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Realizing Technologies for GHG reduction

SHIPBUILDING
in JAPAN 2026

GHG

INTRODUCTION

Investment in the shift to renewable energy is advancing worldwide, and the maritime industry is making progress in developing zero-emission vessels. In Japan, the world's first commercial operation of ammonia-fueled ships has commenced, with new vessels scheduled to enter service in 2026.

This issue focuses on "GHG Emission Reduction," covering initiatives for ammonia-fueled ships, how shipyards are responding to alternative-fuel vessels, and how marine equipment manufacturers are developing products to improve operational efficiency. Furthermore, the development of alternative fuel vessels is imperative to stimulate demand and accelerate supply-side initiatives. The cases featured in this issue are pioneers in this movement. We encourage our readers to use these cases as references as we prepare for further progress in decarbonization.

SHIPBUILDING in JAPAN 2026

Supported by THE NIPPON FOUNDATION

We would like to express our sincere gratitude to the Nippon Foundation for their generous support in the publication of Shipbuilding in Japan 2026.

The Nippon Foundation Zero Emission Ship Project

SHIPBUILDING in JAPAN 2026

In 2022, the Nippon Foundation launched the "Nippon Foundation Zero-Emission Ship Project" to achieve carbon neutrality in the domestic shipping sector by 2050. The project involves pioneering the development and conducting demonstration tests of hydrogen-fueled vessels, or zero-emission ships. Within this project, three consortiums are constructing three types of vessels using hydrogen fuel: an offshore wind turbine service vessel, a tugboat, and a large tanker. The offshore wind turbine service vessel "HANARIA" commenced service in April 2024 (see previous issues). This issue covers the development status of the remaining two consortiums.

Dual-Fueled Hydrogen Tugboat "TEN-OH"

LOA x B. x d. : 36.0m x 9.6n x 4.2m | Gross tonnage : Less than 300 tons
Main feature : Two 12-cylinder BEH2YDRO hydrogen dual-fueled engines (4,400-horsepower class)
Fuels used : Hydrogen and heavy fuel oil A

Hydrogen-Fueled Engine Installed Tanker "KIKOU MARU"

Length : 104.93m | Gross tonnage : Approx. 4,500 tons | Cargo capacity : Approx. 5,000 kiloliters
Drive method : Electric propulsion using a twin-engine, dual-propeller electric propulsion system (generator-battery hybrid).It is driven by electricity generated in a hydrogen-fueled engine container unit mounted on the upper deck during hydrogen-fueled navigation.

Japan's First Dual-Fueled Hydrogen Tugboat Enters Service
Tugboat decarbonization to contribute to carbon-neutral port (CNP) concept

The Hydrogen Engine Zero Emission Vessels Consortium, led by JPN H_2YDRO Co., Ltd., has been promoting the development of zero-emission vessels as part of The Nippon Foundation Zero Emission Ship Project. On October 15, 2025, the consortium received delivery of the TEN-OH tugboat, which is equipped with hydrogen dual-fuel engines. Consortium member Tsuneishi Shipbuilding Co., Ltd. built the vessel, which is equipped with BEH$_2$YDRO high-output hydrogen dual-fuel engines and a high-pressure, large-capacity hydrogen gas storage and supply system provided by JPN H_2YDRO. The consortium plans to build two hydrogen-fueled vessels for verification operations; the TEN-OH is the first.

The BEH$_2$YDRO engines use a combination of hydrogen and fuel oil, reducing CO_2 emissions by approximately 60% compared to tugboats that use conventional fossil fuels. Additionally, the high-pressure, large-capacity hydrogen gas storage system enables the conversion of hydrogen to fuel while maintaining the same level of navigation functionality as with conventional fuel.

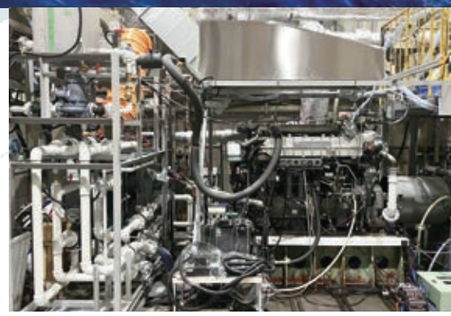
The consortium plans to use the TEN-OH for verification operations and demonstration testing, including bunkering, through 2026.

Launch of Demonstration Tanker 'KIKOU MARU' with Plans for Hydrogen-Fueled Engine Installation
Demonstration test voyage with zero emissions planned for 2026

On February 14, 2025, a newly built tanker vessel was launched and named KIKOU MARU. The vessel is part of the Marine-Use Hydrogen-Fueled 4-Stroke Engine/Hydrogen Engine-Compatible Large Coastal Tanker Development Consortium, led by Yanmar Power Technology Co., Ltd., and is being developed by The Nippon Foundation Zero Emission Ships Project. It will be equipped with a marine-use hydrogen-fueled 4-stroke high-speed engine.

Built by consortium member Uyeno Transtech Ltd., the vessel will serve as a hydrogen-fuel demonstration ship to promote zero emissions in coastal shipping. It will be equipped with a hydrogen-powered 4-stroke high-speed engine that uses hydrogen fuel to generate electricity and operate the motor, enabling zero-emission shipping.

Construction of the KIKOU MARU is ongoing, with completion scheduled for 2025. A zero-emission demonstration voyage using hydrogen fuel and hydrotreated vegetable oil (HVO) is planned for 2026 and is expected to significantly contribute to promoting zero emissions in Japan's coastal shipping industry.



Test Bench for High-Speed Hydrogen-Fueled 4-Stroke Engine (Pilot Ignition Type)

Don't Be Overly Afraid of Ammonia

NYK Line

Sakigake: World's First Commercial Ammonia-Fueled Tugboat

In August 2024, NYK Line completed Sakigake (literally meaning "pioneer"), the world's first commercial ammonia-fueled tugboat. It was developed under the New Energy and Industrial Technology Development Organization's (NEDO) Green Innovation Project for next-generation vessels. In collaboration with IHI Power Systems Co., Ltd. and ClassNK, the vessel was converted at the Oppama plant of Keihin Dock Co., Ltd. from Japan's first LNG-fueled tugboat (built in 2015) to the world's first commercial ammonia-fueled tugboat. NYK Line shared with us the challenges and solutions encountered during the conversion and operation, as well as the company's future initiatives for ammonia-fueled ships.

After conducting a thorough cost and risk assessment that considered crew availability for gas-fueled vessels and the status of engine development, it was determined that modifying the LNG-fueled Sakigake was the optimal solution rather than building a new vessel. Since tugboats typically serve for 30 years, the eight-year-old Sakigake was ideal for confirming the feasibility of future retrofits. Becoming the world's only commercial ammonia-fueled vessel attracted numerous inquiries from both domestic and overseas.

The construction work involved a major overhaul and replacement of approximately 95% of the equipment. This included converting to an ammonia-fueled main engine, as well as updating the bridge control systems, engine-related equipment, fuel tanks, fuel supply systems, and peripheral facilities. In addition to the space required for tank connections and additional equipment, such as selective catalytic reduction (SCR) systems, the use of ammonia fuel, which has a lower energy density than LNG, necessitates larger equipment. Consequently, considerable time was spent designing the equipment layout. Adding more equipment to the small vessel increased construction work in confined spaces, significantly raising the difficulty level. Unlike standard new shipbuilding, the conversion work involved splitting the hull in two and installing equipment from the far ends, which made managing the procurement schedule even more critical. The utmost attention was given to countermeasures against ammonia toxicity. Significant time was required to develop meticulous leak prevention measures, detection systems for abnormal occurrences, and automatic shutdown systems that comply with ClassNK guidelines. Since there were no similar products to reference, every decision had to be made independently; however, experience gained from building the LNG-fueled Sakigake proved invaluable. So, they could complete that in approximately two years of design and 10 months of conversion work. The vessel has been operating safely since its completion.

