rules and platform usage. In particular, it has a large effect on data "standardization." When it comes to ship data, the data names obtained from sensors differ by company and ship. Because each of the three companies managed data with different standards, ONE initially had to convert this data to names which complied with the ISO 19848 (see "Standardization Initiatives" in Topic 7) ship data international standard. At the same time, IoS-OP implemented the AI which assigns the ISO 19848 standard names.

Subsequently, ONE achieved business efficiency and cost reduction by utilizing the standard data name conversion function which uses the AI provided by IoS-OP with respect to the issue in which the data names differ due to different shipbuilding yards for the new ship introduced by ONE.

MISUGA KAIUN: Application API connection via the ISO standard shipboard servers and IoS-OP

Not only ship operators such as ONE but also shipowners who possess ships are starting initiatives to collect and utilize data.

In May of 2022, the companies involved in the building of MISUGA KAIUN's new ship, the "MV MAINE SOLEIL," started utilizing IoS-OP. In this ship, approximately 800 operational data points including the draft and shaft horsepower are automatically collected in addition to information from the voyage data recorder (VDR), fuel and power consumption from the main engine, generator engine, and the auxiliary equipment, and other data.



Provided by: MISUGA KAIUN CO., LTD.

Through the utilization of IoS-OP, the MISUGA KAIUN superintendent understands the ship's condition as analyzed by the manufacturer in real time to prevent problems in advance. In addition, the main feature is that it aims to systematize the ability to monitor the rate of increased fuel consumption to prevent declines in the actual fuel consumption rating to comply with future environmental regulations.

The ship collects and sends data through the "TERASAKI Marine Information Platform (TMIP)" onboard data platform provided by Terasaki Electric. The shipboard data server collects navigational data from the VDR and engine-related data from the Data Logger and sends it to the IoS-OP data center.



Provided by: TERASAKI ELECTRIC CO., LTD

This data is analyzed by the "HiZAS®VDA (Vessel Data Analysis)" provided on IoS-OP by Hitachi Zosen Marine Engine. This is application service provided by Hitachi Zosen Marine Engine which includes performance monitoring, report functions, performance analysis, and an engine condition diagnosis system.



Provided by: Hitachi Zosen Marine Engine Co., Ltd.

The Terasaki Electric platform complies with the ISO 19847 onboard server standard specification. Because ISO-compliant apps can be freely selected, apps may be configured later. At one time, it was necessary in some cases to significantly change the onboard equipment, etc. depending on the app, and shipowners could not configure the app until the charterer was specified or incurred replacement costs based on requests. However, if you prepare a system in advance which can collect and send data to an ISO-compliant server, it can be utilized if it connects to IoS-OP even if the apps that the charterer wishes to use are specified after the vessel operator is decided or changed to realize portability for ship operation data.

Chugoku Marine Paints: Understanding the performance of antifouling paint through the visualization of ship hull fouling

With the adoption of amendments extending the scope of EU directives establishing the EEXI regulations and CII rating system from 2023 and the EU Emissions Trading System (EU ETS) from 2024 to the maritime transportation sector, initiatives to manage ship hull roughness and fouling and curb the deterioration of ship hull performance for the purpose of increasing ship performance and reducing GHG emissions have been attracting attention at shipping companies.

Chugoku Marine Paints registered the "CMP-MAP" ship hull data analysis service that it has provided since 2019 on IoS-OP and began offering analysis services to shipping companies.

The CMP-MAP technologies include performance analysis (ship hull performance analysis based on ISO 19030) and in-service analysis (recommendation of the optimal antifouling paint according to the route,



operation rate, ship speed, and sea water temperature assessment) technologies, but it is essential that the shipping companies provide data in order to conduct the performance analysis, and there were issues with data sharing and the prompt reporting of results. The utilization of IoS-OP further promotes the automation of data sharing by the shipping companies and the sharing, etc. of CMP-MAP analysis reports and visualizes the performance of ship hull antifouling paint by providing efficient analysis reports while also achieving ship hull performance with low ship hull fouling and frictional resistance to help reduce GHG emissions from ships.

Japan Coast Guard: Providing data to public institutions for the public interest

In the past, oceanographic data was voluntarily provided by "K" LINE, MOL, and NYK Line in response to a request for cooperation from the Japan Coast Guard. By utilizing the massive volume of data accumulated in IoS-OP, it has become possible to centrally provide large-scale and detailed oceanographic data to a greater extent than before. The Japan Coast Guard aims to efficiently utilize this data to improve the accuracy of tidal forecasts, contribute to maritime safety, and further promote business efficiency.



Expected future utilization

Most recently, it is believed that the ship operation data sharing platform IoS-OP can utilize data in the following ways as a platform where the participants view the same data and make business improvements. 1. In chartering contracts between shipowners and charterers, speed and fuel consumption are important indicators, and there are a number of cases in which

the actual values are unknown. Operational analysis will



2. If the measurement of the effectiveness of wind powered ships and energy-saving additives aimed at reducing GHG can be clarified through operational



analysis, we can expect to see the adoption of nontraditional initiatives such as profit sharing of reduction benefits, etc. rovided by: Mitsui O.S.K. Lines, Ltd.

3. Through continuous data collection and the adoption of the same analysis methods, it will become possible to assess ship hull fouling and degradation over time to

perform cleaning at the appropriate time. Moreover, comparing the pre- and post-dock performance improvement will also enable the verification of its effectiveness.



Provided by: Chugoku Marine Paints, Ltd.

4. In cases where low-load and other types of operation are conducted which differ from the design conditions during construction, performance improvements through



be studied such as propeller retrofitting in accordance with actual operational conditions determined through

retrofitting work can

Provided by: Nakashima Propeller Co., Ltd. data collection.

Realizing these forms of data utilization will require the application of the Data Handling Rules already developed by IoS-OP as well as the standardization of data analysis methods and the training of data analysts, etc. which are considered to be issues. Going forward, the IoS-OP Consortium will eliminate arbitrariness and promote initiatives directed at fair and impartial data utilization.

Greetings



Michitomo Iwashita Managing Executive Officer Kawasaki Kisen Kaisha, Ltd. Chair of the IoS-OP Consortium

outside of the industry, is required. partake in collaborating and cooperating with each other.



Hiroaki Sakashita President & CEO NIPPON KAIJI KYOKAI <ClassNK>



Yasuhiro Ikeda President Ship Data Center Co., Ltd. IoS-OP Consortium Secretariat

Following the CII fuel economy performance rating system started in 2023, the application of the EU Emissions Trading System (EU ETS) to the maritime transportation sector started in 2024, and the management of GHG emissions has become an important management issue in the maritime industry. As the maritime transportation industry aims to decarbonize, ClassNK is using fuel consumption and other data provided by ships to offer the "ClassNK ZETA" tool that can efficiently manage everyone's GHG emissions, and it has already been adopted for use by 300 companies and over 5,000 ships. At the same time, carrying out management in line with actual operation requires performance improvements using high frequency sensor data instead of one data point per day, and expectations are rising for the initiatives of IoS-OP as a platform that handles sensor data. ClassNK will continue to actively propose and offer our distinctive solutions as the industry evolves in these ways while also supporting the development of everyone's business through evaluation and certification. In addition, the Ship Data Center which administers the data utilization infrastructure is an ClassNK subsidiary, and ClassNK will continue to actively engage in IoS-OP activities through the operation of the Ship Data Center.

technology advances in the physical world.

data and create innovation In this booklet, we explain the structure of IoS-OP and its past results as well as introduce the participant initiatives in each topic. We hope that you pick up this booklet and seriously consider joining the IoS-OP Consortium. We look forward to registering your operating ship data as well as hearing about your solutions and proposals for collaboration.

The maritime industry is witnessing a period of significant change, with the environmental regulations concerning the carbon neutrality of ships, improvements in safety utilizing big data from ships, economic improvements and the like. Since there exists limitations to what individual companies can do to adapt to these significant changes by themselves, initiatives in cooperative domains through collaboration with other relevant players, both within and

The IoS-OP Consortium, inaugurated in 2018, has clarified the cooperative and competitive domains within the utilization and application of ship operational data and promoted datadriven services without harming the interests of the relevant data providers. Currently, it has expanded into a world-class initiative in which 70 companies from various industries including maritime transportation, shipyards, ship equipment, service providers and others,

Hence, in consideration of said significantly changing industry conditions, it has been decided that the booklet issued in 2023 be revised. It is our hope that this booklet will contribute to the decarbonization and digitalization of each and everyone involved in the domestic and international maritime industry.

Ship Data Center is in charge of operating the IoS-OP Consortium Secretariat and the IT platform which serves as its infrastructure. The utilization of the ship operation data collected in the Ship Data Center forms the digitized cyber world of the physical world. We have promoted the creation of maritime cluster innovation by circulating cyber

Those activities are carried out under committees led by consortium participants and advanced through the following four working groups (WGs).

1. Rule Establishment and Data Governance WG: establishes the data handling rules 2. Solutions WG: examines technologies concerning data distribution and various services 3. Business Promotion WG: adoption of various services and the sharing of best practices 4. Human Resource Development WG: develops human resources who utilize and apply

IoS-OP Consortium History

Ship Data Center Co., Ltd. (ShipDC) was established in 2015 as a wholly-owned subsidiary of ClassNK. Through activities such as demonstrations of onshore storage facilities for ship operational data and the formulation of rules concerning data ownership and data usage rights, the IoS-OP Consortium was launched in 2018 with industry members.

Year	Primary activities	Registered providers (related pages)	Members
2015	Established Ship Data Center Co., Ltd. as a wholly-owned subsidiary of $\ensuremath{ClassNK}$		
2016	Developed the ship IoT data distribution platform infrastructure		
2017	Developed the rules concerning ship IoT data usage rights with industry organizations		
2018	IoS-OP Consortium inauguration MOL Senior Managing Executive Officer Yoshikazu Kawagoe appointed as the first Chair		44 companies
2019	Recognized by the government as Japan's first data sharing business Danelec joins as the first overseas company Start of data sharing in actual business (for ONE)	PP: Terasaki Electric (P46) BEMAC (P45) Furuno Electric (P44) SP: NAPA (P29) NKCS (P26, P41, P52)	55 companies
2020	ShipDC portal construction NYK Line agrees to register the operational data for all ships equipped with SIMS (approx. 200 ships)	PP: Alpha Ori Technologies(P28)	58 companies
2021	 "K" LINE agrees to register the operational data for all ships equipped with K-IMS (approx. 140 ships) MOL agrees to register the operational data for all ships equipped with the FOCUS project (approx. 180 ships) marineworks joins as the first South Korean company Full-scale overseas activities (hosting of the Taiwan seminar) Shin Kurushima Sanoyas Shipbuilding and Tsuneishi Shipbuilding start to utilize IoS-OP Japan Fisheries Information Service Center joins to improve the precision of their current assessment of fishing conditions and to predict future fishing conditions 	PP: Mitsui E&S Shipbuilding(P51) SP: Harmony Creative Solutions NYK Line(P43)	58 companies
2022	NYK Senior Managing Executive Officer Tomoyuki Koyama appointed as Chair Start of connection confirmation services for shipboard data servers and application software Think Nature joins to protect biodiversity through the linking of ship operational data Shipowners (MISUGA KAIUN) start utilizing IoS-OP Hosting of the Singapore seminar	SP: TSUNEISHI SHIPBUILDING Ocean Network Express Nautilus Labs Nabtesco (P27) Hitachi Zosen Marine Engine (P45) Weathernews Chugoku Marine Paints (P26)	65 companies
2023	Shipowners (Sumisho Marine) share IoS-OP data Chugoku Marine Paints joins as the first paint manufacturer	PP: Smart Ship Hub SP: seawise National Maritime Research Institute Smart Ship Hub MOL(P14) BEMAC(P45)	67 companies
2024	Centralized provision of oceanographic data to the Japan Coast Guard starts	SP: Toqua(P31) zero44(P17) CetoAl(P47) Daphne Technology(P48)	70 companies

Data Handling Rules

Due to the thinking around data hoarding and concerns about unexpected uses, the sharing of operational data with relevant parties has not made much progress, but it is expected that innovative value will be created through open innovation by means of cross-industry collaboration. To dispel the concerns of data holders in IoS-OP, we define the relevant parties for data distribution, establish various terms, and aim to promote data utilization and application.

Legal basis of data use

Data is intangible and not covered by ownership under the Civil Code. Moreover, factual data such as operational data has no creativity and is not covered by copyright. Therefore, rights are organized as usage rights in IoS-OP, and safe and smooth data sharing is realized without creating unnecessary friction by establishing data usage rights and usage conditions through contracts.

Definition of relevant parties

When arranging data usage rights in IoS-OP, we establish data ownership and organize the relevant parties by determining which parties need to sign a contract.

Data ownership

The shipowners or businesses which collect data at their own expense with the consent of the shipowners as data usage right managers are called Platform Users (PU) in IoS-OP. Furthermore, PU decide who should be granted permission to use the data. In many cases, this is handled by charterers, but it can be taken on by shipowners and shipyards, etc. regardless of business attributes. Data use consent is



decided based on the attributes of the party who wishes to use it and the purpose of use.

Who can use the data?

Based on PU consent, use is possible in the case where the business attributes and purpose of data use match the rules (e.g. party concerned with the corresponding ship) from the perspective of a Solution User (SU) who uses the data through IoS-OP-registered applications as a party involved with the ship operation and a Data Buyer (DB) who receives the data provided by ShipDC. SU may optionally join the IoS-OP Consortium. However, it is essential for DB to participate in the IoS-OP Consortium and register as a business, and the obligations and privileges are defined in the terms.

For what purposes can data be used?

Data can be used for various purposes with PU consent if the purpose of use is clear and without unreasonableness such as contributing to ship operation or providing feedback to a company's own products. However, the provision of data to competitors for any purpose is prohibited.

Provider

Businesses which provide servers to collect data onboard are called Platform Providers (PP), and businesses which provide applications are called Solution Providers (SP). Participation in the IoS-OP Consortium and business registration are essential, and the obligations and privileges are defined in the terms.

