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**PROJECT**

# **MEET NEWS**

Mitsubishi Marine Energy & Environment Technical Solution-System

**19**

19th Issue  
April 2021

Special Feature:

## **Commencement of the Joint Project**

### **Proposal of Solutions for Meeting EEXI (Energy Efficiency Existing Ship Index) Requirements**

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For Even Safer Operation

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Special Feature:

# COMMENCEMENT OF THE JOINT PROJECT



Marine Machinery



Marine Engineering

## *More than Marine Technology More than Integration More than Solutions*

With the objective of creating and providing new solutions toward decarbonization of the maritime industry, the Mitsubishi Heavy Industries Group has launched a joint project that integrates the state-of-the-art marine engineering technologies of Mitsubishi Shipbuilding and the technologies in the field of marine machinery that have been nurtured over the years by MHI-MME. While we have already moved into action on the joint development projects and marketing activities introduced in this issue of MEET NEWS, we will be expanding the joint project to include other activities and will proactively communicate information on them. What's more, we will also be collaborating with other MHI Group green energy businesses, CO<sub>2</sub>-emission reduction technologies and products to contribute to decarbonization globally, not only on land but also of maritime industries.

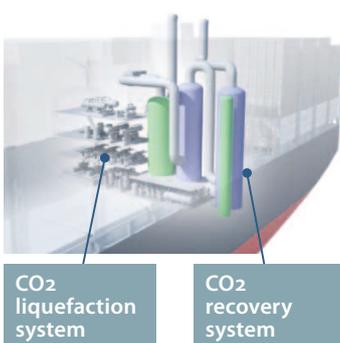
## Development of Safety Measures and Device for Handling Ammonia Fuel

Ammonia holds promise as a candidate as a carbon-emissions-free maritime fuel. In addition to the formulation of design requirements for ammonia-fueled concept ships and the safe handling of ammonia fuel, we are also developing a fuel supply system for such ships.



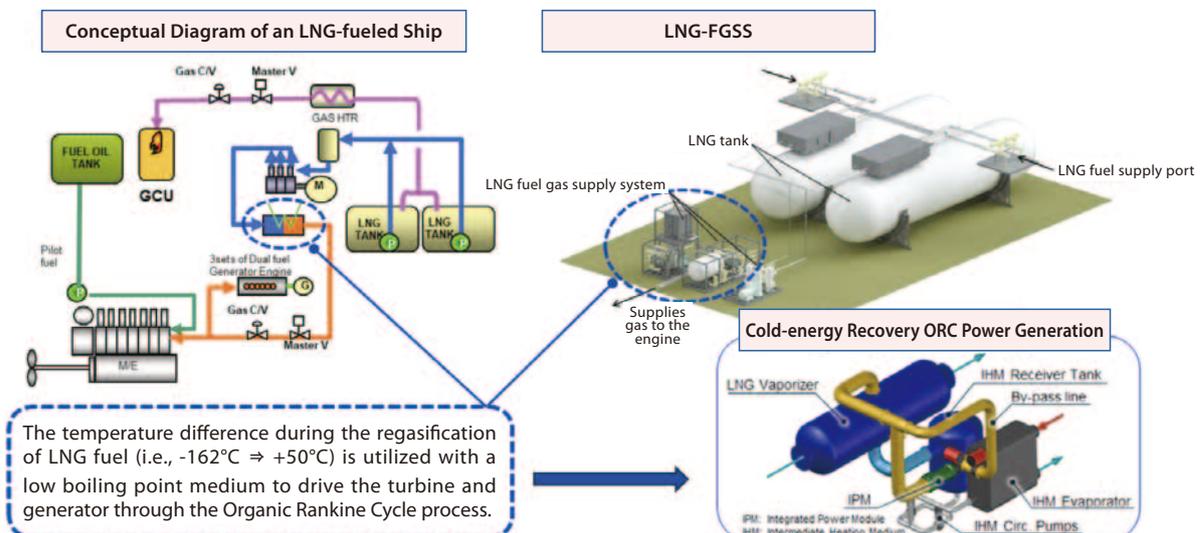
## Ship-based CO<sub>2</sub> Capture System

We have completed the concept design for a ship-based CO<sub>2</sub> capture system that can reduce the carbon dioxide emitted during navigation by 80 percent. A review is also being carried out for its use as a measure for meeting EEXI requirements.



