

**Message**from the **President and CEO**

## Entering a significant turning point of the maritime market as environmental regulations continue to be strengthened, We provide the optimal solutions that can respond flexibly to the diverse requests of our customers.

As compared to the steady recovery of the global economy, the market environment surrounding the maritime and shipbuilding industries is undergoing very moderate recovery. While it seems to have bottomed out, we see very challenging market conditions continuing for these industries.

Amid such circumstances, the 2020 global sulfur limit under the Tier III standards of the International Maritime Organization's strengthening of marine environment conservation measures will be entering into force in less than two years. What is more, the time has arrived in which the application of countermeasure technologies must be considered. They include measures to deal with strengthened Energy Efficiency Design Index (EEDI) regulations, which aim to reduce CO2 emissions, and fuel conversion and environmental countermeasure technologies as well as the installation of additional machinery and equipment. We believe that the maritime and shipbuilding industries have entered a significant turning point that will determine their future direction.

In relation to the application of countermeasure technologies to deal with the strengthening of environmental regulations, MHI-MME will not only provide its product technology but will also carry out, under such market conditions, advance verification—including analysis of impacts on MHI-MME products—so that it can respond flexibly to customer requests. At the same time, the company will further increase its opportunities to come into direct contact with customers so that it can listen to and endeavor to respond to the opinions and requests of customers.

MHI-MME also expects energy efficiency needs to become large due to fuel conversion, increases in onboard power consumption from the addition of machinery and equipment, and the need to address EEDI regulations. With this in mind, the company is preparing by making various energy-efficient systems and solutions available, and is making it possible to consider, with our customers, optimal solutions and systems that can respond to the diverse needs of our customers and their different ships and shipping routes.

MHI-MME is also engaged in the further enhancement of the performance and reliability of its individual products as well as the improvement of after-sales services, including the reduction of lifetime costs.

MHI-MME's corporate policy is to continue to be needed and trusted by customers through its excellent products and services, and we look forward to your further patronage.



President & CEO  
**Toshiaki Hori**

# PROJECT MEET NEWS

Mitsubishi Marine Energy &amp; Environment Technical Solution-System

# 13

13th Issue  
April 2018

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MHI-MME Exhibited at Marintec China 2017, Asia's Largest International Maritime Exhibition

Technical Seminar Held in Athens, Greece

## GO OVER THE WAVES!

## Official Sea Trial of Sayaringo STaGE Next-Generation LNG Carrier Completed

The official sea trial was successfully completed in February 2018 for the first Sayaringo STaGE (STaGE: Abbreviation of Steam Turbine and Gas Engines), which was developed and built by Mitsubishi Shipbuilding as a next-generation LNG carrier with a twin-shaft hybrid propulsion plant.

The propulsion plant of the Sayaringo STaGE consists of the MHI Ultra Steam Turbine (UST) Plant, which utilizes the MHI-MME reheat boiler and turbine, and a combination of a dual-fuel diesel engine and a propulsion electric motor. Waste heat from the engine is recovered through the UST plant and reused effectively to achieve a significant improvement of plant efficiency.

In the sea trial, various equipment that constitute STaGE, including MHI-MME's reheat boiler and turbine, fully exhibited prescribed performance, and good fuel economy and operability

that were in accordance with plans were confirmed.

MHI-MME currently has UST orders for eight Sayaringo STaGE vessels. MHI-MME will utilize the results from the official sea trial as well as any future at-sea service data toward further enhancement of performance and reliability.



JHT ACHIEVED **200 BOILER ORDERS**

## MHI-MME's licensee Jiujiang Haitian Equipment Manufacture Co., Ltd. achieved 200 units of boiler orders

MHI-MME and Jiujiang Haitian Equipment Manufacture Co., Ltd. (JHT), a licensee of Marine Auxiliary Boiler\* of MHI-MME, have achieved 200 units of orders of the licensed boiler.

JHT is the state-owned marine equipment manufacturer owned by the major shipbuilding group China State Shipbuilding Corporation (CSSC) who has the largest shipbuilding capacity.

At the launching stage, JHT mainly received orders from shipyards in CSSC group. However, along with the growth of their delivery record, shipyards besides CSSC group started to adopt JHT licensed boiler, and this time JHT achieved to receive 200 units of record of the licensed boiler.

Their delivery record includes boilers not only for Chinese ship owner's new building but also for European ship owner's ones.

