Shipbuilding in Japan
Welcome to Japanese High Quality Shipbuilding & Shipmachinery

Introduction

Initiatives by the International Maritime Organization (IMO) and other worldwide agencies on enhancing environmental regulations have spurred interest in new technologies and new products. In Japan, work on new technology development has proceeded apace, and major companies have already placed orders for dual-fuel engines and emissions treatment systems.

Further, as interest in energy conservation remains high, Japan’s shipyards have garnered a number of orders for eco-ships, a testament to the high levels of technology and quality offered by Japanese shipyards.

For example, Japan’s shipyards and marine equipment manufacturers got together at Posidonia, the International Shipping Exhibition held in Greece in June 2014, to exhibit not only eco-ships, but also many other energy-saving and eco-friendly technologies. During the exhibition, Japan’s shipbuilders and shipboard equipment manufacturers presented a seminar that introduced Japanese shipyards and marine equipment to an audience of about 250 people, including Greek shipowners. This also reflects the shipping industry’s high level of interest in Japanese technology.

Further, in the field of high value-added vessels, which demand the most advanced technologies, Japanese manufacturers have established their presence in the market by developing new ship types other activities, winning a growing number of orders. At the same time, demand for transport of shale gas exports from the United States, meanwhile, is spurring orders for liquefied natural gas (LNG) carriers.

Shipbuilders and marine equipment manufacturers are also putting considerable energy into the offshore development market. While some are engaged in building facilities for the Brazilian offshore development market, domestic shipowners are ordering Platform Supply Vessels (PSVs) from domestic shipyards, which shows that the domestic offshore development market continues to expand.

Much of Japan’s strength lies in its marine industry clustering, which brings together government agencies, shipowners, shipyards, marine equipment manufacturers, and so on, to create high-quality products that the needs of the times. Activities that take advantage of Japan’s marine industry clustering are on the increase, and the Sea Japan exhibition held in April 2014 spotlighted marine industry clusters that are working on such issues as environmental protection, new technology, and many others.
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In November 2013, Mitsui Engineering & Shipbuilding Co., Ltd (MES) delivered the 66,000 DWT class bulk carrier Clipper Excalibur to Clio Marine of Liberia. The Clipper Excalibur is the first ship of MES’s “neo66BC” series developed to reduce CO2 emission by 30%. The “neo66BC” ships have five cargo holds and four cargo-handling cranes and maintain the superior usability of the “Mitsui56,” which is MES’s best-selling 56,000 DWT class handymax bulk carrier. Development of the “neo66BC” design was preceded by discussions with many shipowners and operators and investigations on more than 600 ports all over the world. “Neo66BC” is designed with a beam of 36m and a shallow draft, considering current trade patterns of 56BCs and the expansion of the Panama Canal. MES has delivered five “neo66BC” ships as of November 2014.

The “neo66BC” series is available in two types of specifications – the Premium model including an electronically controlled diesel engine and a Standard model equipped with a conventional diesel engine. The Standard model achieves a 12% reduction in CO2 emissions on a ton-mile basis. The Premium model reduces CO2 emissions by 21%, with optional software/hardware applications bringing the total reduction to 30%. MES’s current “neo series” bulk carriers consists of the “neo66BC,” “neo56BC,” “neo60BC,” and “neo182BC.” In October 2014, the company announced the development of the “neo82GC,” a prototype medium-size multi gas carrier.
Mitsubishi Heavy Industries, Ltd. (MHI) delivered the 155,000m³-capacity LNG carrier Seishu Maru on September 30, 2014. This marked the first delivery of the next-generation Sayaendo series LNG carriers. Sayaendo (“peapod” in Japanese) is the nickname of the vessel, which has a continuous tank cover that contains the four spherical cargo tanks like peas in a pod. This design reduces wind resistance while under way and reduces the vessel’s weight while strengthening the hull. It was developed at MHI in cooperation with Aker Arctic Technology Inc. of Finland.

MHI started sales promotion of the Sayaendo in 2009, and received the first order in 2011. The company has received orders for a total of eight vessels including the Seishu Maru, as of October 2014.