## LNG Fuel Gas Supply System and ORC Generator Based on LNG Cold Energy

We have developed an ORC generator based on LNG cold energy. Also providing the function as a regasification unit of an LNG fuel gas supply system (LNG-FGSS), the ORC generator utilizes the cold energy from LNG regasification to generate power. A demonstration test is scheduled to take place at MHI-MME's LNG site. Irrespective of high- or low-pressure gas, the LNG-FGSS uses the latest, incombustible coolant with low global warming potential (GWP) to drive the ORC. The main unit is a completely enclosed integrated power module (IPM), and there is no concern of the coolant leaking outside of the system.



# PROPOSAL OF SOLUTIONS FOR MEETING EEXI (ENERGY EFFICIENCY EXISTING SHIP INDEX) REQUIREMENTS

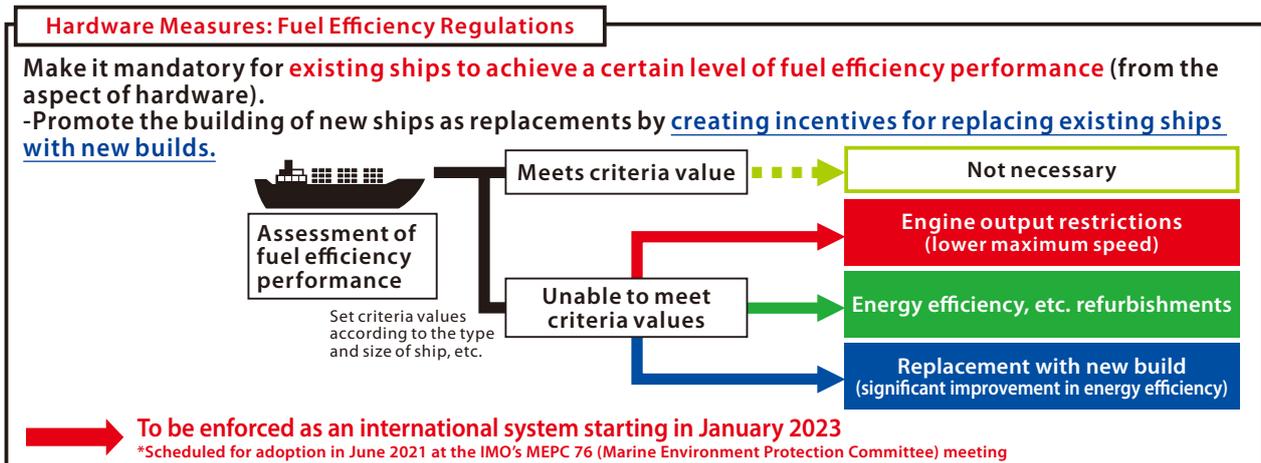
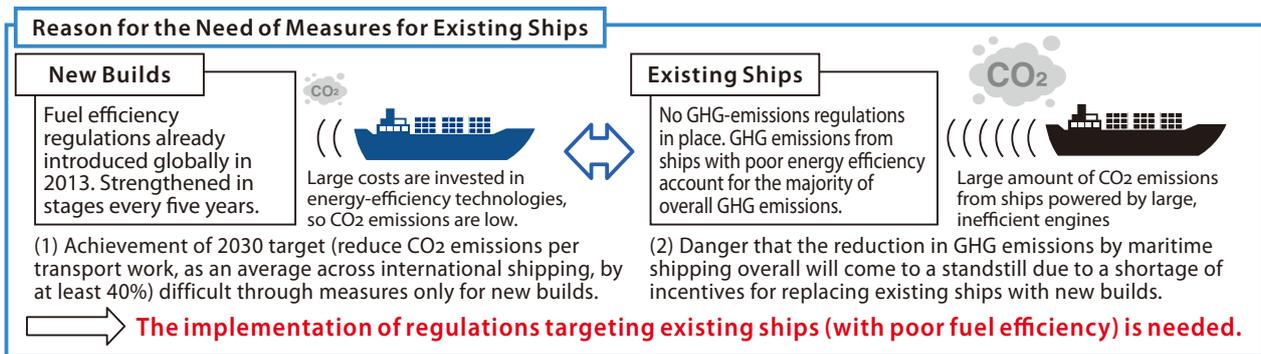
## Background to EEXI

