

Mitsubishi Emission reduction technology

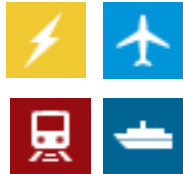


2015 06 04

SHIP & OCEAN ENGINEERING DEPARTMENT

Commercial aviation & transportation systems

Product Keys



Domains



Commercial aviation
& transportation systems



Energy & Environment



Machinery equipment
& Infrastructure



Defense & Aerospace

Division



Ship building & Ocean development



Commercial aviation



Transportation system

Ship building & Ocean development



Koyagi & Nagasaki yard



Ship building

Ship repair

Global partners



Engineering and Marine solution

Overseas Shipbuilding business

Engineering service and Marine solution



Bulk carrier (SEAHORSE series)



Container (MERMAID series)

Design package of Conventional ships

- Bulk carriers
- Container ships
- LPG carriers
- Chemical tankers

Green technology

✓ CO2 emission reduction

- Mitsubishi Reaction Fin
- Mitsubishi Stator Fin
- Mitsubishi Hub Vortex Free Cap
- Hybrid CRP pod system
- Solar power system
- Mitsubishi Air Lubrication System (MALS)

✓ SOx emission reduction

- LNG as fuel technology (MHI-GEMS)
- Emission abatement technology (MHI-EGCS)

Ship Design Package Line-up

MHI is providing ...



Line-up for container carriers

- 1,000TEU
 - 1,800TEU
 - 2,600TEU
 - 3,600TEU
 - 4,900TEU
 - 10,000TEU
 - 18,000TEU
- Ready
 - Coming soon
 - Under development

Line-up for bulk carriers

- 35,000DWT “SEAHORSE 35”
- 37,500DWT “SEAHORSE 375”
- 38,000DWT “SEAHORSE 38”
- 41,000DWT “SEAHORSE 41”
- 61/62,000DWT “SEAHORSE 61/62”
- 180,000DWT



Engineering service and Marine solution



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SOx Emission reduction technology (MHI-GEMS)

