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The Nippon Foundation

TEXTBOOK

for

Seminar on Japanese Ship Machinery Industry

The Regal Room, Trident, Nariman Point, Mumbai, India, September 9, 2009

In cooperation with

The Shipyards Association of India (SAI)

Supported by

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Japan Marine Equipment Association

Contents

Seminar on Japanese Ship Machinery Industry

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PROGRAM :

09:00-09:30	Registration	
09:30-10:00	Opening Ceremony	
09:35-09:45	Welcome address by Japan Marine Equipment Association (JSMEA)	
09:45-10:00	Welcome address by Shipyards Association of India (SAI)	
10:00-10:50	Keynote Speach by Ministry of Land, Infrastructure, Transport and Tourism (Japan), and Q and A	
11:00-11:20	Coffee Break	
11:20-11:50	Lecture No. 1	Niigata Power Systems Co. Ltd.
11:50-12:20	Lecture No. 2	Nakashima Propeller Co., Ltd.
12:20-12:50	Lecture No. 3	Taiyo Electric Co., Ltd.
12:50-13:05	Q and A	
13:05-14:00	Lunch	
14:00-14:30	Lecture No. 4	Mitsubishi Heavy Industries, Ltd.
14:30-15:00	Lecture No. 5	Kamome Propeller Co., Ltd.
15:00-15:30	Lecture No. 6	Japan Radio Co., Ltd.
15:30-16:00	Lecture No. 7	Yanmar Co., Ltd.
16:00-16:20	Q and A	
16:20-16:40	Coffee Break	
16:40-17:10	Lecture No. 8	Akasaka Diesels Limited
17:10-17:40	Lecture No. 9	Sasakura Engineering Co., Ltd.
17:40-18:10	Lecture No. 10	Nippon Hakuyo Electronics, Ltd.
18:10-18:40	Lecture No. 11	Daihatsu Diesel Mfg. Co., Ltd.
18:40-19:00	Q and A	
19:00-20:00	Cocktail Reception	

Strategy for Green Marine Engines

Yoshihiro Itoh
Managing Director
NIIGATA POWER SYSTEMS CO., LTD.

STRATEGY for GREEN MARINE ENGINES

ABSTRACT

Niigata has developed and manufactured many four-stroke engines for land, marine and rail car applications for about 90 years. However, increasingly severe regulation conditions on air pollution arise from contemporary public opinions concerning environmental protection topics such as forest damage due to acid rain, green house gas effect due to carbon dioxides and photochemical oxidants due to hydrocarbons and nitrogen oxides, especially for land engines, since 1980s. Moreover, the IMO NOx regulation Tier I for marine engines came into effect on May 19, 2005. Further stringent regulation, IMO Tier II and Tier III has been adopted that will become effective in 2011 and in 2016 respectively. Tier II NOx regulation shall be reduced by about 20% and Tier III NOx regulation shall be reduced by 80% in Emission Control Area. To comply with these regulations, the recent four-stroke engines have been developed mainly with the environmental preservation as well as taking economy, durability and maintainability, etc. into account for each application.

In these situations, a concept of simultaneous reduction both of NOx and BSFC was established by simulation analyses and engine tests by Niigata in 1990s. This concept has been adopted to our engines to comply with the present regulations. Furthermore, the advanced technologies have been studied to comply with the future legislations, especially for IMO Tier II and Tier III. The studies have been carried out by using engine performance simulation, CFD analyses and engine tests to optimize the parameters of fuel injection system, combustion pattern, intake and exhaust cam timing and turbo-charging system. It has also been examined about 80 % NOx reduction by using SCR system for marine application. On the other hand, Niigata has been also examined the countermeasure of green house gas and has been studied.

Here, the strategies for future emission standard and global warming through the above developments and studies for medium speed engines are presented.

ENGINE PORTFOLIO

Figure 1 shows Niigataís medium speed engine program mainly for marine application. All of these engines are 6/8 cylinders in line configuration. The primary markets for Niigata marine engines are tugboats, fishing boats, work boats and high-speed vessels and so on. The configuration of medium-speed diesel engines for using in such applications is generally in-line. Furthermore, newly developed advanced 28AHX engine that complies with IMO NOx Tier II will be launched into the market in 2010.

