

Welcome to **INNOVATION Island**

Explore the Japan's Cutting-Edge Ship Technology



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Welcome to

INNOVATION Island

Explore the Japan's Cutting-Edge Ship Technology



Japan is an island nation surrounded on four sides by the sea. From that special geographical industries to become a maritime nation. Also, it can be said to have another face as a leading advantages it has always been able to take a lead in developing ship technology to meet the bring new ship innovation, is taking on new challenges including the protecting world maritime

position historically it has developed its shipbuilding and shipping country in the fields of science and technology. By combining these two changing demands of the times. Today Japan, an island that continues to environment and utilizing internet communication technology.

Ship Machinery Beach P17~

From this Island all the materials and machinery that go into making a ship can be procured. Challenging themes such as reducing emissions from ships and automated navigation are the specialist fields of Japanese ship machinery suppliers.



EMISSION DIGITALIZATION INNOVATION NEW MARKET

Shipbuilding Beach P03~

From this Island every day ships with high safety levels and advanced fuel efficiency continue to be produced. This has been made possible through many years of experience, engineering capability and craftsmanship.



BULK CARRIER TANKER



CONTAINER CARRIER GAS CARRIER



CAR CARRIER/RO-RO SHIP PASSENGER SHIP WORK BOATS



Information Beach P21

Digitalization Beach P13~

In the near future digitalization has the potential to change the profile of the maritime industries. It is likely this Island will become central to this development and it has already started to make progress in that direction.



Green Beach P12

The world maritime industry has set the extreme target of achieving zero emissions. In the field of Green Shipping this Island over the past decades has brought many new innovations.



Welcome to INNOVATION Island
Shipbuilding Beach

BULK CARRIERS

Bulk carriers are ship types that are a specialty of Japanese shipbuilders. Japanese shipbuilders are continually offering new optimized designs to the market based on close detailed research into the dry bulk trades and port conditions. And the "Made in Japan" bulk carrier is always one step ahead in terms of its fuel consumption performance.

**250,000 - DWT
 ORE CARRIER CAPE HAYATOMO**

This is the first vessel of the second generation of the "WQZMAX" developed by Namura Shipbuilding, which is optimum size of ore carrier for main West Australian Ports. The vessel achieves over 250,000 deadweight tons under shallow draught, and improves efficiency for cargo loading and unloading with adoption of 7-holds and 7-hatches.



Photo: Namura Shipbuilding Co., Ltd.



Photo: Oshima Shipbuilding Co., Ltd.

100,000 - DWT COAL CARRIER ISUZU MARU

The Oshima Shipbuilding-built dedicated coal carrier ISUZU MARU is a wide beam shallow draught ship type that has increased the cargo capacity of the conventional panamax bulk carrier. At 260 meters in length it is the largest ship type that can access the berth at Chubu Electrical Power Company's power plant discharge port at Hekinan. It is engaged in mainly in transporting Australian and Indonesian coal to Japan.

**182,000 - DWT
 CAPESIZE BULK CARRIER M.V. GOOD HORIZON**

Mitsui E&S Shipbuilding's next generation Eco-Ship design, neo 182BC, maintains the same dimensions as the Dunkerque-max while increasing deadweight to 182,000 tons, and, with plentiful cargo hold capacity, it improves transport efficiency. By adopting new form of bow and stern and fitting a high efficiency propeller and other energy-saving devices, fuel consumption performance is improved.



Photo: MITSUI ENGINEERING & SHIPBUILDING CO., LTD.



Photo: Sanoyas Shipbuilding Corporation

**82,000 - DWT
 PANAMAX BULK CARRIER MONDIAL SUCCESS**

Sanoyas shipbuilding's 82,000-dwt bulk carrier design has larger cargo hold capacity and further improved fuel consumption by 10% compared to the previous design. For improvement of propulsion efficiency, the vessel is equipped with various energy saving devices developed by Sanoyas. The vessel achieves Phase 2 level of the EEDI regulations and contributes to reduction of CO₂ emissions.

**34,000 - DWT
 HANDYSIZE BULK CARRIER
 HILMA BULKER**

The Hakodate Dock and Namura shipbuilding jointly developed Eco Ship design HIGH BULK 34E has become Hakodate Dock's best seller. With a shallow draught of less than 10 meter it is able to access a wide variety of ports around the world. Its double hull cargo holds also achieve a high loading efficiency.



Photo: The Hakodate Dock Co., Ltd.



Photo: TSUNEISHI SHIPBUILDING Co., Ltd.

63,700 - DWT SUPRAMAX BULK CARRIER FUKUYAMA STAR

TESS64 AEROLINE, a new series of bulk carriers developed by TSUNEISHI SHIPBUILDING, features a cut-corner design for the accommodation which is shaped in a tower configuration, and a streamline-shaped upper bow, resulting in reducing wind resistance by 10%. Moreover, aiming at improving the fuel efficiency of engine, the Waste Heat Recovery Unit is adopted in TESS64 AEROLINE, which functions to convert heat to energy. This effects the reduction of fuel consumption by 20%, compared to the previous series.

TANKER

The Malaccamax, the global mainstream tanker design that can pass through the Malacca Strait, was a concept first developed by Japanese shipbuilders. Japanese shipbuilders are continually building state of the art tankers that are versatile and have advanced safety and environmental features.



Photo: Japan Marine United Corporation

300,000 - DWT VLCC *AGIOS FANOURIOS I*

Japan Marine United Corporation has upgraded its 2 million barrel tanker design as a next generation energy-saving VLCC optimized for spot trading. It has been fitted with a sharpened bow shape and a variety of other energy-saving devices that contribute to advanced performance in actual sea conditions and has achieved a large reduction in fuel consumption.



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Shipbuilding Beach



Photo: SHIN KURUSHIMA DOCKYARD CO., LTD.

35,100 - DWT CHEMICAL CARRIER *ARPEGGIO*

Shin Kurushima Dockyard specializes in chemical tankers and has established a reputation for product quality and its advanced fuel consumption performance designs.

ARPEGGIO was built for the ocean transport of IMO type II and III chemicals and oil products.

The vessel has 28 cargo tanks constructed of SUS316LN stainless steel and SUS316LN clad steel. All cargo tanks are built with a double-hull structure and have sufficient strength to permit the carriage of a full cargo with a specific gravity of 1.30 t/m³.

Photo: SUMITOMO HEAVY INDUSTRIES MARINE & ENGINEERING Co., Ltd.



112,000 - DWT AFRAMAX TANKER *WISDOM VENTURE*

Sumitomo Heavy Industries Marine & Engineering, which specializes in medium-sized tankers, is well known for developing designs that meet the latest market requirements on the basis of its extensive market research. In addition to an optimal hull form with high propulsive performance, the *WISDOM VENTURE* is also equipped with several Sumitomo patented energy saving devices to reduce fuel consumption.



Photo: IMABARI SHIPBUILDING CO., LTD.

20,000 - TEU CONTAINER CARRIER *MOL TRUTH*

In 2017 Imabari Shipbuilding completed a new 610 meter in length large size dry dock and created a system which could construct containerhips with a very short production time. In the same year it delivered a 20,000-teu containerhip deploying state of the art technology to reduce its environmental footprint and improve safe operations. The ship's CO₂ emissions per container are some 20% lower than that of a 14,000-teu containerhip. In preparation for the global regulation of SO_x emissions from 2020 these ships have also been constructed as both LNG ready and scrubber ready.



Photo: HAKATA SHIPBUILDING CO., LTD.