Al use

Previously, it was unclear as to whether SP could feed data into AI. In addition, because there were terms which required acquired data to be deleted after the termination of service provision, such data had to be deleted when used as teaching or training data for AI, etc. However, in consideration of data transaction

activation, the ecosystem program was systematized and reflected in the terms. As a result, it became possible for SP to apply for special AI provisions to not only feed the acquired data into AI to improve the accuracy but also continue using it as teaching or training data after the termination of service provision.



Ensuring security

Businesses involved in data distribution are required to observe the security guidelines designated by the IoS-OP Consortium. These guidelines mainly summarize the confidentiality requirements for the data that should be protected, so they were formulated by the IoS-OP Consortium Solution WG based on "NIST SP800-171" (issued by NIST (National Institute of Standards and Technology), protection of Controlled Unclassified

Information (CUI) in non-federal organizations and systems).

Moreover, ShipDC has acquired information security management (ISO 27001) certification as a data custodian and its operation is also recognized by the Japanese government as a data sharing business which can utilize the System for Permitting Businesses to Request Public Data.

Topic 1 Environmental Regulations

Conversion to Sustainable Maritime Transportation

Front lines of environment regulations and the future of data utilization

As a measure to deal with global warming, movements aiming for carbon neutrality including decarbonization are accelerating globally, and decarbonization initiatives are trending in the maritime industry as well. In 2023, the Carbon Intensity Indicator (CII) started as a new set of GHG emission regulations, and in the same year, the IMO revised its GHG reduction strategy to set a target of net-zero GHG emissions by or around 2050. In the EU, regional regulations such as the EU Emissions Trading System (EU ETS) and the FuelEU Maritime will be introduced going forward, and it is expected that the cost burden will increase for ships coming and going to the EU according to their GHG emissions and fuel used. In GHG emission reduction, it is expected that the necessity of utilizing ship data to improve operational efficiency will increase more than ever. In order to clear these new environment regulations, it is anticipated that a new era is coming in which all stakeholders including shipowners and operators will share operational data.

In 2023, IMO strengthened its GHG reduction target in international maritime transportation. Under the initial strategy, the focus was a Tank-to-Wake base (only GHG emitted from the ship), but the strategy was revised to consider a Well-to-Wake base (GHG emitted throughout the entire life cycle in fuel manufacturing, transportation, storage, and shipboard use). Moreover, in the target for international maritime transportation, "in this century" was deleted in the revised strategy and changed to "aims to phase them out as soon as possible." In the specific numerical targets, the text was changed to "reach net-zero GHG emissions by or around, i.e., close to, 2050," and interim targets were established for 2030



and 2040. Going forward, IMO plans to examine measures to reach these new goals.

Furthermore, the EU aims to reach net-zero GHG emissions in 2050 and has set its own target of reducing emissions by 55% or more of 1990 levels by 2030. To reach this target, the "Fit for 55" package to make the EU climate-neutral was announced in July 2021 and includes a proposal to extend the EU-ETS, which offers EU Allowances (EUAs) according to GHG emissions, to the maritime transportation sector. The amended EU-ETS was adopted in April 2023, and the EU-ETS started in the maritime transportation sector on January 1, 2024. In addition, FuelEU Maritime was proposed to promote the decarbonization of fuel used by ships entering and leaving ports in the EU, and the regulation is scheduled to begin in January 2025.

EU-ETS is applied to ships with a total tonnage of 5,000GT or more that call at ports in the EEA (total of 30 nations including all 27 EU nations plus Norway, Iceland, and Liechtenstein) member nations. The target GHG emissions include 100% of emissions on voyages between EEA member nations and emissions in ports of EEA member nations and 50% of emissions on voyages between EEA member nations and non-member nations. Shipping Companies are required to purchase EUAs equivalent to the targeted annual GHG emissions and surrender (pay) that amount by September 30 of the following year. If applicable Shipping Companies do not comply with the EUAs surrender, they will be subject to measures such as fines and denial of port entry in the EEA.

FuelEU Maritime is an EU regulation for the purpose of



ship fuel decarbonization which will be applied from January 2025. This regulation sets an upper limit on the GHG intensity (GHG emissions per energy) of fuels used on voyages in and out of ports in EU/EEA member nations, and it mandates that container ships and passenger vessels must use on-shore power supply (OPS) or zero-emissions technology in ports. The upper limit of the GHG intensity is evaluated on a Well-to-Wake base, and if the average annual value exceeds the established upper limit, a fine must be paid according to the fuel used.

Thus far, there have been initiatives to collect data during ship operation from onboard equipment and utilize this data to improve operational efficiency, but such efforts were independently carried out by the ship operator from the perspective of reducing fuel costs. However, with the introduction of a series of environmental regulations, shipowners and other charterers and other stakeholders are also strengthening their interest in operational efficiency and data. Operational data will become essential for examining ship fuel consumption improvement measures and verifying their effects such as the use of alternative fuels. Reducing GHG emissions will increasingly the cooperation of international organizations, various countries, the maritime industry, energy industry, shippers, and the finance industry as well as the IT industry for the utilization of data.

Various services are also appearing which utilize ship data to support environmental regulation compliance by shipowners, etc. For example, Nippon Kaiji Kyokai (ClassNK) released the "ClassNK ZETA (Zero Emission Transition Accelerator)" tool which can efficiently manage GHG from ships. This service has already registered more than 5,000 ships.

"ClassNK ZETA" has functions for real time monitoring of the CO₂ emissions and CII rating for individual ships and an entire fleet, simulating how the CO₂ emissions and CII rating change with the addition of energy-saving

additives, and the reporting of CO₂ emissions. Against a backdrop of a need for local EU regulation in the maritime industry, ClassNK released functions to support the EU-ETS starting from this year. These functions provide comprehensive support for EU-ETS including the visualization of voyages that are subject to the EU-ETS, calculation of GHG emissions on those voyages, and management of EUAs required for surrender.

Going forward, it is expected that scenarios in which shipowners, operators, and ship managers utilize platforms such as "ClassNK ZETA" to consult about operation while verifying the operational status of the ship will also increase. Until now, there have been almost no opportunities for multiple parties to share ship-related data. Prior arrangements are essential for data sharing, but agreed-upon rules concerning data usage rights, etc. exist in IoS-OP. Smooth data sharing is enabled by utilizing these rules. For example, each function of "ClassNK ZETA" can be used by shipowners and operators with the usage permission of the ship management companies, and this data usage mechanism also uses the IoS-OP framework. The need to utilize ship data is increasing toward the realization of a sustainable society together with new environmental regulations. A new era is expected to arrive in which all stakeholders in the maritime cluster will share operational data. <ClassNK>

KAWASAKI KISEN KAISHA, LTD. We aim to accomplish our goals in GHG reduction and achieve enhancement in operational management by using data from our vessels

"Kawasaki - Integrated Maritime Solutions" - our company's management system for monitoring vessel operations & performances - is comprised of route optimization system for safe operation and efficient fuel consumption, based on digitalized AB-LOG, performance analysis, latest weather database and analysis models for performance in actual sea conditions, which is integrated with automatic data collection and monitoring systems. Data from each vessel is visualized by our internal platform called "K-IMS for Office". We aim to strengthen our vessel management by allowing multiple data processing, incorporating external





ClassNK Innovation Endorsement C.T. - C.T.

databases, introducing AI technologies etc. in order to meet various requests/

objectives of users, which is also supported by the flexibility when customizing the needed information. Moreover, owing to recent additions of monitoring function of current CII rating and CII simulating function using cutting-edge AI technologies, this system has become an indispensable factor for accomplishing our goals in GHG reduction.

Currently, operational data of 131 vessels from our fleet have already been registered at ShipDC*. We believe that the data provided from our company will be of some help to any party related to the marine industry - those of whom share the common objective in GHG reduction - and we hope the data will be utilized to enhance performances and monitoring qualities of vessels and the various machineries on board. (* as of Jan 2024)



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We harness the Seawing that converts wind into propulsion, uses less fuel and reduces CO₂ emissions to various "K" Line ships for our beautiful skies and oceans.

Full ahead to carbon neutral



Mitsui O.S.K. Lines, Ltd. Ship big data utilization platform "FOCUS"





it has become possible to collect sensing data from a wide variety of operating vessels and it is available in almost real time at shore side just like onboard.

We are promoting the "FOCUS" (Fleet Optimal Control Unified System) project with the aim of further enhancing of safe operation and reducing environmental impact by utilizing the operational data collected in this way. As a core project for MOL's ICT utilization, MOL collects detailed voyage and machinery data from over 250 operating vessels in service and develops applications for advanced operation monitoring and propulsion performance analysis. Collecting data during actual operation >> Analyzing the collected data >> Giving feedback to the vessel and maritime cluster based on the analysis results >> Collecting data during actual operation >> ... We are running the data utilization cycle.



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NIHON SHIPYARD CO., LTD. Data & Operation Support Integrated Platform Sea-Navi®2.0

Sea-Navi[®]2.0 is an integrated platform that provides various applications to data monitoring and operations.

The platform collects various types of big data, such as voyage information and equipment operation data, in real time and combines them with R&D and design data for analysis, as well as



from various external sources. This enables users to not data collected, but also

providing services that are

interoperable with various

marine data applications



only visualization of the big immediate feedback of the results to actual operations and equipment manufacturers for seamless use in operational support, improvement, and troubleshooting of managed

To deliver is to fulfill.

To fulfill your desire for better days. To fulfill your hope for a more secure tomorrow. To fulfill the various wishes of many different people. Mitsui O.S.K. Lines delivers the goods needed for our daily lives and industry, from resources and energy to goods of every kind.



Growing together with our customers in the shipbuilding and offshore technology



vessels, as well as in studies of next-generation vessels. Sea-Navi[®]2.0 provides high-performance evaluations using ship R&D and design data for environmental performance and energy loss, hull and propeller fouling analysis, weather routing, structural monitoring, parametric rolling measures, LNG fuel monitoring, and more. The platform also offers a wide variety of optional functions such as equipment maintenance, ordering, inventory management, and linkage with useful external applications such as those provided by marine equipment manufacturers, and we are actively

- developing new functions upon request. ClassNK Digital Smart Ship Notation: Available
- ClassNK Innovation Endorsement: Certified

Sea-Navi[®]2.0 😔



[Contact Details] URL: https://www.nsyc.co.jp/en/contact/

NIHON SHIPYARD

Kawasaki Heavy Industries, Ltd. **ICT/IoT Solution for the Maritime Industry: SOPass and CMS**

Kawasaki Heavy Industries, Ltd. is a conglomerate that operates in multiple industries - including both shipbuilding and marine equipment. In addition to manufacturing, we provide solution services that support the operation of vessels and marine equipment using ICT/ IoT technologies based on data collected from ships.

1) SOPass (Ship Operation and Performance Analysis Support System) SOPass provides "improvement of voyage safety" and "reduction of operating costs" functions for vessels by proposing optimal

operations. In particular, for LNG carriers, it has the function of maximizing transportation efficiency by accurately predicting BOG (boil-off gas) generated during transportation and proposing optimal operations.



2) CMS (Condition Monitoring System) for Marine Propulsion Equipment Collecting data from onboard machinery including our environmentally friendly propulsion system with battery, gas only engine. It enables grasping the condition of onboard machinery from the office, supporting economical operation & Display samples of CMS for Marine Propulsion Equips



prompt troubleshooting for safe operation.

- 3) CMS for Rudder and Mooring Winch
- Collecting data from Steering gear and provide to on-land teams, for safe navigation and quick troubleshooting. While at mooring, this system improves safety and reduces workload for seafarers, by visualizing the tension of mooring rope.

Going forward, Kawasaki will integrate the above services with our aim to continue providing maritime solutions for a wider spectrum of





🕂 Kawasaki Powering your potential

[Contact Details]

SOPass: https://kawasaki-corporate.spiral-site.com/SOPass_EN CMS for marine propulsion equipment: marine-machinery-sales@khi.co.jp CMS for rudder and mooring winch: https://kawasaki-corporate.spiral-site.com/hyd_product_EN

SHIN KURUSHIMA DOCKYARD Co., Ltd. **Connecting with the Ocean. Connecting with Happiness.**

In October 2020, Shin Kurushima Toyahashi Shipbuilding Co., Ltd. built SAKURA LEADER, Japan's first LNG-fueled car carrier. SAKURA LEADER up to about 40% more energy efficient (by reducing carbon dioxide (CO₂) emissions per unit of transport) compared with ships using conventional heavy oil fired engines. The vessel is also expected to reduce sulfur oxide (SOx) emissions by about 99% and nitrogen oxide (NOx) emissions by about 86% compared with ships using conventional heavy oil fired engines. Shin Kurushima Dockyard plan to build various LNG-fueled car carriers, and we continue to work on global warming countermeasures through LNG-fueled ships.



In addition, we are working on technological development for the future. In November 2021, we obtained basic approval for the design of an ammonia-fueled car carrier that does not emit CO2.





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zero44 GmbH **Digital solution to manage EU Emission Trading**

In January 2024 the EU Emission Trading System (EU ETS) will enter into force, enforcing shipping companies to pay for EU Allowances to compensate for carbon emissions from voyages involving EU ports. Additional voyage costs easily amount to millions of euros.

In order to comply with the regulation, the different stakeholders along the marine transport value chain need to align on roles and responsibilities (who will buy allowances, who will pay for the allowances) as well as settlement processes for carbon costs (when and how do we settle EU ETS costs between us?).

zero44 provides a one-stop-shop to manage EU ETS. Based on the vessel performance data and the charter contracts, users will find automatically created ETS settlements which allow them to invoice

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or pay for EU ETS and organize the trading activities to purchase EU Allowances. Also, the management of the Union

Registry Accounts is included in the solution.

Going forward, zero44 will also support the upcoming Fuel EU Maritime Directive as well as other upcoming global or regional carbon regulations for the maritime industry.