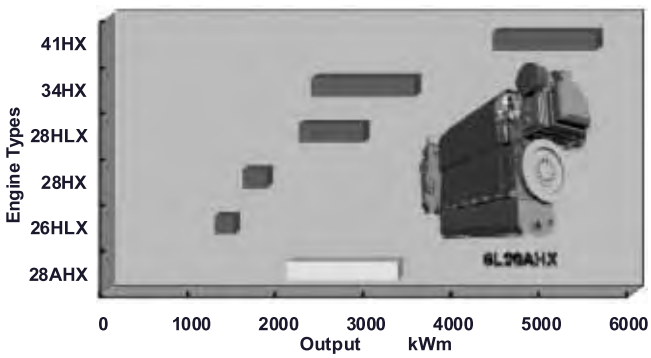


Fig. 1 Marine Engine Program

REVIEW OF FUTURE REGULATIONS

Figure 2 shows the IMO NOx Tier I, Tier II and Tier III regulations. Tier I is already effective, however Tier II and Tier III has been reviewed and adopted. It can be seen that the NOx regulation level of IMO Tier III has to be complied with after-treatment system. To comply with severer Tier III regulation, the present candidate of the technologies is SCR system.

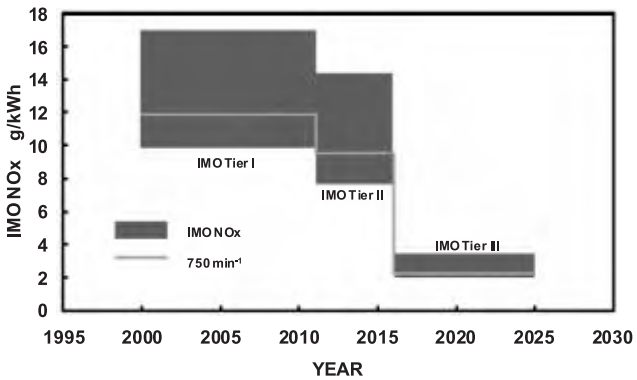


Fig. 2 IMO NOx Regulations

COUNTERMEASURES FOR THE FUTURE NOx REGULATIONS

Fig. 3 shows our history of studies for reducing NOx. Many technologies have been studied for marine application as well as stationary engines. As can be seen from the figure, our efforts to reduce NOx can be traced back to the early 1970s.

