KAIJI PRESS *Special Issue*

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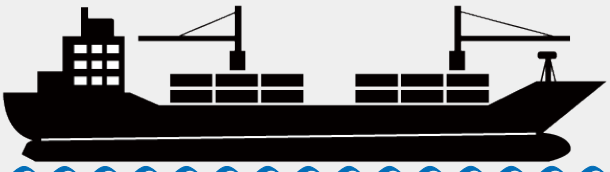
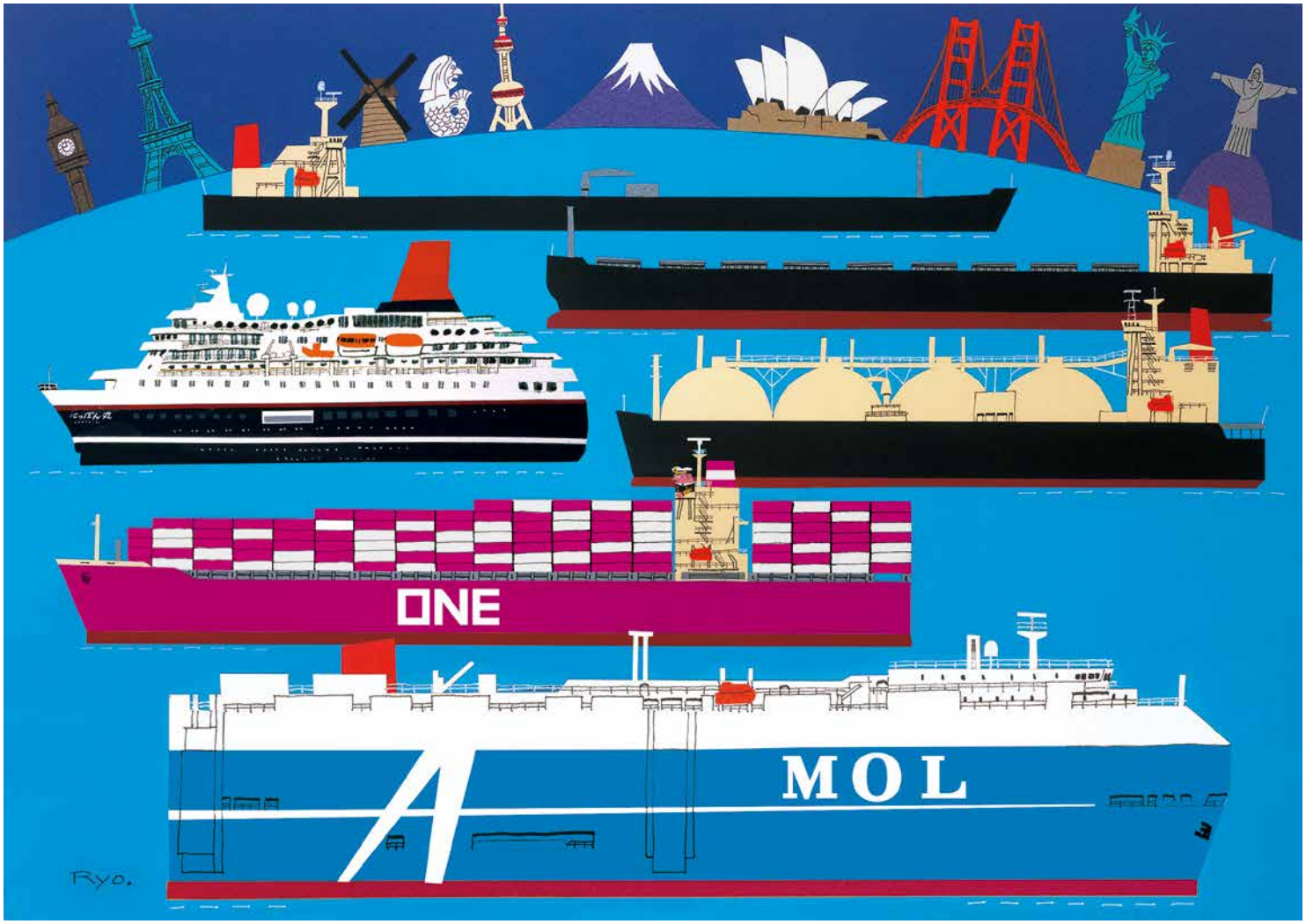
Japan Rising



challenge for innovation and reformation



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Sailing for everyday life and industries.

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KAIJI PRESS Special Issue

Japan Rising

challenge for innovation and reformation

CONTENTS

（Photo : Bloomberg）

Japan Looks to be World's First to Attain Zero Emission

The World Maritime Organization (IMO) has adopted a two-tier strategy aimed for a drastic reduction of greenhouse gas (GHG) emissions from international shipping. The initial target obliges ships to cut their average fuel cost by 40% by 2030. The second target year has been set for 2050 when the total GHG emissions are to be reduced by at least 50%. Decarbonization is a major challenge not experienced before by the shipping industry which has supported global logistics for more than 200 years by burning fossil fuels. The images of both fuels and ships may greatly change and huge environmental costs may dramatically transform the shipping business itself. Japan has just come out with its own "zero emission strategy" to attain the IMO goals.

Two Years Ahead of World

"We are committed to commercialize zero-emission oceangoing ships by 2030." That was the message sent out by "Getting to Zero Coalition", a maritime industry alliance, to the UN Climate Action Summit 2019 held in New York in September 2019. The world has begun taking huge steps toward achieving zero emission. The European Union has bared a long-term vision dubbed "Clean Planet for All", pledging to build zero-emission short-haul vessels and barges by 2030 and make all types of ship carbon-free by 2050. Shipping operators have also announced their own policies. A.P. Moller-Maersk Group was among the first to pronounce a goal to make all its shipping operations carbon-neutral by 2050. By ramping up technical innovation, the group will decarbonize all its supply chains by adopting commercially viable carbon-neutral ships by 2030.

In Japan, members of its maritime cluster joined forces and began working on a roadmap for GHG emission reduction in August 2018, four months after the IMO decided on its strategy. A government-industry-academia panel formed for the purpose was joined by specialists from shipping, shipbuilding and maritime equipment companies, a classification society, research laboratories and the Ministry of Land, Infrastructure, Transport & Tourism (MLIT). It had spent two years studying world trends on energy saving and decarbonization and discussing agendas for technology development, and in April 2020, Japan launched its zero-emission strategy.