1,000 - TEU CONTAINER CARRIER *SUNNY CANNA*

Hakata Shipbuilding and Mitsubishi Heavy Industries jointly developed this 1,000-teu containerhip. Generally 1,000-teu vessels have a 22.5 meter beam, but in this case it has been widened to 25 meters improving stability performance, reducing ballast water and increasing cargo capacity. With the sharp hull design, it has achieved low resistance, along with significant savings of fuel. Also, through the use of an electronically controlled engine and a rudder hull, it has improved propulsion efficiency and become more environmental friendly.

CONTAINER CARRIERS

Containerhips have very high fuel consumption making them one of the most suitable ship types to demonstrate Japanese energy saving technology. World leading technology from Japan's steel companies is also contributing toward containerhip safety.



Photo: Kawasaki Heavy Industries, Ltd.

164,700 m³ LNG CARRIER *BISHU MARU*

BISHU MARU is a 164,700m³ LNG carrier possible to pass through the new Panama Canal built by Kawasaki Heavy Industries. While maintaining the hull dimensions that allow the vessel to enter the world's major LNG terminals, the Moss type LNG tanks were enlarged to increase cargo capacity. The ship features a fully optimized hull structure for reduced weight, as well as a hull shape that is optimized below the waterline for the maximum propulsive performance. Kawasaki's LNG carriers feature a proprietary thermal insulation system — Kawasaki Panel System — with an excellent track record spanning over 30 years. The panel system has been further improved for the ship to achieve the world's lowest boil-off rate at 0.08%.



Photo: SAIKI HEAVY INDUSTRIES CO., LTD.

RO-RO CARRIER *SYUREI II*

This vessel was built by the Daomichi Group shipyard Saiki Heavy Industries. The vessel has achieved energy saving by utilizing the space under the slope way from the deck of the upper carriage to fit a high sided slow speed main engine. An auto rushing system has also improved the efficiency of loading operations. In consideration of the environment an electronic controlled engine and LED lighting has been installed.

CAR CARRIER/ RO-RO SHIP

Japan, the country which first invented the car carrier, continues to bring new innovations one after another in this ship sector.

83,000 m³ LPG CARRIER *ASTOMOS VENUS*

Mitsubishi Shipbuilding is one of a limited number of shipyards around the world that can build Very Large Gas Carriers (VLGC). Its 83,000m³ LPG carrier is provided the superlative fuel efficiency and outstanding adaptability to the diverse connecting conditions of the major LPG terminals around the world. The ship also has the industry's most advanced systems, including mooring arrangement, to enable passage through the newly expanded Panama Canal. It has also fitted a re-liquefaction plant for boil off gas that occurs during transportation to improve the ship's economic performance.



Photo: Mitsubishi Shipbuilding Co., Ltd.

3,985-UNIT PCTC *AUTO ECO*

The *AUTO ECO* and *AUTO ENERGY* were the first car carriers to employ a dual fuel system for the main engine and main generator. The ships were contracted and designed by Kawasaki Heavy Industries and built at its Chinese joint venture company Nantong COSCO KHI Ship Engineering Company. The vessels are fuelled by LNG which reduces exhaust gas emissions considerably. The ships have also been awarded an Ice Class 1A Super notation allowing them to trade in the Baltic consistently all year round even in the winter months.



Photo: Kawasaki Heavy Industries, Ltd.

GAS CARRIERS

Japan, as the world's largest importer of LNG, has assembled the complete value chain across the gas industry.

The Japanese shipbuilding cluster has made a specialty out of constructing safe, economic and versatile LNG and LPG carriers.

Welcome to INNOVATION Island Shipbuilding Beach



Photo: NAIKAI ZOSEN CORPORATION



3,000-UNIT PCTC *TRANS HARMONY 1*

The Naikai Zosen built new type car carrier is equipped with two lift-able decks which improve its capability to transport high and heavy cargo. By using various types of energy saving devices and increasing the size of the vessel it is expected that the CO₂ emissions for each vehicle transported has been reduced by 52% compared to existing 1,000-vehicle capacity vessels. An onboard crew safety check system has also been developed which can monitor and locate crew in all areas of the vessel and verify their safety.

ROPAX FERRY LAVENDER

The Mitsubishi Heavy Industries (Mitsubishi Shipbuilding) built ferry is the first instance of a ferry using a vertical hull shape to reduce wave resistance.

A variety of energy saving technology has been employed on the ship. The propulsion system includes two closely located twin shaft propulsion system along with a reaction type rudder fitted with a bulb. Underneath the hull Mitsubishi Air Lubrication system (MALS) uses a cushion of bubbles to reduce sea resistance. The vessel's public spaces are enriched by an outside hot bath and sauna.



Photo: Mitsubishi Shipbuilding Co., Ltd.



Photo: WATANABE SHIP BUILDING CO., LTD.

PASSENGER FERRY HAHAJIMA MARU

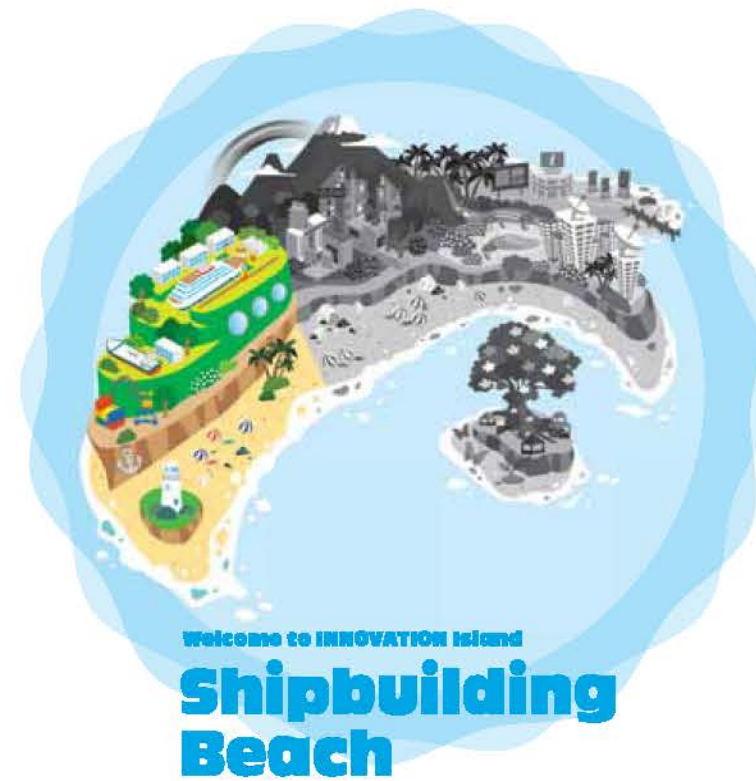
The ferry HAHAJIMA MARU was built by Watanabe Shipbuilding and operates between the World Heritage recognized Ogasawara Islands of Chichijima and Hahajima. It has been given the unusual name of Whale Liner as from the sun deck and the corridor on the lower forward section of the bridge there are plenty of facilities for passengers to enjoy whale and bird watching.



Photo: Japan Marine United Corporation

ROPAX FERRY SUNFLOWER FURANO

The new ROPAX ferry built by Japan Marine United Corporation has realized advanced fuel consumption performance through a contra-rotating propeller (CRP) system and an optimized hull form. It has a hybrid propulsion system involving the main engine and an additional motor to provide two driving sources to the vessel. The system satisfies the two important performance factors for ferries, which are fuel consumption performance while in navigation and operational performance while in port.