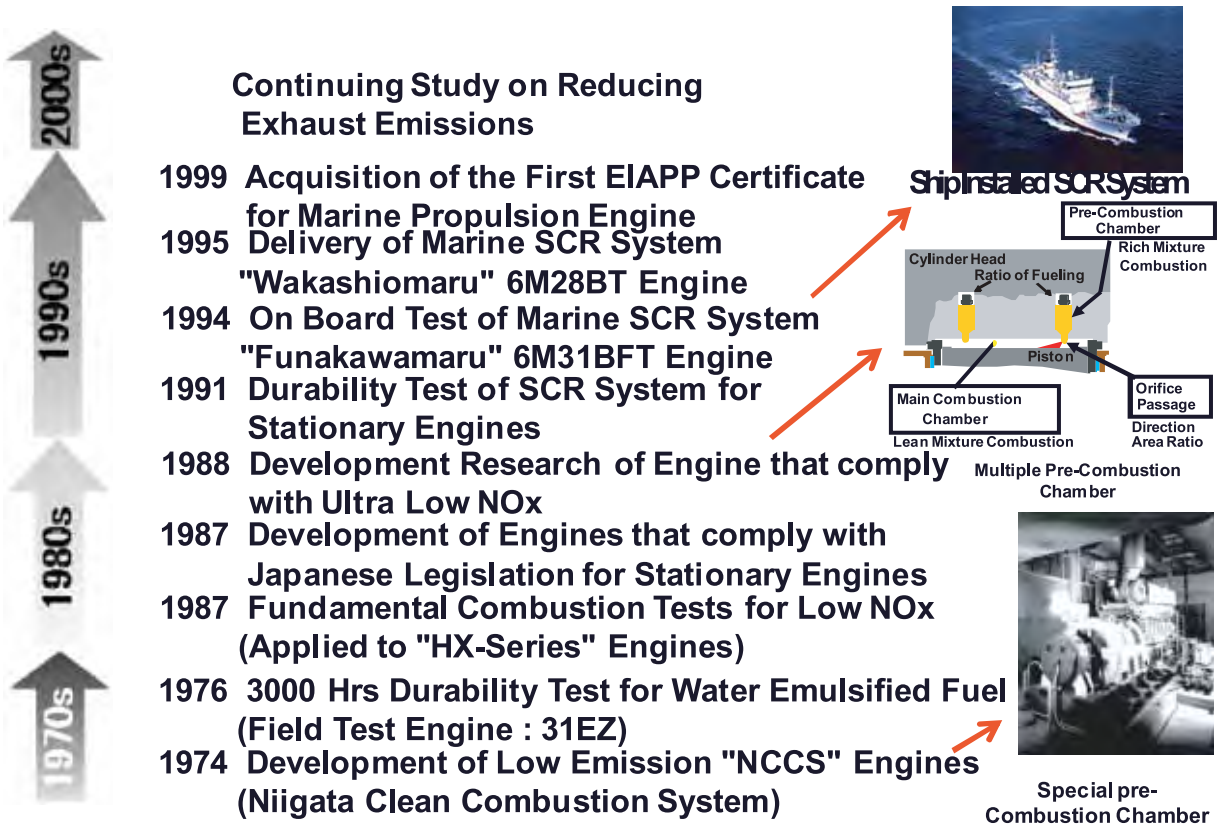


Fig. 3 History of Environmental Protection Efforts

Fig. 4 shows the relation between NOx and specific fuel consumption. It can be seen that if the low Pmax/Pcomp combustion could be realized with higher Pmax, the specific fuel consumption could be reduced. To achieve it, the compression ratio, boost pressure, intake valve timing, injection rate and so on should be optimized.

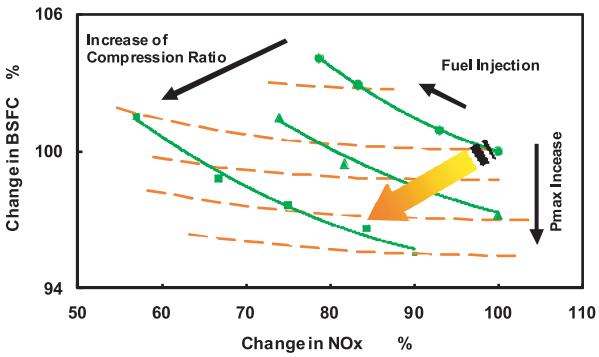


Fig. 4 Correlation between BSFC and NOx

From the review of the NOx reduction technologies; For complying with IMO NOx Tier II, injection system, combustion system, valve timing and turbo-charging system should be optimized for each engine.
On the other hand, from the view point of present technologies, SCR system should be introduced for complying with IMO NOx Tier III.

The effects of fuel injection rate patterns on NOx, specific fuel consumption and excess air ratio has been investigated by simulation calculations for three patterns. Pattern A for the current injection rate; Pattern B for a cam mechanism with suppressed initial injection rates; and Pattern C for electronically controlled injection rates.
Fig. 5 shows the comparison of the change in engine performance and NOx. Compared to the current pattern A, these analysis shows that pattern C with fuel injection rates initially suppressed by an electronically controlled fuel injection system, then later increased, can achieve faster combustion that permits NOx reductions without degrading specific fuel consumption and smoke so much.