The capacity of the Seishu Maru was increased by 8,000m³ with the same breadth as the previous 147,000m³ class ships by adopting the vertically stretched spherical tanks, which are extended with a cylindrical section in the center. MHI’s Ultra Steam Turbine (UST) plant was adopted for the propulsion system, realizing an increase of about 15% in energy efficiency. Fuel efficiency was increased by more than 5% with an improved hull design that reduces wind resistance. As a result, fuel consumption per unit of cargo volume was reduced by over 20% compared to previous 147,000m³ class vessels. Adoption of the continuous tank cover eliminated the complicated configuration on the top of the tanks that supports piping, electrical wiring, and passageways, thus streamlining maintenance.

Test operation confirmed the effectiveness of the fuel efficiency measures outlined above.

In November 2014, MHI announced the Sayaringo STaGE, which evolved from the Sayaendo series. The adoption of apple-shaped tanks with an enlargement of the upper part of the spherical section increases tank capacity by 16% without changing the breadth of the vessel. The Sayaringo STaGE also adopts a hybrid propulsion system that combines the Stream Turbine & Gas Engine (STaGE). This results in further improvements in fuel efficiency from the Sayaendo. MHI set this newly developed vessel’s LNG tank capacity at 180,000m³, but the total tank capacity can vary according to transport volume needs.
Naikai Zosen Corporation delivered the new passenger ferry Akatsuki Maru to Uwajima Unyu Ferries at the end of May 2014. Twin skegs, developed by Hitachi Zosen Corporation, formed the core of the energy-saving efforts on the new ferry. Concern for passenger safety has meant that passenger ferries are virtually all equipped with twin engines/twin props, and twin skegs improve the wake effect, improving propulsion efficiency of two-engine/two-propeller systems. Compared to vessels with traditional stern configurations, fuel consumption efficiency is increased by 5%. Since Naikai Zosen built its first twin skeg passenger ferry in 1981, the company has built about 25 of these ships. In all, including twin-skeg ships, Naikai Zosen has built some 180 vessels. Based on this history of fine ship construction, Naikai Zosen continues to take a proactive approach to building vessels that use less fuel, put less burden on the environment, and offer improved safety.

In addition to twin skegs, the Akatsuki Maru achieves even greater energy savings through optimized hull design, controllable pitch propellers (CPP), stern fin, and low-friction paint. In the past, Uwajima Unyu ferries were equipped with anti-rolling tanks to help damp the vessel’s rolling motion, but now, for the first time, this new ferry has fin stabilizers to further reduce rolling. On the deck, the Akatsuki Maru has two standard charging plugs for electric vehicles, and LED lighting, reflecting the company’s concern for passenger convenience and earth and eco-friendliness.
In February 2014, Japan Marine United Corporation (JMU) delivered the very large crude oil carrier (VLCC) Kyo-Ei at the Ariake Shipyard. This is the first Super Malacca-max VLCC, the successor to the previous Malacca-max class.

The Malacca-max class was designed to transport crude oil between the Middle East and Asia, with the optimum draft and maximum capacity to transit the Strait of Malacca. What’s more, it meets Japanese port restrictions on vessel length and deadweight tonnage. JMU Super Malacca-max took an initiative in conformity with the Japanese restriction of calling in ports, and secured the 318,000 DWT by extending the length to 335m.