The Energy Efficiency Existing Ship Index (EEXI) is a mandatory greenhouse gas reduction measure set by the International Maritime Organization (IMO). It will extend the Energy Efficiency Design Index (EEDI) requirements for new builds to existing ships through such measures as engine output control and energy-efficiency refurbishments, bringing their energy efficiency level requirements to the same level as new builds.

## EEXI Regulatory Values for Main Ship Types

Ship type	Size	Reduction rate
Bulk carrier	200,000dwt and above	15%
	20,000dwt and above but less than 200,000 dwt	20%
Tanker	200,000 DWT and above	15%
	20,000 DWT and above but less than 200,000 DWT	20%
Containership	200,000 DWT and above	50%
	120,000 DWT and above but less than 200,000 DWT	45%
	80,000 DWT and above but less than 120,000 DWT	35%
	40,000 DWT and above but less than 80,000 DWT	30%
LNG carrier	15,000 DWT and above but less than 40,000 DWT	20%
	10,000 DWT and above	30%
	15,000 DWT and above	30%
Gas carrier	10,000 DWT and above but less than 15,000 DWT	20%
	10,000 DWT and above	15%
Car carrier	10,000 DWT and above	15%

\*Reduction rate is as compared to the average (standard rate) for ships built between 1999 and 2008



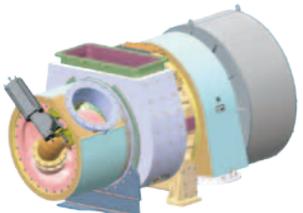
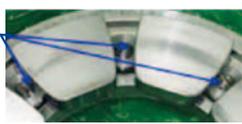
Source: Ministry of Land, Infrastructure, Transport and Tourism road map summary explanatory material

## Proposed Solutions

In addition to future GHG reduction targets, the IMO has also established EEXI targets and regulations for existing ships. The improvement of the energy efficiency of existing ships will also be required for the reduction of CO<sub>2</sub> emissions.

Here is a list of our main solutions for the machinery supplied by MHI-MME, which will contribute greatly to the improvement of energy efficiency.

Based on market changes, including decarbonization of the maritime industry and the diversifying needs of our customers, we will endeavor to continue proposing even more attractive solutions through the adoption of state-of-the-art technologies.