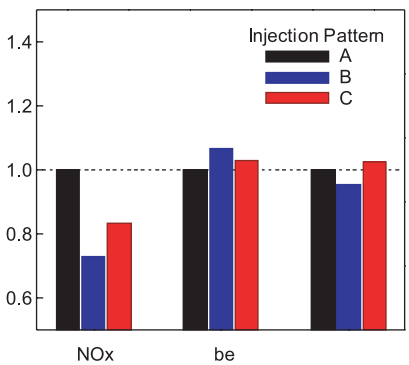


Fig. 5 Influence of Injection Rate on Engine Performances

One method for realizing NOx reduction while retaining engine performance is the miller-cycle method. However, this method requires increased boost pressures to retain performance. Fig. 6 presents the results of simulation analysis on NOx, specific fuel consumption and excess air ratio using intake valve closure timing and boost pressure as parameters. These results show that the NOx reduction with keeping engine performance as possible can be achieved by the early closure of the intake valve and increased boost pressure.

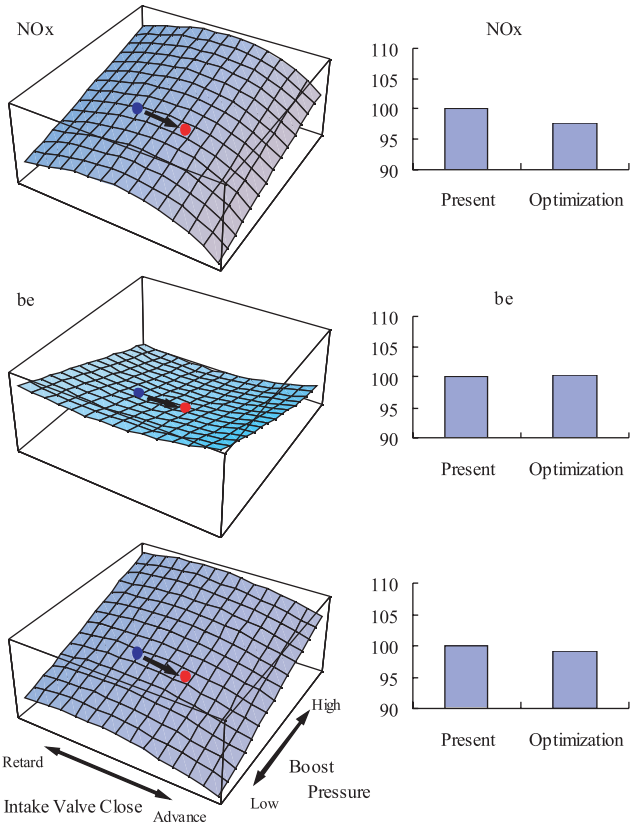


Fig. 6 Effects of intake valve closure timing and boost pressure on NOx formation and engine performance

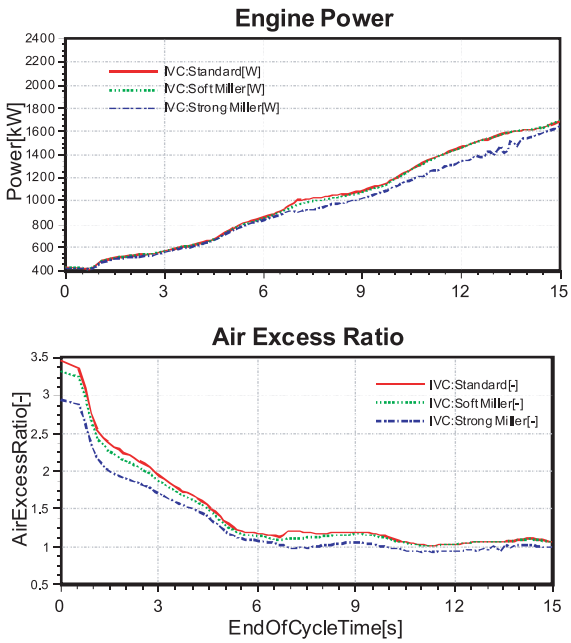


Fig. 7 Effects of intake cam closure timing on start-up and trans ient characteri stics

A comprehensive study of intake and exhaust valve timing is needed. Niigata implements engine performance simulations and engine tests to optimize engine start-up and acceleration characteristics and smoke. Fig. 7 presents an example of the results of such simulation analysis performed to confirm the effects of intake valve closure timing on acceleration characteristics. The figure shows that adopting the miller method in advancing the initiation of the intake valve closing reduces excess air ratios at acceleration, increasing smoke and degrading acceleration characteristics. Therefore, this point should be minded to introduce miller-system.