The hull design was further enhanced with the adoption of a unique bow shape called the “LEADGE Bow.” In addition, a high-lift rudder and high-efficient propellers are adopted, and a Surf-Bulb and a Super Stream Duct (SSD) are equipped around propellers to increase propulsion. The ship is also the first Japanese vessel to use the MAN Diesel & Turbo’s G-type electronically controlled engine “MAN B&W 7G80ME-C9.2.” A low-friction bottom paint further boosts efficiency. Its advanced, efficient technologies are not limited to hardware – on the software side, the Kyo-Ei is equipped with the “Sea-Navi®” operation support system, which will help shipowners maximize the ship’s effectiveness. Overall, the Kyo-Ei boats a 15% improvement in fuel efficiency compared to previous models of the Malacca-max VLCC, and JMU looks forward to a significant increase in orders.
Imabari Shipbuilding Co., Ltd. has developed the 95,000-DWT class bulker IS Nuster with an eye to the expansion of the Panama Canal. Designers expanded the capacity by lengthening the vessel to 234.9m, a 5m increase from the previous 88,000 DWT class. This allows the ship to call at a wide variety of ports and handle a diverse lineup of bulk cargoes such as iron ore, coal, and grain. Imabari Shipbuilding currently offers IS series vessels including the 61,000 DWT class IS I Star, 63,000 DWT class IS New I-Star, 33,000 DWT class IS Tri-Star, and 38,000-DWT class IS Bari-Star. The Raga, which is the 38th IS Nuster, was completed in June 2013. The superstructure Aero-Citadel design reduces wind resistance, offers a range of safety features including anti-piracy measures, and increases the comfort of crew accommodations. The design of the upper part integrates crew quarters, the funnel, and the walls surrounding the engine room. Slimming and streamlining the vessel with a wing-like shape reduces wind resistance by 25-30%. The vessel greatly enhances visibility from the bridge compared to conventional ships in this class, and incorporates a range of anti-piracy measures developed in consultation with security experts. All these initiatives, along with more comfortable accommodations, allow the crew to focus more effectively on vessel operation.

In June 2014, the Raga received the Ship of the Year 2013 from the Japan Society of Naval Architects and Ocean Engineers.

Imabari Shipbuilding has already received orders for more than 25 vessels equipped with the Aero-Citadel.
Kawasaki Heavy Industries, Ltd. (KHI) has developed a 82,200m³ Very Large liquefied petroleum Gas Carrier (VLGC), based on the conventional 80,000m³ class carriers, and introduced it to the market. The second vessel in this series, the Galaxy River, was delivered in June 2014. Three others were on order as of October 2014.

The Galaxy River greatly improved transport efficiency by increasing cargo capacity and fuel economy compared to the previous 80,000m³ class. An electronically controlled engine, Variable Turbine Area (VTA), KHI’s exclusive Sea-Arrow Stem, ladder valves with Kawasaki Fins around the propellers, semi-duct equipment with contra fins, and other technologies contribute to a major improvement in fuel efficiency. The electronically controlled engine increases fuel efficiency by 2%, and VTA reduces engine load by up to 3%. The Sea-Arrow Stem, boosts fuel efficiency by 6-10%, the ladder valve by 2-7%, and semi ducts another 3-7%. In addition to energy conservation, the ship’s environment-friendly features include a ballast water treatment system and an MGO (low sulfur fuel) cooler when the engine is running on MGO that reduces SOx emissions.
Kitanihon Shipbuilding Co., Ltd. jointly developed a 19,000 DWT chemical tanker with National Maritime Research Institute (NMRI), and also teamed up with Nippon Kaiji Kyokai (Class NK) and NMRI to develop a 35,000 DWT chemical tanker. Both vessels were awarded the world’s first Energy Efficiency Design Index (EEDI) Weather certificate from Class NK. The EEDI Weather certification also includes actual sea conditions in the vessel EEDI. At the same time, those two vessels achieved the numerical targets required in Phase 2 of EEDI regulations.

The first vessel in the 19,000 DWT class vessels, the Chem Houston, was completed in July 2014. The ship offers an increase of about 36% in fuel efficiency compared to conventional 19,000DWT class. The length was increased from the conventional 141m to 145m, and the hull design was optimized to reduce wave making resistance by using Computational Fluid Dynamics (CFD). Further, the propulsion is improved with the addition of an energy-saving duct on the front part of the propellers, a new innovation from NMRI, and by increasing the diameter of the propellers. The company has received about 20 orders for 19,000 DWT class vessels as of the end of July 2014. It has also received four orders for 35,000 DWT class vessels, with the first delivery slated for March 2017.