	Product	Improvement Menu	Improvement Effect
Propeller		<p><b>Retrofitting</b> Retrofit the optimum propeller based on new load settings that presume slow steaming by limiting engine load (low load operation). Application of the suitable propeller design based on operational conditions and according to arbitrary engine load settings improves fuel efficiency.</p>	<p>Fuel efficiency improvements as follows: Tankers/BCs: about 3 to 5% LNGCs: about 3 to 5% Containerships: about 3 to 10% Further improvement of between 1 and 2% through the use of eco caps (as compared to without them) Proposed since 2013 Orders received: retrofitting of 84 ships (*of which retrofitting completed for 68 ships)</p>
	Turbocharger		<p><b>Turbocharger cut-out</b> Turbocharger cut-out enables an engine equipped with several turbochargers (e.g., three turbochargers) to stop a single turbocharger during partial load operation and increase the exhaust gas being supplied to the remaining turbochargers. This enables the high efficiency operation of the turbochargers in operation.</p>
		<p><b>VTI Turbocharger</b> Modifying the turbocharger on the turbine side to one with a variable turbine inlet makes it possible to achieve turbine capacity that is suitable for partial-load operation, optimizing turbocharger efficiency at the operational point.</p>	<p>About a 3% improvement from conventional models (in the case of MET66MA)</p>
		<p><b>Integrated EGB</b> Replacing several parts on a standard MET Turbocharger allows retrofitting to an integrated EGB turbocharger. Installation of an exhaust gas bypass line will allow exhaust gas to be bypassed during high load operation, enabling tuning suitable for low load operation.</p>	<p>Fuel efficiency improvement of about 2.5%</p>
Main turbine		<p><b>Reduction of leak losses and exhaust losses</b> Improves internal efficiency through the optimization of the turbine nozzle, flow guide, etc.</p>	<p>Fuel efficiency improvement of 1.0% (as compared to conventional CST series)</p>
		<p><b>Turbine gland leakage steam waste heat recovery</b> Gland leakage steam, which used to be released into the main condenser during high load operation, is recovered utilizing a newly installed spill condenser to raise the feed-water temperature and improve plant efficiency.</p>	<p>Fuel efficiency improvement of 0.5% (as compared to conventional CST series)</p>
		<p><b>Reduction of mechanical loss through LO temperature control</b> Turbine efficiency is improved by raising the LO temperature (lowering viscosity), while monitoring the soundness of the shaft bearing and shaft vibration behavior and reducing mechanical loss. * The additional installation of TCMS and other monitoring systems is a precondition.</p>	<p>Fuel efficiency improvement of 0.2% (as compared to conventional CST series) *during +4°C LO temperature increase process</p>
		<p><b>Reduction of mechanical loss through adoption of the direct lubrication of the turbine thrust bearing</b> Reduces mechanical loss and improves turbine efficiency by changing an oil bath lubrication type bearing to a direct lubrication type bearing.</p>	<p>Fuel efficiency improvement of 0.5% (as compared to conventional CST series)</p>

## Development and Delivery of a Low Pressure, Cylindrical Marine Auxiliary Boiler

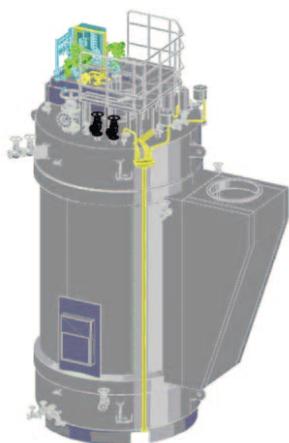
To meet the demand of customers to reduce initial costs, MHI-MME newly developed a low pressure, cylindrical MAC-DS marine auxiliary boiler, primarily for installation on product carriers and other tankers, thereby expanding the company's core auxiliary boiler product lineup.

The order for the first MAC-25DS (rated evaporation: 25 ton/hr.) for 50K DWT product carriers was received through CSSC Jiujiang Boiler Co., Ltd., an MHI-MME licensee in China. Delivery was completed in February 2021 to COSCO (Dalian) Shipyard Co., Ltd.

A MAC-D Series high pressure cylindrical auxiliary boiler for driving a tanker unloading pump turbine is also currently being developed and is scheduled to be released successively.



First MAC-25DS unit



Traditionally, MHI-MME's core boiler product has been the two-drum water tube MAC-B Series for tankers, with a large number delivered to customers. The two-drum water tube MAC-B Series features technology that has frequently been adopted for use in larger capacity, higher temperature, higher voltage power generation as well as for marine main engines. It is highly recognized in the market as a marine boiler that is superior in terms of reliability and durability.

To ensure the same reliability as the MAC-B Series, the new MAC-D/MAC-DS Series were developed in cooperation with the MHI Group's Shared Technology research division. For commercialization of the model, structural strength and heat exchanging performances were evaluated based on numerical analysis to achieve an optimal design that can withstand long-term use.

MHI-MME will continue to leverage the expertise and technical capabilities gained through its copious track record and deliver products that meet the needs of customers.

## **BOILER** LICENSE

### 10th Anniversary of Marine Boiler Licensing in China

In 2011, MHI-MME granted a license for the manufacture and sale of marine boilers in China to CSSC Jiujiang Boiler Co., Ltd., a state-owned marine equipment manufacturer, and steadily accumulated orders for licensed boilers. March 2021 marked the 10th anniversary of this license agreement.