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Topic 2 Alternative Fuels and Our Environmental Response

Alternative Fuels and Greener Ships

GSC Initiatives

Trends in international shipping

The International Maritime Organization (IMO) during its 80th session of Marine Environment Protection Committee (MEPC 80) has adopted the revised 'IMO GHG Strategy'. striving to reach net-zero GHG emissions by or around, i.e. close to, 2050. This target, shown in Figure 1, will significantly impact on international shipping, necessitating an earlier-thanexpected fuel transition.



Alternative fuel needs and trends

In order to achieve the 2030/2040 GHG emission reduction targets outlined in the revised 'IMO GHG Strategy', ClassNK estimates that fuels with zero or near-zero GHG emissions (hereinafter referred to as 'zero GHG emission fuels') used in international shipping in 2030 will require the uptake of approximately 25% of the energy base. This amount will be equivalent to the current total production of about 106 million tons per year in terms of methanol, and about 114 million tons per year in terms of ammonia, which is more than 60% of the current total production. This is, in fact, clearly a very challenging target.

The results of the survey of shipping company respondents published by the Global Maritime Forum (GMF) in April last year, shown in Figure 2, also show various opinions regarding the fuel types that will become mainstream in the future. Therefore, it is essential to consider multiple types of fuel in the development of greener ships.

After comparing major candidates for zero GHG emission



fuels. as shown in Table 2, the GSC believes that ammonia is expected to become one of the main fuels for

Figure 2: Results of the survey of shipping company respondents (Source: GMF)

international shipping due to its relatively low cost and ease of scaling in terms of manufacturing technology. In addition, methanol requires synthesis with CO₂ (e.g. biologically originated or DAC. etc.). which can reduce GHG intensities

but is limited in		Advantage	Disadvantage	
availability.	Liquid	Hydrogen is a feedstock for all synthetic fuels	Large energy and infrastructure development required for liquefaction	
Nevertheless,	Hydrogen	production volumes are expected to increase.	be improved.	
methanol is also		Competing sectors for direct use are relatively	As deleterious substances, additional safety costs and concern for odours	
a good candidate	Ammonia	small, and the highest potential supply is expected as a marine	for people living near ports are required. Measures against N2O emissions, with large global warmin	
due to its ease of		fuel.	effects, are required.	
handling	Methanol	The additional cost of onboard equipment for use is smaller than for other alternative fuel.	Biomethanol is in limited and uneven supply. Synthetic methanol is more available, but certification is complicated.	
onboard as a	Liquid	They can be used on existing LNG-fuelled	Biomethane is in limited and uneven supply. Synthetic methane also has	
liquid fuel.	Methane	vessels.	high additional costs for liquefaction and its supply is limited.	
-	Table 1: C	Comparison of majo	or zero-GHG emission fuel	

Greener ships in operation and on order

According to the results of a survey by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), the proportion of Dual Fuel (DF) specification ships equipped with dual-fuel engines capable of using LNG, LPG, or methanol has increased in all kinds of ships on order since 2020, as shown in Figure 3. The proportion of DF-specification vessels in the order backlog at the end of August 2023 will be 30% (less than 20% in 2020, more than 20% in 2021 and 30% in 2022).

As noted above, the shipping industry is in the process of transitioning to Greener ships.



Infrastructure and Transport Homepage)

Greener ship design

Normally, the fuel tank is not a critical factor in the initial design stage, as the remaining space provides sufficient capacity. However, it becomes a critical factor when zero-GHG emission fuels are required. This is because these fuels require 2-3 times more fuel tank volume than conventional fuels over the same range. It is therefore important to select the most appropriate fuel according to the type of vessel

and route, considering the required volume, ease of handling onboard, and economic efficiency. In particular, the volume and weight of the fuel greatly affect the initial design, including the loading capacity, of international shipping, especially in long-distance navigation. (See Table 2)

Heavy Fuel Oil	LNG	Ammonia	Methanol
1.00	1.63	2.86	2.39
0.93	0.48	0.70	0.79
1.00	0.84	2.15	2.03
200 - 400	-162 (CH4)	-33	65
abt. 90~100	-188 (CH4)	132	11
-Integrated	Independent Type-C Membrane (Low temp.)	Independent Type-C Square integrated Type- A/B (Low temp. or press.)	Independent Square integrated
At normal temperature and pressure	-160~-140°C 0.07~0.5MPa	-30~10°C 0.07~0.5MPa	At normal temperature and pressure
	Heavy Fuel Oil 1.00 0.93 1.00 200 - 400 abt. 90~100 -Integrated At normal temperature and pressure	Heavy Fuel Oil LNG 1.00 1.63 0.93 0.48 1.00 0.84 200 - 400 -162 (CH4) abt. 90~100 -188 (CH4) -Integrated 'Independent Type-C 'Membrane (Low temp.) At normal temperature and pressure -160~140°C 0.07~0.5MPa	Heavy Fuel Oil LNG Ammonia 1.00 1.63 2.86 0.93 0.48 0.70 1.00 0.84 2.15 200 - 400 -162 (CH4) -33 abt. 90~100 -188 (CH4) 132 -Integrated -Independent Type-C (Low temp.) -Soperating and pressure (Low temp.) -Soperating and pressure 0.07~0.5MPa

Table 2: Comparison of main fuel candidate characteristics and tank specifications

When ammonia is used as a fuel, due to restrictions such as the large volume per calorific value of approximately 2.86 times that of heavy oil, the low boiling point of - 33°C, and the fuel tanks which are required to handle low temperature or be pressurized, there is a direct impact on range and/or reduced deadweight and/or layout including accommodation. Therefore, careful consideration is required.

As for the design flow, first, the type of zero GHG emission fuel to be adopted and the necessity of considering the ready specification are determined. Next, the required cruising range is determined. These factors lead to the required fuel tank volume. Based on this volume, a general arrangement and initial design should be developed. If the design is not feasible, the design should be decided in consultation with the relevant parties to see what the priorities are in terms of cruising range, cargo volume, maintaining main dimensions, etc.



Challenges for greener ships

Ammonia is a deleterious substance, and safety must be ensured in places where it is handled, such as the engine room and onboard refuelling areas. In addition, both hardware and software measures need to be taken, such as measures against emissions of nitrous oxide (N₂O) and consideration of odour. Currently, the equipment for ammonia-fuelled vessels may still be under development, but manufacturers are making progress in their development.

On the other hand, for methanol-fuelled bulk carriers, the advantage lies in the lower additional cost of onboard equipment since methanol is a liquid at ambient temperature and pressure. However, the main challenge is probably the limited supply of methanol with a low GHG intensity.

In addition, the development of energy-saving technologies will become more and more important in reducing the consumption of expensive zero-GHG emission fuels.

Examples of GSC developing greener ships

As an example of the development, the status of the GSC development is presented: by 2022, a total of six ship types and sizes have been developed as ammonia-fuelled ships or as ammonia-ready LNG-fuelled ships (LNG-fuelled ships based on conversion to ammonia fuel), including the following ammonia-fuelled Panamax bulk carrier.



Figure 5: Ammonia-fuelled Panamax bulk carrier

In this conceptual design, the minimum cruising range on ammonia fuel is set at 12,000 nautical miles, allowing for a round trip between Japan and Australia. The fuel oil tanks are of a similar volume compared to conventional oil-fuelled vessels, enabling service on routes without an ammonia fuel supply base. In addition, in order to install the large-capacity ammonia tanks on deck, the design was adopted with the accommodation compartment located at the aft end of the ship and space for the ammonia tanks above the engine room. This arrangement ensures that the fuel tanks and the accommodation area are separated providing an escape route to reach the life-saving equipment without having to pass through the area around the fuel tanks in the event of an emergency. In addition, positioning the heavy fuel tanks closer to the center of the hull than at the aft end is expected to reduce the effect on the ship's balance. The conceptual design was awarded Approval in Principle (AiP) from ClassNK in January 2022.

Future challenges for the shipbuilding industry

The challenge for the Japanese shipbuilding industry is to rapidly establish a production system for zero-GHG emission fueled vessels by utilizing its accumulated design capabilities and collaborating with the marine industry to meet the social demand for reducing GHG emissions. The GSC is committed to accelerating this development. <GSC>

Oshima Shipbuilding Co., Ltd. World's Leading Bulk Carrier Supplierz

Oshima Shipbuilding Co., Ltd. has been a leading and reliable partner in the bulk carrier shipbuilding industry with 50 years of experience. By specializing in bulk carrier construction, we lead the shipbuilding industry with the highest productivity in the world.

We understand that every bulk carrier has unique requirements for each of our customers. Therefore with our extensive experience, we are designing and building the best ships that meet those needs.



At Oshima, we are constantly pursuing to produce bulk carriers with the world's highest fuel and cargo handling efficiency. We are also boldly challenging ourselves to develop environmentallyconscious new technologies to reduce GHG emissions with ships that use alternative fuels designs, and wind-powered hard-sails such as the WindChallenger

By providing world-class products and services, we strive to contribute to the development of a better world for people around the globe. Oshima Shipbuilding Co., Ltd. are proud to be a reliable partner in the industry, and we look forward to working with you to build a vessel that suits your needs and exceeds your expectations.



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Taiyo Electric Co., Ltd. System Integrator for Marine Electric Equipment

Contribute to realize carbon-free society in shipping by our "Power Electronics Technology" accumulated many years.

Shaft Generator System

Permanent magnet type shaft power generation system that further improves the efficiency of the power generation system cultivated through the development of the conventional thyristor method.



Electric Propulsion System

Electric propulsion system that combines optimal rotating machines and control equipment.



Tokyo University of Marine Science and Technolog





[Contact Details] Uchikanda Mid Square 1-16-8 Uchikanda Chiyoda-ku, Tokyo 101-0047 Tel: +81-3-3293-3061 URL: https://www.taiyo-electric.co.jp/english/

Planning and Design Center for Greener Ships Development of advanced Greener Ships with execution of studies and research for commercialisation

To attain zero emissions in international shipping, the Planning and Design Center for Greener Ships (GSC) was established to combine technological capabilities of Japanese shipbuilding industry and develop internationally competitive, advanced and environmentally friendly ships. GSC collaborates with a wide range of stakeholders, including member shipyards, marine equipment manufacturers, shipping companies, classification societies, and the Japanese government

In addition, following a comprehensive evaluation of the availability, economics, and safety of alternative fuels, GSC proposes fuel



Sumisho Corvus Energy Co., Ltd. Li-ion Battery Energy Storage System for Maritime **Industry manufactured by Corvus Energy**

The lithium-ion battery system of Corvus Energy of Norway is a provider of ESS (Energy Storage System) developed specifically for the maritime industry. The company boasts the largest market share in the industry by its proven technical capabilities and safety standard. The ESS ensures hardware safety through single cell isolated thermal runaway insulation, waterproofing and vibration resistance of the enclosure, and software safety through monitoring system, thus satisfying the strict standards required by classification societies.

Sumisho Corvus Energy is a joint venture established in 2021 between Sumitomo Corporation and Corvus Energy.

The company also has an engineer stationed in Japan to promote sales of Corvus ESS, provide technical support for delivery, and provide after-sales service after delivery. Sumisho Corvus Energy will contribute to the low-carbon and decarbonization of the maritime industry through the electrification and hybridization of ships and port facilities.





conversion scenarios from a medium- to long-term perspective. Based on these scenarios, GSC developed basic designs for bulk carriers and container ships that use ammonia or methanol as fuel. Furthermore, GSC has been awarded Approval in Principle (AiP) from ClassNK for IMO independent tank type B, expected to be the next generation ammonia fuel tanks for Container Ships. Through these initiatives, GSC is actively working to enhance the international

competitiveness of the Japanese shipbuilding industry, with a specific focus on promoting ships using alternative fuels.



Ammonia DF Panamax Bulk Carrier (AiP Obtained



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VOLCANO CO., LTD. VOLCANO GHG Reduction Initiatives

In international shipping sector, various efforts are being made to reduce GHG emissions in order to achieve carbon neutrality by 2050. Volcano has been developing various products that contribute to GHG reduction by utilizing its combustion technology, which has been refined over 95 years, and the vast amount of data it has accumulated. For LNG-fueled vessels, we have built up a supply record with the Gas Combustion Unit "MECS-GCU" and the Gas/Oil simultaneous mixed combustion DF (Dual Fuel) burner for auxiliary boilers "Vignis", both of which have been delivered in Japan and overseas. In 2023, the development of the Gas Combustion Unit for Ammonia-fueled vessels "MECS-N25" and the Gas Combustion Unit for Hydrogenfueled vessels "MECS-H25" was completed with a subsidy from the Nippon Foundation and the products were launched into the market.



Volcano has delivered DF burners to more than 270 vessels, which include LNG carriers, offshore vessels, and LNG fueled vessels for over 40 years. Volcano has built an automatic control system based on the data of our knowledge, including extensive test results and our engineers' experience in actual operation. "MECS-GCU" and "Vignis" can accumulate various operation data by monitoring the status of the equipment itself, and we can provide the demanded data upon customer needs. "MECS-GCU" and "Vignis" are also designed to be easy to operate, and are equipped with a touch panel with easy-tounderstand visual graphics. Customers can select an operation mode or perform automatic operation by operating switches on the screen. Volcano will continue to contribute to environmental conservation around the world by providing products and services that utilize its core combustion technology and the latest data application technology.



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Topic 3 Initiatives to Improve Operational Performance Initiatives to Improve Operational Performance

Operational performance improvements are directly connected to monetization

Regulations concerning ship emissions and fuel consumption are being introduced one after another aimed at reducing the emissions of GHG from the international maritime transportation (see Topic 1 "Environmental Regulations"). We have entered an era in which the reduction of ship GHG emissions and fuel consumption reduction through operational efficiency improvements will directly tie into profits more than ever before. Expectations for the use of detailed ship operation data to examine performance improvements and verify their effectiveness are further increasing, and the IoS-OP Consortium is also carrying out various initiatives to solve the issues.