Welcome to INNOVATION Island
Shipbuilding Beach



Photo: Sumidagawa Shipyard Co., Ltd.

SIGHTSEEING BOAT NANTAI

NANTAI, a sightseeing boat which recently started to operate on Lake Chuzenji, is an Eco-ship which utilizes the solar power. Solar panels fitted to the ship's upper deck generate electricity used for lighting system and general use in the passenger rooms. During periods of poor weather, when there is not enough sunlight to generate power, an onboard generator provides high quality power rectified by Off Grid Power Supply System. The vessel was built by Sumidagawa Shipyard.

PASSENGER SHIPS

From the distant past Japan, as an island nation, has always had a strong need for comfortable passenger ship transport. Japan's unique shipbuilding technology is not only now being used to reduce the fuel consumption of passenger ships, it is also suppressing onboard vibration and noise.

PASSENGER AND VEHICLE CARRIER FERRY SHIMANTO

FERRY SHIMANTO and FERRY RITSURIN are simple ferries that have comprehensively pursued energy and labor saving and low maintenance. The vessels were built by the Onomichi Group shipyard Saito Heavy Industries. They adopt a single propeller propulsion with an electronically controlled diesel engine and reduce the effective of sea condition by hull design to achieve a 20% energy saving compared to previous vessels.



Photo: SAIKI HEAVY INDUSTRIES CO., LTD.



Photo: TSUNEISHI SHIPBUILDING Co., Ltd.

CRUISE SHIP *guntō*

Just like an exclusive hotel built in a traditional Japanese style, *guntō* built by TSUNEISHI SHIPBUILDING, materializes and voyages in the Seto Inland Sea. Altogether, there are nine suite cabins. Most parts of the cabin interior are made of fragrant wood. A veranda deck and an open-air bath facing toward the sea are attached to each cabin. The traditional Japanese cuisine, sushi and sweets are available on board. Being powered by electric propulsion system, which produces less noise, makes *guntō* quiet. The voyage around the Seto Inland Sea can be experienced and enjoyed tranquilly and comfortably.



SELF-PROPELLED MULTI-PURPOSE VESSEL AUGUST EXPLORER

The Sanoyas Shipbuilding built *AUGUST EXPLORER* is a multi-purpose vessel suitable for both construction work and offshore raw material surveys. Fitted with five thrusters it can maintain a fixed position and, using its broad 926 meter square deck space and 500 ton crane, conduct a variety of construction and other work. The vessel is equipped with accommodation space for 52 people and can work at sea for up to three months without having to call at a port.



Photo: Sanoyas Shipbuilding Corporation



Photo: MUKAISHIMA DOCK YARD CO., LTD.

TUG BOAT UMEMARU

The circular shaped tug boat *UMEMARU*, owned by ship repair yard Mukaishima Dock Yard, has completely changed the concept of a tug boat. At the center of the hull a Rexpeller azimuth thruster is located allowing simple operation of the vessel through the use of just one lever. Also the vessel does not use a rope during towing and instead uses a connecting device. This greatly reduces the manning required for towing operations.

Welcome to INNOVATION Island Shipbuilding Beach



WORK BOATS

As a maritime nation Japan has always had a variety of industrial needs at sea including construction work, deep sea raw material exploration and surveying and towage. Workboat designs have been changing over time to meet these evolving needs.

SUBSEA CABLE LAYING VESSEL KIZUNA

KIZUNA built by Kanrei Shipbuilding is a vessel designed for laying and maintenance of subsea cables on the seabed of which role in today's digital society becomes more important than ever. It enables the vessel to quickly recover communications from the damage caused by a natural disaster such as a major earthquake. The vessel can transport containers filled with necessary materials and vehicles for a disaster recovery. It can also establish temporary mobile phone facilities and is equipped with a satellite communications system and accommodation unit for rescue and reconstruction workers.



Photo: MTT World Engineering Marine Corporation

Welcome to INNOVATION Island Green Beach

The world maritime industries are developing technologies to meet the challenge of realizing a shipping industry that is environmentally friendly. And, in the field of green shipping, Japanese shipping companies, shipbuilders and ship machinery manufacturers have been creating many new innovations.

As far as technology for reducing CO₂ emissions from shipping is concerned for many years, since the 1970s oil shock, fuel efficiency has been a major theme of ongoing research for Japanese shipbuilders.

Japan has become a world leader in developing ship types with advanced propulsion performance and fuel efficient equipment. Over recent years Japan has continuously produced many low CO₂ emission Eco ships. Also on the theme of reducing NO_x, SO_x and other exhaust gas emissions, a rich source of technology developed in Japan to control emissions from land based power plants has been applied to shipping. In addition Japanese technology is being utilized in developing of the next generation of technology for reducing exhaust gasses. In realizing the use of LNG as a fuel it is widely known that research from Japanese engine makers has made a large contribution to the development of two stroke dual fuel engines. To utilize natural energy, as well as advancing research into sailing vessels and solar energy, research is also progressing into LPG as a new source of fuel.

A recent major theme is to improve ship performance in actual sea conditions. Until now, ship designs have been based on calm seas unaffected by winds and waves. But in actual navigation conditions, encountering waves reduces ship speed and increases fuel consumptions. In Japan, since 1990s, the researches focusing on improving the ship performance in actual sea conditions, such as new bow shapes that reduce resistance due to waves and upper structures that reduce air resistance, have been conducted. In 2017, 25 Japanese shipping, shipbuilding, marine equipment companies and the related organizations established a joint project for 'Evaluation of Ship Performance in Actual Seas'. By 2020, after three years of the beginning of the research, the project is aiming at to establish an accurate method of evaluating the performance - in terms of speed and fuel consumption - of ships operating in actual sea conditions. In recent years, there has been widening of activities such as shipping



companies' implementations of performance monitoring systems for improving their operations and shipbuilders' installations of similar systems on their constructing vessels. However, due to the lack of standardized measurement, interpretation and evaluation methods for this type of performance monitoring systems, objective comparisons of the results have been very difficult. There is also an issue that without established methods of theoretical calculation, model testing and measurements of ship performance in waves, winds and currents, ship performances in operation in actual

seas cannot be estimated at the design stage accurately.

The joint project in Japan is aiming to deliver outputs in the three separate areas.

1) Creating a method of analyzing the operational data of ships to evaluate the performance of ships in actual seas 2) Creating a method of estimating the performance of ships in actual seas at the design stage 3) Establishing a method of evaluating the performance of ships in actual operations with a vision to develop technical standards for the global maritime industry.

The target of the development

is to set the level of precision for the estimation of ship performance in waves to the world's top level of 5%.

If the performance of the world fleet in actual sea conditions can be objectively assessed and compared it will lead to a real improvement in performance and contribute to the greener maritime industry.



National Maritime Research Institute has the most advanced model basin for the simulation of actual sea environment.



Japan's "Wind Challenger Project" aiming the next generation sailing vessel Photo: Wind Challenger Project



Welcome to INNOVATION Island Digitalization Beach

A new wave of digitalization is starting to bring change to the world maritime industries. Japanese players from shipping and shipbuilding companies to machinery manufacturers are now combining their efforts to take on the challenge of adjusting the structure of the industry for the new age.

National Strategy for Digitalization

When the Japanese government released its Growth Strategy 2017 it announced an objective of "Working toward the realization of automated vessels by 2025." Tackling the digitalization of the shipping industry has now become a national theme in Japan.