Tugboats require significant fluctuations in engine power output during towing operations, and initially, LNG-fueled tugboats experienced knocking when power increased quickly. This forced them to switch back to heavy oil mode. Although ammonia fuel is more expensive than heavy oil, it offers better operability by eliminating knocking and enabling smoother power adjustment even after operations begin, there is much trial and error in addressing minor equipment issues, such as the durability of exhaust gas treatment systems and necessary countermeasures against ship vibrations. Understanding from port authorities was essential, as steam generated after treating ammonia fuel exhaust was sometimes mistaken for white smoke caused by engine malfunctions.

They have learned many things through developing ammonia-fueled ships, but the most important lesson was: "Don't be overly afraid of ammonia." Due to its toxicity, there are strong concerns about ammonia fuel leaks. It's unrealistic to expect zero leakage of any fluid. Therefore, it is necessary to establish measures and defenses to prevent large-scale leaks. Handling ammonia also requires knowledge of it. In addition to learning the basics in a lecture, crew members are exposed to ammonia in safe conditions. This includes identifying the odor within levels that are harmless to humans and conducting simulations on how to respond if ammonia comes into contact with the skin. Training sessions are conducted regularly. In anticipation of an increase in ammonia-fueled ships in the future, operational and safety manuals have been developed, including the selection of safety gear, and are continuously updated.

In general, the ammonia-fueled vessel has been operating smoothly, and the insights gained are being incorporated into the design of an ammonia-fueled medium gas carrier (AFMGC) scheduled to enter service in November 2026. Though tugboats and oceangoing vessels differ in many ways, the auxiliary engines of the AFMGC use scaled-down versions of the main engines found on tugs. To prevent issues encountered on Sakigake from occurring on the AFMGC, proactive countermeasures can be taken. Block construction for the AFMGC has already commenced. The NYK Group is developing various types of ammonia-fueled vessels and plans to introduce 15 ships by 2033.

(Left) Kentaro Nonaka, Deputy Manager of Ship Planning Team, Technical Group
(Right) Kiho Takano, Deputy Manager of Ammonia Fueled Vessel Development Team, Next Generation Fuel Business Group

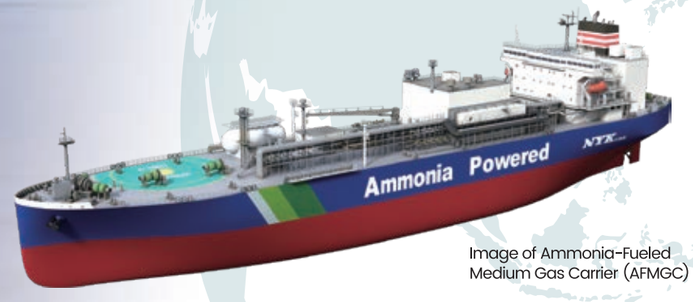


Image of Ammonia-Fueled Medium Gas Carrier (AFMGC)

To Increase Production of Alternative Fuel Including Ammonia Tanks

Imabari Shipbuilding Co.,Ltd from SAJ Member

Established in 1901, Imabari Shipbuilding Co., Ltd., a member of the Shipbuilders' Association of Japan (SAJ), is known as the largest shipbuilder in Japan. Since constructing its first steel ship in 1955, the company has built over 3,000 vessels and has remained an industry leader. In an era of shifting energy sources and growing demands to reduce greenhouse gas emissions, the company has intensified its focus on developing and building eco-friendly vessels, such as ships fueled by new sources. To that end, the company has started manufacturing LNG fuel tanks in-house. Since 2023, the company has supplied domestic LNG tanks at its Nishi Tadotsu factory, setting an example for the industry.
They will now expand their production capacity and aim to manufacture ammonia fuel tanks.

Imabari Shipbuilding Co., Ltd. is centered in the Seto Inland Sea area and boasts the top market share in Japan for shipbuilding volume. The company reached a milestone in 2025 by building its 3,000th new ship.

The group consists of the following:
- Head Office & Imabari Shipyard
- Marugame Headquarters, the nucleus for inventing new technologies
- Saijo Shipyard, with three 800-ton cranes
- Hiroshima Shipyard, an expert in constructing large-scale ships
- Iwagi Zosen Co., Ltd., with original techniques for constructing special cargo carriers
- Shimanami Shipyard Co., Ltd., with experience in constructing mid-sized ships
- Shin Kasado Dockyard Co., Ltd., with a reputation for quick responses and a convenient location
- I-S Shipyard Co., Ltd., providing flexible support to meet diverse needs
- Tadotsu Shipyard Co., Ltd., playing a prominent role in constructing vessels of all sizes
- MinamiNippon Shipbuilding Co., Ltd., with experience in constructing tankers
- Marugame Headquarters Hohrai Factory, the main production base for funnels and pipework
- Marugame Headquarters Nishi Tadotsu Factory, the central base for hull block production
- Saijo Shipyard Higashi Hiuchi Factory expertized in the accommodation area
- Steel Hub Co., Ltd., a hub station for steel processing and logistics.

After receiving a contract to build a fleet of LNG-fueled car carriers for a major Japanese shipowner, Imabari Shipbuilding Group decided to manufacture LNG fuel tanks in-house. This move aims to fulfill the shipbuilder's responsibilities, particularly with regard to stabilizing delivery schedules.

The car carriers are primarily constructed at the Tadotsu Shipyard and the Marugame Headquarters. The former delivered the group's first LNG-fueled car carrier to Kawasaki Kisen Kaisha ("K" Line) in 2021. The latter has built over 100 car carriers. Imabari Shipbuilding introduced new equipment for manufacturing gas fuel tanks at its Nishi Tadotsu Factory, which supports both main plants by producing hull blocks and other components.

The company has advanced its decarbonization efforts by establishing a CO_2-saving manufacturing process. Moving forward, they plan to increase production of alternative fuel tanks and accelerate environmental initiatives.

Specifically, by fiscal year 2028, they will have constructed six new buildings for all-weather tank manufacturing, bringing the total to thirteen buildings, including existing facilities. Since welding accounts for a large part of the fuel tank manufacturing process and outdoor welding is affected by rain and other weather conditions, they will establish a system to ensure that welding operations can continue without interruption, even during inclement weather.

They will also introduce new press machines to manufacture "end plates," which are components attached to the ends of tanks. While end plate production was previously outsourced, in-house production will increase supply capacity and reduce costs.

Furthermore, the company will expand the outfitting basin for alternative-fuel-powered tankers. In addition to the current outfitting basin, which can accommodate a 300-meter-class vessel, a new basin for a 400-meter-class vessel will be constructed. Equipment such as a 70-ton crane, which is used to transport outfitting materials, will also be installed.

Through these enhancements to production capacity, the company aims to expand tank manufacturing to include methanol- and ammonia-fueled vessels, which are anticipated to be zero-emission ships.

The Imabari Shipbuilding Group will promote decarbonization across the entire maritime sector by advancing the adoption of eco-friendly ships powered by alternative fuels, such as LNG. For LNG-fueled vessels, the group is securing orders for car carriers and capesize bulk carriers through Nihon Shipyard Co., Ltd. (NSY), a sales and design joint venture with Japan Marine United Corporation (JMU).

Striving for the Performance

Fukuoka Shipbuilding Co.,Ltd. From CAJS Member

Fukuoka Shipbuilding Co., Ltd., a member of The Cooperative Association of Japanese Shipb uilders (CAJS), is known as a chemical tanker shipbuilder. They have a proven record of building LNG-fueled chemical tankers. President and Representative Director Yoshikazu Tanaka said, “These experiences will give us an advantage when adapting to ammonia-fueled ships.” Their policy is fully tailor-made construction and "doing what we can now and delivering the necessary ships to those who need them". Rather than focusing on specific fuels, such as hydrogen, ammonia, or methanol, the company will respond to each request as it arises.