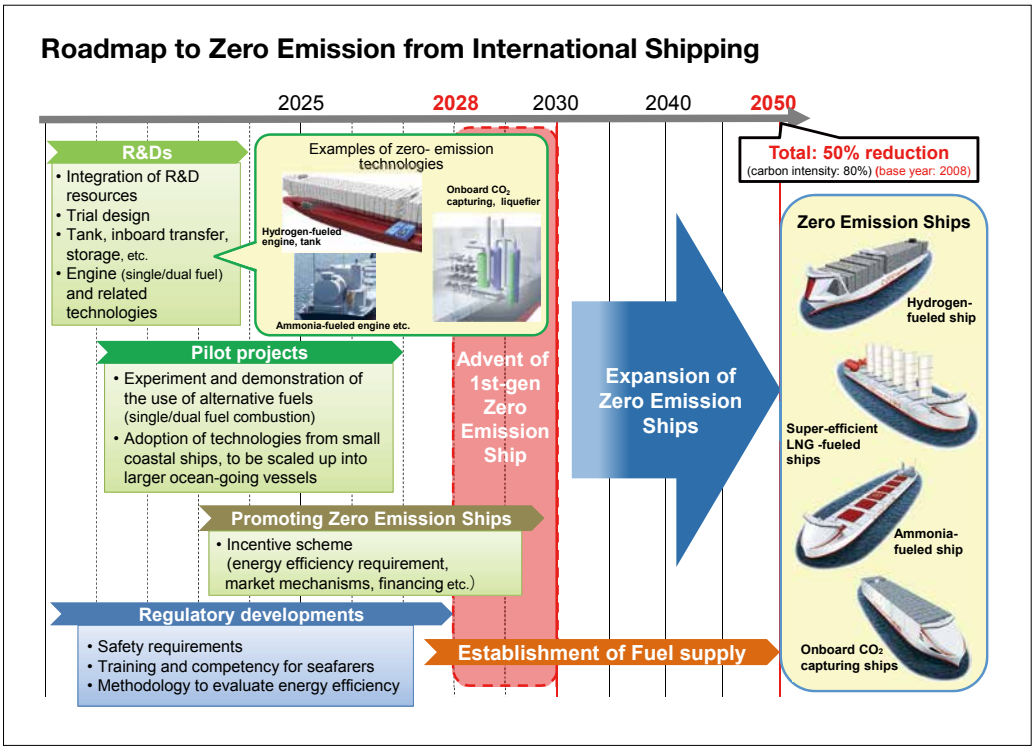
The panel set a target to "realize zero-emission ships by 2028," while many other maritime countries in the world have chosen 2030 as their target year. It is a manifestation of Japan's intention to achieve zero emission earlier than the rest of the world.

Improving 78% Fuel Efficiency by 2050

When the IMO adopted its GHG strategy in 2018, the Japanese maritime industries were not quite sure as to exactly what they should do and how much improvement they could attain to clear the high hurdle of cutting the total GHG emissions by half by 2050. However, the target set by the panel has given them a detailed roadmap.

Even considering the future growth of marine cargo hauls, each ship will need to make sizable improvement in order to slash its total emissions by half. The panel reassessed how much fuel efficiency in average will be necessary, based on a plural number of future scenarios. It figured out that a 78.2% improvement will be needed as compared to 2008. Now Japanese shipping operators have been given a specific goal to reach.

The year 2030 will be crucial for the achievement of the IMO's 50% reduction target. Given that a ship's average lifespan is 20 years, many ships built in 2030 will still be in service in 2050. At present, a common understanding in the world is that first-generation ultra-low emission ships will come into service in 2030 and become increasingly popular thereafter. Japan has prepared a work schedule to bring about its first zero-emission ship two years earlier than that. In accordance with the schedule, Japanese shipping operators, shipbuilders and marine equipment manufacturers will carry out necessary R&D schemes and technical demonstrations ahead of peers in other countries. The government will step up its efforts to put related rules and systems in place. For Japan, it turned out that not much time is left before the global trendline for the 2050 target becomes clearer. It is about to step into its crucial eight years.



Chugoku Marine Paints, Ltd.

Fuji Trading Co., Ltd.

NYK Line, JMU and ClassNK develop ammonia-fueled ammonia gas carrier


Japan's Wind Challenger Project

Synthetic Methane Seen Promising

The scheduled reduction of GHG emissions from international shipping will drastically change the propulsion systems and marine fuels. LNG fuel is now becoming increasingly popular. But its emission reduction ratio is known to be about 30%, much lower than that of the 2050 target. Ammonia, hydrogen, biodiesel and battery are mentioned as "post-LNG" substitute fuels. A shipping official said, "Each has its own pros and cons and we don't know at this time which will be definitely promising." Uncertainty persists as to future trends of fuel shift and related technology development. This makes many shipowners hesitant to make their next investment.

One of important points about Japan's zero-emission strategy is that it has presented a range of specific scenarios for fuel shift. After listing up candidate substitute fuels and reduction technologies, it has specified four fuels seen highly effective in reducing emission by almost 90% by 2028. They are hydrogen fuel, ammonia fuel, synthetic methane (methane recycled from carbon dioxide) and carbon dioxide recovered onboard from waste gas. Then the panel has envisioned two scenarios for future energy shift.

One of them predicts that the core fuel will shift from LNG to synthetic methane. The latter emits as much CO_2 as LNG, but as CO_2 is used to produce it, it can be regarded as carbon-neutral fuel. This scenario is considered promising. One of reasons is that the same technologies and infrastructure used for LNG fuel (for the transitional period) can be applied to synthetic methane. Since methane is the main component of LNG, the LNG-fueled ships in service can use synthetic methane without any major remodeling. If this scenario works, shipowners are highly likely to clear the 2030 target and respond to the 2050 target by stepping up their investment to promote a shift away from LNG fuel.

Scenario for Ammonia, Hydrogen

The other scenario presumes that apart from the ongoing spread of LNG fuel, hydrogen and ammonia will become popular as ship fuels in the future. At the moment, ammonia has problems about toxicity and flammability while hydrogen is technically difficult to handle. However, marine engineers have already been speeding up their R&D initiatives on both fuels and may overcome those problems. Both fuels emit no CO_2 when burned and can easily assure zero emission.

Specialists on the panel have conducted a series of simulations to see how the 2050 target of 50% reduction can be attained on the basis of the two scenarios.

Understandably, whether those substitute fuels will be adequately supplied remains to be seen. The panel has drawn attention to the possibility that the advantage of each substitute fuel can change depending on future technology development and energy supply. However, it has specified the substitute fuels and technologies Japan should focus on. Technology development will proceed for a while in the direction recommended by the panel.

Four Concept Ships

One Japanese shipowner questioned, "I can understand that zero emission will be feasible with large containerships, but is that really possible with ships like a Handysize bulker?" Larger ships have more space to house additional equipment. Their prices are high enough to absorb the extra cost needed to ensure zero emission. Operators who run such ships are seen to have a good capacity to invest and can work out a scheme for investment return backed by their long-term service contracts. But what about midsize bulkers whose combined tonnage is biggest in the market? In fact, they have made no progress at all in switching over to LNG fuel, a step that should precede zero emission. This suggests that such smaller ships face a high

Mitsui E&S Machinery Co., Ltd.