The products covered under the original license agreement in 2011 were four types of water tube type boilers (small donkey boilers, composite boilers, high-pressure two-drum boilers for medium- and large-sized tankers, and exhaust gas economizers) in the 2 ton/hr. to 55 ton/hr. evaporation range. However, additional licenses (smoke-tube boilers, low pressure cylindrical boilers for small- and medium-sized tankers, and multi-fuel firing, small donkey composite boilers for LNG fueled ships) were later granted to meet the needs of the Chinese market.

MHI-MME is continuously providing technical guidance to CSSC Jiujiang Boiler Co., Ltd. so as to strengthen product quality. When a new plant was launched in February 2019, production capacity was expanded, and streamlining was implemented so as to boost the strength of the products.

A close, collaborative relationship has also been built in terms of sales activities and after-sales services. The total number of orders received by CSSC Jiujiang Boiler Co., Ltd., has reached 450 units, making the company a strategically important partner for MHI-MME's business rollout for marine machinery in the Chinese market. With the extension of the license agreement, we will further deepen this partnership.

## MET TURBOCHARGER APPROVAL

# All New MET-MBII Series Turbocharger Models Obtain Approval from MAN ES and WinGD

All new MET-MBII Series models received approval on December 11, 2020, from MAN Energy Solutions SE (MAN ES) for use with two-stroke engines. At the same time, they were listed in the Turbocharger Selection, the turbocharger selection program offered by MAN ES on the Web.

<https://www.man-es.com/marine/products/planning-tools-and-downloads/turbocharger-selection>

Furthermore, Winterthur Gas & Diesel Ltd. (WinGD) also granted approval in March 2021 for use of all models with dual fuel engines (X-DF).

Approval had already been obtained from WinGD for use with diesel engines. Approval for installation with X-DF engines was based on the favorable results of performance tests carried out in mid-January this year using the test engine (6X72DF) at the IHI Power Systems Co., Ltd., Aioi Plant. The MET-MBII Series models have also been listed in WinGD's "General Technical Data for WinGD 2-Stroke Engines" turbocharger selection program provided on the Web.

[https://www.wingd.com/en/engines/general-technical-data-\(gtd\)/](https://www.wingd.com/en/engines/general-technical-data-(gtd)/)

A total of 10 MET-MBII Series turbochargers have so far been delivered as of the end of March 2021 (eight MET33MBII units in Japan, and two MET53MBII in China). We have received many inquiries and orders incoming orders at present.

By having obtained approval from both engine licensors for all MET-MBII Series models, information on the series will now be shared with customers through the turbocharger selection programs of the two companies. As with the existing MET-MB Series, we will endeavor to receive the patronage of many customers for the MET-MBII Series, by taking advantage of the characteristics of this series – such as the reduction of initial costs through downsizing, lower weight (enhanced mountability), and reduced maintenance costs – as strengths.



MET60MBII mounted on the test engine (6X72DF)

## MET TURBOCHARGER LICENSE

# 10th Anniversary of the MET Turbocharger Licensing Agreement with HSD Engine

The licensing agreement with HSD Engine Co., Ltd. of South Korea for MET Turbochargers reached its 10-year milestone in September 2020. Based in Changwon, South Korea, HSD Engine Co., Ltd. is a marine engine builder founded in 1983. The MET Turbocharger manufacturing licensing agreement with MHI-MME was first concluded in September 2010 and still continued today.

HSD Engine Co., Ltd. extended its client base even outside of South Korea, and the company has a track record of having delivered many products to leading shipyards in China.

In 2020, an engine manufactured by the company and a MET Turbocharger, manufactured under the license agreement, were installed on what was then the world's largest 24,000 TEU containership.

More than 400 MET Turbochargers have been manufactured as of today by HSD Engine Co., Ltd. What is more, the new MET-MBII Series has also been added to the licensing agreement.

Going forward, MHI-MME and HSD Engine Co., Ltd. will continue to maintain and develop our good relationships and contribute to high energy efficiency and realization of environmentally friendly solutions by manufacturing engines and turbochargers that correspond to new technologies and new fuels.