Fukuoka Shipbuilding Fukuoka Factory

Fukuoka Shipbuilding Nagasaki Factory

Fukuoka Shipbuilding Co., Ltd. is renowned for building chemical tankers, operating factories in Fukuoka and Nagasaki in the Kyushu region. Additionally, its subsidiaries, Usuki Shipyard Co., Ltd. in Ōita and Fukuoka Watanabe Shipbuilding Co., Ltd. in Nagasaki, build chemical tankers and large fishing vessels, respectively. Each constructs approximately four vessels annually. The Fukuoka Factory and Usuki Shipyard have building docks capable of handling 19,000 DWT chemical tankers, and the Nagasaki Factory can accommodate up to 47,000 DWT chemical tankers. The Fukuoka Factory is a rare shipyard located in an urban area, just about 3 kilometers from Tenjin, the central district of Fukuoka City.

The company is a pioneer among CAJS members for its focus on and development of LNG systems. In 2012, Fukuoka Shipbuilding developed a 12,500 DWT LNG-fueled chemical tanker and became the world's first chemical tanker to receive approval in principle from DNV. In 2023, the company completed Japan's first LNG dual-fuel chemical tanker using the national shipbuilding support program and has built four such vessels to date. Recently, as part of the Nippon Foundation's Zero Emission Ship Project, the large domestic tanker “Kikou Maru”, which is equipped with a hybrid electric propulsion system compatible with hydrogen fuel engines, was launched. The company has gained expertise in hydrogen technology. Additionally, their experience building LNG-fueled ships will give them an advantage when adapting to ammonia-fueled ships. Consequently, the company is preparing to consider development if actual demand arises. President Yoshikazu Tanaka said, "I am delighted to have been involved in the construction of this state-of-the-art vessel. Through these technologies and knowledge, I feel we have taken the first step toward building alternative fuel vessels.”

However, given that heavy fuel oil (HFO) remains the mainstream choice for construction demand worldwide, the company's core product line continues to be HFO-fueled chemical tankers. The company's current strategy is to maximize fuel efficiency and environmental performance with HFO engines. Even though it uses HFO, oil majors require chemical tankers to meet very high standards, and vessels that do represent the industry's highest benchmark. As these standards continue to rise, the industry will adapt. For now, the focus is on refining existing technologies and advancing the development of eco-friendly hull designs. The construction of alternative fuel ships will be approached cautiously, based on actual demand. Rather than focusing on specific fuels, such as hydrogen, ammonia, or methanol, the company will respond to each request as it arises.

There are no standard hull designs; tailor-made construction is the norm. The company has strong confidence in its safety record and design capabilities based on past performance. Safety is the top priority. The president explains why they don't use designs provided by external firms: they cannot be held liable for the design. They generally handle all design work in-house, taking full responsibility for every process, including after-sales service. As a shipyard that specializes in chemical tankers, they strive to meet their customers' needs. Many customers understand this approach, fostering strong, trusting relationships. Building on this trust, the company maintains its stance of "doing what we can now and delivering the necessary ships to those who need them" in its newbuilding business. Therefore, in addition to chemical tankers, they build approximately one other type of vessel per year, including domestic tankers, cement carriers, and domestic ferries, to meet a wide range of needs. As the markets in India and Africa have recently flourished, new demand is anticipated.

Procurement is largely domestic, which results in shorter lead times and stable maintenance. They primarily use Japanese manufacturers to meet shipowners' requests, and many shipowners are satisfied with this approach. There appears to be deep trust in Japanese-made products. Furthermore, to improve efficiency, the hull factory at the Fukuoka plant was rebuilt during the pandemic and began operating in January 2023. In addition to introducing a movable roof, robots, and automatic cutting machines, three 150-ton cranes were added, and the 20-ton crane was upgraded by October 2025. This significant investment in equipment has streamlined operations and reduced CO_2 emissions.

Executive President Yoshikazu Tanaka

President Yoshikazu Tanaka shares his vision: "While various fuels are currently under consideration, my personal dream is to see ships powered by seawater. Seawater is an infinite resource, and if we could extract hydrogen directly from it, it would become a highly attractive energy source.” He added, "Chemical tankers transport raw materials for chemicals, so the more convenient they become, the more needed they will be. Demand for them will never disappear." The company will continue to face the future with chemical tankers as its strength.

Ship of the Year 2024

The Japan Society of Naval Architects and Ocean Engineers (JASNAOE) annually recognizes ships built in Japan for excellence in technology, artistry, and social contribution. For the 35th edition, a total of nine vessels were nominated, and the small passenger ship “HANARIA”, which is equipped with hydrogen fuel cells, lithium-ion batteries, and a biofuel engine, won the Ship of the Year award. The world's first commercially operated ammonia-fueled tugboat “Sakigake,” was entered in the Workboat/Special Purpose Vessel sector, received the Special Technical Award. “HANARIA” is featured in ‘Shipbuilding in Japan 2024’ and ‘Shipbuilding in Japan 2025’, while “Sakigake” is covered in a separate article in this issue.

Other winners are: “Mahoroba” in the Small Passenger Ship sector, “Shimokita Maru” in the Small Cargo Ship sector, and “Kangei Maru” in the Fishing/Research Vessel sector. Large ships were excluded from the awards this time due to a lack of entries.

“Mahoroba” won among three vessels excluding “HANARIA”. Like “HANARIA,” it uses hydrogen fuel cells as its power source. In addition to its unique appearance, it was recognized for being used as transportation to the venue of the Osaka-Kansai Expo 2025 and for widely disseminating new ship technologies to society.

In the small cargo ship sector, “Shimokita Maru” was highly praised not only for its social role as a domestic limestone carrier, but also for achieving zero emissions within ports by installing an LNG-fueled gas engine, shaft generator, and large-capacity batteries. By utilizing the batteries to manage output fluctuations, it leveled engine operation and reduced fuel consumption by over 30%. It was also recognized as a vessel designed with crew comfort in mind.

In the Fishing Vessels and Research Vessels sector, the new whaling mother ship “Kangei Maru” won the sector award. It is the world's only operational whaling mother ship and is recognized as a modern large fishing vessel with an onboard processing plant for dismembering and processing whales.

Ship of the Year 2024

Shipowner	MOL Techno-Trade, Ltd.
Designer	Hongawara Ship Yard Co., Ltd.
Shipbuilder	Hongawara Ship Yard Co., Ltd
Completion	15-Mar-2024
Lpp x B x D - d	29.70m x 10.00m x 3.70m - 2.00m
Gross tonnage	238 tons
Speed	10.2 knots
Main engine	Electric motor FTW-400L 400kW x 900min^{-1} x 2 units
Passenger capacity	103 (seats for 76, BF seats for 5 and a standing space for 22)
Characteristic outfitting	a hydrogen fuel cell-powered propulsion system, hydrogen fuel tank modules, lithium-ion batteries, a unique upper hull design mostly made up of curved surfaces, stern and bow thrusters

The small passenger ship “HANARIA” is Japan's first zero-emissions passenger ship and contributes to the formation of a carbon-neutral domestic fleet.

It has a unique system that allows it to select a propulsion energy source from hydrogen fuel cells, lithium-ion batteries, or biodiesel fuel. Compared to conventional vessels that run on fossil fuels, the HANARIA can reduce CO_2 emissions by 53% to 100%, paving the way toward a low-carbon or decarbonized society.