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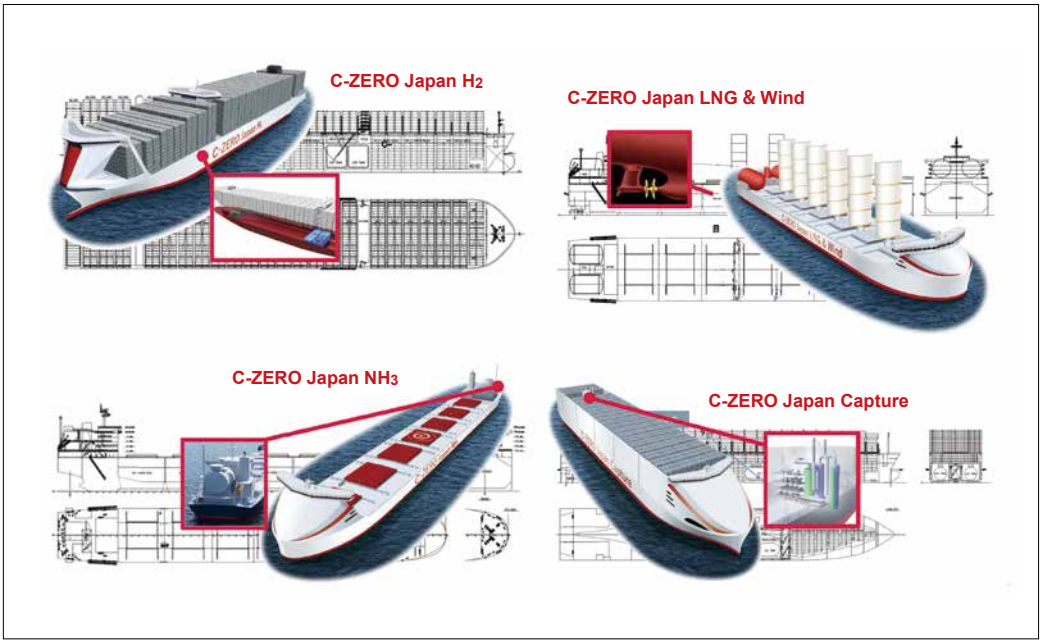
hurdle to clear.

To provide cues for discussion, the panel has designed four zero-emission concept ships dubbed "C-ZERO Japan" based on its two energy shift scenarios. The feasibility of their materialization and technical agendas to be addressed will be considered here.



Concept design of C-ZERO Japan

Two of the ships are based on the scenario that LNG and synthetic methane will become core fuels in the future. One of them will be built by mobilizing all existing technologies such as LNG fuel, speed reduction, wind propulsion, air lubrication and hybrid contra-rotating propellers. This ship comes in two models, an 80,000-dwt bulker and a 20,000-TEU containership. The panel has confirmed that CO_2 emissions can be cut by a maximum of 86% with each of the models. The other concept ship will be based on combination of an onboard system to store CO_2 recovered from exhaust gas, and a methane fuel-powered propulsion system. The panel has prepared a concept design for a 20,000-TEU containership.

Based on its scenario that hydrogen and ammonia will become core fuels, the panel has designed concepts for a liquefied hydrogen fuel-powered ship and an ammonia fuel-powered ship. The former also comes in two models, an 80,000-dwt bulker and a 20,000-TEU containership. Assuming that it will be powered by a dual-fuel reciprocating engine, the panel has sorted out all relevant technical matters such as engine performances, fuel supply, enlarged fuel tanks, heat protection system, hydrogen leakage and fuel supply. As to the latter, a concept has been designed for an 80,000-dwt bulker. To tide over the poor flammability of ammonia, a pilot fuel will be used to help stabilize ignition. Even so, the panel has estimated that the ship can cut CO_2 emissions by 91.9% as compared to a conventional bulker of the same tonnage.

Particularly notable is a concept presented by the panel that emissions can be reduced by more than 80% even by simply relying on the existing technical solutions such as sailing at lower speed and using LNG fuel. The concept bulker is easier to image as it will be based on combination of a hybrid contra-rotating propeller, hard sail and air lubrication that unique to Japan in addition to an enhanced speed reduction and upsized wide-hull vessel.

The panel has drawn a roadmap for its four concept ships to pave the way for putting them to practical use by 2028. For example, engines and other equipment needed for hydrogen fuel-powered and ammonia fuel-powered ships will be developed by 2024, they will be tested either in mixed fuel burning or on board a coastal ship by 2026 and first such ships retrofitted with them will be commissioned in 2028. Based on this work schedule, Japanese shipping, shipbuilding and marine equipment companies will advance their necessary R&D schemes and technical demonstrations.

The big challenge in zero-emission is not just technology, but the funding to reach initiating it. It does require a huge amount of money. As bulky R&D investment will have to be made, cross-industry partnerships and public-private projects will be imperative.

Japan's roadmap has also proposed forming international frameworks to secure necessary funds. One of the ideas floated by the panel calls for shipowners to contribute money in accordance with their fuel consumption. The money will be pooled in a fund which will invest in international R&D projects. The panel has reckoned that contributions of about $2.00 per ton of fuel consumption can create a pool equivalent to $500 million per year. Japan is expected to propose such fuel billing system to the IMO in the future.

Mitsui E&S Shipbuilding developed autonomous navigation support system

Japan Looks to Run Autonomous Ships in 2025

Autonomous navigation has been one of core technical themes addressed over the years by the maritime industries. The development of related elemental technologies and demonstration projects have been in progress in Japan and various other countries, touching off a fierce battle for technologies that will hold the key to future competitiveness. In Japan, which has 50-year history of unmanned navigation, five consortiums made up of shipping, shipbuilding, trading and IT companies have started up full-scale projects to harness new technologies needed for autonomous ships.

More than 40 Firms Taking Part

Mitsuyuki Unno, executive director of the Nippon Foundation, told "We want to show Japan's ability to the world by revolutionizing logistics through popularization of unmanned ships." He was talking about his foundation's "MEGURI2040" initiative which aims to replace 50% of coastal ships in Japan with unmanned ships by 2040. The scheme primarily provides funds to finance projects undertaken by partner companies.

The foundation has formally picked Japan's first five such projects it will fund. Each project will end demonstration tests by the end of fiscal 2021 and put unmanned ships to practical use by 2025 ahead of other countries. The five consortiums engaged in the projects have been joined by more than 40 entities which include local municipalities, colleges and IT firms besides shipping, shipbuilding and marine equipment companies. They look to make various types of ship autonomous. These include large ferry, small passenger boat, containership and amphibious vehicle, etc. Among others, they will be demonstrating the operation of large unmanned ferries and autonomous navigations in waters with heavy traffic for the first time in the world.