Commemorative photo from the presentation ceremony in December 2020  
With a MET Turbocharger rotor model, presented as a 10th anniversary gift

## MET TURBOCHARGER COMMENDATION

# Excellent Supplier Award Received from China's Largest Engine Builder

Hudong Heavy Machinery Co., Ltd. and CSSC-MES Diesel Co., Ltd. (HHM-CMD) are important MET Turbocharger customers in China for MHI-MME.

On November 2, 2020, HHM-CMD held its Supplier Convention 2020 in Shanghai, and MHI-MME received the Excellent Supplier Award for FY2019-2020.

HHM-CMD is the largest builder of 2-stroke engines in China, and they have adopted a large number of MET-MB/MBII Turbochargers in recent years. HHM-CMD had also been stepping up its efforts on the manufacture of new models and environmental technologies. HHM-CMD manufactured the "12X92DF" LNG-fired dual fuel (DF) engine, which was certified by Guinness World Records in January this year as the "Most powerful marine internal combustion engine (otto cycle) commercially available."

We believe that one of the factors for winning the award was that the MET83MB Turbocharger was adopted for use on nine 23,000 TEU containerships on which the aforementioned engine was first installed.

With the unchanging relationship of trust with customers in China at the core, MHI-MME is continuing to provide customer-oriented products and fine-tuned response on site in China in order to enhance customer satisfaction.



Commemorative photo at the award presentation ceremony  
Attendees from our company are second from the left  
\* Face masks were removed for the commemorative photo



The FY2019-2020 Excellent Supplier Award plaque

**MET TURBOCHARGER** AFTER SALES SERVICE

# For Even Safer Operation Recommendation for Pre-docking Survey of the Hot Parts of an Axial MET Turbocharger

There are cases in which a MET Turbocharger's hot parts (turbine blade/nozzle ring) are damaged due to a foreign material flying in from the engine side. Depending on circumstances, it may make continued use impossible. To avoid such unforeseen circumstances, we recommend the advance survey of hot parts around two months before a ship is scheduled for dry-dock. The survey can be carried out by simply removing the gas inlet casing and can be completed in about three hours while the ship is in harbor. There is no need to replace consumable parts.

If parts damage should be discovered, replacements can be ordered in advance. This will make it possible to complete the replacement within the docking period, enabling safe operation afterward.

If you have any questions, please feel free to contact us (a-met-service@mhi-mme.com) or the nearest authorized repair agent.



**Examples of damage**



**T-85: slinging device**  
Attach slinging device(T-85) to gas inlet casing



Screw 2 lifting screws(T-22) & lift slowly using a cable with chain block.  
\*Stop lifting when the cable is under tension.



**Turbine blades**  
The casing will be able to pull out.

For more information on dismantling procedure, please refer instruction manual.

# London Office



### Mitsubishi Heavy Industries EMEA Ltd.

Address : Building 11, Chiswick Park, 566 Chiswick High Road, London, W4 5YA, UK  
e-mail (Common): london-mme@mhie.com Mobile : +44-75-2733-7413

This office opened in April 2014 to further strengthen the support framework for customers in the region. It is now located in Chiswick in West London, within a business park lush with greenery. From April this year, the name of the company changed to Mitsubishi Heavy Industries EMEA, Ltd. As is apparent from the "EMEA" in the company name, it now handles Europe, the Middle East, and Africa. There are many users of our products in Europe and the Middle East. We will engage in our activities with the enhancement of customer services and the provision of immediate response in mind.

### Greetings from Masahiro Sato, Incoming General Manager

I was assigned to the London Office to serve as Koichi Matsushita's successor as general manager from April. In the field of marine machinery, I engaged in the design of marine boilers for about 12 years after which I was also involved in auxiliary marine machinery. While I felt the joy of sending products forth to customers as a designer, there were also many times when I came into direct contact with customers. It made me keenly aware of their expectations and high demands toward our products and technologies as well as the magnitude of the impact that our services have on our customers' businesses.

COVID-19 has greatly changed society. At the same time, the tsunami of energy transition and decarbonization has also hit the marine machinery industry. While utilizing my past experience, I will work to ensure that our technical expertise and services will be of use to our customers. I look forward to doing business with you.