The license agreement covers Auxiliary boiler which evaporation amount is up to 55 ton per hour, Exhaust Gas Economizer, Exhaust Gas Boiler, etc., and MHI-MME proceeds with further development and expansion of product line-ups to meet the market demand.

MHI-MME, in the wake of the achievement of the 200 units order record, will accelerate business development in Chinese market further.



\* Note: Marine Auxiliary Boilers are used for produce steam necessary for driving cargo oil pumps in tankers and providing various on-board heating demands such as hot-water heating for heating systems and a galley.

**STEERING GEAR PUMP ROTATION PROGRAM** ACHIEVED FOR 100 VESSELS

## A Total of 100 Orders Received to Date Under the Steering Gear Pump Rotation Program

Pumps are essential units of steering gears, and the maintenance of pumps is indispensable because the wear over time of sliding components is unavoidable. MHI-MME's pump rotation program reduces the hours of maintenance work required, enabling it to be carried out in a shorter amount of anchorage or docking time. The exchanged pump that was in use is reconditioned at an MHI-MME plant and rotated for use on another ship when its steering gear undergoes maintenance. It can also be used as an emergency spare pump during breakdowns. Although an initial investment is required (customers need to purchase a spare pump) shortening of the hours of onboard maintenance work reduces total maintenance

costs. The total number of orders that we have received under the pump rotation program recently hit 100, most of which were received from customers who own more than one ship using the same pump model. We will continue offering proposals that match customer needs.



Onboard pump exchange



Verification run on a plant test stand

## A Total of 200 Orders to Date Achieved for Retractable Fin Stabilizers

In 1988, MHI-MME started the development and manufacturing of retractable fin stabilizers using original technology. This year, the company is marking its 30th anniversary in fin stabilizers.

The world's first fin stabilizer was developed by Mitsubishi in 1920. It was installed on a ship that carried passengers between Hakata and Tsushima. However, the use of fin stabilizers did not take off at that time in Japan, although fin stabilizers were later adopted for use by passenger-cargo ships in Europe.

Production of MHI fin stabilizers resumed in 1983 through a technology partnership with British shipbuilder Vosper & Company. They were manufactured and sold as Mitsubishi-Vosper-type fin stabilizers for destroyers and patrol boats. Based on its track record, MHI developed Mitsubishi retractable fin stabilizers in 1988, delivering the first such fin stabilizer in 1989. Since then, they have been sold and delivered for use on ferries, passenger ships and roll-on/roll-off (RO-RO) ships built not only in Japan but also at shipyards in Europe. Orders have also been recently received from shipyards in China and South Korea.

MHI-MME has 100% market share of fin stabilizer delivery for ferries and RO-RO ships built in Japan in recent years. With an order for Yamanaka Shipbuilding's SNO.1085 (Ship type: ferry; Shipowner: Kyushu Yusen), MHI-MME has achieved a total number of 200 fin stabilizer orders to date.

Fin stabilizers are now indispensable for ferries, passenger ships and RO-RO ships. MHI-MME will continue to enhance anti-rolling performance, reliability and ease of maintenance, thereby contributing to the safe voyage of the world's ships.



The world's first fin stabilizer



Mitsubishi retractable fin stabilizers

PROPOSAL LINKED WITH **SHAFT GENERATING SYSTEM**

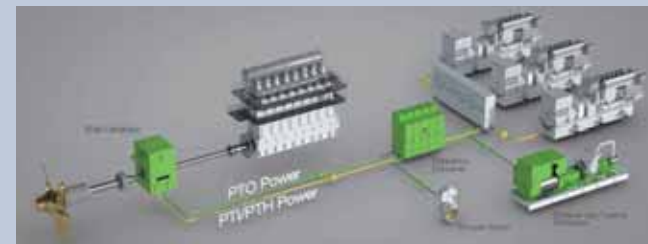
## Mitsubishi Heavy Industries Marine Machinery & Equipment and Wärtsilä to collaborate on improved power and propulsion solution

MHI-MME and Wärtsilä have signed a Memorandum of Understanding for the joint marketing of a new energy-efficient solution for ships. This solution combines MHI-MME's energy-saving power generation system with Wärtsilä's operational control technology for shaft generator systems, thus producing greater power generation capacity and higher propeller propulsion, which results in more energy-efficient operation and an improved Energy Efficiency Design Index (EEDI).