The Japanese government has earlier worked out a roadmap to bring autonomous ships to practical use by 2025. The projects chosen by the foundation will proceed effectively in keeping with this timeline. Their demonstration tests will be aimed to define the prerequisites needed for autonomous navigation and prompt the development of necessary technologies. They will specifically look to enhance social acceptance of unmanned navigation. Unno said in this respect, "We need to foster social recognition to address public concern over the safety of unmanned ships. While the Ministry of Land, Infrastructure, Transport & Tourism (MLIT) will put various necessary systems and infrastructure in place, our foundation will push demonstration tests in response to public perception." Yohei Sasakawa, chairman of the foundation, laid his hopes on it saying, "If Japan can take the lead in the world, it will be able to exercise its influence by playing a key role in preparing rules and other matters at the World Maritime Organization (IMO)."

Developing All-Inclusive Functions

The five projects covering a variety of ships are advanced primarily by shipping, shipbuilding and marine equipment firms in cooperation with partners from different business lines.

(©The Nippon Foundation)

The biggest among them is "Designing the Future of Full Autonomous Ship (DFFAS)" project which is carried out by a consortium of 22 companies led by the Nippon Yusen Kaisha (NYK) group.

This project mainly addresses standardization of autonomous navigation technologies and prepare necessary systems and infrastructure. It will test an unmanned containership over a long distance in heavy traffic waters within fiscal 2021 for the first time in the world.

Based on its concept "Creating the future of unmanned ship", it works on an open collaboration platform to enlist cooperation from various entities both at home and abroad centered in the consortium of 22 Japanese firms.

DFFAS plans to develop and verify an all-inclusive system encompassing not only automation of pier docking/undocking, planned route navigation and burdened sailing but also support functions such as feedback of data on monitoring from the shore and diagnosis to ships in service and all other functions required for unmanned ships including remote maneuvering in emergencies. A support center to land side is also planned to set up.

Large Ferry to be Tested

The consortium led by Mitsui OSK Lines (MOL), Imoto Lines and Mitsui E&S Shipbuilding will test a containership and a car ferry at actual seas. The tests will focus on technologies to be developed for automated docking/undocking, automated maneuvering, mooring support and land monitoring support. In the mooring support, drones will be employed in heaving line operations where ropes are manually conducted at present. Augmented reality (AR) technologies will be tested in the land monitoring support.

One of project officials explained, "Through our tests

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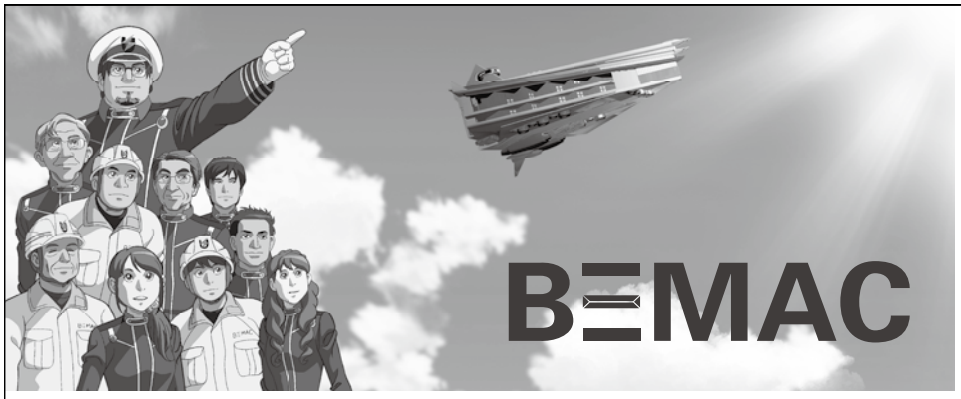

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Demonstration of the unmanned ship navigation on large high-speed car ferry

Autonomous ship operation on small boat (©TRYANGLE)

using a plural number of ships, we will study possible impacts stemming from the differences in their physical characteristics and operational characteristics to build highly versatile technologies that can deal with all tasks to be done." He added, "With our containership, we will focus on work saving in the docking/undocking and mooring operations where all our seafarers are normally mobilized."

The team plans to test a coastal containership on the Tsuruga-Sakaiminato lane and a car ferry on the Oarai-Tomakomai lane. Each will be equipped with simple and economical devices and systems that it will design to be fit for application to existing vessels.

The consortium formed by Mitsubishi Shipbuilding and Shin Nihonkai Ferry will use a newly-built large coastal car ferry for its test on the Oarai-Tomakomai route. Its project is intended to develop automation technologies that will cover all processes from undocking, sailing, flotsam detection/evasion, and docking. It will also develop technologies to be used to reinforce engine room monitoring and a system to be employed for land monitoring. In the engine room monitoring, particular emphasis will be put on enhanced watch during navigation. For this purpose, it will develop technologies to detect fuel oil leakage, accumulate data for analytical diagnosis and predict engine failures and troubles. A Mitsubishi Shipbuilding official explained, "A reinforced engine room monitoring will make it easier to detect signs of trouble, allowing us to fix possible trouble points while ship is berthed. Avoiding troubles during navigation that way will help popularization of unmanned ships."

The developed systems will be installed on a car ferry to be commissioned by Shin Nihonkai Ferry toward the end of June 2021.

Smaller Ships, too

Four companies including Marubeni Corp. and Mitsui E&S Shipbuilding have formed a team to develop technologies that can turn existing small ships into unmanned ships at low costs. A small passenger boat will be used in their tests. Their project will focus on automatic maneuvering technologies applicable to a broad range of smaller vessels.

The equipment and devices of the small tourist passenger boat will be remodeled so that they can be controlled by computer. The upgraded equipment will be retrofitted on the ship along with a newly developed autonomous control module and other devices. At the same time, the team will look to convert automatic maneuvering technologies intended for large ships into ones applicable to smaller ships. It will also study using unmanned passenger boats in the event of disasters.

Specifically, a small ship run by passenger boat operator Tryangle will be retrofitted with an autonomous control module to be developed by Mitsui E&S Shipbuilding. The ship will be tested by the end of March 2022 on a 1.7-km lane to Sarushima Islet located off the city of Yokosuka.

Marubeni explained, "As more than 2,000 such boats are in service in Japan, we are sure that the establishment of an unmanned navigation system fit for a broad range of small vessels will have tremendous spin-off effects."

A test on an unmanned amphibious vehicle is also in preparation. The fifth consortium led by ITbook Holdings will develop technologies that will enable a continuous automatic operation of such vehicle by converting the company's versatile automated driving software "Autoware". An amphibious vehicle equipped with the refurbished software will be tested at Yamba Dam in Gunma Prefecture. The verification test will focus on undocking, operation, docking and remote control.

An official of the consortium said, "By leveraging the car self-driving technologies, we will develop new technologies for ship automatic operation. We want to contribute to enhancing life convenience on isolated islets and promoting regional tourism by materializing a system fit for continuous automatic operation of a vehicle between land and water."

Reconstructing Japanese Shipbuilding Industry

"Reorganization/integration", "government support" and "exit" have been three keywords in recent years for the long-depressed global shipbuilding industry. Japan's ailing shipbuilding industry has also begun undergoing reconstruction along the same lines.