Fuel gas supply

BOG Liquefaction

Gas combustion

MHI-GEMS

LNG Gasification

LNG storage

L N G

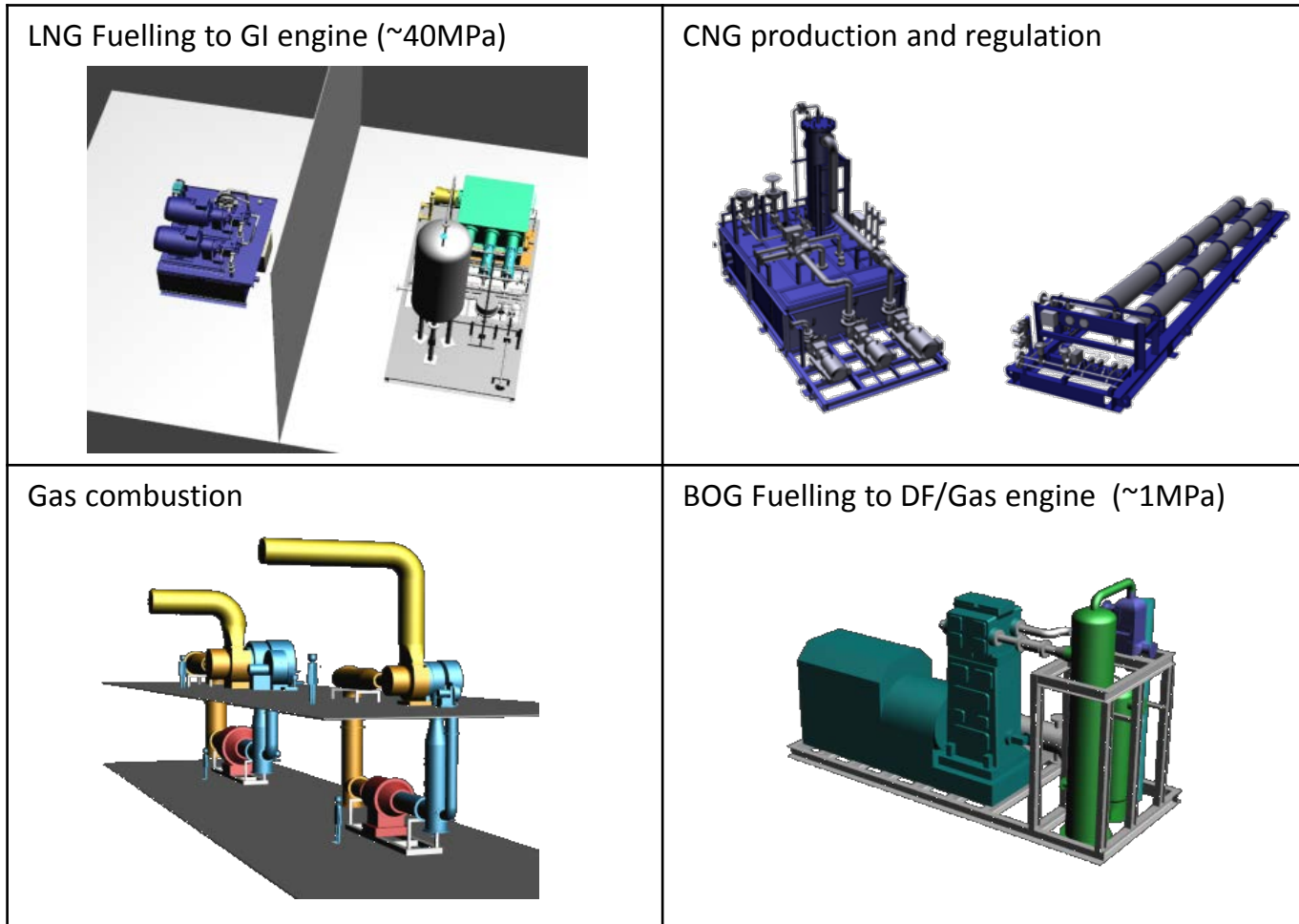


MITSUBISHI
MHI
MHI

Partner since 1972, MHI has been active in long term business relationship of LNG carriers, both the independent spherical "MHI" and the membrane type, in Yokohama and Nagasaki.

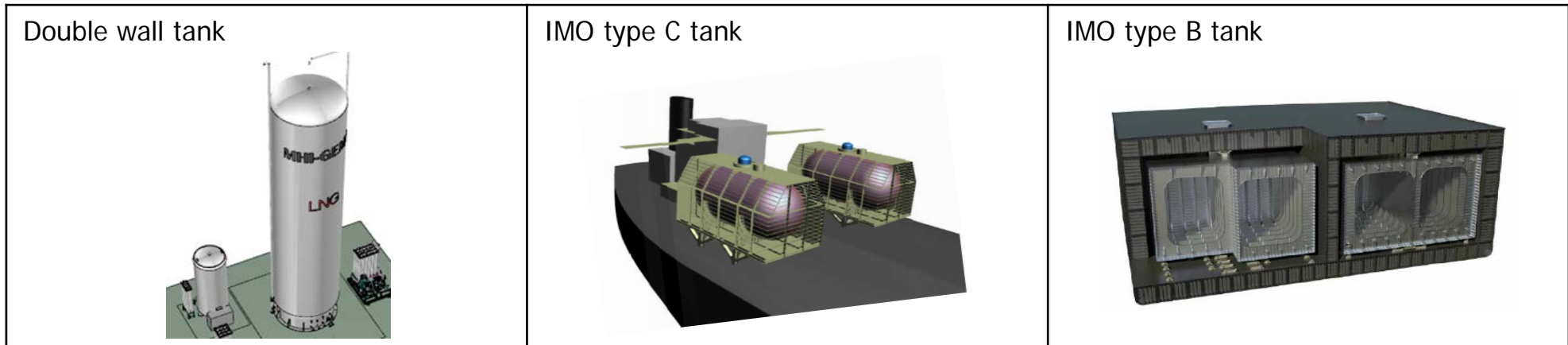
Provide Function in modules

Fuel Gas Supply System(FGSS) for GI engine and DF/Gas engine



Provide Function in modules

LNG containment system (Storage tank)



- Engine factory
 - Ferry
 - Tag
 - etc...