Kitanihon Shipbuilding owned one Slipway as shipbuilding facilities, but changed the Slipway to a Shipbuilding dock in December 2013. This enables the company to expand the size of the ships it can build from 33,000 DWT to 50,000-60,000 DWT. The company has been developing a new 38,000 DWT class vessel, and continues its efforts to improve fuel efficiency and environmental friendliness while striving to build larger-scale ships.
Higaki Shipbuilding Co., Ltd. recently delivered its first Greater Coasting eco-ship, the 14,000 DWT Hi-Max-Eco. The first of this new design, the Epoch Wind, was delivered in February 2014. The second one was completed in June, and as of November 2014, the company has received orders for 10 of these new ships.

Hulls of Greater Coasting Vessels are quite small, so waves cause considerable resistance (the hull has a high Froude number). Thus, designing an energy-saving this size hull is considered a difficult proposition. Nevertheless, the hull of the new Higaki enables a more than 20% increase in fuel efficiency compared to current hull designs. This means the ship already clears Phase 3 of the Energy Efficiency Design Index (EEDI) regulations. Both bow and stern shapes were optimized and for the first time ever in ships under 10,000 GT, the Higaki is equipped with an electronically controlled engine. The ship adopts Non Hub Vortex (NHV) propellers from Nakashima Propeller Co., Ltd., which offer improved propulsion efficiency. The designers did not focus on appendant devices to enhance energy saving; rather, the ship’s engine and the hull itself were designed to reduce fuel consumption. The ship also features a ballast water treatment system to further reduce the impact on the environment. Beyond that, in the cargo holds, heaters are employed to help prevent rust on steel cargo, another step to meet the diversified needs of today’s customers.

Higaki Shipbuilding widened its slipway to meet customer requests for shallow draft vessels, and the new slipway will be ready by spring 2015. This allows construction of vessels of up to 20,000 DWT, and the company will move ahead to construct bigger vessels to meet increasing cargo volume transported in greater coasting area.
Demand for resources continues to expand, and crude oil and gas development is shifting into high gear. “Sound Development of Ocean Industries” was included in Article 5 of the Basic Act on Ocean Policy, which took effect in 2007 in Japan, and the nation’s shipbuilders and marine equipment manufacturers have been working to develop and build offshore support ships for marine resource development, drilling rig systems, and production facilities, at the same time stepping up technological development to supply related equipment and machinery.

In October 2013, Kawasaki Kinkai Kisen Kaisha, Ltd. (“K” Line Kinkai) and Offshore Operation Co., Ltd. (OOC) started a 50-50 joint venture called, Kabushiki Kaisha Offshore Japan that operates offshore support ships in Japan’s coastal areas. The new company aims to offer services for development and investigation of marine resources and offshore renewable energy facilities. Offshore Japan has already ordered one state-of-the-art Anchor Handling Tug Supply Vessel (AHTSV) from Japan Marine United Corporation (JMU). The AHTSV’s bollard pull is Japan’s largest at 150 tons, and the vessel also features the DPS2 dynamic positioning system. It is slated for completion in February, 2016. JMU has built a wide range of marine structures and marine production facilities such as Floating Production Storage and Offloading systems (FPSOs), Floating Storage and Offloading systems (FSOs), and rigs, as well as other offshore support ships.
Japanese Marine Manufacturers
Accelerate Promotion of Equipment for Offshore Projects

Using the brochure “Japanese Marine Equipment Supporting Offshore,” Japanese marine equipment manufacturers are promoting their products for use in offshore projects.

The brochure has five themes—Drillships, Floating Production, Storage and Offloading systems (FPSOs), Platform Supply Vessels (PSVs), Anchor Handing Tug Supply Vessels (AHTSVs), and Semi-submersible Rigs, with detailed listings of Japanese manufacturers of machinery and equipment related to each theme. The products in the brochure are numerically indexed, making it easy to search another brochure, the “Detail Book,” for product specifications, application track records, after-service systems, certifications acquired, and so on. The Japan Ship Machinery and Equipment Association (JSMEA) has used this brochure to promote Japanese marine equipment and machinery for offshore projects, not only at the Offshore Technology Conference (OTC), Posidonia, and other events, but also during visits to marine-related enterprises such as shipowners and shipyards.