Imabari and JMU formed Nihon Shipyard

Rebuilding Production Systems

Japanese shipbuilders are now going through structural reforms, a process that accompanies pains of mergers and closures. Yards run by conglomerate-affiliated shipbuilders have come up for drastic review one after another since 2019. IHI Corp. has closed its Marine Works in Aichi Prefecture, Japan Marine United (JMU) has decided to end construction of merchant ships at its Maizuru Shipyard, Mitsubishi Heavy Industries (MHI) has begun talks to sell the Koyagi Plant of its Nagasaki Shipyard and Mitsui E&S Shipbuilding has decided to discontinue ship construction at its Chiba Shipyard.

IHI's Aichi, MHI's Koyagi and Mitsui's Chiba had one thing in common. They were the yards built for mass construction of VLCCs during the tanker boom that lasted in the 60s and 70s. Other Japanese shipbuilders also constructed large-size yards during the same period. All those yards faced two major crises in later years. The first crisis came during the shipbuilding recession right after many of the yards went into operation. VLCC demand almost disappeared at the time. The second crisis came toward the end of the 90s when South Korean shipbuilders branched out into the VLCC market by offering bargain prices. Japanese shipbuilders managed to survive the two crises by shifting their core operations to high value-added products such as LNG carriers and offshore structures. However, they have failed to overcome their third and latest crisis.

Restructuring of yards is not a phenomenon peculiar to Japanese shipbuilders. Rather they have endured the protracted slump much longer than peers in other countries. In Korea and China, many midsize yards went under in succession over the past ten years while bigger ones had to carry out massive job cuts and streamline their production facilities. Japanese yards have so far managed to avoid such bleeding retrenchment operations.

There were various reasons for the elbow room they had in the past recessions. For instance, they acted in unison to lower their operations and were joined by their business partners in sharing the burdens brought by the recessions. Another factor that benefited Japanese builders was their concerted strategy to forgo any massive expansion of facilities and build up order books including forward deals with longer delivery dates during the boom in the 2000s. This brought them an advantage each time a recession came.

However, Japanese builders have failed to tide over the latest crisis because the slump has lasted longer than expected and the global overcapacities have been saved as many failed overseas peers have been revived one after another with government financial support. Japanese yards have lost the time advantage they once had. In other words, they have been hit by the recession that their foreign peers had experienced five to seven years ago.

Both Korean and Chinese yards have advanced toward a major reorganization following their business failures and subsequent restructuring initiatives. Japanese peers are now proceeding in the same direction.

Challenging Technology Race with Two-way Alliance

Imabari Shipbuilding and JMU concluded a capital and business tie-up agreement in March 2020. Imabari has agreed to acquire a 30% equity stake in JMU. They will be launching "Nihon Shipyard (NSY)", a joint marketing and design company, in October. The new company will design and market all merchant ships and offshore structures with exception of LNG carriers. Kotaro Chiba, president of JMU, emphatically told Kaiji Press, "We can build a strong company by blending Imabari's business scale and marketing/production capacities with our own personnel and technologies."

The two-way alliance is expected to carve an 11-12% share of the global newbuilding market (in grt terms), ranking it third after the Hyundai Heavy Industries group (Korea Shipbuilding & Offshore Engineering) and China State Shipbuilding Corp. (CSSC).

Participation in the global technology race is the prime purpose of the JMU-Imabari partnership. They aim to combine all their technical resources and provide quick solutions in the face of constantly changing international regulations and shipowners' diversifying requirements. "We are looking to get a sense of speed so that we can offer cutting-edge technologies quicker than anyone else," Yukito Higaki, president of Imabari, said of the aim of the new joint venture. Yoshinori Maeta, senior managing officer of JMU who will assume the presidency of NSY, added, "We will be the first to market a ship that can clear the IMO's 2025 regulations."

Japanese shipbuilders had so far been willing to take part in joint R&D projects in non-competitive fields like the development of futuristic technologies but had been reluctant to team up with rivals in competitive fields like the development of ship models which can be a source of differentiation. In particular, conglomerate-affiliated and family-affiliated builders, vying fiercely with each other, had not been willing to go hand in hand. In fact, JMU had taken a policy to put all its technical capacities into its own products, refusing to make them available for use by outsiders. However, it has drastically changed this policy, a move prompted by its sense of crisis over the recent mergers of major Korean and Chinese shipbuilders which have resulted in enhancing their design development and mass construction capacities through merit of scale. Another factor is an imminent prospect that environmental regulations in the future may dramatically change the image of ships. This has made JMU strongly aware of the need to brace for the ongoing "competition for industry standards".

Crucial for NSY will be whether it can benefit from the strong points each partner has through the alliance.

Since the tie-up is focused among others on technologies, JMU's technological development capacity will hold the key. Conglomerate-affiliated builders generally have a powerful team of researchers and design engineers. Among them, JMU which has long been engaged in the construction of tankers, bulkers and containerships is well reputed for the development of fuel-efficient ship models fit for prompt marketing. One shipowner remarked in this regard, "Ships designed by JMU may look almost the same as those designed by others, but they are prominently better in actual sea performance with less oscillation." An industry executive commented, "Today there can be no joint R&D projects without the participation of JMU engineers." Another shipbuilding specialist added, "We are watching whether JMU's technical capacity will be retained and strengthened in its alliance with Imabari."

Imabari's strong points have been said to be its marketing capacity and cost competitiveness. It has nurtured its ability to win competitions with powerful overseas rivals through strong relationships with local shipowners and financial institutions. Another factor has been its positive stance toward joint R&D projects and development of new technologies with material and marine equipment manufacturers both at home and abroad. "Imabari has been most attentive to our proposals for new technologies and products," said an official with a Japanese marine equipment company. Such strong supply chain built by Imabari has proved highly effective in developing products, shortening delivery dates and cutting costs. Its strength comes from a full utilization of the total powers inherent in Japan's maritime cluster. Another marine equipment manufacturer said, "We are strongly interested in seeing whether Imabari can make full use of its unique business model through the integration of its design and marketing capacities with those of JMU." A shipbuilding executive added, "NSY will be fairly strong if JMU can also benefit from its partnership with Imabari."

Tsuneishi-Mitsui Alliance

JMU and Imabari have something in common, particularly their strong aspiration for M&As and persistence to keep their production facilities at home. Even so, they are family-owned and conglomerate-affiliated companies that have totally different histories and corporate cultures. Their differences involve all fields ranging from management philosophy, governance and marketing scheme to customer relationship and modality of organization.

The two such companies have now agreed to go hand in

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hand. Their alliance may prove more practical through their capital affiliation. NSY will aim to become a core alliance that can help the Japanese shipbuilding industry tide over the IMO's targeted major greenhouse gas (GHG) emission reduction by 2050.