It is said that the electronically controlled fuel injection systems will become widely deployed solution for medium-speed engines. To optimize the fuel injection system, for example injection timing, injection pressure and injection pattern against operation conditions, the electronically controlled fuel injection system is very useful. Fig. 8 shows the example of the comparison between the conventional fuel injection systems and the common rail system at the high speed engine test. It can be seen that the engine performance could be optimized suppressing the NOx emission to regulated values for the engine by adjusting common-rail pressures and fuel injection timings under varying load rates.

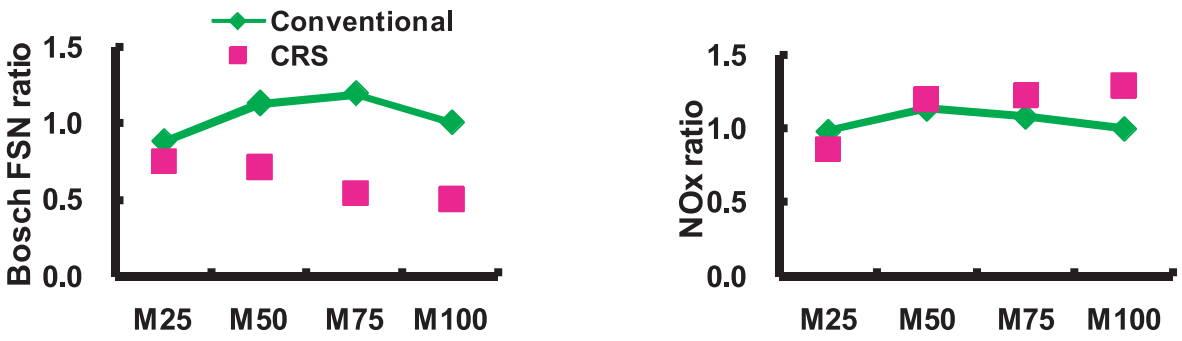


Fig. 8 Effect of injection system on small high speed engine performance

From the review of the above NOx reduction technologies, it can be said that the injection system, combustion system, valve timing and turbo-charging system should be optimized for each engine to comply with IMO NOx Tier II. Furthermore, SCR system should be introduced from the view point of

present technologies to comply with IMO NOx Tier III.

A marine SCR System had been tested by the training ship. Fig. 9 shows the flow diagram of the SCR system that uses urea as the reducing agent.