Japanese shipping and shipbuilding companies and machinery manufacturers have already started to develop Information and Communication Technology (ICT) in areas such as remote monitoring systems for the main engine and utilizing on-board data.

The move toward further expanding this technical advantage as a national strategy started in 2016. The Japanese government launched the Japan Revitalization Strategy 2016 raising "Productivity revolution" as its key theme. This is to be achieved by using technical breakthroughs in the Internet of Things (IoT), big data and artificial intelligence to bring about a national movement toward a fourth industrial revolution.



Teaming up "All Japan" to proceed the joint study project, headed by NYK, on collision risk judgement and the autonomous operation of vessels.

As part of this the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) proposed "i-shipping" as a project to achieve a revolution in productivity.

The basic idea behind i-shipping is that ICT should be used in all phases of shipping, from ship design and development, construction and operation, to improve productivity. For example, in the development and design stage, highly reliable Computational Fluid Dynamics (CFD) could be applied to hasten the development of new ship designs. In the construction phase IoT could be used to bring new production technology to shipyards.

At the operational phase a higher added value shipping industry could be pursued through the collation and accumulation of ship data transmitted ashore through fast high capacity communication



Accumulating data during a simulation led by an experienced captain

systems.

Japanese built ships have, from the beginning, always had advanced fuel efficiency and are reliable. But a target was set to achieve maximum energy saving and zero breakdowns. For example, by combining and analyzing real time data with accumulated data on weather, the sea state, hull condition and navigation, rough seas can be avoided and breakdowns, groundings and collisions can be eliminated and sailing time and fuel costs efficiently managed.

Also, the real time monitoring of ship machinery and other areas will allow the early detection of any abnormalities with machinery and prevent further trouble developing. The target is to work toward improving technology to achieve this.

This would prevent situations such as ships drifting when the main engine stops while on-board maintenance would also help avoid unnecessary dry docking.

In fiscal 2016 the government started a support system that would help businesses progress such research and development.

The International Maritime Organization (IMO) is planning to progress on making sure the necessary international rules are in place and the Japanese government wants to contribute toward that message.

On top of that in fiscal 2018, under the leadership of Japan, the creation of new international rules on the transmission of machinery and other data from ships is planned.

Data Center of Shipping

To maximize the opportunity of using big data for shipping it is necessary to have an open platform. ClassNK subsidiary, Ship Data Center (ShipDC), is currently building such a platform. ClassNK established ShipDC in 2015 to provide a platform that is safe and easily accessible to anyone.

It utilized technological knowledge and experience, gained through its work as a ship classification society, to create the foundation of the ship big data center and promote open innovation.

An Internet of Ships (IoS) open platform manages ship data as a single unit. If stakeholders in the maritime industry use the platform they can obtain the information they need at a low cost and maximize the opportunity for using big data.

For example, it is expected that by allowing shipbuilders and machinery manufacturer's access to greater ship and product information effective product improvement will become possible and, through the promotion of open collaboration, the creation of new business opportunities will be encouraged.

By July 2017 ShipDC had completed the process of identifying the main legal and technical themes and in September more than 50 Japanese companies established the IoS Open Platform Promotion Council. This Council has begun work on preparing the legal aspects of data distribution.

ShipDC is aiming at using the IoS Open Platform to raise shipping safety and ship efficiency.

In information sharing there is a line drawn between open data

and closed data and the detailed adjustments associated with data use are complicated.

The Council has established two working groups one is called "Solution" and the other "Rule Governance Formulation" to organize areas, including the scope of data usage, contractual obligations, the intention of data usage, royalties and discussed how a standard contract might be used. The preparation of the legal aspects has already begun and will come into use from 2018.



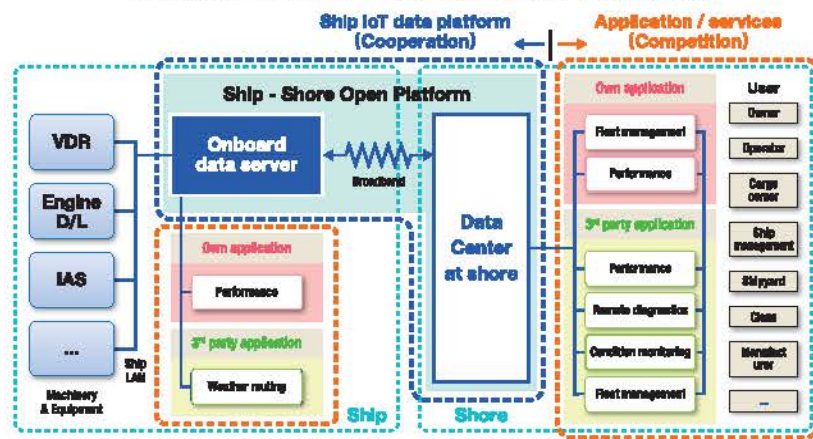
Data Utilization and Standardization

One theme of ship data is standardization for data sharing and usage. And in this sector too Japan is taking the lead through the Smart Ship Application Platform Project (SSAP). Japan Ship Machinery and Equipment Association (JSMEA) established SSAP in December 2012 with the objective of preparing for the use of big data, taken from ship machinery installed on ships, by creating a base through maritime IoT technical development and the standardization. There are about 50 companies and maritime stakeholders participating in SSAP including shipowners, shipbuilders and manufacturers. SSAP is aiming to build a communication platform between ships and land so that data taken exclusively from shipping companies can be shared for the safer and more economical operation of ships. SSAP finished the first period of its activities in March 2015 and in August of the same year launched a second phase as SSAP2.

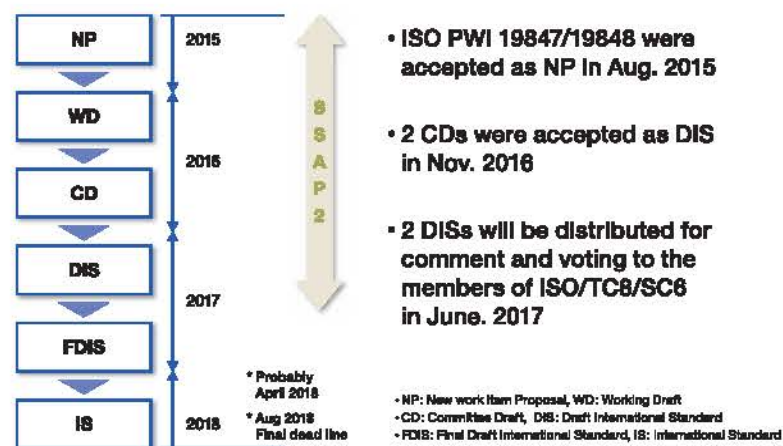
SSAP2 used the results of the first period as a base to work towards the realization of a platform and to achieve an international standardization of rules. SSAP2 also teamed up with ShipDC to create a land based platform and promote information sharing between stakeholders. For the smooth use of maritime big data there needs to be the international standardization of the rules governing ship data. So, with the cooperation of the Japan Ship Technology Research Association (JSTRA) supported by The Nippon Foundation, SSAP2 proposed the "Shipboard data servers to share field data on the ship (ISO19847)" and "Standard data for shipboard machinery and equipment (ISO19848)" to the International Organization for Standardization (ISO) with the aim of completing the international standardization within 2018. Depending on the progress of this, if the sharing of ship data in real sea conditions becomes possible, then - as well as paving

the way for the provision of applications improving the efficiency of ship operation - data on the performance of ships in real operating conditions could also be used as the basis for the development of highly efficient newbuilding ship designs. Also new business development based on ship data can be expected. SSAP2 is from the three viewpoints of applications, platform and rules - while working together with stakeholders - preparing the foundation for the active use of ship data.