Operational Performance Analysis Study Meeting based on naval architecture

Previously, charterers who bear the cost of fuel used Noon Data to examine fuel consumption reduction measures while innovative companies introduced monitoring systems and carried out advanced operational performance analysis. While long-term performance degradation can be ascertained to a certain degree with the once a day data point of Noon Data, analyzing the cause of short-term performance degradation requires the collection of high frequency sensor data with a VDR or engine data logger, etc., the adoption of established disturbance correction methods, and an analysis conducted without arbitrariness.



06 SPEED [463] 06 SPEED [463] In the case of Noon Data, the variation is not improved even with filtering (BF4 or less), and the power curve becomes person dependent.

In order to utilize such detailed data, charterers and some shipowners use applications services provided by third parties while some shipping companies use their own customdeveloped software. The IoS-OP Consortium started a trial education program in 2021 which covers shipping companies and IoS-OP Consortium member companies that support and sponsor this initiative as the "Operational Performance Analysis Study Meeting for shipping companies. "The program entered full-scale development in 2022, and has been attended by a total of 21 companies and 84 people to date.

This study meeting is held every other week over a period of three months and provides lectures and exercises on environmental regulations, calm water and actual sea ship data, and in-service data, etc. In addition, as a final step, each participating company presents a proposal about how they will use what they learned in their own companies. Because a variety of Excel functions are used in the lectures, some participants commented that they were difficult, but many participants offered high praise for the polished lectures and appropriate advice given by excellent instructors including a lecturer from a shipyard and a wave expert. One shipping company had all of their employees in charge of performance analysis participate in the study meeting.



No.	Description
1st	Understanding the power curve and environmental regulations
2nd	Meteorological and oceanic phenomena (disturbance measurement, utilization of hindcast data)
3rd	Powering exercise in calm waters
4th	Actual sea powering exercise
5th	In-service analysis
6th	Presentation (route selection that minimizes CII and what we learned through in-service analysis, etc.)

In addition, sponsor companies also give two presentations during the period. Previous examples include an introduction to in-service analysis and other methods of technology utilization and a lively exchange of opinions. In addition, participants may voluntarily join a hosted facility tour which introduces the manufacturing processes of actual machines and the efforts

behind their manufacture, etc. In this way, we are striving to foster human resources that can understand ship performance analysis results to help improve operational performance.



Facility tour (BEMAC Mirai Factory)

Implementation of an operational profiling report creation trial for shipping companies

We have received various forms of feedback from the participating companies through the Operational Performance Analysis Study Meeting hosted since 2021, and the following points have become clear.

- The analysis of operational performance is useful for selecting the optimal operational route, assessing calm water performance, assessing ship hull and propeller fouling and degradation over time, and verifying the effect of energysaving additives.
- There is a need for sharable analysis, etc. to close the gap between charters and management companies regarding ship bottom and propeller cleaning through continuous monitoring (analysis), assessment of performance deterioration during the chartering contract term, and safe CII optimal operation and the shortest route, etc.
- Established analytical methods are required to justify the validity of the analysis results (eliminate arbitrariness, no reliance on rules of thumb, etc.)
- There is a lack of human resources and time to spend on the analysis of operational performance.
- Know-how is not passed on due to the transfer of human resources with analytical know-how.

For these reasons, the IoS-OP Consortium is conducting a trial project with multiple shipping companies that creates reports on behalf of companies that lack the human resources needed to create reports.

This project aims to establish methods that eliminate analytical bias (arbitrariness) and ensure fairness with the same results being produced regardless of who performs the analysis and standardizes reports for providing low-cost services to be able to contribute to zero emissions.

The analysis tool uses a data analysis app developed in the "Evaluation of Ship Performance in Actual Seas Project (OCTARVIA)" collaborative research involving Japanese maritime organizations. OCTARVIA is a joint project that develops methods for accurately evaluating performance (actual sea performance) such as speed and fuel consumption in seas with waves and wind where vessels actually operate for the purpose of building a standard which can objectively evaluate and compare almost all ships around the world with equivalent accuracy.

The data analysis app includes "EAGLE-OCT" which estimates the ship hull resistance coefficient, self-propulsion factor, and single propeller characteristics, etc., the "OCTARVIA (-prediction/-index)" which performs external force calculations and actual sea performance estimations, and "SALVIA-OCT" which analyzes calm water performance and solves for performance changes over time. Using these functions, calm water power curves, power curves for encountered oceanographic phenomena in actual seas, sea margins, and performance deterioration curves that reflect the impact of ship hull fouling and degradation over time, etc. can be obtained. The data items needed for analysis are limited to the following 14 items, and it is not difficult to prepare the data. These pieces of operational data are linked to the high-precision and freely available wave data (hindcast) needed for the analysis from the European Centre for Medium-Range Weather Forecasts to perform the automatic analysis.

1. Measurement date and time	6. Heading	11. Main engine RPM
2. Ship location (longitude)	7. Course	12. Main engine output
3. Ship location (latitude)	8. Rudder angle	(horsepower)
4. Ship speed over ground	9. Relative wind speed	13. Displacement
5. Ship speed through water	10. Relative wind direction	14. Fuel consumption

<Example of the provided analysis report>





Because safe operation and uptime, etc. are more important factors than verifying daily operational performance for shipowners and management companies in contrast to charterers, the burden of investing in performance analysis and other applications may be too great. However, the fuel economy performance rating system (CII) which started in 2023 and the EU-ETS Emissions Trading System starting in the EU in 2024, etc. impact the evaluations and businesses of shipowners.

We believe that if these reports are utilized in the future, they will be able to easily examine performance improvements based on ship operating conditions and help reduce CO₂ emissions from ships as a result. Moreover, it is also thought that initiatives such as these will provide an opportunity to consider the introduction of more advanced applications. In addition, if a system to present suggestive analysis by experts can be established based on the reports, it can be tied into verification of the effects of energy-saving additives and CO₂ emission reduction in operations. Going forward, we will continue to promote initiatives to improve operational performance for ships through data utilization together with the member companies of the IoS-OP Consortium.

Japan Radio Co.,Ltd. J-Marine Cloud

J-Marine Cloud uses a common platform to collect various types of information, including meteorological and oceanographic information and AIS information. Various data such as voyage data, route plans, and navigational equipment status are also collected on a common platform via VDR, J-Marine NeCST, and other shipboard equipment. These data can be combined to provide advanced vessel management and operational support solutions for onshore fleet managers. J-Marine Cloud also provides a variety of services to vessels, such as meteorological and oceanographic information services and optimal route support services, to boost on-board decision-making capabilities of vessels.



YANMAR POWER TECHNOLOGY CO., LTD. Supporting generator engine control with AI/ICT

Yanmar Power Technology Co., Ltd., a group company of Yanmar Holdings Co., Ltd., has since 2019 been providing SHIPSWEB, which provides information support services to support the control of generator engines mounted in oceangoing ships with Al/ICT technology.

With many devices being electrically controlled, a stable power supply is a ship's lifeline. However, it has become more difficult to maintain the quality of engine control in recent years



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These features contribute to improving and resolving various navigation-related issues, such as energy-saving navigation, environmentally friendly measures, and anti-piracy measures. JRC has received certification for its J-Marine Cloud, a maritime information service that enables safe, secure, and smart ship operation management, under the "Innovation Endorsement" certification service for innovative technologies offered by ClassNK for products and solutions.

JRC will continue to provide effective solutions for realizing the practical application of automated

vessels by 2025.





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due to diversified crews, spending less time on board vessels and environmental regulations leading to more complex inboard equipment.

With a focus on these issues, SHIPSWEB provides various functions such as Engine Performance Analysis, Maintenance Guide, Parts Catalog and Troubleshooting as a platform for information provision services to enable customers to obtain the technical information they need at the appropriate timing to complement their own experience and knowhow.

These services are linked with other companies' data platforms, and SHIPSWEB SMART-LiNK, a smartphone app which can be used offline, is also being released.

Yanmar will continue to do our best to help customers solve problems by providing better ICT services.



[Contact Details] Smart Service Promotion Office Large Power Products Business

Chugoku Marine Paints, LTD. **CMP-MAP CMP Monitoring & Analysis Program**

Greenhouse gas (GHG) emissions are an international concern due to the adverse environmental effects of climate change. The IMO agreed to reduce the total annual GHG emissions by at least 50% from 2008 levels by 2050. EEDI regulation and CII rating have been started from January 2023. GHG emission and vessel performance will be evaluated more strictly. Therefore, maintaining the hull performance by antifouling systems will be more important than ever.

Prediction & Planning (Prediction by Triple "CMP-MAP" approach) Do Professional coating Application under selection professional supervision Hull- PDCA Check

Act Investigation of the "CMP-MAP" reports Solution for better performance

Triple "CMP-MAP" approach

2 Performance analysis (report)

3 Operational profile analysis

FIR analysis (report)

CMP - Monitoring & Analysis Program (CMP-MAP) developed based on our years of experience. The methods visualise the hull performance through the triple "CMP-MAP" approach. "FIR theory" visualises the effects of low-friction antifouling and surface treatment such as full blasting by Friction Increase Ratio calculated from roughness measured by 3D hull roughness analyser. "Performance analysis" visualises hull performance using performance indicator defined in ISO 19030. "Operational profile analysis" helps to find more appropriate antifouling specification using operational profile calculated by AIS or GPS data. The methods continuously improve hull performance through our original PDCA cycle called "Hull-PDCA". CMP will provide the program as solution provider, also using the IoS-OP data platform.



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IHI Power Systems Co., Ltd. The new lifecycle support services for domestic vessels with ClassNK CMAXS LC-A

By utilizing self-development remote monitoring system for marine propulsion system with 4stroke main engine, IHI Power Systems had made efforts to serve quickly understanding and troubleshooting for abnormal situations while sharing operation data with customer. And now, we are launching the new support services with ClassNK

CMAXS LC-A for domestic vessels in which is taken over the knowhow cultivated with CMAXS LC-A for ocean-going vessels.

Through the diagnostic support including predictive maintenance by reducing "secondary damage", "non-operating loss", and "unscheduled work", we will serve more reliable and valuable support in life cycle of products for the customer.

We also confident that ClassNK CMAXS LC-A for domestic vessels could contribute to be realize energy saving and economic operation with labor shortage and society ageing as a background.





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Nabtesco Corporation TELEGRAPH AGENT MTA-800-V

Nabtesco has launched the TELEGRAPH AGENT: MTA-800-V, a device designed to maintain consistent vessel speed, shaft horsepower, and fuel flow rate for ship engines.

Previously, crew members manually controlled engine revolutions and adjusted vessel speed or engine load via the TELEGRAPH HANDLE of the remote control system. The new TELEGRAPH AGENT system automatically tracks and adjusts to the desired vessel speed, horsepower or fuel flow rate, reducing crew strain and promoting fuel efficiency.

Drawing on our expertise as a remote control system supplier, we ensure safe control transitions and engine-friendly rpm management.



For ships lacking shaft horsepower or fuel flow meters, the system can also operate on calculated values from engine data. Furthermore, we are enhancing optimal navigation through our subsidiary DeepSea

Nakashima Propeller Co., Ltd. Ship monitoring system (NASCA) which utilized a shaft horsepower meter (NASCA: Nakashima Ship Cruise Assist System)

NASCA system is to a superior product in the visibility that can read main measurement items related to grasp the navigation situation (vessel speed, shaft revolution, shaft horsepower, fuel consumption, propeller efficiency, CO₂). In addition, this system can grasp the tendency of the navigation status by utilizing a shaft horsepower measurement results and propeller performance information. The deterioration situation can be found from the propulsion performance



Technologies' Pythia system and advancing cybersecurity measures and classification society certifications.



Nabtesco remains committed to advancing technology that meets the maritime industry's safety, environmental, and operational needs, ensuring our customers receive the utmost in safety, security, and comfort.



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and CO₂ discharge obtained from shaft horsepower meter. Consequently, the timing of the dry dock (ship and propeller

**	opeller Performance Monitor
	M NUCASHIMA
	2021-10-05-75-00-00
	ip Speed 17 knots
1	uft Speed i6.0 rpm
1	uft Horse Power 65 kW
111 111 111	el Oli Consumption IS L/h
	el Efficiency 361 km/L
. ,	ita Propeter Efficiency (Ptrc5) O N
	12 7 kg/Total - 7.4 kg/Propulsioni





cleaning) can be judged by a series of data analyzed. Moreover, the cause analysis of fuel oil consumption can be employed. The alert function in this system can be activated when a propeller was damaged.

The loss of data less occurs when malfunction occurs for communication between land and ocean as the PC installed Data base itself, therefore data can be restored if communication becomes normal. It can thereby be employed as a trustworthy data archive.



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Akishima Laboratories (Mitsui Zosen) Inc. Our solid technology supports you to achieve zero emissions

Using statistical methods and AI technology to analyze vast amounts of data measured on actual vessels, it is becoming possible to evaluate the fuel efficiency of vessels in actual sea areas and the effects of disturbances. Unfortunately, however, it appears to be difficult to understand physical phenomena and obtain guidelines for improvement simply by processing data.

To make effective use of the data, analyzing with high precision the various factors that affect a vessel's actual performance at sea, such as the effects of fouling, aging, wind resistance, and added resistance in waves is indispensable. Relating these factors to physical

phenomena, developing effective countermeasures targeting hardware improvements and software



Akishima Laboratories (Mitsui Zosen) Inc., originated from a shipyard, is now "independent from the shipyard". We can make various proposals for effective use of data based not only on data analysis technology measured on actual vessels, but also on performance improvement technology backed by our proven results based on high-precision tank testing technology and large-scale

numerical simulations. Akishima Laboratories (Mitsui Zosen) Inc. will assist you to achieve zero emissions through planning effective measures for highly efficient operation.





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Alpha Ori Technologies (TBN as ZeroNorth A/S) SMARTShip and ShipPalm Tech Solutions

ShipPalm: Future-proof & scalable ERP solution to streamline the various facets of Ship Management - Planned Maintenance, HSEQSystems, Procurement, Document Management, Vessel & Voyage, Certificate Management, and Dry Dock Management modules. The product is compliant with all TMSA requirements and SIRE-2.0. It comes with a guarantee of protecting your IT investment against technological obsolescence.