All MHI-MME energy-saving technologies can be used with this new solution. One example is integration with MHI-MME's power turbine generator. This combination enables electricity to be

supplied across a range from approximately 500 to 2,000 kilowatts (kW), driven by gas extracted from a 2-stroke main engine, via the PTO/PTI generator. Another is integration with hybrid turbochargers.

MHI-MME already boasts a great track record with Waste Heat Recovery Systems (WHRS) and Organic Rankine Cycle (ORC), which are small scale binary power generation systems. With environmental standards and regulations becoming even stricter in the future, MHI-MME will propose these and an even wider range of energy-saving solutions for the maritime and shipping industries.



# MET Turbochargers' Compatibility with Environmental Solutions

MHI-MME offers MET Turbocharger that are compatible with various technologies that respond to IMO Tier III NOx regulations.

To meet IMO Tier III NOx regulations, various two-stroke marine engine licensors have announced the use of technologies such as selective catalytic reduction (SCR), exhaust gas recirculation (EGR) and dual fuel (DF). MET Turbocharger have a proven track record in all three technologies.

For low-pressure EGR, MHI-MME offers a corrosion-resistant turbocharger to be installed on the compressor side. While exhaust gas bypass (EGB) is executed in low-pressure SCR as a means to raise exhaust gas temperature, we can provide a compact turbocharger with a built-in EGB. As for high-pressure SCR, depending on how the pipes are arranged, the gas inlet is sometimes in the direction of the axial flow. MET Turbocharger can provide an axial-flow gas inlet.

We will continue to consider the protection of the global environment and strive for further enhancement of performance and reliability so as to meet the expectations of customers around the world.



Integrated EGB casing

Tier III Equipment application table (As of January 2018)

|                                    | SCR |    | EGR |    | DF (Dual Fuel) |
|------------------------------------|-----|----|-----|----|----------------|
|                                    | HP  | LP | HP  | LP |                |
| J-ENG (Japan Engine Corporation)   |     | ✓  |     | ✓  |                |
| MAN D&T (MAN Diesel & Turbo SE)    | ✓   | ✓  | ✓   |    | ✓              |
| WinGD (Wärtsilä Gas & Diesel Ltd.) | ✓   | ✓  |     |    | ✓              |
| Number of MET applied              | 14  | 8  | 20  | 1  | 34             |

### EGR-SCR Turbocharger Layout



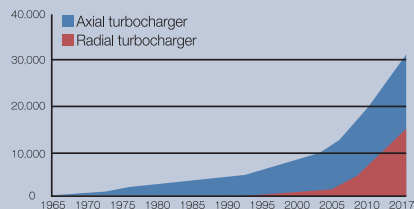
15,000 MET-RADIAL / 2,000 MET-MB PRODUCED

# MET Radial Turbocharger Production Gains 15,000 Mark, MET-MB Turbocharger Reaches 2,000 Units

MHI-MME manufactured its first radial turbocharger—the MET26SR—in 1988, and the total number manufactured to date has exceeded 15,000 units.

Meanwhile, the MET-MB series is the latest model in MET axial turbocharger. Since shipping the first turbocharger produced in the series (MET71MB) in 2011, MHI-MME has now achieved the manufacture of 2,000 units. With this, the total number of axial turbocharger manufactured has now exceeded 16,000 units, with the total number of MET Turbocharger manufactured to date exceeding 31,000 units.

The development of next-generation turbocharger is also progressing steadily, and MHI-MME will continue to develop and manufacture turbocharger as well as provide services that meet customer needs.



# MET Turbocharger Seminar Held in Bangkok, Thailand

MET Turbocharger Seminar was held in Bangkok, Thailand, in September 2017. The seminar was hosted by Techno Pacific Thailand, which is a newly authorized repair agent (ARA) in Thailand. In addition to introducing Techno Pacific Thailand to seminar participants, MHI-MME explained the structure of MET Turbocharger as well as maintenance tips and confirmation points to prevent the occurrence of problems. More than 40 people

attended the seminar, and an active Q&A session took place. Similar seminars were held in Vietnam and Indonesia in 2016. MHI-MME will further enrich MET Turbocharger services in Southeast Asia, together with our ARAs, by continuing to deepen communication with customers in the region and ensuring the provision of services that meet expectations.