Concept of Ship - Shore Open Platform



Process for ISO (ISO 19847, ISO 19848)



Source: Japan Ship Machinery and Equipment Association

Towards the *Autonomous Ship

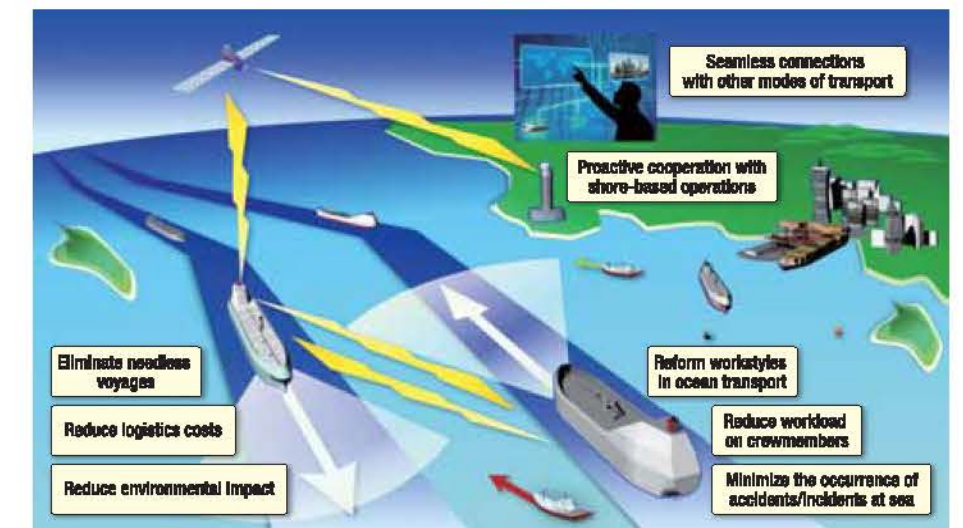
* Vessels that are remotely controlled at a distance from shore and are partially automated.

In recent years one of the targets of digitalization - the autonomous operation of ships - has been drawing a lot of attention as a research theme. For several years Japan has been leading the world in developing automated ship technology and has already realized much of the necessary technology such as elemental and component technology. In 2017 the Japanese maritime cluster combined its forces to begin a joint industrial study group to conduct research with the ambition of realizing the autonomous ship. The Japan Ship Technology Research Association (JSTRA) brought together a research committee to form a joint research platform and, over three years until 2019, set about developing a road map toward an autonomous maritime transportation system. The joint research involved the big three Japanese shipping companies, leading shipbuilders and machinery manufacturers as well as a university research unit, a national research center, a classification society, insurance and communications company and others. To achieve the autonomous ship requires research and study into a wide variety of areas including both hard factors such as automated technology, and soft factors such as operational and legal issues. For this reason the joint research project is aiming to create a vision for the future of the autonomous ship including a

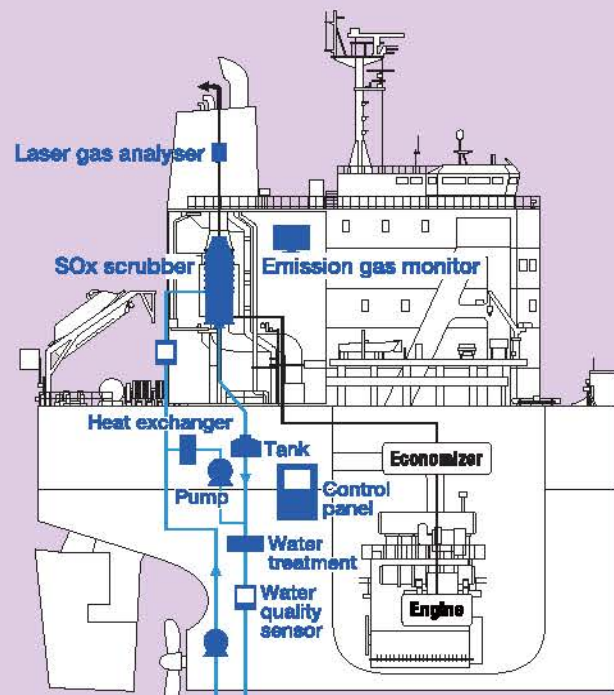
business model and other factors. It will also conduct research into the necessary technology to realize the autonomous vessel and system concepts and, at the same time, identify issues to be tackled such as the legal and infrastructure requirements to permit the operation of the automated ship and to make the commercialization of the business possible. In terms of developing the technological concepts this is being led by a joint research team of seven parties, including Mitsui Shipbuilding and Engineering (MES), Mitsui OSK Lines and others. While looking at the possibility of applying existing technology - such as developing automated steering based on a dynamic positioning system (DPS), an operational support system and monitoring systems based on ship to shore communications and other areas - the companies are developing technical concepts for an advanced practical autonomous ship. In 1961 the world's first Remote Operation and Automatic Control of the Main Engine was achieved on the vessel Kinkasan Maru. And in 1969 Japan the ship Mangolia became the first vessel with an unmanned engine room. With regard to automation technology for maritime transport, from the very start, Japan has been a world leader in the field. In the same way that Japan's Eco Ships now have an advantage today after 30 years of research - in the field of digitalization and the Autonomous Ship - Japan's maritime industry will also work together to become a world leader.



Welcome to INNOVATION Island
Digitalization Beach



Autonomous vessel technology concept
Source: Mitsui O.S.K. Lines, Ltd.



Structure of the ECGS for Marine Vessels
Source: FUJI ELECTRIC CO., LTD.

FUJI ELECTRIC WORLD'S SMALLEST EGCS

Fuji Electric (FE) has produced the world's smallest SOx scrubber for ships with a 10MW engine and is the first scrubber to adopt cyclone technology. It is an easily installable, lightweight exhaust gas cleaning system (EGCS) that is 50% more compact than competing systems and is suitable for both retrofitting and newbuildings. In combination with FE's high-speed accurate laser gas analyzer its system allows ship operators to comply effectively with IMO emission regulations to be implemented in 2020.



Welcome to INNOVATION Island Ship Machinery Beach

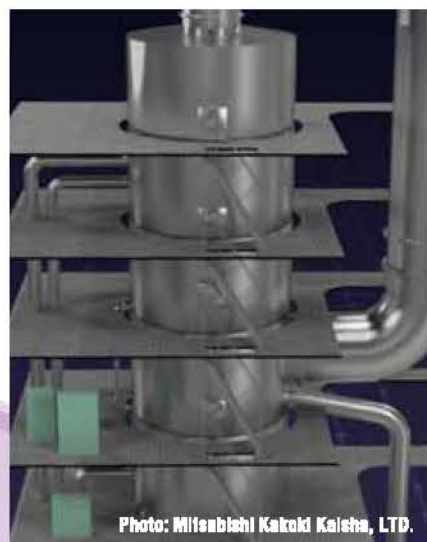


Photo: Mitsubishi Kakoki Kaleha, LTD.