SMARTShip™: SMARTShip™ revolutionizes maritime operations with its cutting-edge digital platform. Integrating real-time sensors and third-party data (including noon reports, weather, AIS, etc.), it enhances transparency and facilitates seamless communication between ship and shore to improve vessel performance, safety, and sustainability. This innovative system offers wide-ranging applications addressing diverse maritime needs, including fuel optimization, emissions management, predictive maintenance, hull assessments, and more, ensuring a smarter and more sustainable maritime journey.





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KOZO KEIKAKU ENGINEERING Inc. Design, Manufacturing and Operation Support by Engineering

Kozo Keikaku Engineering Inc., as an engineering consulting firm based on engineering knowledge, is working to solve complex social issues. Since our founding as a structural design office in 1956, we



omputer Aided Engineering st

have expanded our business into various fields such as construction, disaster prevention, telecommunications, manufacturing, logistics and decision-making support for various corporate activities. Using our diverse technologies such as data analysis, optimization, simulation, and image analysis, we offer solutions suitable for clients' challenges and support the installation of them.

<Examples of Design and Manufacturing Support>

- Improving design efficiency and preventing defects by CAE and past findings
- Non-contact deformation strain/displacement measurement using image analysis
- Magnetic non-destructive testing

Napa Ltd NAPA Fleet Intelligence

NAPA Fleet Intelligence is a user-friendly cloud-based solution for improving ship efficiency and safety. This software enables you to analyze and optimize vessel and voyage performance with high accuracy, helping you reduce emissions, increase profitability, and even validate new technologies.

NAPA Fleet Intelligence software combines a variety of data sources, such as weather, AIS data, navigable routes, and noon reports or automation data, with highly accurate ship performance models to create insights and advice for improved performance. NAPA Fleet Intelligence modules include

NAPA Voyage Optimization, for safe and fuel-efficient weather routing
CII Simulator, to monitor and manage the CII rating



- Cargo lashing safety assessment
- Production management
- Quality risk management
- <Examples of Operation Support>
- Improving transportation efficiency through optimal repositioning and vanning planning
- Seafarer and worker shift scheduling
- Condition monitoring and maintenance by vibration analysis and abnormality detection
- Ship performance diagnosis by big data analysis
- Accident sign detection of engine section
- Inspection automation with image recognition
- 3D data measurement and platform of inboard space
- Container stowage operation support at Advanced Ocean
- Container Transportation Engineering Lab



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- Fleet and Voyage Monitoring
- Regulatory Reporting, for regulatory compliance
- Technical Performance, advanced analysis of vessel performance • Charter Party, for monitoring of commercial contract compliance
- Stability & Emergency, to follow up on stability, strength and vulnerability
- Navigational Risk Monitoring, to be alerted on grounding risks
 Logbook Reporting



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Sunflame Co., Ltd. Sunflame Smart Support System

The "SUNFLAME SMART SUPPORT SYSTEM" is an operation monitoring and performance analysis system for auxiliary boiler burners and marine incinerators. It offers real-time data collection and visualizes operation data using IoT and provides advice on parts replacement and engineer dispatchment along with operation monitoring and performance analysis. Using the system, SUNFLAME offers suggestions for parts replacement and equipment maintenance as well as advice for effective operation for trouble prevention and fuel efficiency. The system allows its users to maximize operation safety and cost performance of their equipment.

The operational data, which is collected using the data logging function in our products, is sent to shore real-time using ship-to-shore communication infrastructure. The system can be installed



with minimal changes to the preexisting infrastructure because the data used for analyses can be sent without passing through the vessel's data logger. The data is then accumulated by SUNFLAME's own internal server for further analysis of its operation. The data is then distributed



to the users in forms of daily and monthly reports, which displays the equipment's operational status, and critical reports, which provides an explanation of troubles that have occurred on the vessel.

The communication device used for SUNFLAME SMART SUPPORT SYSTEM can also be used by non-SUNFLAME products as a standalone data transfer gateway.



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Toqua Ship Kernels: Turn Sensor Data into Fuel Savings

Toqua helps you unlock the full potential of your sensor data. More and more ships are collecting high-frequency sensor data, but few companies are able to unlock the full potential of this data. Toqua's Ship Kernels do exactly this.

Toqua's technology is compatible with existing solutions. Our Ship Kernels can be plugged into all the different software solutions you already have. This way all systems can benefit to the fullest from sensor data, while also ensuring a single source of truth on vessel performance.

In short, Toqua makes sure you capture the full potential of your sensor data, in a way that allows this potential to be shared with all solutions and stakeholders. This creates one shared truth for performance based on sensor data, to facilitate data-driven decarbonization decisions between stakeholders.

TOKYO KEIKI INC. Straight Leg Course Control Unit CC-06

The latest Automatic Steering Function (ACE: Advanced Control for Ecology) is now available for integration to existing PR-6000 Autopilots!

* Optional installation for PR-9000 series Autopilot.

The Course Control Function (ACE: Advanced Control for Ecology) that automatically creates a route on the heading between the ship's current position and destination, calculates outside disturbances (tides), and implements the best rudder control making it possible for the vessel to sail the most efficient route.

Compared to normal automatic steering (Heading Control),

- Less route deviation
- Shorter sailing distance
- Reduction in the use of Rudder
- Minimized burden on the Helmsman
- contribute to a safe and more efficient voyage.











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Autonomous Vessels and Initiative of ClassNK

Cause

The development of autonomous vessels is advancing around the world. For example, the "MEGURI2040" Fully Autonomous Ship Program of The Nippon Foundation conducted demonstrations with a sightseeing ship, coastal container ship, and a large-sized ferry along actual commercial routes through five different consortia. Berth to berth autonomous operation has also been implemented through crew shadowing which successfully executed maneuvers to avoid other ships and fishing vessels conducting commercial activities. Through the experiences gained through these demonstrations, each of the manufacturers is accelerating development with the goal of social implementation in 2025.

In this way, autonomous operation technologies are attracting attention as technologies that are necessary to solve social issues such as measures to address the shortage and aging of crews, crew load reduction (crew work style reform), and environmental load reduction as the development of autonomous operation technologies advances. The role of ClassNK is to set rational safety standards and steadily implement the necessary evaluations after understanding what kinds of changes will occur in the maritime industry and society as a whole with the appearance of autonomous vessels and keep in mind the "significance" of considering how autonomous operation technologies should be implemented as a piece which is needed for the maritime industry to continue to be sustainable.

Project team for Maritime Autonomous Surface Ship (MASS)

The role of ClassNK in the maritime industry is to provide full support so that newly developed technologies are implemented at an early stage. The greatest task is to develop rules while steadily advancing evaluation and certification. In order to steadfastly fulfill this role with respect to autonomous vessels as well, the cross-functional "NK MASS PT" was established in 2020, and the team is building a system to meet the needs of the maritime industry.

In addition to surveying technology development trends in autonomous vessels, the Project Team is conducting research, etc. concerning safety evaluations and supporting the safety evaluation of MEGURI2040.

Guidelines

ClassNK has undertaken research related to autonomous vessels as one of its most important themes since 2017. The results of those efforts were summarized in the guidelines issued in May 2018 and January 2020. ClassNK is utilizing these guidelines to conduct safety evaluations of newly developed autonomous operation technologies in a rational and transparent manner and continues to accumulate technical knowledge through the issuing of AiP certificates for conceptual designs and the screening of component technologies, etc. while cooperating with Japanese frontrunners.



Figure 1: Autonomous operation guidelines

International contributions

The development of international regulations for maritime autonomous surface ship (MASS Code) is being advanced by IMO. A development roadmap has already been presented, and mandatory codes are scheduled to come into force from January 2028 after creating non-mandatory, goal-based regulations within 2024.

Furthermore, an expert group (EG/MASS) has been launched within IACS to conduct an expert review of autonomous vessels, and ClassNK is also participating as a member. ClassNK is actively working to stimulate discussion within IACS.

Active dissemination of opinions

Based on its experience working on the demonstration project and standards development for autonomous vessels, ClassNK published a white paper in April 2023 titled, "Towards MASS social implementation" which summarizes its current thinking on the topic. The white paper summarizes the use cases for autonomous vessels, perspectives for the examination of safety requirements, differences with existing technologies, and a risk assessment, etc. before proposing a framework for safety evaluations in the design and development phase and the ideal form of the PDCA cycle in the operation phase.



Figure 2: White paper

For example, it is expected that autonomous operation systems will be large-scale and complex. Because a systematic approach is required in the safety evaluations of the design and development phase, the white paper proposes a framework based on system engineering.

MASS = ANS + AM system + Communication system + ROC (requirement definition)				
MASS Requirement definition , Conceptual design Test based System test System operation				
l Based on risk assessment, etc. on testing plan Functional - Requirement definition decomposition - Functional decomposition (including safety functions) - Extract test specifications, etc.				
ANS, AM system, Communication system, ROC Dominuncation system, ROC				
Module decomposition				
Lookout sensor Detailed design + Component test - Module unit test				
CA route planner, etc. Implementation Timeline				
System design and development system and process screening Document-based screening (Review of the risk assessment results) Require a functional verification test as needed State of the sta				

Figure 3: Framework

Moreover, because they are new technologies with no track record, some aspects remain which "cannot be understood without trying it out." The discovery of defect data and cases of unsafe incidents post-implementation should be expected, and a mechanism is needed to collect these cases in a timely manner and feed that information back into the technologies and regulations. Accordingly, the importance of the PDCA (Plan-Do-Check-Act) cycle in the operation phase is being raised while also proposing the utilization of a vulnerability database.

The white paper does not have the coercive power of regulations or guidelines and it was created with the intention of being useful as material for stimulating discussion among the relevant parties. If a gap in understanding were to occur between ClassNK's approach and the relevant parties, it also aims to clarify issues that would close that gap. This was the first attempt by ClassNK to issue deliverables in the form of a white paper, but it was done so with the expectation that it would stimulate discussion between a broad range of parties involved in autonomous vessel development, operation, business creation, and regulatory review, etc.

Issues and future course of action

Autonomous vessels have shifted from research and development to the demonstration phase, but there are issues. For example, because they are systems which include component technologies that have not reached technological maturity, validation of the overall system safety has yet to take place. Moreover, various use cases such as manned support, labor saving, and remote support, etc. are conceivable, but the safety standards according to each use case must be established going forward.

In addition, issues such as how to organize the scope of responsibility if a defect occurs in an autonomous operation system and how to establish the risk tolerance still need to be discussed. In this way, there are still "discussions which must take place" as an industry. We will continue to work to ensure that attention is paid to such issues.

Conclusion

Autonomous vessels should be developed in a way that aligns with the changes in crew work styles and roles, and coordination with the education and logistics side will also be important. To complete the depiction of autonomous vessels as the core of a new social system in a larger frame instead of simply stopping at technological innovation in ships, it is important that each stakeholder consider from their own standpoint the question of what technology evolution can bring about in society. On this point, we acknowledge that the classification societies have a huge role to play from a neutral standpoint. We will continue to strive to further stimulate discussion about the social implementation of autonomous vessels. ClassNK>

SKY Perfect JSAT Corporation JSATMarine with CIR high-speed communication service

In response to accelerating digitalization in the maritime industry and ever-growing demand for crew internet connectivity, SKY Perfect JSAT leverages its own GEO HTS (high throughput satellite) to deliver high-speed internet access with CIR (Committed Information Rate). Its platform operates from SKY Perfect JSAT's teleport, together with enhanced network security such as encryption and managed firewalls. Its service covers major shipping routes from Western Pacific Ocean region to Indian Ocean region.

With the introduction of "JSATMarine", shipping companies can take advantage of its connectivity in promoting maritime IoT solutions to achieve higher standards of safety navigation and operational efficiency. For installation and maintenance support, SKY Perfect JSAT works closely with Japanese reliable maritime equipment manufactures to provide our customers with top-tier professional and comfortable services. In addition, SKY Perfect JSAT will continue to work towards developments of autonomous ships in the future of the Japanese maritime industry.

Furthermore, as part of our commitment to achieve SKY Perfect JSAT's SDGs target, "JSATMarine" platform and teleport facility are fully powered by renewable energy.





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JRCS infoceanus: Digitalizing the Maritime Industry

As a company with a strong motivation to help achieve the marine industry's vision of zero-emission sailing, digital transformation, and automated vessels, JRCS has created infoceanus, a digital series that maximizes the potential of ships and provides support for all those who work in the industry.

infoceanus provides multiple solutions, one of which is "assist", a



maintenance solution that centralizes onboard troubleshooting management and reduces the burden on the ship's crew. The solution "command", is an AI solution that supports safe ship operations through situational awareness using cameras and computer vision. There is also the solution, "connect", which collects and analyzes vessel operation status in real time to support operational management.

These solutions work by connecting the onboard Edge server with the cloud, using IoT technology. The data collected has real time analyzation capability to ensure safe vessel operations.

Through their infoceanus series, JRCS will continue innovating as a comprehensive solution provider for all those involved in the industry and will maintain a progressive motivation to make new changes and provide positive support.



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Developments in the Maritime Industry

The maritime industry is one of the key pillars of the global economy, and its safety is of vital importance. In recent years, the significance of cybersecurity in the maritime sector has been heightened due to cyberattacks. However, cyber-attacks cannot be completely thwarted by operational measures taken by ship crew. To ensure cybersecurity on vessels, it's imperative to design them with cybersecurity in mind from the construction phase. In light of the above, unified requirements IACS UR E26 and E27 were established in April 2022.

Overview of IACS UR E26/27

IACS (International Association of Classification Societies) has established UR E26 for vessels and UR E27 for onboard systems and equipment as minimum requirements for cyber resilience – the capability to reduce and mitigate the impact of incidents resulting from cyber-attacks.