Japanese offshore machineries are introduced at world’s maritime exhibitions. Presentation for customers using a brochure.

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Demand for liquefied natural gas (LNG) has been expanding in step with the shale gas revolution, spurring a succession of Japanese companies to participate in U.S. shale gas projects and resulting in orders for additional LNG carriers. LNG is also drawing attention not only as a cargo, but also as a fuel supply for LNG carriers, because it eliminates SOx and particulate matter (PM) emissions and sharply reduces emissions of NOx and CO2 compared to conventional fuel oil. An increasing number of dual fuel gas engines, which can run on both LNG and conventional fuel oil, have been introduced in response to stricter regulations on vessel exhaust emissions. In addition to initiatives by Japanese manufacturers, Japan’s Ministry of Land, Transportation, Infrastructure and Tourism, industrial organizations, ship classification societies, and other organizations are backing development of these engines in a bid to reduce the environmental impact of the marine shipping industry.

Among gas engines, one of the Gas Injection (GI) type is a large 2-stroke low-speed diesel engine that offers high thermal efficiency, yet allows a direct connection to the propeller shaft while maintaining high output and preventing knocking during gas operation. In June 2014, Kawasaki Heavy Industries, Ltd. (KHI) announced that it became the Japanese marine engine maker to receive the first orders for vessels equipped with the Kawasaki-MAN B&W 8S50ME-C8.2-GI an ME-GI engine. The engines will power two car carriers (capacity: 3,800 units) ordered from KHI by United European Car Carriers (UECC) of Norway. In December 2013, KHI completed development of the propulsion plant, which uses ME-GI for the main engine and started a full-scale demonstration test at the Kobe Works. Since then, the company has launched sales promotion efforts for the new engine.

In June 2014, Mitsui Engineering & Shipbuilding Co., Ltd. (MES) received its first order for Mitsui-MAN B&W 8S70ME-C8.2-GI as the main engine for two RO/RO containerships to be constructed at VT Halter Marine of the U.S. for U.S. shipowner Crowley Maritime Corporation. And in December 2014, MES received the world’s first order for the Mitsui-MAN B&W 7G50ME-C9.5-GI-Ethane engine, which runs on ethane rather than natural gas. This engine will be used on three 36,000m3 Liquefied Ethylene Gas (LEG) carriers, which German and Norwegian shipowners will construct at shipyards in China.
In addition to GI-type gas engines, Japanese manufacturers have been receiving an increasing number of orders for lean-burn type engines as well.

In June 2014, Niigata Power Systems Co., Ltd., a subsidiary of IHI Corporation, announced that it had received the first order for its 6L28AHX-DF 4-stroke medium-speed dual-fuel marine engine from Keihin Dock Co., Ltd. The engine will be the main engine for the LNG-powered tugboat Keihin Dock is constructing for Nippon Yusen Kaisha (NYK). With the exception of LNG carriers, the tugboat will be the first-ever LNG-powered vessel in Japan. It is slated for launching in summer 2015. The 28AHX-DF complies with Tier III NOx emission standards imposed by the International Maritime Organization (IMO) when operating on gas. The engine’s load-carrying capacity matches that of diesel engines, and it can connected directly to fixed pitch propellers as well.

In December 2014, Diesel United, Ltd. (DU) of the IHI Group announced receipt of an order for one lean-burn low-speed 2-stroke DF engine—the 5RT-flex50DF—through Wärtsilä Switzerland, Ltd. with an option to buy one more. The engine is for an asphalt carrier being built at the Beşiktaş Gemi Inşaat Turkey. The first engine should be launched in autumn 2015. The 5RT-flex50DF complies with the Tier III NOx emission standards as a single engine unit without exhaust gas post-treatment system, and as it uses a low-pressure gas supply, initial costs for plant and equipment investment, as well as operating costs, can be cut significantly. Medium-sized gas engines have also been developed by Daihatsu Diesel Mfg. Co., Ltd. Yanmar Co., Ltd. and other companies.