This partnership between family-affiliated and conglomerate-affiliated players may become one of modalities in future reorganization of the Japanese shipbuilding industry.

Mitsui E&S Holdings and Tsuneishi Shipbuilding also began talks in July on the latter's acquisition of some of Mitsui E&S Shipbuilding's stock capital. Their present plans call for Mitsui E&S Holdings retaining a majority stake in Mitsui E&S Shipbuilding. They plan to conclude a final agreement by the end of December and complete their deal in October 2021. Mitsui E&S Shipbuilding will sell its naval vessel business to MHI and enter into a capital tie-up with Tsuneishi in merchant ship business. Mitsui and Tsuneishi had been in a business tie-up since 2018. By agreeing to expand it to capital affiliation, they are expected to ramp up their relationship in merchant ship construction.

Tetsuro Koga, president of Mitsui E&S Shipbuilding, said time and again in the past, "Any tie-up will be hardly feasible unless backed by capital affiliation." As Mitsui has offered technical assistance to Tsuneishi in the past, they have many things in common such as design formats and technical standards they use. Also, as Mitsui has decided to transfer ship construction from its Chiba Shipyard to its Tamano Shipyard, the two builders will be able to enjoy geographically closer relationships by having their mother yards in Fukuyama, Hiroshima Prefecture, and neighboring Tamano, Okayama Prefecture. Some industry officials are of the view that the two have greater potential for closer alliance.

Structural transformation of the Japanese shipbuilding industry will get an added momentum from the birth of the Imabari-JMU alliance and the imminent start of the Tsuneishi-Mitsui alliance.

Five Pillar Policies

Government support to shipbuilders has now become a global trend. For almost ten years in the past, South Korea has kept many of its failed shipbuilders afloat with the injection of public funds. Many of the support schemes were in possible violation of the World Trade Organization (WTO) rules. China has also been providing massive official support to its state-run shipbuilding groups. Then, what ought to be Japan's future policy for its shipbuilding industry?

The Ministry of Land, Infrastructure, Transport & Tourism (MLIT) set up its "Study Panel on Future Image of Maritime Industries" made up of maritime cluster managers and the panel has held a round of discussions there since 2019. Despite its naming, the panel has actually focused its debate on what should be done specifically for the shipbuilding and marine equipment industries. It came up with its final report in April 2020.

Tsuneishi and Mitsui E&S join forces

The report recommended five pillar policies, namely corporate alliance and integration, digitalization, export promotion for public agency vessels, realization of a zero-emission ship and reinforcement of coastal ships.

One of specific policy measures the panel recommended was "reorganization" of both industries. It called for corporate alliance, collaboration and integration. The need of policy finance was mentioned as a backup means. The report urged the government to go beyond its traditional tax incentives to allow the government financial institution Development Bank of Japan (DBJ) to finance the establishment of joint companies, corporate acquisitions and export promotion to the extent it does not violate the WTO rules.

It also called for measures to enhance the efficiency of the entire supply chain including both industries. The call came amid the growing initiatives by shipbuilders and marine equipment manufacturers to hone their competitive edge through a comprehensive review of their trade practices and supply chains. They may become more competitive if they can build a system for timely sharing of design and production information. However, collaboration ideas like standardization of specifications that require corporate adjustment are not easy to materialize due to possible conflicts of interests. The seriousness of the two industries about their future is likely to be tested when MLIT decides to carry out the panel's recommendations.

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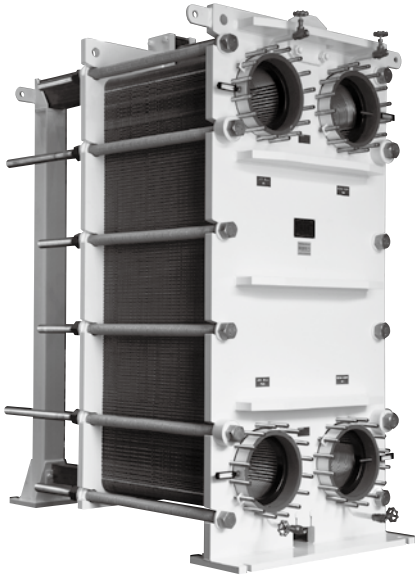

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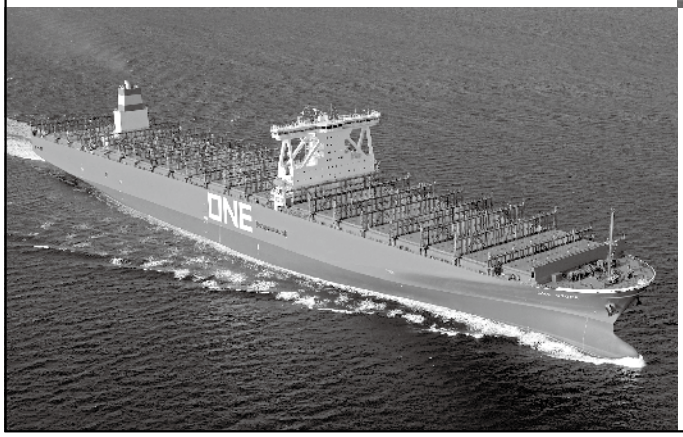

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Japanese Shipping Companies Work to Go Carbon-Free

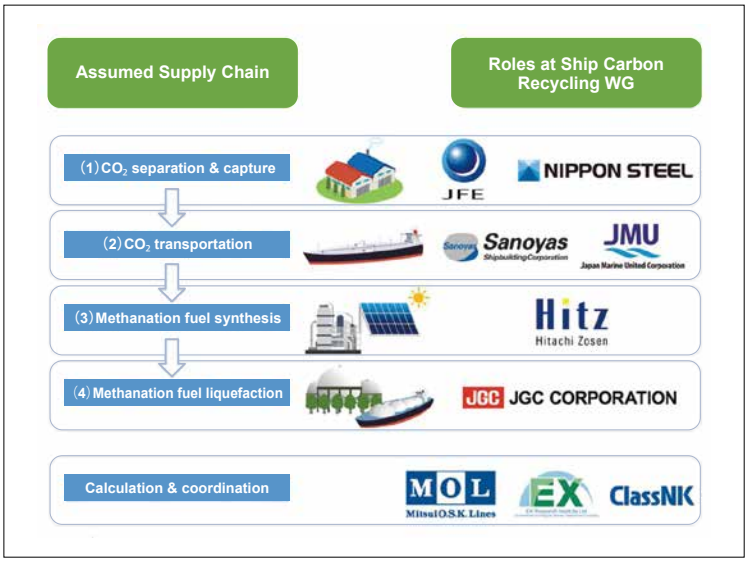
Major Japanese shipping operators are pushing ahead with decarbonization projects aimed to develop ship fuels that should come after LNG.