Small Passenger Ship Award

Shipowner	Iwatani Corporation
Designer	Namura Shipbuilding Co., Ltd. and Setouchi Craft Co., Ltd.
Shipbuilder	Setouchi Craft Co., Ltd.
Completion	9-Dec-2024
Lpp x B x D - d	29.30m x 8.00m x 2.50m - 1.10m
Gross tonnage	177 tons
Speed	Maximum of 13 knots
Main engine	Electric propulsion motor 226kW x 1,800min^{-1} x 2 units
Passenger capacity	150 people
Characteristic outfitting	Hydrogen fuel cells, hydrogen fuel tanks, lithium-ion batteries, a quick battery charging system and a hybrid electric propulsion system

The small catamaran passenger ship "Mahoroba", which runs solely on hydrogen fuel cells, was constructed with financial support received in 2021 from the New Energy and Industrial Technology Development Organization (NEDO). Unlike conventional vessels with internal combustion engines, "Mahoroba" is a zero-emission ship powered by hydrogen fuel cells that do not emit CO_2 or substances of concern (SoCs). In addition to its high environmental performance, "Mahoroba" offers great comfort by releasing no odors and minimizing noise and vibration.

"Mahoroba" entered commercial service for the 2025 Osaka/Kansai Expo to demonstrate the potential of hydrogen in a decarbonized society.

Small Cargo Ship Award

Shipowner	NS United Kaiun Kaisha, Ltd.
Designer	Kawasaki Heavy Industries, Ltd. (main engine) , Tsuneishi Shipbuilding Co., Ltd. (hull)
Shipbuilder	Tsuneishi Shipbuilding Co., Ltd.
Completion	19-Mar-2024
Lpp x B x D	93.78m x 18.20m x 9.90m
Gross tonnage	5,154 tons
Speed	12.9 knots
Main engine	Kawasaki 8L30KG 3,560kW four-stroke trunk piston natural gas-only engine x 1 unit
Cargo	Limestone (5,646 tons)
Characteristic outfitting	A natural gas-only engine, high-volume lithium-ion batteries, LNG tanks (material: 7% nickel steel), a self-unloader, a shaft generator/propulsion motor and a shore-to-ship power system

The self-unloading limestone carrier “Shimokita Maru” is the world's first bulk carrier with a hybrid propulsion system that uses batteries and a shaft generator/propulsion motor. During normal operations, it burns no heavy fuel oil (HFO). Instead, it exclusively consumes LNG for propulsion and to meet onboard power demands, eliminating the need for HFO in marine fuel ahead of other ships. A load fluctuation control system enables the ship to maintain a fixed load on its main engine. Even when greater propulsive force is required under severe hydrographic conditions, its batteries cover the difference. Thanks to this system, the ship can depend solely on its gas engine to navigate smoothly in rough waters, such as the Tsugaru Straits.

It continues to be commercially operated with high environmental performance, enjoying several advantages over conventional vessels, such as reducing CO_2 emissions by some 30%.

Special Technical Award

Shipowner	NYK Line
Designer	Keihin Dock Co., Ltd
Shipbuilder	Keihin Dock Co., Ltd
Completion	23-Aug-2024
Lpp x B x D	37.2m (LOA) x 10.2m x 4.4m
Gross tonnage	278 tons
Speed	13.8 knots
Main engine	IHI Power Systems Co., Ltd.'s 4,400-horsepower Niigata Diesel 6L28ADF
Characteristic outfitting	Main engine: Ammonia-powered dual-fuel engine (6L28ADF)

The ammonia-fueled tugboat "Sakigake" was developed by three partners: NYK Line, IHI Power Systems Co., Ltd., and ClassNK. It was selected through a public solicitation for a New Energy and Industrial Technology Development Organization (NEDO) Green Innovation Fund project. Since its completion in August 2024 as the world's first ammonia-fueled commercial vessel, “Sakigake” has engaged in towing activities in Tokyo Bay and elsewhere, pioneering the social implementation of ammonia fuel.

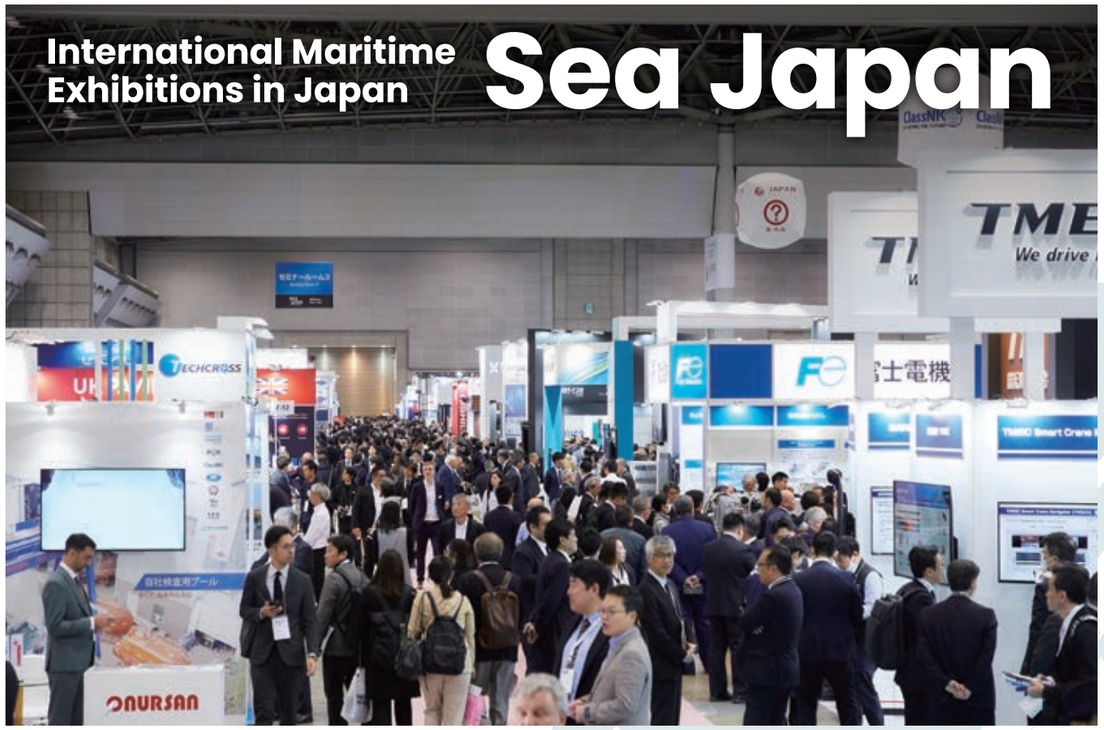
Fishing / Research Vessel Award

Shipowner	Kyodo Senpaku Co., Ltd.
Designer	Kyokuyo Shipyard Corporation
Shipbuilder	Kyokuyo Shipyard Corporation
Completion	29-Mar-2024
Lpp x B x D - d	99.40m x 21.00m x 7.60m - 5.20m
Gross tonnage	9,299 tons
Speed	Approximately 12.0 knots
Main power generator	Yanmar Power Technology Co., Ltd. 6EY22ALW (max 1,370kW x 900 min^{-1} x 4 units)
Cargo and crew capacity	Whale meet (40 20-foot reefer containers) 100 crewmembers
Characteristic outfitting	Main engine: Ammonia-powered dual-fuel engine (6L28ADF)

The whaling mother ship “Kangei Maru” was built to succeed “Nisshin Maru”, a whaling mother ship that underpinned Japan's whale fishing industry for over 30 years. Outfitted with an electric propulsion system, “Kangei Maru” is more eco-friendly. With a large on-board whale factory, it offers a higher level of hygiene.

As the leader of a whaling fleet, “Kangei Maru” moves toward whales with cutting-edge equipment. The factory allows the ship to complete cutting, processing, and shipping preparation tasks onboard. These features make it an iconic next-generation ship.