UR E26 aims to safely integrate operational technology (OT) and information technology (IT) related equipment into the ship's network at every stage – design, construction, commissioning, and operation – treating the ship as a collection of cyber



resilience, specifying requirements related to identification, protection, cyber-attack detection, response, and recovery.

UR E27 focuses on ensuring and enhancing the integrity of systems through third-party equipment suppliers. It sets requirements for cyber resilience of onboard systems and equipment, interfaces between onboard users and computer-based systems, and product development and development requirements before the implementation of new devices onboard. In 2023, Rev.1 of UR E26/27 was issued, clarifying requirements for required surveys and applying to ships whose construction contracts are concluded on or after July 1, 2024.

Response to IACS UR E26/27

IACS UR E26/27, focusing on maritime cybersecurity, involves 'suppliers', 'integrators' and 'shipowners/ companies'. 'Shipowners/companies' need to share relevant information with 'integrators' post-shipyard contracts. 'Suppliers' need to ensure their products meet UR E27 standards, requiring classification society approval. 'Integrators' need to create inventories, build networks, and implement cybersecurity measures per UR E26, covering design to commissioning phases. After a ship is operational, 'shipowners/companies' are required to operate it according to UR E26. This

includes managing an inventory list and responding to cyber incidents in accordance with a 'Ship cyber security and resilience program'.

Initiatives of ClassNK

ClassNK will integrate UR E26/27 requirements into the 'Part X of the Rules for the Survey and Construction of Steel Ships'. This includes cybersecurity classification rules and type approval for marine equipment under UR E27 in the 'GUIDANCE FOR THE APPROVAL AND TYPE APPROVAL OF MATERIALS AND EQUIPMENT FOR MARINE USE'.

In addition, ClassNK's guidelines will explain UR E26/27 requirements to aid stakeholders. These guidelines, understandable cybersecurity concepts and approval processes, will make our regulations more accessible. The guideline for UR E26 will be issued in May 2024, while the UR E27 guideline was issued in October 2023. These guidelines cover cybersecurity basics, including key terms like 'identification' and 'authentication', and outline the approval process in a flowchart, detailing required documents and survey steps.

Guidelines for Cyber resilience of ships



CONTENT Commentary on UR E26 **TARGET** Shipowners & Shipyards **ISSUE DATE** Scheduled May 2024

Guidelines for Cyber resilience of on-board systems and equipment



CONTENT Commentary of UR E27 **TARGET Suppliers PURPOSE** Providing followings - Understanding of cyber security

- Processes required for approval

Understanding of Cybersecurity

- System Secure develop
- Explanation of security requirements and terminology
- Specific examples of security measures are introduced.
- > Supporting suppliers in understanding the ements and considering the necessary security measures for a product

Process Required for Approval Scope 🚠 Approval Process

- Clarifying more clearly the subject of compute
- Clarifying the process depending on whethe
- type approval is required > Supporting the process by which approval is
- completed for a product

Other Initiatives

In addition to issuing the above guidelines, ClassNK will conduct awareness activities regarding UR E26/27 through external seminars and other means. Information about these activities will be announced at the following URL.

URL: https://www.classnk.com/hp/en/activities/ cybersecurity/ur-e26e27.html

<ClassNK>

nation of System Requireme

Partially omitted approval process by type approval

Individual product approval

Normal approval process

Approval process by omission request

Flowchart of Ind

MOL Techno-Trade, Ltd. **Providing Resilient PNT** and Remote Cyber Security Measures

Global Navigation Satellite Systems (GNSS) have enabled the widespread adoption of Positioning, Navigation, and Timing (PNT) services in many applications across modern society. On the other hand, GNSS signals are fragile and vulnerable to jamming and spoofing. The loss of PNT information can result in crippling critical infrastructure that is necessary for survival.



The maritime sector, which until a while ago was considered safe due to the lack of Internet connectivity, is showing an increase in cybersecurity breaches as it enters the digital era. Therefore, cyber security measure needs to be in place to handle the safety considerations and risks new technology brings with it, as well as to ensure that we keep vessel operation and crew and passengers safe.

Marine Net Co., Ltd. Vessel IT network and equipment status monitoring using MN-Station®

Marine Net helps ship owners/ship management companies build IT infrastructure on their ships.

As part of this, we will provide the "MN-Station® Service", a service for realizing the monitoring and management of onboard IT equipment through the "MN-Station®" unit developed in-house. Management and understanding of IT assets

When introducing MN-Station[®], we will understand the ship's network environment and propose improvements. After installation, based on remote status monitoring information, we will provide support and proposals for the appropriate maintenance and





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MOL Techno-Trade now works on developing cyber safety solutions to ensure the safe future of maritime digitalization. As a marine cyber security expert, we combine specialist industry



knowledge and the best solution systems to provide customers with strategic solutions to prevent and recover from cyber incidents. We provide the latest range of PNT and cyber security services below.

- Safran: GNSS Anti-Jamming and Spoofing Device
- Athena Dynamics: Remote Cyber Security Service



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management of shipboard IT assets.

Reduce the burden on customers involved in IT operations! With the introduction of MN-Station[®], alerts will notify you of daily troubles, risks, and replacement of devices. We can take countermeasures in a timely manner, start updating the IT asset ledger, and reduce the customer's work burden.

Cyber Security Management System (CSMS) and MN-Station® In order to build and operate a cyber security management system (CSMS), it is necessary to manage the IT assets onboard and grasp the situation appropriately. must be done. MN-Station[®] supports your company's CSMS operation through the onboard IT network/ equipment status report required for CSMS operation.



[Contact Details] IT Development Group E-mail: it_support@marine-net.com Topic 6 Technology and Solutions

IoS-OP Shore Data Center

Shore data center functions

The shore data center provided by Ship Data Center Co., Ltd. (ShipDC) is equipped with functions that control access based on the IoS-OP Terms of Use, and functions are provided based on each role which organizes the stakeholders in the data distribution. The Platform Users (PU) who are data usage right managers have data access setting and management functions, Platform Providers (PP) who are data collection server providers have functions for checking the data reception status, Solution Providers (SP) who are shore solution service providers have a data retrieval interface through an Application Programming Interface (API), and the Solution Users (SU) who are the SP's service users transfer and receive access keys called "data keys" based on the PU access settings. These functions are provided in the "ShipDC portal" web system for each role via robust security authentication. In addition, a simple wake display for PU, data downloading, and other functions are implemented so that the platform may also be used as a data vault.



Role organization within IoS-OP

Data reception

The shore data center can receive and store data in various formats. It can receive and store not only time-

series text data (CSV) but also file-formatted data, and depending on the communication line, it can handle PDFs, photos, videos, and binary files, etc.

Moreover, it provides two types of methods for data transmission protocols that can be freely selected by the user: API-based data transmission and the transmission of email with a compressed data file attachment.



Data storage

The data names use a mechanism which retains both the original name and the code specified by ISO 19848 (machine-readable name) only when the received and stored data is text data, and the data user can freely switch between both names. The codes specified by ISO 19848 are automatically assigned by natural language AI.

Moreover, it provides a data reception monitoring



Access control

In IoS-OP, the PU register and issue the data key to the SU who share data. Moreover, they can specify in detail what ships and what data items to grant access to for each data key.

Data retrieval (API)

The SP who provide ship performance monitoring, weather routing, engine monitoring, and other services must register to use IoS-OP in advance and obtain a key called the "app key" for API connections. SP use both this app key and the data key possessed by the SU who are permitted data use to call the API and retrieve the data.

Application-specific APIs are provided to assess the

Meteorological and oceanic phenomena data grant service

As mentioned in Topic 3 "Initiatives to Improve Operational Performance," there is a mechanism in the operational profiling report to grant meteorological and oceanic phenomena data from the time and location information (longitude and latitude) of the data stored in ShipDC. The meteorological and oceanic phenomena function that can be freely configured by the PU and is equipped with a system that sends mail notification when nothing is received for a certain period of time or when a data item that is outside of the monitoring item setting range is detected. In addition, when an SP discovers a data error and reports the details, the PP is contacted, and there is a function for managing the bug fix.

In addition, the registered SU can check the frequency at which they are retrieving data and with which SP apps to provide highly transparent sharing management.

data storage conditions, check the scope of permissions, retrieve the channel names, identify differential data, and retrieve time-series data, etc. With the exception of files, data retrieved via the API is provided in JSON format, which is easy to handle in programming. SP need to parse this JSON-formatted data, convert it into a format according to the app, and store it in a database.

data uses fifth-generation atmospheric reanalysis data (ERA5) from the European Centre for Medium-Range Weather Forecasts (ECMWF) that links a 0.5-degree mesh, hourly wind and waves (significant pulse height, direction, period), and swells (significant pulse height, direction, period) to the analysis data.

ClassNK Innovation Endorsement

ClassNK has offered Innovation Endorsement as a certification service to promote the spread and development of innovative technologies and initiatives. In the pursuits of environmental issues, including decarbonization, safety, working environment improvement, and acceleration of digital technology utilization, ClassNK supports the spread and development of advanced initiatives of those involved in the maritime industry through third-party certification.

Among the certification categories, "Products & Solutions" covers equipment and software technology installed for use on vessels. ClassNK has so far certified a wide variety of innovations; various types of monitoring, ship maneuvering assistance, onboard data collection platform, ship-shore communication, weather routing, fuel efficiency improvement, remote assistance, cyber security support, freshness preservation in chambers, AR utilization, and microplastic collection, based on our expertise of rulemaking, survey, and evaluation refined through classification services.

For "ships", ClassNK also supports the ship's value enhancement by granting notations: Digital (DSS), Environment (a-EA), Safety (a-SAFE), Working Environment (ELW), on the certificates of the

ships in which innovative technologies are adopted. For "providers" engaging in the innovative initiative, ClassNK offers three levels of certification: Concept Stage (Class C), Development Stage (Class D), and Sustainable Implementation Stage (Class S).

The scope and methods of Innovation Endorsement are expanded and improved flexibly through dialogues with customers. Please feel free to contact us to find out how ClassNK can offer the best tailored options for your products and solutions.

ClassNK Innovation(Endorsement SAMPLE

[Contact Details] **ClassNK**

Digital Transformation Center, ClassNK Tel: +81-3-5226-2738 E-mail: dxc@classnk.or.jp

> For more information, please access our website:

ClassNK Innovation Endorsement

Third-party certification of innovations and initiatives (concepts and real services) Convincing stakeholders of feasibility and value of the innovations Developing adequate and accountable standards for emerging tech

	Digital	Green	Safety	Labor	
Ships Notations on Class Cert.	Digital Smart Ship (DSS)	Advanced Environmental Awareness (a-EA)	Advanced Safety (a-SAFE)	Excellent Living and Working Environment (ELW)	
Products & Solutions	Machinery Monitoring, Data Quality	HW/SW for Energy Efficiency	Navigation Monitoring, Alerting	Low Cabin Vibration	& YOURS
Providers - Concept - Development - Sustainable Implementation	Management Optimization	Decarbonization, Environmentally Sound Facility	Fleet Control Support, Advanced Monitoring	Working Condition Improvement, Remote Hospital	

DAIHATSU DIESEL MFG. Co., LTD. **CMAXS LC-A**

DAIHATSU'S NEW SERVICE SOLUTION, CMAXS LC-A, utilizes cloud-based engine condition monitoring (ECM) and diagnostic and troubleshooting technologies for the safer operation of vessels and reductions in life-cycle costs.

Building up our range of IoT-supported products and services the CMAXS LC-A integrates the management and monitoring of main engines, auxiliary engines and auxiliary devices in one, easy to use internet-based platform. And with trouble-shooting functions connected directly to Daihatsu you can be ensured of quick and relevant maintenance support.

the condition of any vessel from any location.

As the same data can be viewed by jumping from the fleet list to

operation of vessels and helps to reduce life-cycle costs. Retrieve a target vessel's data at any time





the same monitoring screen as that onboard the vessel, you can address device management problems from the same viewpoint as that of the crew.

MITSUI E&S Co., Ltd. Engineering & Services for Evolution & Sustainability

Established in 1917 as the shipbuilding division of the former Mitsui & Co., Ltd., we have enlarged business domains such as marine engines, industrial machinery and port cranes.

On April 1, 2023, we have changed our trade name to MITSUI E&S to make a fresh start and turn toward achieving our growth strategy. We have defined the core of the growth strategy as two major pillars, the green strategy and the digital strategy. We will increase the added value of both products representing our strengths, marine engines and port cranes, by the greening and the digital transformation (DX) and achieve continued improvement. We will



remain a manufacturer. Going forward, we will strive to become an engineering supplier capable of providing comprehensive services encompassing single products as well as their peripheral equipment and systems to be more than just a supplier.



In accordance with the quick shift

to a sustainable society and environmental change, we reviewed the meaning of the "E" and "S" of our company name as "Engineering & Services for Evolution & Sustainability." It conveys the significance of our existence (purpose), namely contributing to the achievement of a sustainable society through our engineering and services.



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Engineering & Services

for **E**volution & **S**ustainability

MITSUI E&S

Nippon Yusen Kaisha (NYK Line) Utilizing the data for ship safety and optimized operations

NYK Group promote "Digitalization" initiatives for solving the various issues faced by our sites by making use of digital technologies and analyzing collected data to create new value.

Through the implementation of SIMS (Ship Information Management System) in 2008, the NYK Group has been able to share data among workplaces on land and sea in real time, including detailed hourly updates on shipping operations and data related to fuel consumption. Optimized economic vessel operations and energy-saving operations are realized by visualization of information and close informationsharing among crew members, shipowners, ship operators, and ship managers. SIMS has been installed on 200 of our operating vessels. From December 2020 NYK and Ship Data Center Co., Ltd. have agreed to use the latter's IoS-OP to share data received from all NYK-operated vessels equipped with SIMS, expanding the total to about 200 NYK vessels.

NYK Group also developed Ship Data Viewer* for the purpose of sharing vessel safety and optimized operations.