MITSUBISHI HYBRID SOx SCRUBBER SYSTEM

Mitsubishi Kakoki has installed a hybrid SOx scrubber on a large merchant vessel with an emissions volume of 120 t/h and has become the first manufacturer to achieve national approval from the Republic of Panama. If the SOx scrubber is installed from 2020 a vessel can still use 3.5% sulphur content fuel and navigate in waters where the limit on the sulphur content of fuel is 0.5% or 0.1% which will contribute toward a reduction in fuel costs. Mitsubishi Kakoki is supplying hybrid and open loop-type multi-inlet SOx scrubbers that can handle 30MW class main engines.



6EYG26
Photo: Yanmar Co., Ltd.

YANMAR MARINE GAS ENGINE "EYG26L"

Yanmar has developed a new marine gas engine to reduce CO2 emissions and to meet IMO Tier II requirements. The engine can reduce 90% of NOx and 27% of CO2 compared to diesel engines that are designed based on IMO Tier II requirements. By developing new technology to maintain the air-fuel ratio within certain ranges to the changes of fuel calories and load variation it provides high reliability. It has also achieved 45% of thermal efficiency with 1.6MPa meaning effective pressure by installing the combustion control system.



MORE THAN PAPER CHARTS "J-MARINE NeCST"

JRC's J-Marine NeCST is an operational support tool that presents a variety of information on a large display unit. It works together with Electronic Chart Display Information Systems (ECDIS) and includes a function that allows route planning with handwritten information to be overlaid on electronic maps. It also combines with weather and other systems to realize the optimum voyage. Through digitalization this product has made possible the speedy and accurate supply and collation of data between vessels and land.



J-Marine NeCST
Photo: Japan Radio Co., Ltd.

DIGITALIZATION

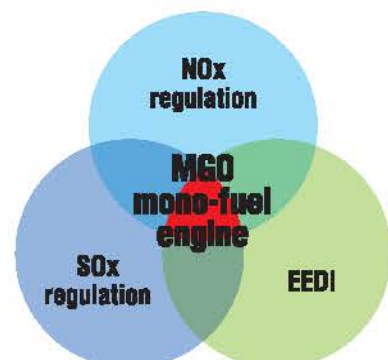
In Japan, with a view to achieving automated, independent and autonomous ship operation, technological development utilizing digital technologies is becoming more and more active. Marine equipment suppliers are advancing technological development in the field of ship operation support systems and engine monitoring, contributing toward improving the efficiency and safety of ship operation.

EMMISSIONS

In the pursuit of a sustainable society measures from the maritime industry aimed at reducing pollution that is harmful to the environment are being strengthened. Japanese ship machinery suppliers have from an early stage established products and technology to meet International Maritime Organization (IMO) regulations and are developing new technologies to meet and surpass a further strengthening of environmental regulation.

J-ENG'S MGO MONO-FUEL ENGINE

Japan Engine Corporation (J-ENG) is developing marine gas oil (MGO) mono-fuel engines collaborating with Onomichi Dockyard Co., Ltd. The MGO mono-fuel engine meets all requirements of environmental regulations such as NOx and SOx reduction and the Energy Efficiency Design Index (EEDI). Compared to existing engines, it saves fuel consumption, extends maintenance intervals and improves reliability. The MGO mono-fuel engine "SUEC50LSH-Eco-C2-MGO" is expected to be introduced into the market in March 2019 followed by the "SUEC50LSH-Eco-C2-MGO" and "SUEC35LSE-Eco-B2-MGO" which will be released in September 2019.

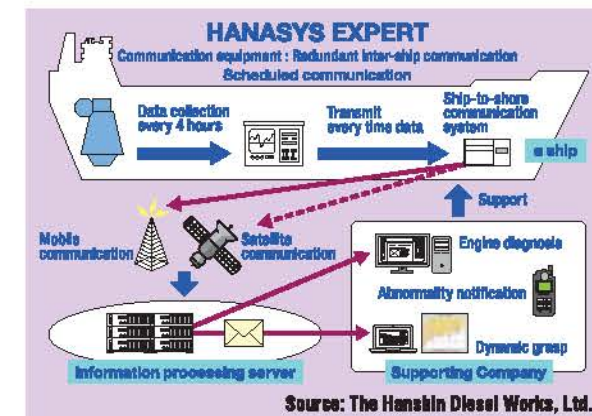


Concept of MGO Mono-fuel engine
Source: Japan Engine Corporation

TOKYO KEIKI AUTOPILOT "PR-9000"

The PR-9000 series makes it possible to operate on autopilot on straight controlled navigation routes without connecting to ECDIS through the option of the Advanced Control for Ecology (ACE) function. It automatically sets the route from the starting point to destination and, based on a calculation of estimated current and route deviation, the rudder settings are fixed at the optimum level. Compared to previous products, route deviation and route distance is reduced while a reduction in wasteful rudder movement is also achieved.

PR-9000
Photo: TOKYO KEIKI INC.



Source: The Hanshin Diesel Works, Ltd.

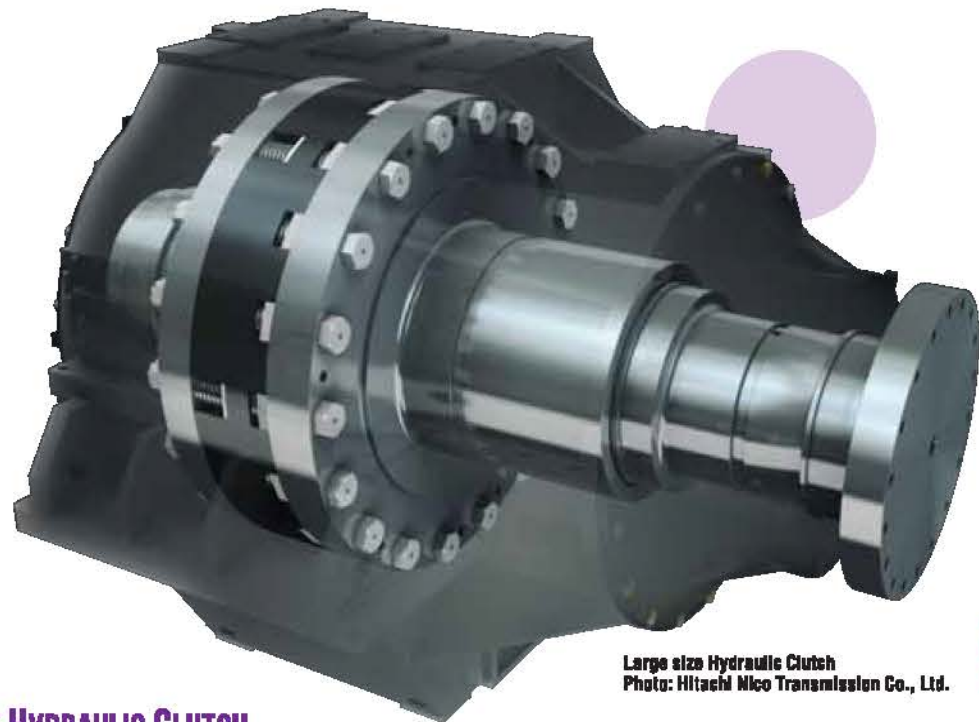
HIGH LEVEL SHIP SAFETY MANAGEMENT SYSTEM

Hanshin Diesel and Yanmar are supplying a high-level ship management system for propulsion systems. The high level management system uses sensors to collect and accumulate information from the main engine allowing a lead based management center to remotely monitor and assess the condition of the engine. Because of this any problems with the engine can be quickly discovered and major breakdowns prevented from developing at an early stage. It also optimizes the maintenance of the engine which, as well as reducing onboard work for the crew, also contributes to a reduction in maintenance costs.