International Maritime Exhibitions in Japan Sea Japan

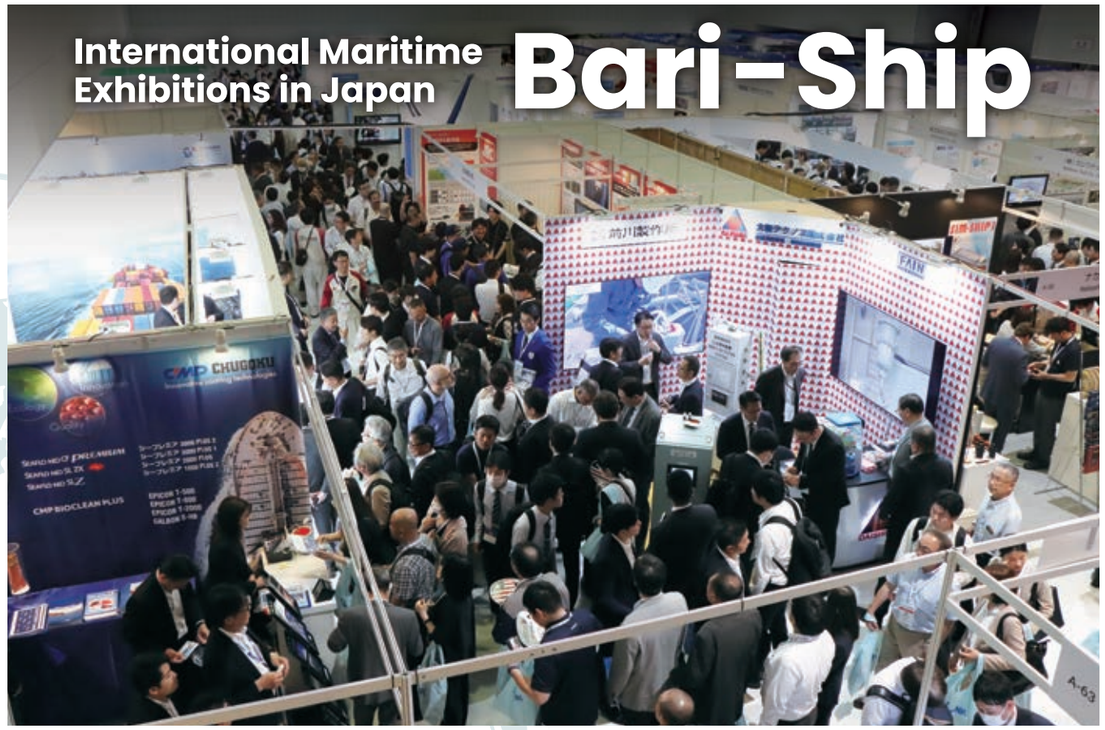


Held biennially since 1994 in Tokyo, the capital of Japan, SEA JAPAN is Japan's largest international maritime exhibition. The event attracts approximately 30,000 visitors from around the world. Over 600 stakeholders from various industries, including shipbuilding, marine equipment, shipping companies, classification societies, and research institutions, exhibit at the event. In 2024, it was held concurrently with “Offshore & Port Tech.” In 2026, it will be held concurrently with both “Offshore & Port Tech” and “Digital Solution Square,” establishing itself as an integrated maritime exhibition that encompasses peripheral fields of the maritime industry.

● Sea Japan

	2018	2020	2022	2024	2026 (est.)
Dates	11-13, Apr	Cancelled due to the COVID-19 pandemic	20-22, Apr	10-12, Apr	22-24, Apr
Venue	Tokyo Big Sight East Halls 5, 6		Tokyo Big Sight East Halls 5, 6	Tokyo Big Sight East Halls 1, 2, 3	Tokyo Big Sight West Halls 1, 2, 3, 4
Exhibitors	580 Companies (Domestic: 359, Overseas: 221) / 28 countries		350 Companies (Domestic: 308, Overseas: 42) / 16 countries	620 Companies (Domestic: 379, Overseas: 241) / 32 countries	620 Companies
Attendance	20,226		18,183	29,983	30,000
Joint Events	—		—	Offshore & Port Tech	Offshore & Port Tech, Digital Solution Square

International Maritime Exhibitions in Japan Bari-Ship



Bari-Ship exhibition is an international maritime exhibition that has been held biennially since 2009. Taking place in Imabari City, Ehime Prefecture — a city known for its maritime industry — the exhibition attracts approximately 18,000 visitors. Over 350 exhibitors participate, primarily from the shipbuilding and marine equipment industries, as well as research institutions. Numerous activities are held during the event, including factory tours at nearby shipyards, launching ceremonies, and trial rides at Imabari Port, as well as various seminars. A major highlight is the public opening on the final day, which provides a crucial opportunity to showcase the maritime industry.

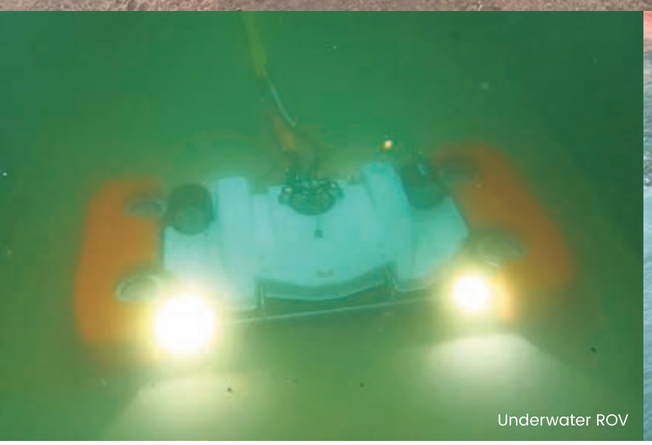
SHIPBUILDING in JAPAN 2026

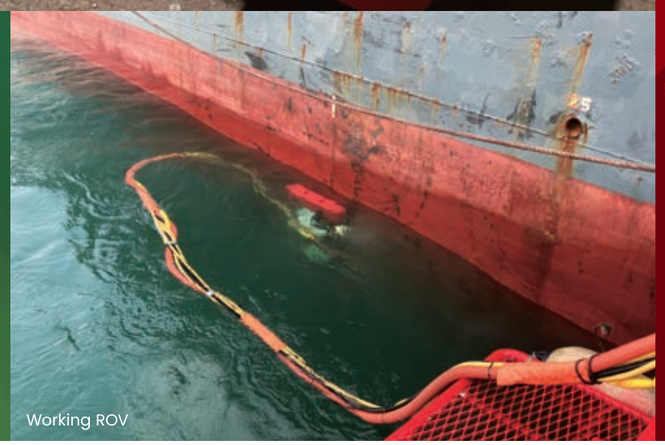
● Bari-Ship

	2017	2019	2021	2023	2025
Dates	25-27, May	23-25, May	7-9, Oct	25-27, May	22-24, May
Venue	Texport Imabari, and more	Texport Imabari, and more	Held online due to the COVID-19 pandemic.	Texport Imabari, and more	Texport Imabari, and more
Exhibitors	347 Companies / 18 countries	350 Companies / 16 countries		351 Companies (Domestic: 283, Overseas: 68) / 15 countries	384 Companies (Domestic: 301, Overseas: 83) / 24 countries
Attendance	16,062	16,259		19,634	18,785

Yanmar Power Solutions Co., Lt d.

Japan Ship Machinery and Equipment Association (JSMEA)


Underwater ROV


Working ROV

Abstract

Yanmar has developed a hull cleaning remotely operated vehicle (ROV) for large vessels, as well as a device that collects biofouling removed from the hull during cleaning. This project was supported by the Nippon Foundation. This system quickly removes biofouling from the hull and filters and collects it to prevent contamination of the surrounding waters.

Purpose

This technology enables more frequent and convenient cleaning of hull biofouling underwater than periodic dry dock cleaning. This reduces the transfer of fouling organisms between seas, which helps prevent the spread of invasive species at destinations and mitigates the impact on ecosystems. Constantly maintaining a clean hull is expected to suppress the increase in propulsion resistance during voyages, which leads to reduced greenhouse gas (GHG) emissions.