- Partial LNG fuel ship
(LNG for ECA)

- Full LNG fuel ship

DRIVE GREEN PROJECT

Kawasaki Kisen Kaisha, Ltd. ("K" Line) has launched "DRIVE GREEN PROJECT" in order to pursue environmental protection and energy savings with the world's most advanced technologies to be integrated on the 7,500-unit Car Carrier on order with Japan Marine United Corporation as Flag Ship of this project.

Ships have the lowest environmental impact of all transportation modes compared with aircraft, railway and motor vehicles. On the other hand, exhaust gas from marine diesel engines include factors that cause photochemical smog and acid rain, such as sulfur oxide (SOx) and nitrogen oxide (NOx), in addition to carbon dioxide (CO2) that are causes of global warming.

In K-Line "DRIVE GREEN PROJECT," to reduce CO2 emissions per transport vehicle, advanced hull design and energy saving technology have been adopted, with the goal of reducing CO2 emissions 25% or more compared to conventional design. In addition, SOx and NOx emissions are also reduced by using the world's most advanced technology.

To protect the environment of the earth and its oceans, K-Line will continue to vigorously strive to promote energy saving and reduce environmental impact of our fleet.

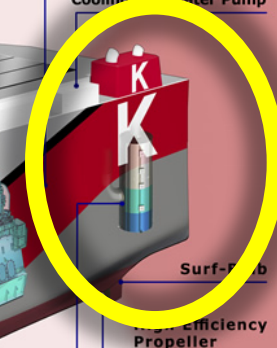


SOLAR FRONTIER Solar Power System

This is a system that utilizes the electric power generated by solar for inboard power and can generate about 150kw, this power generated amount being the world's largest as for ships. K-Line is planning to utilize solar power supply for the LED lighting in car holds (about 150kw) and order solar panels for this system from Solar Frontier K.K. that can be expected to provide stable power generation in the long term.

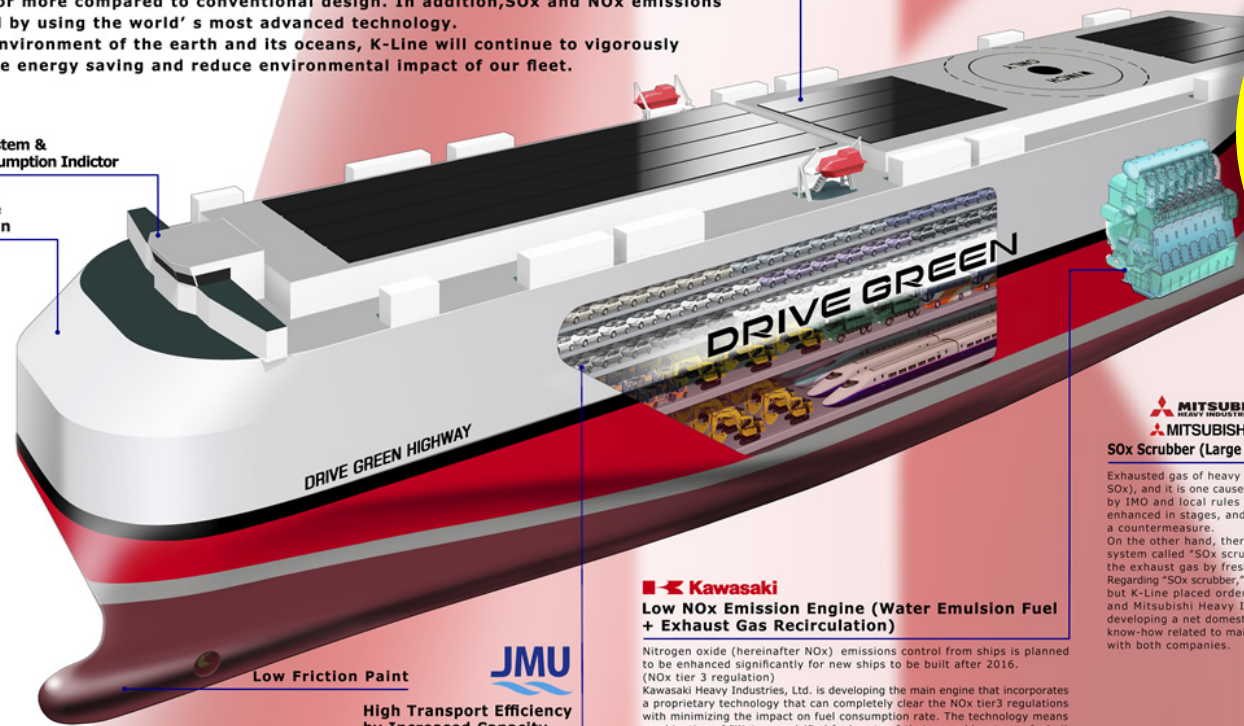
Exhaust Gas Heat Recovery System for Diesel Generator