### Greetings from Koichi Matsushita, Outgoing General Manager

After successfully completing my three years in London, I will be returning to Japan at the end of March 2021. There have been times when I received the cooperation and support of the customers with whom I worked, and I would like to use this opportunity to express my appreciation to you. With COVID-19, decarbonization issues, etc., this past year has been one in which I saw significant change within the marine machinery industry. Decarbonization is a theme that European shipowners are engaging in proactively. I learned many things through my meetings with our customers. After returning to Japan, I will make the most of my experience in Europe and work to contribute to the development of the marine machinery industry. I look forward to your continued support.



# Singapore Office



### Mitsubishi Heavy Industries Asia Pacific Pte. Ltd.

Address : 150 Beach Road, #29-00 Gateway West, Singapore 189720  
TEL: +65-6305-5461 Mobile: +65-9237-8565

This office opened in April 2014 in Singapore, a key junction of maritime traffic. The office provides technical support not only domestically in Singapore but also for the Asia-Pacific region and India as well as collects information for the areas. The office is located in the Central Business District in an office building from which you can see the Singapore Strait and many ships passing by. (The photo on the left shows the view of the Singapore Strait from the office with the Singapore Flyer giant Ferris wheel, constructed by Mitsubishi Heavy Industries, to the right.)

### Greetings from Kazuyoshi Fujioka, Incoming General Manager

I was assigned to the Singapore Office to serve from April as Daisuke Takeuchi's successor as general manager. After assuming my sales post in Tokyo in August 1998 for Mitsubishi marine machinery products, I was in charge of the sale of Mitsubishi marine machinery manufactured at the time in Nagasaki, Shimonoseki, Takasago, Kobe, and Yokohama. My customers were primarily Japanese shipyards and shipowners. After 16 years in Tokyo, I was relocated to Nagasaki and was engaged in sales for boilers and rudders for new builds. For the past two years, my main responsibilities were in sales of our after-sales services, including the LSDO modification of boilers and propeller retrofits. It provided an opportunity to hear the expectations of customers around the world toward MHI-MME in addition to areas in which they were not satisfied. Due to the COVID-19 pandemic, my way of working changed a great deal over the past year. I will listen very closely to the opinions of our customers and devote myself to ensuring that our customers will continue their patronage of marine machinery products manufactured by MHI-MME while listening to the needs of our customers, including those related to regulatory response and proposing new initiatives that leverage MHI-MME's technological capabilities.

### Greetings from Daisuke Takeuchi, Outgoing General Manager

I completed my posting to the Singapore Office at the end of March 2021 and will be returning to Mitsubishi Heavy Industries Marine Machinery. While my time in Singapore was only three and a half years long, I am grateful for the great deal of kindness that I experienced during that time from our customers and partners. I feel very sad to have to say good bye but look forward to your continued patronage of Mitsubishi Marine Machinery. After returning to Japan, I will be engaged in the design of auxiliary marine machinery (propellers, rudders, fin stabilizers, special machinery, etc.) and intend to continue my involvement in the provision of green products and maritime safety.



DECK CRANE NEW SERIES

# Change of the Deck Crane Series Name to the S Series

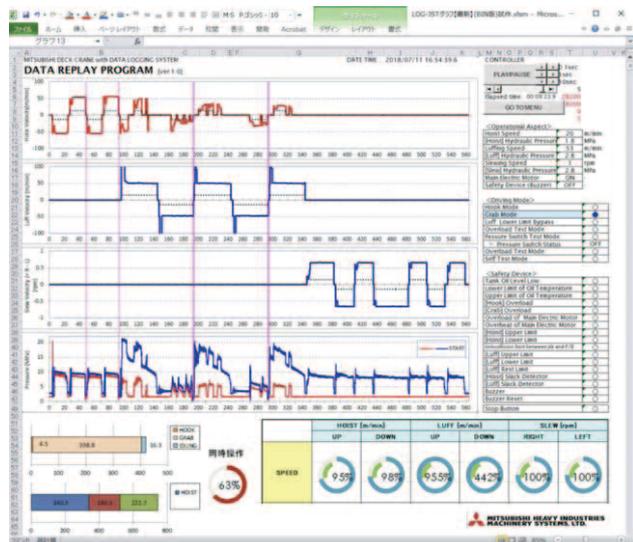
Before now, Mitsubishi Heavy Industries Machinery Systems has delivered approximately 8,500 V Series deck cranes to shipyards both in Japan and abroad. However, the series name of the deck cranes has been changed to the S Series beginning in January 2021.