System Overview

The system primarily consists of a hull-cleaning ROV, an underwater unit, and a biofouling collection device. The ROV uses thrusters for propulsion and has two operational capabilities: swimming underwater and traveling along the hull's shape. The hull cleaning method uses high-pressure water jets. Moving the ROV while spraying high-pressure water efficiently cleans the hull.
In addition to the ROV and biofouling collection device, the system includes power supply equipment, such as a generator, distribution panel, and control panel; a hose reel to wind the 100-meter hose and cables connected to the ROV; a high-pressure water supply pump for cleaning; and a controller for the operator. All of these major pieces of equipment, except for the ROV itself, are installed and operated on the deck of the cleaning workboat.

Development of ROV with High-Speed Cleaning Performance

Thanks to its slim body design, the ROV boasts a world-class cleaning speed of 2,000 m²/h. This high-speed cleaning capability allows the ROV to meet the cleaning demands of large vessels. It is equipped with six electric thrusters for underwater mobility and has a high-pressure water jet device mounted on its underside for cleaning. This ROV specializes in rapidly cleaning nearly flat hulls (handling gentle curves up to a radius of approximately 4 meters) and removing biofouling up to 10 mm thick from the hull surface. The operator controls the ROV remotely while viewing images from forward and rear cameras mounted on the upper section of the ROV and monitoring data from various sensors on a monitor aboard the workboat.

Biofouling Collection System Capable of Continuous Filtration

The biofouling collection system sucks up debris generated by cleaning the hull from the ROV onto the workboat, filtering and collecting solid biofouling. To prevent the dispersed biofouling from entering the surrounding waters, a dispersion prevention cover is installed around the cleaning equipment. Biofouling is sucked onto the workboat through a 100-meter hose connected to the cover.
This collection system filters at a rate of 6 kL/h. Crucially, the system's two-stage filter structure and continuous backwashing mechanism prevent operational interruptions due to clogged filters. The filtered water generated during biofouling filtration undergoes UV sterilization before discharge, demonstrating consideration for marine environmental conservation.

Conclusion

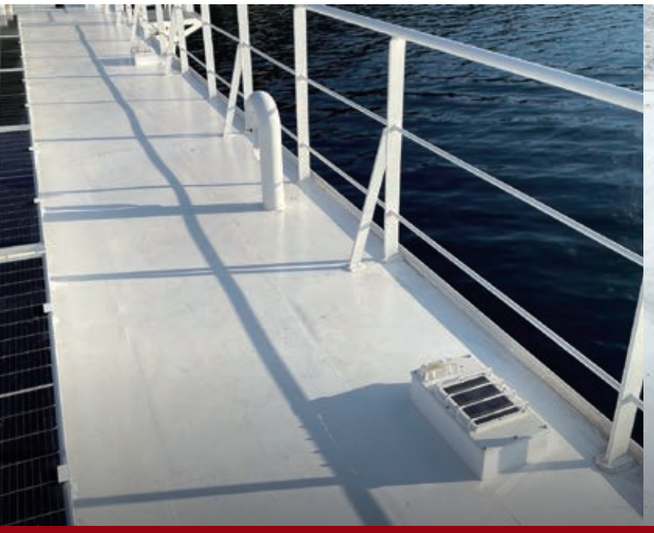
Yanmar is committed to developing solutions tailored to customer needs, including methods for cleaning complex hull structures and enhancing filter performance to meet IMO regulations.

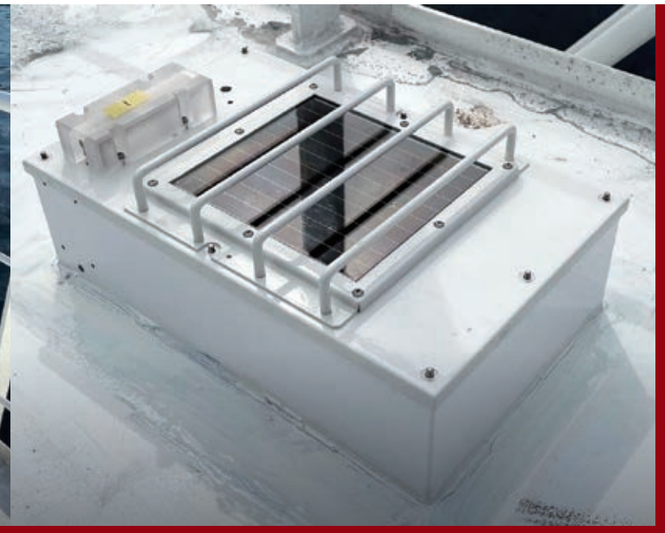
Hull Cleaning ROV System for Saving the Ocean by Suppo rting Large Vessel Operations

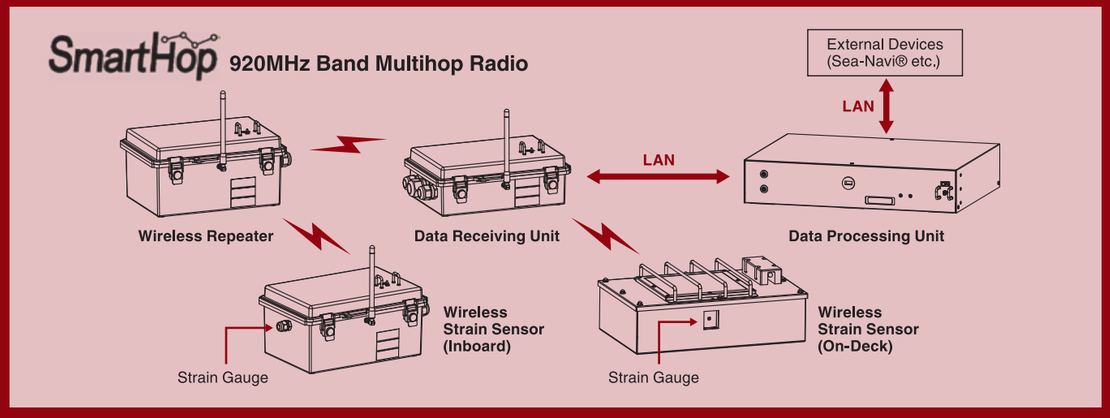
Supported by THE NIPPON FOUNDATION

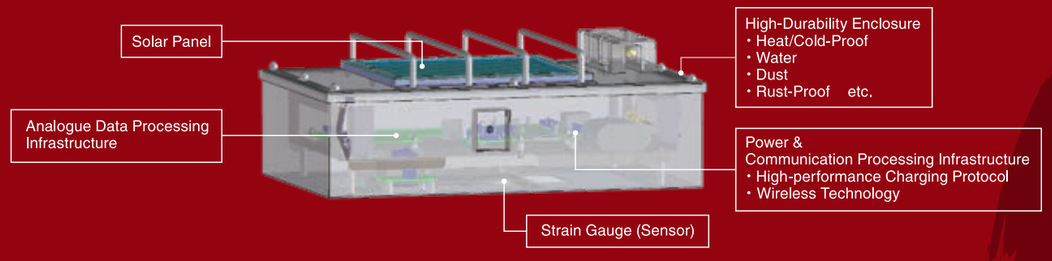
Oki Electric Industry Co., Ltd. (Oki)

Japan Ship Machinery and Equipment Association (JSMEA)









Background

Accurately assessing the stresses applied to the hull during operation and adjusting navigation accordingly is crucial to preventing breakage accidents in large vessels. Autonomous and remote-controlled ships have recently garnered attention as future technology. Realizing this technology requires mechanisms that can automatically monitor the conditional information of the ship that was traditionally gathered through the senses of the crew. Consequently, interest in a hull structure monitoring system that supports safe navigation is growing; however, hull structure monitoring systems are not yet widely popular. The main factors are the high implementation costs and the significant challenge of laying cables for sensors placed throughout the hull. To address these challenges, Oki Electric Industry Co., Ltd. developed the "Wireless Hull Stress Monitoring System for Ships," which utilizes wireless communication and power-saving technologies. This system builds on the expertise gained from the “Zero Energy IoT Series,” which makes monitoring easier to implement in infrastructure and other areas by eliminating the need for power supplies and wiring. This system enables the provision of solutions that support the safe operation of a greater number of vessels at a lower cost.