INNOVATION

Japan's ship machinery manufacturers are continuously creating new innovations. Japan Ship Machinery and Equipment Association (JSMEA) has received support from the Nippon Foundation and is now providing business assistance to these companies to help them develop and realize new products.



Large size Hydraulic Clutch
Photo: Hitachi Nipo Transmission Co., Ltd.

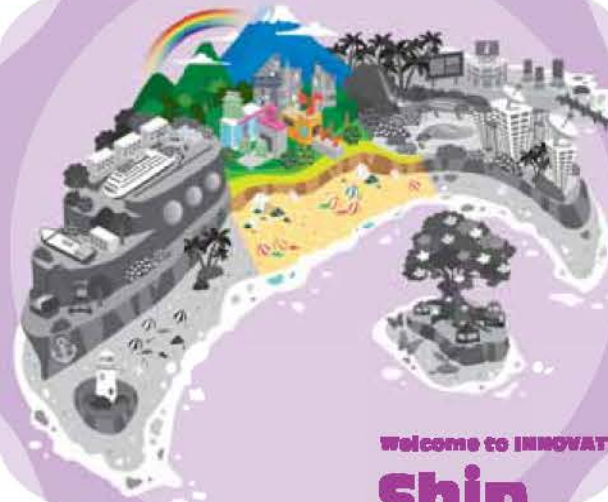


LARGE SIZE HYDRAULIC CLUTCH

In a ship equipped with a two-stroke engine, a hybrid propulsion system is one of measures against IMO NOx tertiary regulation. The system has both propulsion by the main engine and auxiliary motor, and at the time of propulsion by the auxiliary electric motor, the main engine which becomes resistance is disconnected from the propeller shaft. A clutch is used as a means for separating. Hydraulic clutches are mainly developed for medium speed engines, and there were no large hydraulic clutches suitable for two stroke engines. When switching propellers, it was necessary to stop the engine. Hitachi Nipo Transmission has newly developed a large hydraulic clutch with capacity of 8.5 MW to 20 MW that can be applied to handy max, cape size bulk carrier, and twin shaft LNG carriers. The hydraulic clutch can switch the main engine and the auxiliary electric motor without stopping the engine. Also, the main engine and the propeller can be connected and disconnected between single engine propulsion and a twin engine of twin engine twin shaft or twin engines single shaft.



Photo: Hitachi Nipo Transmission Co., Ltd.



Welcome to INNOVATION Island
Ship Machinery Beach



Composite material pump
Photo: Naniwa Pump Mfg. Co., Ltd.



COMPOSITE MATERIAL PUMP

For marine pumps to achieve a reduction in energy consumption, together with reduced generator fuel requirements, a lightening of the weight of equipment on a ship is necessary. Naniwa Pump is attempting to improve efficiency and to reduce the weight of centrifugal pumps by substituting bronze as material of pump casings and impellers with fiber reinforced plastic (FRP). Research and development conducted until the end of the last fiscal year resulted in a new design and optimized production method (CM-RI method) for FRP pumps. The target to achieve a 2% improvement in pump efficiency coupled with a 40% weight reduction was met. Because FRP surfaces are smoother and lighter than bronze, running costs are lower (reduction in friction and weight). Naniwa is continuing with a variety of tests for mass production based on a prototype. Following onboard trials, Naniwa aims at marketing a product within fiscal year 2018. Naniwa Pump plans to expand the use of FRP pumps beyond merchant shipping and to install the equipment on high speed vessels.



Smart power meter
Photo: Uzushio Electric Co., Ltd.

A SMART MARINE POWER METER

Uzushio Electric has developed a power meter which can collect and accumulate data and has an internal communication function installed. In addition it has developed a data management application software that can combine the accumulated electrical data with the ship's operational information, leading to a variety of analysis and realizing a visualization of the use of electrical power. Using this the vessel's power requirement can be represented on a graph in real time and indicate power saving zones to the ship's crew and promote onboard energy conservation. Also it can make possible energy saving during peak energy usage by identifying the connection between peak energy and running onboard auxiliary equipment. With this application package the user can achieve the visualization of onboard electrical power at a low cost and smoothly carry out the plan, do, check, act (PDCA) cycle of electrical power management to achieve reductions CO2 emissions and fuel consumption.

NEW MARKETS

Japanese ship machinery manufacturers are attempting to bring technology developed into the merchant shipping sector into new markets. Japan Ship Machinery and Equipment Association (JSMEA) is aiming for new business development in the offshore and foreign fishing markets as it strengthens efforts to break into new markets and expand in the export sector.



In 2017 JSMEA established a working group to study expansion into foreign fishing markets. The member companies of the working group shared their knowledge of the fishing industry to pinpoint targets in different countries and fishing sectors. A study was also initiated into those developing countries that showed promise of increasing fishing volumes. Toward the future the working group is now looking at putting together packages of products for expansion overseas. Because many Japanese ship machinery manufacturers were founded on developing products for fishing vessels they can take advantage of this specialty to supply

high quality products to foreign fishing markets. In the offshore sector every year JSMEA is participating in the world's largest offshore exhibition the Offshore Technology Conference (OTC) to promote its products. At the exhibition, among the promotional measures taken, a specialist catalogue introducing member's products is distributed at the show. The catalogue not only illustrates individual products but also packages of products aimed at the offshore market. From now JSMEA, aiming at participating in the offshore supply vessel (OSV) market, is considering producing design plans that promote the sale of packages of Japanese products.



Photo: Japan Ship Machinery and Equipment Association

Welcome to INNOVATION Island

Information Beach



Major Shipbuilding & Ship Machinery Organizations

JAPAN SHIP TECHNOLOGY RESEARCH ASSOCIATION (JSTRA)

Office

Round Cross Akasaka, 10-9, Akasaka 2-chome, Minato-ku, Tokyo 107-0052, Japan
Tel: +81-3-5575-6426 Fax: +81-3-5114-8941
E-mail: info@jstra.jp Website: <https://www.jstra.jp/english/>

Membership

Supporting members: 189

Purpose :

The key words of JSTRA are Ship Regulations, Standards and R&D. JSTRA provides a platform for close cooperation integrating the maritime industry, academia and government as a single unit. JSTRA's activities will enhance the international competitiveness of our country and contribute to maritime safety and marine environment protection in international society.



THE SHIPBUILDERS' ASSOCIATION OF JAPAN (SAJ)

Office

3F, The Japan Gas Association Building., 15-12, Toranomon 1-chome, Minato-ku, Tokyo 105-0001, Japan
Tel: +81-3-3580-1561 Fax: +81-3-3580-1633
Website: <https://www.sajn.or.jp/e>

Membership

17 Member Companies and 1 Member Association

Purpose :

To promote the sound and sustainable development of shipbuilding Industry, thereby to contribute to enhancing the domestic and international economies and public welfare.



THE COOPERATIVE ASSOCIATION OF JAPAN SHIPBUILDERS (CAJS)

Office

Toranomon Mitsui Bldg., 8-1, Kasumigaseki 3-chome, Chiyoda-ku, Tokyo, 100-0013, JAPAN
Tel: +81-3-3502-2061 Fax: +81-3-3503-1479
Website: <http://www.cajs.or.jp/english.html>

Membership

Ordinary members: 50 shipbuilding companies
Supporting members: 9 shipbuilding companies and 20 associations

Purpose :

The Cooperative Association of Japan Shipbuilders (CAJS), established in 1959, now has 50 member shipyards. Since its founding, CAJS has been committed to modernization and rationalization of the medium and small-size shipbuilding industry and enhancement of its technical standards, and also endeavored to promote international cooperation.