## TRAINING FOR MET TURBOCHARGER

# Training on MET Turbocharger

Technical services for MET Turbocharger are carried out by MHI-MME's authorized repair agent (ARA) around the world. If you should ever encounter any problems with our turbocharger while at sea, taking necessary measures swiftly while you wait for the arrival of parts or a field engineer as well as communicating the situation correctly to MHI-MME or one of our ARA will lead to an early resolution of the problem.

If you would like, MHI-MME can provide training on MET Turbocharger that consists of classroom lectures and hands-on training. For details, please feel free to contact us at a-met-service@mhi-mme.com.

### Training Content

Classroom lecture

Detailed lecture content is available, from the structure of past MET turbocharger to troubleshooting. Lectures make it possible for participants to learn skills that will enable swift onsite response.

Hands-on training

Hands-on training is carried out using actual turbocharger. Participants learn how to Overhaul (open / dismantle / assemble) equipment to understand structure.



MHI-MME also holds training sessions every year for its ARA to ensure improvement of technical skills as well as updating ARA on the latest information.

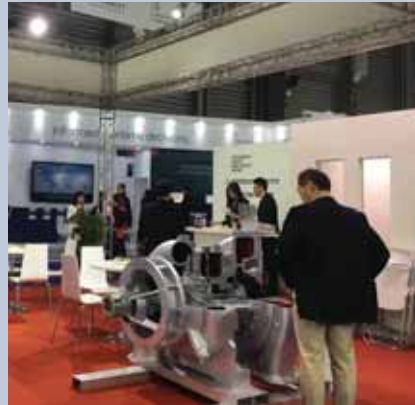
## MARINTEC CHINA 2017

### MHI-MME Exhibited at Marintec China 2017, Asia's Largest International Maritime Exhibition

MHI-MME, Mitsubishi Heavy Industries Engine & Turbocharger, Ltd. (MHJET) and Mitsubishi Heavy Industries (Shanghai) Co., Ltd. exhibited jointly at Marintec China 2017 held between December 5 and 8, 2017, in Shanghai.

MHI-MME's MET37SRC turbocharger as well as an MHJET S16R2-T2MPTK engine for high-speed vessels and a Smart Cruising Assist, a propulsion device for eco-friendly operation were exhibited at the booth. A seminar introducing a wide range of products, technologies and services was carried out at the booth. There was an extremely high interest in MHI Group products. With many visitors to the booth, we were able to boost our presence in the Chinese market.

MHI-MME licensees also exhibited at Marintec China, and many people visited their booths. We will continue to maintain and develop our good collaborative relationships with our partners, as we further pursue our sales activities in China.



## Technical Seminar Held in Athens, Greece

On February 1, 2018, MHI-MME hosted a Mitsubishi Technical Seminar in Athens, Greece. This was the fourth technical seminar hosted by MHI-MME in Athens, following the seminars held in 2011, 2013 and 2016.

A wide range of products were introduced in the recent seminar, with a focus on MET turbochargers, energy-saving solutions and other MHI-MME products. Other products that were introduced included Mitsubishi Shipbuilding Co., Ltd.'s SOx scrubber. The latest information on Japan Engine Corporation's UE Engines was also provided.

For customers in Greece, centering on those in the pre-owned market, the seminar theme primarily emphasized maintenance. It was a good opportunity to enhance the understanding of seminar participants regarding the maintenance of our machinery. The seminar attracted over 80 participants—mostly Greek shipowners. A high level of interest in products and technologies could be felt at the seminar.

In the evening, a party was held in which many questions could be heard on the products and technologies introduced at the seminar while everyone enjoyed Greek cuisine. MHI-MME will be exhibiting later this year at Posidonia 2018 to be held in Athens in June. We look forward to seeing you at our booth!



## NEW FACE IN SINGAPORE

### News from MHI-MME Offices Abroad



#### Singapore Office

Mitsubishi Heavy Industries Asia Pacific Pte. Ltd.  
150 Beach Road, #29-00 Gateway West, Singapore 189720

#### Daisuke Takeuchi, General Manager

I succeeded Manager Egashira last October. Before taking on this assignment, I spent the first 15 years of my career at MHI-MME designing marine boilers, and a little over five years after that engaged in planning and management duties in the Marine Machinery Division.

I will be providing MHI-MME technologies and services to our customers in the Asia-Pacific region, with a focus on Singapore—a key strategic center for maritime operations. I intend to be of use to our customers in enable to safe and secure voyage across the sea.

I will make sure that I am light on my feet, visiting customers and partners to listen to your opinions and desires. Please feel free to call me at any time.