And Mitsubishi Heavy Industries Marine Machinery & Engine (MHI-MME) also promotes low speed, and develops the dual fuel engine.
Integration of data on the voyage, engine, vessel hull, weather and sea conditions, and other factors, and its usage in a coordinated, effective manner – are vital to safe and efficient steaming.

That said, onboard systems and equipment currently in use are often made by different companies, hampering the efficient integration of data.

To help remedy the situation, the Japan Ship Machinery and Equipment Association (JSMEA), in collaboration with ocean shipping companies, shipbuilders, onboard equipment manufacturers, Nippon Kaiji Kyokai (ClassNK), and others, has set up the Smart Navigation System Project. The project is aimed at standardizing data systems and building the ship-to-shore information infrastructure necessary to integrate data from different models of equipment.

The e-Navigation Project led by the International Maritime Organization (IMO) and International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) is related to the Smart Navigation Systems Project. To move these projects ahead in tandem, the Smart Ship Application Platform (SSAP) testbed is registered on the e-Navigation portal site at http://www.e-navigation.net/.

JSMEA presented its results and conducted promotion activities for international standardization at the 1st Navigation, Communications, Search and Rescue (NCSR 1) meeting held at IMO headquarters on June 30, 2014.
Current Situation
Because data is taken from different types of onboard equipment and transmitted directly from sensors, it is difficult to develop and install new applications that promote safer, more efficient operation.

Post-R&D Prospects
Establishing and standardizing a data infrastructure between onboard and shoreside operations allows the integration of onboard data in one place, making it easier to install more new applications and equipment. This will promote safer, more efficient steaming.

The study group has chosen two types of vessels to conduct experiments on, and has received permission from the shipowners to do so.
In Sri Lanka, many fishing harbors face offshore depth ocean. These harbors and their entrances are often fill with silt during the monsoon season, making it difficult for fishing boats to get in and out, and generally disrupting fishery production. To help solve that problem, Japan provided Sri Lanka with a dredger, which is playing an essential part in keeping the harbors clear and improving the productivity of the nation’s fishing industry.

With 20 fishing harbors and only four dredgers, the wear and tear on the vessels affected their dredging capabilities, so replacement became a matter of some urgency. At the request of the government of Sri Lanka, the Japanese government provided one dredger to the island nation in October 2014 with a grant in aid.

Myanmar Ferries Serve 30,000 Commuters A Day

Myanmar has some 6,600 km of navigable rivers within its boundaries. These rivers provide an essential mode of transportation and logistics. One ferry that carries some 30,000 commuters a day on the Yangon River is more than 60 years old. At the request of Myanmar’s government, Japan to use grants in aid to provide Myanmar with three ferries in the 40-meter class. The built-in-Japan ferries, which will be christened Cherry 1, 2, and 3, have solar panels installed on deck to provide power for the ferries’ lighting. The 360-degree swinging propeller also improves the ship’s maneuverability. Launching ceremonies for the Yangon River ferries, the first new vessels to ply the route in 60 years, were held November 15, 2014, and the ferries went into operation the same day. These new ferries are expected to provide many years of services as they provide the people who live along the Yangon River with safer and more convenient public transport.

Grab Hopper Dredger Supports Sri Lanka’s Fishing Industry

In Sri Lanka, many fishing harbors face offshore depth ocean. These harbors and their entrances are often fill with silt during the monsoon season, making it difficult for fishing boats to get in and out, and generally disrupting fishery production. To help solve that problem, Japan provided Sri Lanka with a dredger, which is playing an essential part in keeping the harbors clear and improving the productivity of the nation’s fishing industry.

The grab-hopper dredger, MV Sayuru (49.9m LOA, 624 GWT), was built at a Japanese shipyard, and is designed for optimum performance in rough seas, and it has the capacity to take the dredge spoils offshore for dumping. With the new dredger, Japan is helping to improve the environments of fishing harbors and contributing to a stronger, more efficient fishing industry in Sri Lanka.
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