The S Series is equipped with a programmable logic controller (PLC) as a standard feature, enabling the automatic logging of operation time, operating mode, and alarm activation status on an SD card. Furthermore, data logging advanced (DLA) with additional hydraulic and speed sensors will be available as an optional upgrade.

A dedicated program for visualization of the data recorded on the SD card will be provided to users of the DLA-equipped deck cranes. This will make it possible for crane operators to monitor hydraulic equipment performance as well as swiftly identify causes when problems arise.



**S-SERIES**



Screenshot of the DLA-dedicated program's status display

## “S Series Connected” with Remote Monitoring Function Launched

The “S Series Connected” is a DLA-equipped S Series model with a remote monitoring function added on. The first unit was applied to an actual ship. The operation data of the deck crane is automatically transferred to the ship bridge by wireless communication, making it possible to monitor the deck crane's operating status from a PC on the bridge. This will enable bridge crew to prevent the occurrence of problems through the speedy detection of overloading, rough handling by operators, and so on.



Remote monitoring top page

**S-SERIES CONNECTED**

## Consider measures for environmental regulations

With the COVID-19 pandemic, I assume that 2021 began around the world in a way that differed from other years. In regard to the global spread of the COVID-19 pandemic, the number of new infections seems to be decreasing somewhat through the limitation of people's movement. However, the global economy has been greatly impacted. As for the business environment surrounding the maritime and shipbuilding industries, there was an extreme fall in orders for the construction of new ships, projects were rescheduled or temporarily suspended. While that situation continued for some time, we are, however, starting to notice some signs of recovery. While it is still very small, I believe that we are starting to see the light at the end of the tunnel.

I am placing my expectations on the effectiveness of the COVID-19 vaccines, and earnestly hoping that inoculations will spread around the world, and the pandemic will be contained. In the meantime, it is important that we take the view of coexistence and improve our lifestyles and ways of doing business. We will therefore strengthen our efforts to build a new style of conducting business.

On the other hand, with the yearly increase in the frequency of abnormal weather events, there is concern of an escalation in the occurrence of natural disasters. Under such circumstances, proactive initiatives are being undertaken on a global scale. I feel that the awareness that humanity must work together to protect the global environment has spread to a great extent.

In the ships and marine areas, with the strengthening of fuel-efficiency regulations, such as EEDI and EEXI, and greenhouse gas emissions regulations and zero-emissions efforts, R&D related to the application of countermeasure environmental technologies, such as the additional installation of facilities for fuel conversion, is being carried out at a rapid pace. Future propulsion systems and energy management, including that of onboard electricity, are being considered, and demonstration tests are being carried out at an accelerated pace.



President & CEO

### Toshiaki Hori

Mitsubishi Heavy Industries  
Marine Machinery & Equipment

The game changing moment in which the direction of the future is transformed is approaching rapidly. While MHI-MME has been impacted by the novel coronavirus, we are leveraging web conferencing and other means to discuss, with parties concerned here in Japan and abroad, how we can apply the environmental technologies of the MHI Group and others to the maritime and shipbuilding fields.

In this 19th issue of MEET NEWS, we are introducing the state of our efforts, such as technologies for meeting EEXI regulations as well as the undertakings of the MHI Group toward carbon neutrality, in addition to the latest topics. What is more, we will speed up our efforts for the streamlining of operations, including digitalization, and undertakings related to new methods and services.

MHI-MME will continue to keep its original intentions in sight while launching bold challenges toward reform. We will carry out our business activities under the motto of continuing to be a company that is needed and trusted by our customers through the provision of high-quality products and services. We look forward to your continued patronage.

#### Inquiry

**Mitsubishi Heavy Industries Marine Machinery & Equipment Co., Ltd.**

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