Inverter Control of E/R Fan & Cooling Water Pump



Voyage Support System & Real Time Fuel Consumption Indicator

Wind Resistance Reduction Design



Low Friction Paint

High Transport Efficiency by Increased Capacity



Kawasaki Low NOx Emission Engine (Water Emulsion Fuel + Exhaust Gas Recirculation)

Nitrogen oxide (hereinafter NOx) emissions control from ships is planned to be enhanced significantly for new ships to be built after 2016. (NOx tier 3 regulation)

Kawasaki Heavy Industries, Ltd. is developing the main engine that incorporates a proprietary technology that can completely clear the NOx tier3 regulations with minimizing the impact on fuel consumption rate. The technology means combination of "Water emulsified fuel system" that can add water to fuel oil and "Exhaust gas recirculation system" that can reflux the exhaust gas in scavenging air. In addition, in order to reduce CO2 emissions, "Turbo charger cut-out device" is also incorporated, that can control turbochargers' running in accordance with the load. K-Line decided to install this engine and perform a test operation proactively before the IMO regulation is strengthened.



SOx Scrubber (Large Scale Exhaust Gas Washing System)

Exhausted gas of heavy fuel oil contains sulfur oxide (hereinafter SOx), and it is one cause of air pollution. SOx emissions regulations by IMO and local rules such as in the United States have been enhanced in stages, and expen sive low sulfur fuel oil is used as a countermeasure. On the other hand, there is the large scale exhaust gas washing system called "SOx scrubber" that can remove SOx contained in the exhaust gas by fresh water or seawater. Regarding "SOx scrubber," foreign products have been the mainstream, but K-Line placed order with Mitsubishi Kakoki Kaisha Co. Ltd. and Mitsubishi Heavy Industries Co. Ltd. in order to promote developing a net domestic product and is planning to accumulate know-how related to maintenance and operation of "SOx scrubber" with both companies.

Ministry of Land, Infrastructure and Transport

ClassNK R&D PROJECT

These programs are supported by Ministry of Land, Infrastructure, Transport and Tourism (MLIT) development of the combined emission reduction system for marine main diesel engine and SOx scrubber) and ClassNK as part of the ClassNK Joint R&D Industry Program (development of the combined emission reduction system for marine main diesel engine and SOx scrubber).

<http://www.kline.co.jp>

Bulk Carrier Developed by MHI Wins Nor-Shipping Energy Efficiency Award



Harvest Frost is a 95,000 dwt bulk carrier designed by Mitsubishi Heavy Industries, built by Oshima Shipbuilding and delivered to Archer Daniels Midland USA on October 29, 2014. MHI provided most of its innovative features, including the conceptual design, various green technologies and the Mitsubishi Air Lubrication System. The vessel also features a new bow shape designed to reduce wave-making resistance. For propulsion, it has adopted an innovative system that effectively converts the main engine power into propulsion power by positioning fins forward of the propellers and placing special grooves in the propeller boss cap.

(<http://messe.no/en/nor-shipping/Spotlight-on-excellence/Energy-Efficiency-Award-2015/>)



With the increasing adoption of international rules on easing environmental burdens imposed by marine transport, expectations of and demand for environmentally harmonious “Eco-ships” are steadily rising.

In response MHI is not only developing and constructing Eco-ships of every kind, MHI is also applying its expertise accumulated in its shipbuilding and ocean development businesses to provide engineering support to other shipbuilders.

MHI has adopted a long-term strategy for its shipbuilding and ocean development business to focus on high-value-added vessels and to strengthen its engineering operations by providing a wide spectrum of energy efficiency technologies to other shipbuilders both in Japan and abroad.

We want to keep possible future in mind during developing collaborative relationship with you.



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Our Technologies, Your Tomorrow