Nippon Yusen Kaisha (NYK) has unveiled its zero-emission concept by announcing its carbon-free concept ship "NYK Super Eco Ship 2050" in 2018. It has since been advancing initiatives to develop next-generation ship fuels based on hydrogen and ammonia. NYK is associated with various projects under way across the world. It has become the first Japanese shipping firm to join the Hydrogen Council, the biggest global initiative aiming for a hydrogen society, for the purpose of taking part in an overall hydrogen supply chain. It had already been engaged in multiple hydrogen supply chain projects. Those included one promoted by the Advanced Hydrogen Energy Chain Association for Technology Development (AHEAD) for demonstration of a hydrogen energy supply chain between Brunei and Japan.

NYK also participates in other projects aimed for the development of decarbonization technologies. Those include the Green Ammonia Consortium formed by the Ammonia Energy Association for social implementation of ammonia production and utilization technologies and DecarbonICE, an international initiative for the development of technologies to recover CO_2 onboard, turn it into dry ice and store it into seafloor sediments.

Mitsui OSK Lines (MOL) Group has launched the Group Environmental Vision 2030 featuring a goal to create a sustainable net zero-emission oceangoing ship in 2030. The initiative looks to introduce next-generation zero-emission ship fuels to replace LNG fuel and develop technologies needed to apply its wind power propulsion system "Wind Challenger" to actual ships. MOL works with industry organizations and government agencies to formulate public regulations and rules with a view to forging new business models devoted to net zero emission.

As part of its initiative, MOL is aiming to develop a ship fuel based on methanation (synthetic methane). It has joined hands with eight other Japanese companies to form the Ship Carbon Recycling Working Group (WG) under their Carbon Capture & Reuse (CCR) Study Group to address each stage of a supply chain ranging from separation, recovery and transportation of CO_2 to generation and liquefaction of synthetic methane. The WG will identify technical challenges and develop a roadmap for its projects, which will include technical demonstration of a 10,000-dwt CO_2 carrier.



MOL coordinates Ship Carbon Recycling WG

Kawasaki Kisen Kaisha (K Line) has just made a full revision of its K Line Environmental Vision 2050 "Blue Seas for the Future". It has set a new target to improve the CO_2 emission efficiency of its ships by 50% in 2030 compared to 2008. To this end, it will promote what it calls "LNG-plus" initiatives such as deployment of more LNG-fueled vessels, practical application of its "Seawing" automatic kite system and enhancement of low-speed navigation.

It has already accomplished a number of targets set in its previous environmental vision, including one on reduction of CO_2 emissions and another on construction and demonstration of an environmental flagship.

K Line will also put emphasis on popularization of LNG fuel by developing necessary supply infrastructure. It will start up an LNG fuel supply business in central Japan later in 2020 and has agreed with FueLNG, a Singapore-based LNG bunker supplier, to manage the latter's LNG fuel supply vessels.

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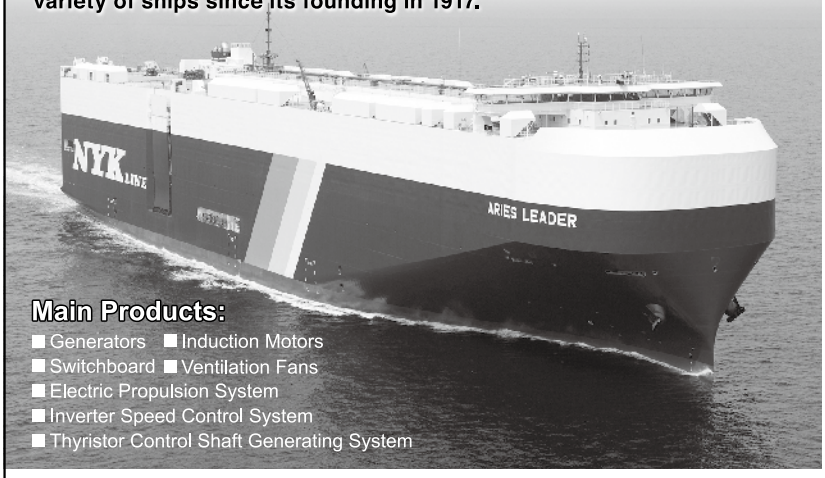

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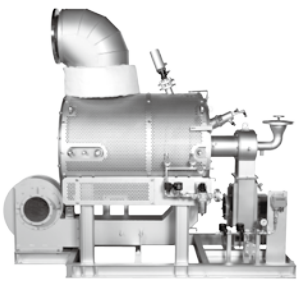

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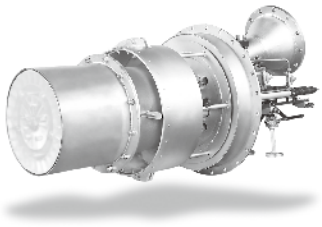

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Trading Houses Go Digital and Green

Japanese trading houses have traditionally displayed their big presence in the trading ships. Now they are turning their eyes to advanced technologies.

Sojitz Marine & Engineering and Orient Marine of the Mitsui & Co. Group entered into a tie-up agreement on marine equipment-related business in June 2020. One of their aims is to build synergetic effects in the equipment and materials they deal in. Among trading houses, Sojitz had been prominent in the marine equipment business. Its team is engaged in marketing marine equipment and engine components to shipyards. Orient Marine is primarily engaged in marketing and arranging export and import deals for various marine equipment used in versatile newbuilding projects handled by Mitsui & Co.. They look to complement each other through the tie-up in marketing machinery.

Another aim they share is to provide Japanese marine equipment firms with all-round support in the development and marketing of next-generation technologies. As shipping industry faces two major themes of autonomous navigation and decarbonization, marine equipment systems need to be upgraded in both environment and digitalization fields. The development of next-generation technologies requires the presence of a system integrator who can deal with all processes from the development of basic designs to the development and procurement of necessary equipment. The two partners will look to become a Japanese-style system integrator by capitalizing on the networks and experiences of trading houses and the broad-ranging businesses they do and in closer collaboration with marine equipment manufacturers to propose and jointly develop new systems.

Japanese trading houses have primarily associated themselves with the trading and owning of ships by helping shipyards market their newbuilding ships and organizing charter parties for shipowners. They have also been engaged in exporting and importing marine equipment. Now they have more chances to go beyond agency business to invest in marine equipment manufacturers and take part in new business and research projects.

Environmental protection is one of the domains where they may find new chances. A project to commercialize ammonia as a decarbonized ship fuel has just been launched under the leadership of Itochu Corp. The company has teamed up with Imabari Shipbuilding, Mitsui E&S Machinery and MAN Energy Solutions to develop a fuel supply ship, owns and operate ones, build infrastructure needed for the supply of ammonia fuel and put relevant rules in place.

Sumitomo Corp. has tied up with major marine battery manufacturer Corvus Energy. They will set up a joint company to undertake market surveys and expand energy storage systems (ESS) sales in Japan and Southeast Asia. They plan to undertake ESS production in Japan in the future.