Dramatically increasing the amount of data being transferred via the IoS-OP and makes it possible to increase corporate value by utilizing the data for ship safety, economic pursuits, environmental



efforts, and innovation within the shipping industry to enhance international competitiveness.

* Ship Data Viewer is a registered trademark of NYK Line.





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Enhance your fleet operations and maintenance with ship-shore DX infrastructure



Data collection from

a wide variety of onboard equipment

- Automatic data collection from VDR, Alarm Monitoring System and each onboard equipment
- Statistical edge processing
- Periodical ship-shore data transfer

Flexible data platform to enhance your fleet operation and maintenances

- Web-based standard dashboards
- Customizable dashboard, Camera viewer (optional supply)
- Integration with 3rd party systems/services

CONTACTUS FURUNO ELECTRIC CO.,LTD.

MITSUBISHI SHIPBUILDING CO., LTD. Mitsubishi Shipbuilding Power prediction & Lines selection: MiPoLin

Power prediction & Lines selection system "MiPoLin" is an easy-touse, highly accurate web application based on the huge database of model test results accumulated in MHI Nagasaki Experimental Tank.

This system was originally a tool for initial design used in-house. And through this tool, we hope that MSB's technology will be widely used to solve problems related to the maritime industry. We improved this tool more user-friendly and started offering it in 2022 as "MiPoLin".

By utilizing the more than 1,200 tank test results accumulated for over 100 years and the experience and know-how acquired in shipbuilding, this tool can accurately estimate propulsion performance from simple input data of design ship such as hull form



parameters and engine output. In addition, based on the more than 300 hull form data of model ships in "MiPoLin" database, this tool creates a



hull form data that inherits the performance of MSB model ship, and that can be used for ship design work.

As the need for environmentally friendly ships and operations grows, "MiPoLin" can be used in a variety of situations, including the development and evaluation of ships with superior propulsion performance, and also the new ships that are developed for achieving zero GHG emissions.



[Contact Details] MITSUBISHI SHIPBUILDING CO., LTD. E-mail: MiPoLin@mhi.com URL: https://www.mhi.com/products/ ship/engineering_mipolin.html

BEMAC Corporation "MaSSA Insight", power distribution system troubleshooting application

MaSSA Insight ~WADATSUMI~ is a web application that automatically collects data, analyzes the cause, and proposes troubleshooting solutions when a problem happens in the power distribution system.

The following are the four main features:

- When a trouble happens, a troubleshooting guidance automatically pops-up by the application. No special operations are required during the hectic time when a problem happens. Simply launch the application to confirm the next steps for recovery.
- 2) The application can be used on board and shore. The application can be used anytime on a PC connected to the ship's LAN on board or the Internet at the shore office. In the event of trouble, the exact same situation can be monitored both on board and shore simultaneously to support the quick recovery.
- 3) The only preparations required are the installation of a shipboard data server and a data output device to the main switchboard.
- Compliant with international standards ISO 19847/19848. The data collected are converted to unified data format and commonly utilized.

Hitachi Zosen Marine Engine Co., Ltd. HiZAS® VDA (Vessel Data Analysis)

In recent years, due to tightening of regulations and growing need for safe vessel operation management has become sophisticated, data amount collected from vessels is increasing. Shipowners/Ship management companies spend time and effort analyzing, and there is urgent need to improve work efficiency through DX. We have developed "HiZAS®VDA" as new service that utilizes our main engine performance analysis know-how and latest ICT technology, to support analysis for vessels with data collecting platform service. We will



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MaSSA Insight is also equipped with other data analysis/monitoring functions such as "Engine Monitor," which enables monitoring of engine conditions from various angles, and "Knowledge Alarm," which allows setting alarms under multiple conditions based on the knowledge of skilled engineers.



Troubleshooting guidance





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continue to accurately grasp customers needs and provide further functions as sustainable growth service.

- Service
- Cloud base web application
- Contract
- Annual contract (subscription)
- Main functions
- Main engine performance analysis
- Alarm notification
- Vessel operation performance visualization and evaluation
- Parts measurement data management



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Japan Engine Corporation **Towards Comprehensive Digitalization for UE Engine**

In addition to focusing on the development of engines compatible with new fuels toward carbon neutrality in international shipping, mass-producing engines compliant with CO₂/SO_x/NO_x emission regulations is currently underway. To comply these regulations, it is essential for each stakeholder to cooperate throughout the product's life cycle, and we believe that using digital technology is one of the effective means of strengthening such cooperation. We will continuously develop products and services utilizing digital technology so that our stakeholders can use UE Engine with confidence and safety.

Upgrading Engine Control System to 5th Generation;

By installing an IO board equipped with communication functions on the engine, the number of wirings for sensors can be significantly reduced. In addition, system integration with the general-purpose computer enables improved functionality for engine performance and/



or condition monitoring through application expansion. Data and ICT-based After-Sales Service;

Along with proposing comprehensive maintenance plans, mainly for coastal vessels, we have built the system in which our in-house developed condition diagnostic system determines the operational status based on vessel

operation data and notifies our engineers via SNS. This service will provide that enable planned maintenance and reduce downtime in emergency.



Japan Engine Corporation

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TERASAKI ELECTRIC CO.,LTD. Onboard Data Platform TMIP

In recent years, the use of various ship data is progressing for the purpose of improving energy efficiency during navigation, reducing maintenance costs, and ensuring safe operation of ships. Therefore, a flexible data sharing system is required, such as a data platform for collecting and using onboard data, ship-land communications for sharing data with land, and data centers on land. Terasaki Electric provides TMIP (TERASAKI Marine Information Platform) as an onboard data platform.

TMIP can be connected to monitoring systems such as TERANET50X and other onboard equipment to collect and store data and share it with various devices and applications. In addition, the marine computer series, which is the main component of TMIP, is a highly reliable product developed for



marine use, and has sold more than 1,000 units in total. It is mainly used in the distributed integrated monitoring and control system TERANET50X installed on large ships.



Altair Engineering Digital Twin Platform changing existing processes

Altair has been supporting decision-making through simulation technology (CAE) for product design and manufacturing.

In the shipbuilding industry, Altair HyperWorks has been adopted as the platform for PrimeShip-HULL, a hull structure design support system being released by Nippon Kaiji Kyokai, and is contributing to efforts to streamline the shipbuilding design process and achieve hull structure design and 3D data approval with 3D models as the core (Figure 1). We are striving to contribute to efforts to streamline the shipbuilding design process and to realize hull structure design and 3D data approval with 3D models as the core (Figure 1).

At the same time, data science technology has developed remarkably in recent years, and the shipbuilding industry has the





CetoAI, a maritime-focused technology company, revolutionises ship operations by leveraging existing onboard data across all vessel types. Our Watchkeeper product enhances vessel availability, prevents machinery failures, bolsters crew safety, manages risk, and cuts down fuel consumption. We use high-frequency, high-fidelity data to construct detailed vessel profiles, employing cutting-edge artificial intelligence models which identify anomalies. This approach extends operational time and amplifies value for our partners.

Our unique circular data ecosystem captures live operational data, enriched with additional sources like weather information. This data is then analysed and presented via an intuitive web application for ship owners, managers and crew. Our system not only notifies for early engineering intervention, ensuring safer and more efficient operations, but also aids in cost reduction, fuel saving, and regulatory compliance.

Continuously innovating, CetoAI plans to launch several products in 2024. These include a diagnostic decision support system, currently in alpha testing, to ease the burden on technical managers, allowing them to focus on complex challenges. Additionally, we're introducing a compliance-focused large language model, trained on industry

regulations and tailored to company-specific documents. In Q1 2024, we're releasing a tool that enhances value from noon-report data through visualization and cross-fleet comparison, offering greater transparency for commercial management teams. [Contact Details]

potential to transform existing processes by utilizing data for marine transportation, hull design, and ship operations.



Altair's product offerings can provide advanced and comprehensive assistance, including Digital Twin. For example, we can build a dashboard that visualizes sensor data from a vessel in operation, and then incorporate machine learning models based on CAE data into this dashboard to create a digital twin environment that predicts vessel behavior and abnormalities during operation, as well as repair schedules, in real-time using products such as Altair Panopticon and other products (Figure 2).

Altair provides not only software sales and support, but also technical consulting services. If you are interested in our services, please contact us at the contact information below.



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Headquarters: Hoults Yard Walker Road Newcastle Upon Tyne United Kingdom NE6 2HL Sales Department Email: sales@ceto.ai

Danelec Together, We Deliver the Agnostic Platform to Accelerate Maritime Sustainability and Safety

As a global leader in maritime Safety, Data Collection, and Albased Analytics, Danelec is driving the digitalization of the maritime industry to accelerate the route to net-zero shipping.

Leading manufacturer of Voyage Data Recorders (VDR), Shaft Power Meters, and supplier of advanced Ship Performance Monitoring systems, Danelec leverages decades of expertise in ship data collection. With installations on more than 13,000 vessels, we drive operational optimization across safety, sustainability, and performance metrics.

Our recent acquisition of the New York-based AI technology platform, Nautilus Labs, positions us uniquely to enable the maritime industry to achieve net-zero emissions. This integration enriches our product offerings with sophisticated tools for Fleet Performance Management, Advanced Voyage Optimization, Boil-Off Gas Management, and transformative Charter Parties Clauses.

Headquartered in Denmark, Danelec extends its impact through 14 global hubs. With more than 700 factory-trained personnel across 50+ countries, our global footprint ensures that we deliver reliable, cost-efficient, and prompt service and support to our customers everywhere.

We are committed to delivering innovative solutions and cuttingedge technology, we are transforming the way maritime operations are conducted, enhancing efficiency, safety, and sustainability for ship owners and operators worldwide.



Danelec

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Daphne Technology PureMetrics™ - measuring, reporting & optimising GHG emissions

PureMetrics[™] is a pioneering solution for measuring, reporting, and optimising GHG emissions. With a commitment to transparency, accuracy, and innovation, PureMetrics[™] empowers businesses to achieve their carbon reduction goals and meet their internal objectives while contributing to a sustainable future.

PureMetrics^m is a stand-alone emission monitoring system that can measure greenhouse gases and other pollutants released in the exhaust from different combustion units burning all available fuels. It offers a cost-effective real-time method for quantifying the emissions of multiple greenhouse gases such as CH₄ and CO₂ and toxic gases such as CO, SOx, and NOx.

PureMetrics[™] measures and reports CO₂e MT (mass) GHG emissions and is compliant with Regulation 2015/757 (Article 21) on the European Union's guidelines for monitoring, reporting, and verification ("MRV") of carbon dioxide emissions, as well as Regulation 22A in MARPOL Annex VI of the International Maritime Organization's ("IMO") Data Collection System ("DCS") for fuel oil consumption on vessels.

• PureMetrics[™] supports optimising the operational profile of the vessel based on historical data.

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• PureMetrics[™] enables asset owners to establish accurate baselines for pre-abatement measurement so quantifiable reductions can be reported.

• PureMetrics™ complies with Vessel Performance Management Systems using sensor data rather than one data point per day.





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Inmarsat K.K. Satellite Communications Service Provider

Inmarsat is a global leader in providing mobile satellite communications worldwide. It owns and operates the world's most diverse global portfolio of mobile communications satellite networks, with a multi-layer global frequency portfolio covering L-band, Ka-band and S-band, enabling unparalleled breadth and diversity in the solutions it offers.

Inmarsat has established its own strong direct sales network as well as the world's leading channel partners, enabling an end-to-end



Japan Fisheries Information Service Center Smart fisheries and cross-industry collaboration

Smart fisheries is a new trend in the Japanese fisheries. The points are collection of digital data necessary for fishing and the linkage with various data relating fisheries and marine environment. An example of data linkage is the use of merchant ship data. Merchant ships collect marine data such as water temperature, and this data will be used in fisheries field.

Cross-industrial collaboration is expected to progress further.



customer service guarantee. It also operates the world's most reliable global mobile satellite communications network, with an unrivalled track record of supporting business and mission-critical safety and operational applications for over 40 years. It drives innovation in mobile satellite communications and maintains its leadership through significant investment and a strong network of technology and manufacturing partners. It also has the financial resources necessary for its business strategy and operates in a diverse range of sectors. It occupies a leading position in the maritime, government, aviation and corporate satellite communications markets, and is consistently a trusted, responsive and high-quality partner for customers worldwide.



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[Contact Details] URL: https://www.jafic.or.jp <Japanese Only>

MarineSL Co., Ltd **Toward Digitalization of Spare Parts Distribution Using Onboard Data**

MarineSL Co., Ltd is a Kobe based start-up company promoting the digitalization of maritime industry. As its inherited business, we developed "Si-Trax," a parts demand forecasting and sales support system for maritime equipment manufacturers. By multiplying data obtained from AIS (Automatic Identification System) with a proprietary algorithm, the system visualizes the utilization rate and wear and tear of each part installed on ships. It also contributes to the improvement of equipment manufacturers' management strategies and production plans over the medium and long term.

On the other hand, there is still much room for digitization of business processes such as equipment management, quotations, and



purchasing that originate from shipowners and management companies. Thus, we intend to promote digitization of business transactions by utilizing onboard equipment data. Specifically, we will support the establishment of a mechanism to realize long-term parts supply contracts to avoid the risk of product shortages and long-term service agreements to equalize ship management costs.



Marineworks Co., Ltd. **MyFleet Solution**, **Smart Fleet Management**

The shipping industry is making various attempts to effectively respond to digital transformation and decarbonization.

'MyFleet solution model' powered by marineworks secures the business competitiveness of the shipping companies.

Smart Fleet Management solution of marineworks consists of an optimal ship management solution based on a ShipDC compatible structure and a smart ship data platform that meets the standards of cyber security.

In the Korean market, innovative changes are taking place in ship management solutions to comply with the guidelines of TMSA and RightShip based on the state-of-the-art ICT environment.

Our solution's development productivity and operation efficiency are 30% or more higher than existing solutions. So it can maximize



the utilization of IT resources and provide a flexible user

environment. In addition, flexible interface with ERP, HR, operation

If the existing IT system is outdated or does not fit the digital transformation strategy, marineworks proposes the core digital solution.