The development of this project was funded by a grant from The Nippon Foundation, a public interest incorporated foundation. MTI Co., Ltd. perticipated it, and NIPPON KAIJI KYOKAI (ClassNK) provided guidance. Nihon Shipyard Co., Ltd. provided practical feedback. (NSY), a joint research member and user.

Abstract

This system consists of sensors that are deployed at up to six locations – on the port and starboard sides at the bow, stern, and midship – and processing units that are installed in living quarters, such as the bridge.

The Wireless Strain Sensor measures hull stress and transmits data to the Wireless Repeater or Data Receiving Unit via the 920 MHz wireless communication band. If direct wireless communication is not possible between the wireless strain sensor and the data receiving unit, a wireless repeater must be installed. The data receiving unit sends the received data to the data processing unit. The unit then converts the data into strain and stress values, stores them in a database, and displays them graphically. Data can also be transmitted to external devices via LAN.

Features

The Wireless Strain Sensor eliminates the need for power wiring thanks to its solar panels and internal battery. Additionally, it does not require communication wiring because it uses 920 MHz band multi-hop wireless technology for data transmission.

Installing wired systems on existing vessels requires major retrofitting work. In contrast, this system eliminates the need for wiring work, facilitating easy application to existing vessels and contributing to the safe operation of a greater number of ships.

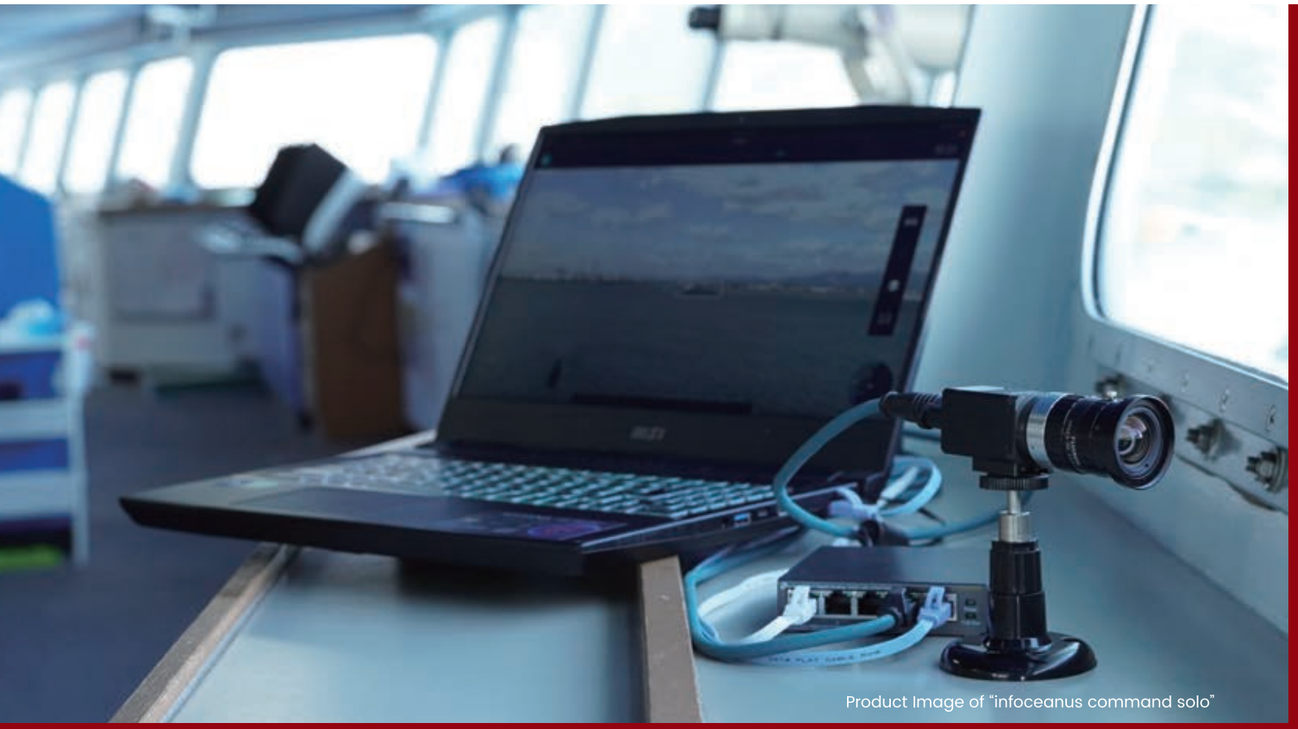
Oki has created an optimal enclosure that meets environmental durability requirements for installation aboard ocean-going vessels while achieving low cost, leveraging expertise in developing products for diverse environments. Since the Wireless Strain Sensor is installed on the deck, it is necessary to take countermeasures against rust caused by the sea breeze and seawater, as well as temperature increases due to solar radiation. To prevent rust, it uses rust-resistant materials and a heavy-duty, salt-resistant coating to ensure high anti-corrosion performance. To counter high temperatures from solar radiation, it uses components with high heat resistance and a structure that can withstand pressure changes inside the enclosure.

Wireless Hull Stress Monitoring System for Marine Structure

Supported by THE NIPPON FOUNDATION

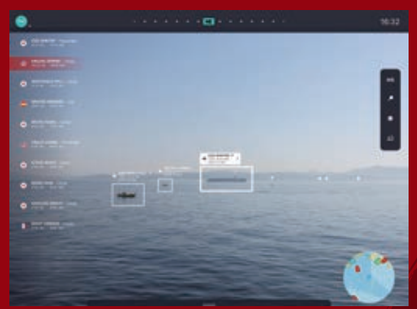
JRCS Co. Ltd.

Japan Ship Machinery and Equipment Association (JSMEA)



Product Image of “infoceanus command solo”

Dates	
Functions	Camera object detection［60-70° view arrange］-6NM range
Power Supply	AC 100 to 200V
Remarks	Online activation via the Internet is required
Components (Standard)	
Server	Notebook PC with monitor
Camera Unit	1 camera with cable
POE HUB	Installed between server and camera
Accessories	Carrying case and setup instructions included
Optional Configuration / Equipment	
Waterproof Lens Tube (IP67)	Required for outdoor camera installation
Camera Housing	Dedicated enclosure (set with the lens tube)
IMU	Needed for distance estimation functionality
GPS	Displays vessel position within the application
Telephoto Lens	Fixed 50mm focal length (approx. 11° field of view)
Extended Server Warranty	Available for 3, 4, or 5 years



*The camera base and bracket must be supplied by the customer to suit the installation site. (Main unit uses a standard 1/4" camera screw.)
*The stated range of vision is for reference only and may vary with weather and sea conditions. *Wi-Fi access is needed to operate the product, with minimal data usage - under 1MB per month.

Abstract

In recent years, watchkeeping support systems that use computer vision have advanced toward practical implementation. However, due to the high initial cost, they have not yet been widely adopted. Since 2019, JRCS has been planning and developing computer vision products. In April 2025, JRCS Released a standard model of a watchkeeping support system capable of detecting surrounding obstacles, such as other vessels, even at night or under low visibility conditions. This system is based on image recognition technology and uses standard notebook PCs and general industrial optical cameras.

JRCS's Targeted Value

Our mission is to “Never to stop the marine transportation”
Since its founding in 1948, JRCS has designed, manufactured, and maintained marine electrical equipment, contributing to maritime logistics. Furthermore, to promote digital transformation in the maritime industry, JRCS established the Digital Innovation Lab in 2018 and released its own line of digital products Under the new product brand “infoceanus”.