Furthermore, trading houses are becoming more active in the field of autonomous ships. Marubeni Corp. has formed a five-company consortium to push ahead with a demonstration project for an unmanned ship. It will initially test a system that can be retrofitted on small ships. After the demonstration tests, Marubeni plans to commercialize operation of unmanned ships and sell them in the global market.

Mitsubishi Corp. has made an equity investment in Groke Technologies, a Finnish developer of autonomous navigation technologies. They plan to develop a situational awareness system and a navigation support system for installation on Japanese coastal ships. Mitsubishi is also involved in a separate project to promote next-generation coastal vessels through equity investment in e5 Lab which undertakes the development and diffusion of electricity-driven ships.

One of background factors behind these their new initiatives is the fact that the introduction of advanced technologies is becoming more crucial than before in the maritime industries. A variety of marine equipment holds the key when clearing environmental regulations. That is also relevant with the rapidly progressing digitalization of ships. Japanese maritime industries are shifting to “open innovation” where they adopt new technologies and development resources from outside suppliers. This is paving the way for market entry by startups who do not have their own value chain. Trading houses who connect necessary functions in value chains are now going to play the role of linking advanced technologies to the maritime industries.

Innovation of Coastal Ships in Progress

e-Oshima


"e5 Project" starts building zero-emission ship

The *E/V e-Oshima*, a passenger-car ferry built by Oshima Shipbuilding, was named Japan's "Ship of the Year - 2019". Run by the company for short distances to move business partners and guests to and from its offices and other facilities, the ferry has attained a clean sailing as it gets the necessary power from a large-volume lithium ion battery. It is equipped with a newly developed automatic maneuvering system, which enables it not only to run on its own along the planned routes but also automatically avoid collision or stranding. Sponsors of the annual award lauded that the *e-Oshima* was among the first in Japan to clear the two major technical themes of "zero emission" and "autonomous navigation".

As the aging of seafarers poses a major agenda in Japan, efforts are being made to harness new technologies to help coastal shipping operators resolve their problems. Applications in study include remote monitoring of ship engines, watch and maneuvering support from land bases, data collection and big data analysis to use them for better navigation and ship inspection, automation or semi-automation of labor-intensive docking and undocking operations to improve the work environment and utilization of sensors and remote communications to control the health of seafarers.

Seven companies have joined forces to start up what they call "e5 Project" with the aim of prompting social infrastructure reforms through the development and diffusion of zero-emission, electricity-powered EV ships. Taking part in the scheme are Asahi Tanker, Idemitsu Kosan, Exeno Yamamizu, Mitsui OSK Lines (MOL), Tokio Marine & Nichido Fire Insurance, TEPCO Energy Partner and Mitsubishi Corp. Their initial plan to materialize is an EV ship. Asahi Tanker is preparing to launch two 499-grt bunker tankers in 2022. They will be the world's first fully electrified tankers. Preparations are in progress to build necessary infrastructure including land power supply facilities. The project is also working on the development of a harbor tugboat jointly powered by a large-capacity storage battery and hydrogen fuel cells, a hybrid pure car carrier retrofitted with hydrogen fuel cells, an LNG fuel-powered generator and a large-size storage battery.

The project aims to bring digital transformation to the shipping industry through the development of not only EV ships but also onboard automation devices, maritime broadband communications, remote ship maneuvering and an integrated common operating system (OS) for ships. Tomoaki Ichida, president of e5 Lab, told Kaiji Press, "We want to provide platforms for both physical things like an EV ship and digital things, and offer new values by putting them together." He added, "We look to restructure social infrastructure through our EV ships."

Shinichiro Otsubo, director general of the Maritime Bureau, the Ministry of Land, Infrastructure, Transport & Tourism (MLIT), commented, "We can think of changing our coastal logistics through innovation and then going out into the world market with the technologies we have tempered there. Autonomous navigation technologies can be a typical example." He was suggesting the possibility of injecting advanced technologies like remote monitoring, automation and data utilization into coastal shipping and using the technical knowledge acquired there to enhance Japan's technical competitive power. Technical demonstration of five unmanned ships, introduced under separate cover, will all be carried out on the existing coastal lanes. Leading Belgian shipping operator CMB group plans to put the world's first hydrogen fuel-powered ferry in service on a coastal lane in Japan. Coastal shipping in Japan is becoming a sandbox for innovation.

Equipment Manufacturers Out to Become System Integrators

The depressed newbuilding market, coupled with complicated R&D themes related to environmental and digitalization fields, is heating up a battle for survival among Japanese marine equipment manufacturers.

In keeping with the progress on digital technologies, system integrators are adding to their presence. As autonomous navigation and the planned reduction of GHG emissions by half are about to bring dramatic changes to the image of ships, their functions to combine all systems related to propulsion, stevedoring and navigation to make a complete ship are drawing attention anew. Those functions used to be performed by shipyards. In the future, however, they may be primarily undertaken by marine equipment firms.

JSMEA develops basic design of OSV

Many Japanese makers boast high global market shares on a product by product basis. But they generally focus on specific product lines and their coverage is rather narrow. They are relatively small in terms of business scale. Meaning, they are hardly competent enough to cater to the future need of system integration.

That is why the Ministry of Land, Infrastructure, Transport & Tourism (MLIT) has come out with a policy to "nurture Japanese-style system integrators". It has defined a new direction where roles of integrators to deal with each subsystem will be created rather than ones to integrate all systems. MLIT looks to promote the development of technologies to merge subsystems in which Japanese makers have an edge and bring up persons who have an ability to combine them into a ship with full functions. It will also work for a better composition and connection of subsystems and their standardization.

Another initiative in progress is cultivation of new markets for Japanese products. In its "Action Plan 2020", the Japan Ship Machinery & Equipment Association (JSMEA) has highlighted a policy to promote exports of equipment and components to U.S. yards which build naval vessels and step up engagement in the global offshore development markets.

As for the latter, JSMEA has developed a basic design for an offshore support vessel (OSV) to be installed with Japanese-made equipment and obtained an approval in principle (AIP) from the American Bureau of Shipping (ABS) in January. In the past, the presumption that OSVs ought to be equipped with European-made equipment had been seen as an entry barrier for Japanese makers. JSMEA, joined by Japanese makers, has developed an OSV optimized for operation in calm and shallow waters with high temperature and humidity in Southeast Asia, the Middle East and Africa. It has presented the reliability and energy-saving performances of Japanese-made equipment evident in merchant ships built in Japan and maintenance service bases Japanese makers have across the world as selling points. Considering the general trends in Europe and the U.S., it has also packaged key equipment and devices.

Partnership is the keyword for Japanese marine equipment manufacturers. With regard to important themes such as GHG emission reduction and autonomous navigation, they are looking into "project-based technology development initiatives" to be undertaken in partnership. They will start with the development of an internal combustion engine powered by carbon-free fuels. They also plan to make their supply chains more efficient and standardize their product specifications in collaboration with shipbuilders.

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