[Contact Details]

system as well as smart ship platform is harmonized. And real-time data synchronization between ship and shore is possible through an optimized data transmission system based on satellite communication.





onboard hardware and software combined with a 24/7 personal Navarino IT Manager, backed up by a dedicated team of IT specialists. All for one fixed monthly fee per vessel. Using an 'IT-as-a-service' concept, Quazar removes the CAPEX for hardware or software acquisition, replacing it with hardware leasing,

NAVARINO

software licensing, and support fees that are all included in one monthly fee. Quazar also allows for the implementation of advanced

acquire, install and manage a vessel's IT infrastructure. It includes all



Mitsui E&S Shipbuilding Co., Ltd. Fleet Monitor & Fleet Transfer

In 2006, we have launched portal site comprehensive information service for ship operation and started the service. As a core of our service, we developed in-house "Fleet Monitor". We install small industrial PC on board for "Fleet Monitor". It collects data from VDR and Data Logger and send data to portal site automatically via the ship's mail system. Customers can monitor data of their vessel data on portal site.



Quazar, IT-as-a-service from Navarino Quazar is Navarino's easy to deploy and cost-effective way to

To provide Quazar, we have partnered with the world's biggest technology providers including Microsoft, Dell, ConnectWise, Canon, and more. Thanks to Navarino's economies of scale, we are able to offer ship operators these technology providers' solutions at much lower cost than if they were purchased alone.

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In 2017, we also developed "Fleet Transfer" as more enhanced model and began to provide the service.

- 1) Extend the number of measure points: 15,000 measure points / at 1 sec interval
- 2) Enhance data send function: Variable number of measure points and sending interval
- 3) Add edge processing function: Processing on board such as mean, maximum/minimum value and deviation send to shore only result of the process

Both of the services have been installed on more than 380 vessels. We are developing additional function to meet the demands of customers.



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security policies that safeguard all digital infrastructure and devices; making systems more robust against cyber-attacks while complying with regulations. In addition, a personal Navarino IT manager assigned per fleet offers an expert, personalized understanding of a vessel's IT infrastructure, and implements any service or support request that the ship operator requires.



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TRIPLE CROWNS CO.,LTD. You can always count on us for your system development needs!

Since its establishment in 2016, TripleCrowns has been engaged in contract system development with consistent development phases from requirements definition to testing.

In addition to developing web-based systems, we are excellent at developing contents using Unity, such as interactive content for exhibitions and showrooms, and application development for smart glasses and XR devices. We also have many achievements in system development for device linkage such as LeapMotion, haptics, and NFC.

We entered the maritime industry four years ago, and as a member of the Japan Ship Machinery and Equipment Association and the IoS-OP Consortium, we have worked on remote monitoring of marine equipment, real-time status display systems, and simulator development. If you are considering transforming your products into digital native, such as equipment monitoring and management, cloud migration, crew support AR, VR applications, etc., please contact us. Experienced engineers will help you to realize your ideas and provide a guidance to lead your company to a successful digital transformation (DX).





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Mitsui E&S DU Co., Ltd. **Next-generation CBM with customer** and ClassNK CMAXS

Nowadays, guite a few general data analysis tools are widely recognized, and development of plain anomaly detection system of machinery equipment has become rather easy. However, sophisticated "cause estimation of detected anomaly" (hereafter referred as "Diagnosis") cannot be performed just with those general data analysis tools. It requires proper consideration of physics, dynamics and engineering design.

The CMAXS Alliance already has implemented "appropriate diagnosis" even in daily operation to carry out our "predictive



maintenance" of vessels. That has been applicable with shared diagnosis system and engineering support by manufactures of machinery.

CMAXS not only reduces direct losses including "secondary damage", "non-operating loss" and "unscheduled works". CMAXS also contributes to develop human resource including know-how of maintenance, skills for trouble shooting and deeper understanding of machinery, by its systematic data accumulation of incidents and knowledge extracted from those incidents. In summary, Users of CMAXS not only improve their business risk control, but also develop their staff to conduct their business.

We will continue our efforts to develop Next-Generation CBM, while introducing new technologies to our business which consists of hardware realm, software realm and support services.

MITSUI E&S Mitsui E&S DU Co., Ltd.

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Topic 7 Standardization Initiatives

of Shipboard Data Collection

Introduction

The Smart Ship Application Platform (SSAP) project of the Japan Ship Machinery and Equipment Association (JSMEA) was established in 2013 with 27 member companies and nine observers based on the antecedent Shipboard LAN Project (2005 to 2012) and the Smart Ship Project (2010 to 2012). Since that time, it has worked to solve common issues for the entire maritime industry crossing the boundaries between sellers, buyers, and competitors such as shipping companies, shipyards, and manufacturers.

The Shipboard LAN Project developed guidelines (later standardized as ISO 16425) for shipboard LAN equipment with the expectation that one-to-one serial communication would be replaced by many-to-many LANs in the near future.

The SSAP, which was established to continue those activities, considered what would be required on ships after the shipboard LAN was developed and whether it would evolve. In addition, it worked to develop shipboard data server requirements (later standardized as ISO 19847) for shipboard IoT data sharing and the data naming rules (later standardized as ISO 19848). Subsequently, it developed the requirements for asynchronous data transmission from ship to shore to meet the needs for the onshore utilization and application of the collected shipboard data (later standardized as ISO 23807).

Shipboard LANs, IoT data sharing, and ship-to-shore



Initiative for the International Standardization

communication are now common practice. In this way, the SSAP has from time to time looked one step ahead into the future and engaged in discussion, technology development and standardization to solve those issues. It is thought that as a forum where the entire maritime cluster gathers, the SSAP was able to develop a consistent system of standards required for shipboard data collection and application that includes everything from network infrastructure to data standards ahead of other countries.

International standards and IoS-OP

We believe that through the aforementioned four types of international standards and ShipDC, we can provide the following advantages for data utilization and application based on consistent requirements that cover everything from the construction of shipboard data collection systems (including infrastructure) to onshore data collection, utilization, and application (Figure 1).

- · Optimization of shipboard data collection server installation costs and ship-shore communication costs
- · Reduction of security risks through easy-to-manage shipboard network configuration
- Reduction of duplicated effort to introduce multiple shipboard apps
- Improved convenience in both ship and shore data utilization and application through name unification
- Realization of data sharing with effective onshore data governance

Figure 1: International standards and an overall image of IoS-OF

Initiative for International Standardization

In order to create international standards, a consensus must first be built in Japan. Therefore, the SSAP members first provided a forum for discussion on a rotating basis and discussed the purpose and justification for the development of standards that can be explained in Japan and overseas. Incidentally, the companies serving as the meeting locations provided opportunities for factory tours, etc., which enabled the members to advance standards development while deepening their knowledge of entire ships as a system by encountering the diverse range of equipment installed on ships.

After a consensus was reached in Japan, discussions were held with overseas experts. We held international conferences and engaged in constructive discussions



while occasionally receiving sharp criticism to gain an understanding of the situation overseas and build a consensus (Figure 2).

O/TC8/WG10@Trondheim, Norwa

ISO 16425

As mentioned above, ISO 16425 prescribes physical and logical requirements for the design and installation of high-quality shipboard LANs.

The amended version of the standard issued in 2024 implemented substantial revisions that include performance standards, inspection methods, cybersecurity, and Wi-Fi setting related standards, etc.

With the revisions, the SSAP members including shipyards and manufacturers were interviewed regarding problems which they actually encountered and clarified the requirements from the perspective of what kind of design, construction, and testing must be carried out to ensure that such problems do not occur. We believe that the 2024 edition based on lessons from actual ships is a standard which will become the bible for the design and construction of shipboard LANs.

ISO 19847/ISO 19848

ISO 19847 and ISO 19848 were developed for the purpose of reducing time-consuming communication protocol adjustments and name aggregation (mapping with sensor names and data names) through standardization with the expectation that conventional data collection methods, in which the data source (sensor) and the data utilization application are connected on a one-to-one basis, would become

unable to cope when a variety of applications were installed onboard.

ISO 19847 prescribes data server hardware requirements for the collection of shipboard IoT data as well as application interface requirements when writing data to a server or acquiring data from a server. ISO 19848 prescribes data formats, data naming conventions, and data name examples. This standard was jointly developed with DNV of Norway, and the data naming conventions include the JSMEA dictionary developed by JSMEA and the DNV-VIS V2 provided by DNV.

ISO 23807

ISO 23807 establishes the minimum requirements for two-way ship to shore asynchronous data communication (periodic or on-demand data transmission to shore) for further utilization and application of data collected through the aforementioned ISO 19847/ISO 19848 standards. Norwegian companies that are actually offering ship to shore data sharing services also participated in the standard development, and the lessons learned from actual operation were incorporated.

Moreover, it also touches on MQTT (Message Queuing Telemetry Transport), which is rapidly being adopted in IoT, and follows the latest trends in the onshore field.

Conclusion

To solve problems that are common to the maritime industry, SSAP provided a forum for open discussion that exceeds corporate boundaries and led international standardization activities in the IoT field.

In 2021, a Special Interest Group was launched to host information sharing sessions and study meetings on occasional hot topics such as cybersecurity, wireless/satellite communication, and functional safety, etc. and companies outside of the maritime industry such as telecommunications companies, etc. were sometimes invited to engage in lively discussions. With autonomous operation, decarbonization, and cybersecurity, etc., the number of challenges is increasing, and we believe that we can reach a solution through open discussion with the cooperation of the participating companies.

<JSMEA Smart Ship Application Platform Project, Terasaki Electric>



Various IoS-OP Costs

Price structure to support small starts for new businesses

Strategic small start

With the progress in ship digitization, the number of companies launching new businesses in shipboard servers and application sales, etc. is increasing. At the same time, face many risks including the search for a product market fit in a new market, the presence of competitors, and discovering the appropriate business model, etc. A small start is said to be an effective strategy for reducing such risks. A small start is a style of business which starts with few resources, polishes the business strategy, and listens to the opinions of customers to improve the product. Doing so can reduce costs and grow the business step-by-step while verifying the market response. A small start plays an important role in new businesses in minimizing failure and increasing success.

IoS-OP support for small starts

IOS-OP requires businesses that sell shipboard servers (PP: Platform Provider), businesses that sell applications (SP: Solution Provider), and businesses that receive data usage permissions (DB: Data Buyer) to register, comply with security, and bear certain costs. Because the previous price structure expected a number of ships above a certain scale, the support for small starts was insufficient. However, prices are now set in a way which makes it easy for businesses adopting a small start approach to join. As a result, this reduces the risk when launching a new business and makes it easy for many businesses to join by enabling a strategic approach to achieve reliable growth, and it is expected to introduce significant insight to the maritime industry.

For businesses selling shipboard servers

Businesses using IoS-OP to sell shipboard servers (PP) are subject to registration. To register as a PP, they must become a ShipDC member and join the IoS-OP Consortium. However, we also offer a plan which exempts small start businesses from joining ShipDC for a period of three years. Taxes are not included in the fees

Plan	Registration fee	ShipDC membership	Conditions
Starter plan	100,000 JPY/year	Required (exempt for three years from registration)	Up to 10 ships
Limited plan	25,000 JPY/ship and year	Required	Uniform 500,000 JPY/year for 20 ships or more
Basic plan	1,000,000 JPY/year	Required	No upper limit on the number of ships

For businesses selling applications

Businesses using IoS-OP to sell applications (SP) are subject to registration. To register as an SP, they must become a ShipDC member and join the IoS-OP Consortium. However, we also offer a plan which exempts small start businesses from joining ShipDC for a period of three years. at included in the f

			Taxes are not included in the lees
Plan	Registration fee	ShipDC membership	Conditions
Starter plan	20,000 JPY/ship and year	Required (exempt for three years from registration)	Up to 24 ships Exempt from recommendation from two or more companies that are ShipDC members for three years from registration
Basic plan	500,000 JPY/year	Required	Up to 25 ships, 20,000 JPY/ship and year if exceeded Recommendation from two or more companies that are ShipDC members
Enterprise plan	1,000,000 JPY/year	Required	Up to 100 ships, 10,000 JPY/ship and year if exceeded Recommendation from two or more companies that are ShipDC members

Becoming a ShipDC member (participating in the IoS-OP Consortium)

To participate in the IoS-OP Consortium, you must become a ShipDC member. We are seeking members who support the purpose of our activities and wish to take part in activities together with ShipDC. Be sure to read the ShipDC Membership Terms and Conditions when applying.

<Membership Terms and Conditions> https://www.shipdatacenter.com/wp-content/uploads/2022/12/TermsConditionsV5_EligibilityRequirements_EN.pdf

1. ShipDC membership qualifications

Membership is subject to business use of IoS-OP and is limited to companies, corporations, organizations, and groups that support the purpose of the company's activities who can actively participate in these activities and observe the ShipDC Membership Terms and Conditions and the IoS-OP Terms of Service (provided after joining) established by the company.

Classification of members to be recruited

ShipDC members a	re primarily classified by sales as follow
(1) Gold members	: companies with group consolidated
	(admission fee: 1.8 million JPY/annu
(2) Silver members	: companies with group consolidated
	(admission fee: 1.2 million JPY/annu
(3) Bronze member	s: companies with group consolidated

(admission fee: 600,000 JPY/annual membership fee: 300,000 JPY)

- (4) Green members : government institutions, local municipal organizations, universities, and other educational and research institutions (admission fee: 300,000 JPY/annual membership fee: 150,000 JPY)
- * The admission fee (two years of the annual membership fee) is required during the first fiscal year only. All fees are tax exclusive.

Moreover, the membership term is from January to December of each year.

Please contact us at the address below for the details. IoS-OP Consortium Secretariat consortium@shipdatacenter.com





NS.

- sales of 100B JPY or more
- ual membership fee: 900,000 JPY)
- sales of 10B JPY or more
- ual membership fee: 600,000 JPY)
- sales of less than 10B JPY