Application of Computer Vision Technology in the Marine Field

In the field of autonomous systems, such as automobiles, computer vision technology that utilizes cameras and various sensors is being employed. In the maritime sector, there are high expectations for computer vision technology to support the development of autonomous ships. Computer vision technology attracts attention not only for autonomous navigation, but also to reduce operator burden and enhance safety during navigation and vessel operations.

A combination of optical and infrared cameras is typically used for situational awareness with conventional cameras, while the computer vision system developed by JRCS used only general industrial optical cameras to reduce costs. This limited its use at night and under restricted visibility conditions. From 2022 to 2023, JRCS conducted additional development and improvements to address these issues, supported by development grants from The Nippon Foundation and JSMEA. This effort culminated in the completion of infoceanus command solo.

Development of mass-market computer vision products

One challenge hindering the adoption of computer vision products is the initial cost. JRCS has developed affordable products based on in-house cultivated technologies. The infoceanus command solo not only reduces initial costs, but also maintains core functionalities, such as object detection. It features a compact design and requires no specialized knowledge for installation, which can be done by the ship's crew.

Response to Nighttime and Poor Visibility Conditions

The infoceanus command solo system is designed for simple configuration. Using general industrial optical cameras instead of specialized cameras like thermal imaging cameras, it successfully developed object detection technology for nighttime and low visibility conditions. We developed algorithms and image enhancement programs that maximize the capabilities of the image sensor. These programs implement image processing that clearly displays the state of the sea at night and in low visibility conditions that were previously impossible to visualize. Furthermore, based on maritime image data collected in Japan and internationally, we created an original learning model that dramatically improves object detection accuracy in nighttime and low visibility conditions. After implementing the algorithm, the object recognition / detection rate increased from 56% to 90%.

AI-Supp orted Watchkeeping Support for Safer Navigation

Supported by THE NIPPON FOUNDATION

Introduction to the Editorial Board Orga nizations for “Shipbuilding in Japan 2026”

SHIPBUILDING in JAPAN 2026

Japan Ship Technology Research Association (JSTRA)

Chairman	Seiichi Tanaka		
Board	1 Board Chairman, 1 Managing Director, 2 Executive Directors, 16 Directors, 2 Auditors		
Staff	49 persons		
Constituent	209 members (As of October 2025) (Academic Society 3, Associations 36, Trading Company 6, Logistics 1, Steel 3, Shipping 10, Shipbuilding 25, Marine Machinery & boats 111, Consultant & others 14)		
Location	2-10-9, Akasaka, Minato-ku, Tokyo		
Foundation	2005	**URL**	https://www.jstra.jp/en/

Activities

JSTRA will develop strategies based on integrated research and development (R&D) to establish international regulations and standards in the maritime sector. These strategies will provide an effective and agile response backed by Japanese technological capabilities. By addressing the needs of maritime industries, we will enhance Japan’s international competitiveness and contribute to global safety and environmental conservation.

Based on this policy, we will promote and establish partnerships between industry (including the shipping, shipbuilding, and ship machinery sectors), government (including inspection organizations and other agencies), and academia (including universities, research institutes, and societies).

The Shipbuilders’ Association of Japan (SAJ)

Chairman	Higaki Yukito		
Board	1 Managing Director, 1 Executive Director, 8 Vice Chairmans, 9 Directors, 3 Auditors		
Staff	27 persons		
Constituent	17 Shipbuilding companies, 1 Association (As of August 2025)		
Location	The Japan Gas Association Bldg, 3rd Floor, 1-15-12, Toranomon, Minato-ku, Tokyo		
Foundation	1947	**URL**	https://sajn.or.jp/en/

Activities

To promote the sound and sustainable development of the shipbuilding industry and thereby contribute to enhancing domestic and international economies and public welfare, SAJ plans the following measures in the following fields: Business Management, Technical Development, International Cooperation, and Data Collection and Analysis.

The SAJ's decision-making entities consist of the General Assembly and the Board of Directors. The respective standing committees established under the board of directors carry out surveys, research, and planning related to the association's specialized affairs.

The Cooperative Association of Japan Shipbuilders (CAJS)

Chairman	Keiji Tanaka		
Board	8 Vice Chairmans, 1 Managing Director, 2 Executive Directors, 29 Directors, 3 Auditors		
Staff	14 persons	**Constituent**	49 General members, 40 Supporting members (As of September 2025)
Location	Toranomon Daibiru East 10th Floor, 3-8-1, Kasumigaseki, Chiyoda-ku, Tokyo		
Overseas Office	JETRO London Office, JETRO Singapore Office		
Foundation	1959	**URL**	https://www.cajs.or.jp/english.html

Activities

CAJS members are collaborating to develop a new framework for small- and medium-sized shipbuilding. They are working to improve the efficiency of design and on-site operations by introducing new systems, such as digital transformation, automation, and remote operations, to address the shortage of human resources. In the environmental field, CAJS is working to achieve carbon neutrality by promoting the design of new fuel-efficient vessels and the adoption of eco-friendly technologies. To attract talent, CAJS opens ship launching ceremonies to the public and plans activities that convey the appeal of the sea and ships to young people.

To strengthen international collaboration, CAJS conducts research and disseminates information through JETRO's overseas joint offices in London and Singapore. Through these activities, CAJS will maintain and develop a sustainable and competitive shipbuilding industry.

Japan Ship Exporters’ Association (JSEA)

Chairman	Yoshinori Kanehana				
Board	4 Vice Chairmans, 1 Managing Director, 1 Executive Directors, 20 Directors, 2 Auditor				
Staff	10 persons				
Constituent	32 members (21 Manufacturers, 11 Trading Companies) (As of June 2025)				
Location	The Japan Gas Association Bldg, 3rd Floor, 1-15-12, Toranomon, Minato-ku, Tokyo				
Overseas Office	JETRO London Office	**Foundation**	1954	**URL**	https://www.jsea.or.jp/en/

Activities

JSEA promotes the sound development of exports of ships and marine machinery. To this end, JSEA engages in activities that prevent unfair export transactions, establish orders in export transactions, and advance the common interests of its members. Specifically, JSEA engages in trade insurance operations, including comprehensive insurance agreements and coordination, as well as overseas public relations and international coordination operations through its London office. JSEA also conducts research and analysis activities involving surveys, statistics, and gathering information on global shipbuilding and shipping markets. Additionally, JSEA supports its members and enhances the export environment by providing information and consultation services.

JSEA actively participates in international maritime exhibitions to strengthen collaboration with overseas organizations. These activities enhance Japan's shipbuilding industry's international presence and help build a sustainable maritime society.

Japan Ship Machinery and Equipment Association (JSMEA)

Chairman	Kazuhiko Kinoshita				
Board	6 Vice Chairmans, 1 Managing Director, 2 Executive Directors, 49 Directors, 3 Auditors, 58 Advisory Board Members (including 22 Standing Members), 7 Senior Advisors				
Staff	19 persons				
Constituent	257 regular corporate members, 83 organizations of supporting members (As of October 2025)				
Location	Toranomon Toyo Kyodo Building, 1-13-3, Toranomon, Minato-ku, Tokyo				
Overseas Office	Singapore, Hong Kong, Houston	**Foundation**	1966	**URL**	https://www.jsmea.or.jp/en/

Activities

JSMEA is organized by enterprises involved in the manufacture, repair, and sale of marine propulsion engines and various auxiliary ship machinery, including pumps, air compressors, oil purifiers, heat exchangers, cargo and mooring winches, anchor windlasses, deck cranes, steering gears, navigational aids, and fittings and accessories.

JSMEA promotes global development, ensures that manufactured products meet user needs, and cultivates human resources to support the future of the Japanese ship machinery and equipment industry, among many other efforts to contribute to the world’s maritime industries. To this end, JSMEA delivers high-reliability Japan-made ship machinery and equipment, providing products that help users save energy and protect the natural environment.