Overseas offices

Japan Ship Centre (JETRO) London, Singapore

JAPAN SHIP EXPORTER'S ASSOCIATION (JSEA)

Office

3F, The Japan Gas Association Building., 15-12, Toranomon 1-chome, Minato-ku, Tokyo 105-0001, Japan
Tel: +81-3-6206-1661 Fax: +81-3-3597-7800
Website: <http://www.jsaa.or.jp/en/>

Membership

21 shipbuilding companies and 11 trading houses

Purpose :

The Japan Ship Exporters' Association was founded to promote the export of ships and ship machinery according to the Japanese Export and Import Trade Law on December 13, 1954.



Overseas office

Japan Ship Centre (JETRO) London

JAPAN SHIP MACHINERY & EQUIPMENT ASSOCIATION (JSMEA)

Office

Toranomon Toyo Kyodo Bldg., 13-3, Toranomon 1-chome, Minato-ku, Tokyo 105-0001, Japan
Tel: +81-3-3502-2041 Fax: +81-3-3591-2206
E-mail: info@jsmea.or.jp
Website: http://www.jsmea.or.jp/index_en.html

Membership

Ordinary members: 256 Supporting members: 67

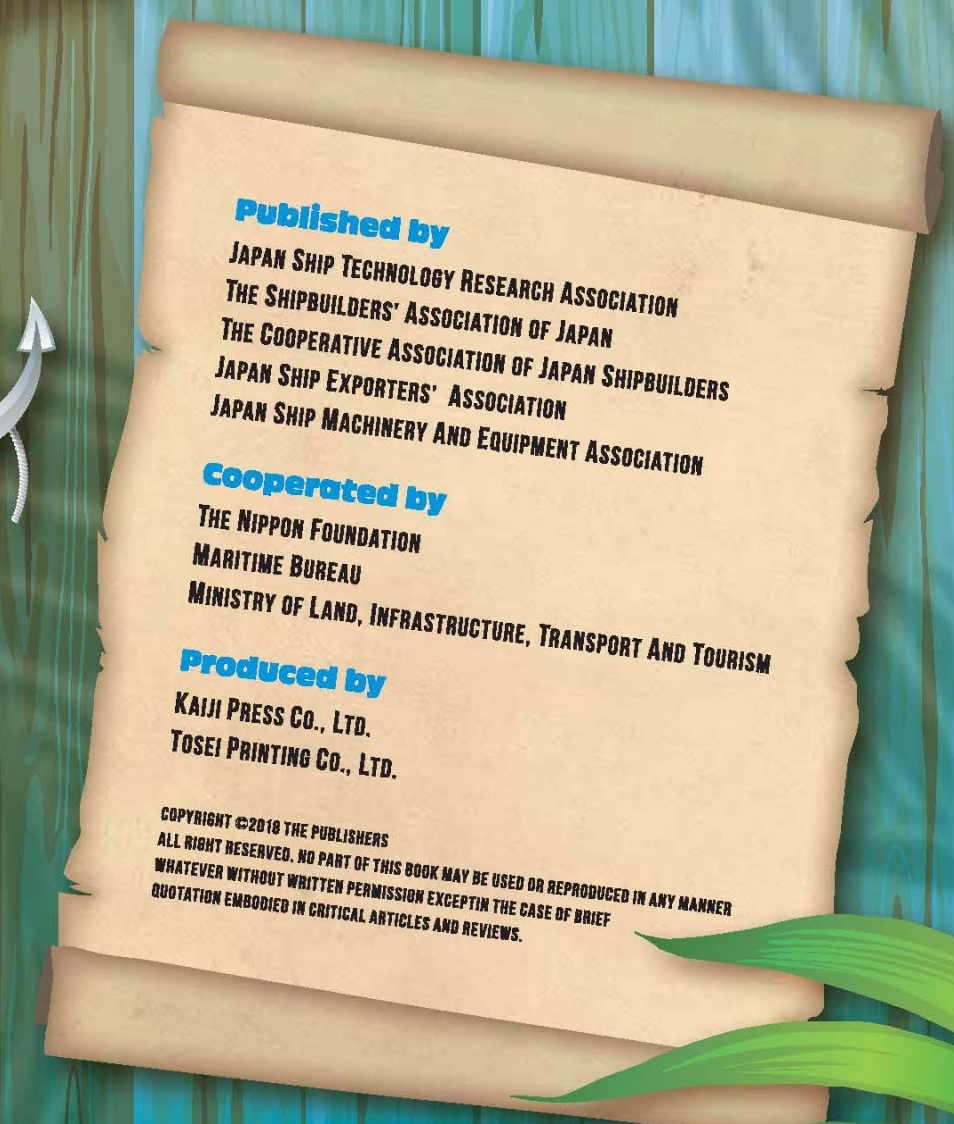
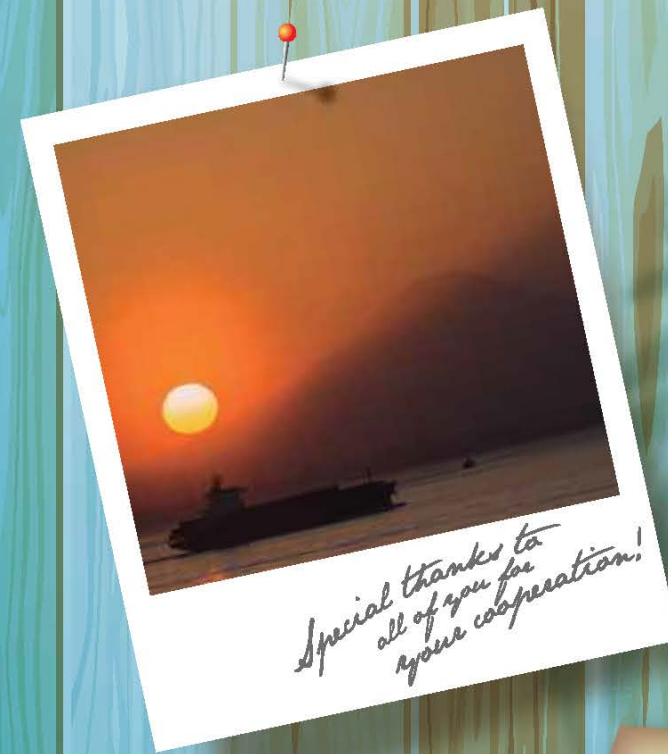
Purpose :

JSMEA activities are all for further upgrading the Japanese ship machinery and equipment industry. The specific efforts that we make to this end include the following: (1) Developing business globally (2) Activating technological development (3) Promoting procurement and development of human resources (4) Developing and enlarge offshore development markets and foreign fishing markets.



Overseas offices

Hong Kong, Houston, Singapore



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JAPAN SHIP TECHNOLOGY RESEARCH ASSOCIATION
THE SHIPBUILDERS' ASSOCIATION OF JAPAN
THE COOPERATIVE ASSOCIATION OF JAPAN SHIPBUILDERS
JAPAN SHIP EXPORTERS' ASSOCIATION
JAPAN SHIP MACHINERY AND EQUIPMENT ASSOCIATION

Cooperated by

THE NIPPON FOUNDATION
MARITIME BUREAU
MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM

Produced by

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TOSEI PRINTING Co., LTD.

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