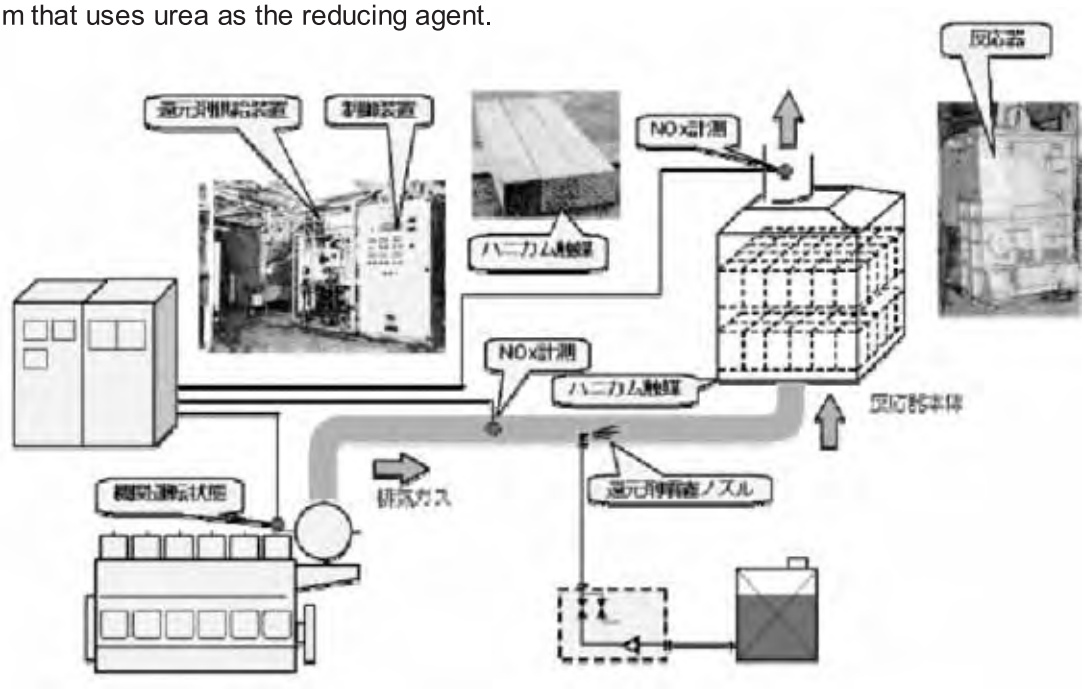


Fig. 9 Marine SCR System

Fig, 10 shows the test results of NOx conversion rate for comparing the test bed result and NOx conversion rate on-board at steady state. It can be seen that the NOx conversion rate on-board is almost same as the test bed results.

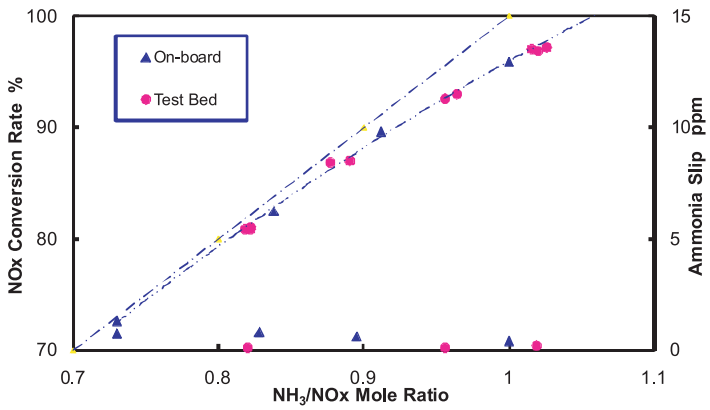
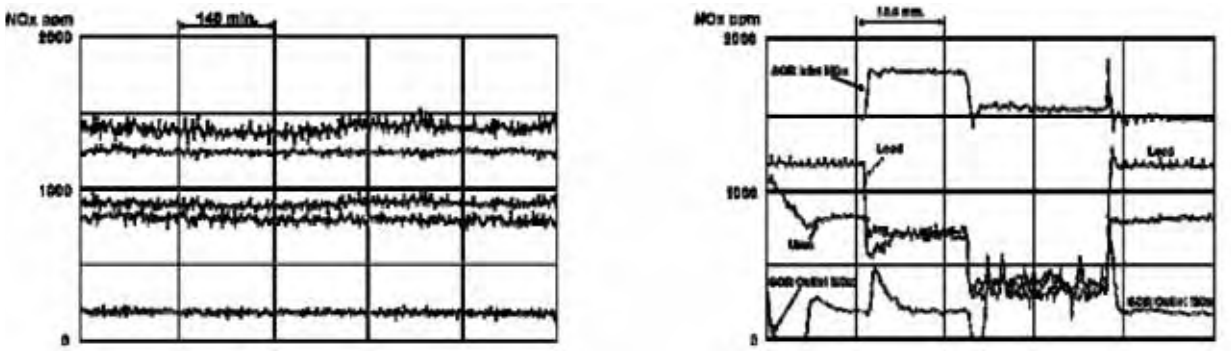


Fig. 10 NOx Conversion Rate of Marine SCR System

Fig. 11 shows the on-board test results at steady load operation and at load change operation. Left side figure shows at steady load operation and right side figure shows at load change test result. From the left side figure, it can be seen that steady NOx conversion rate can be obtained when the load is steady. Furthermore, it can be seen that if the urea supply control system is optimized NOx conversion does not fluctuate so much. That means the level of leak ammonia is low.



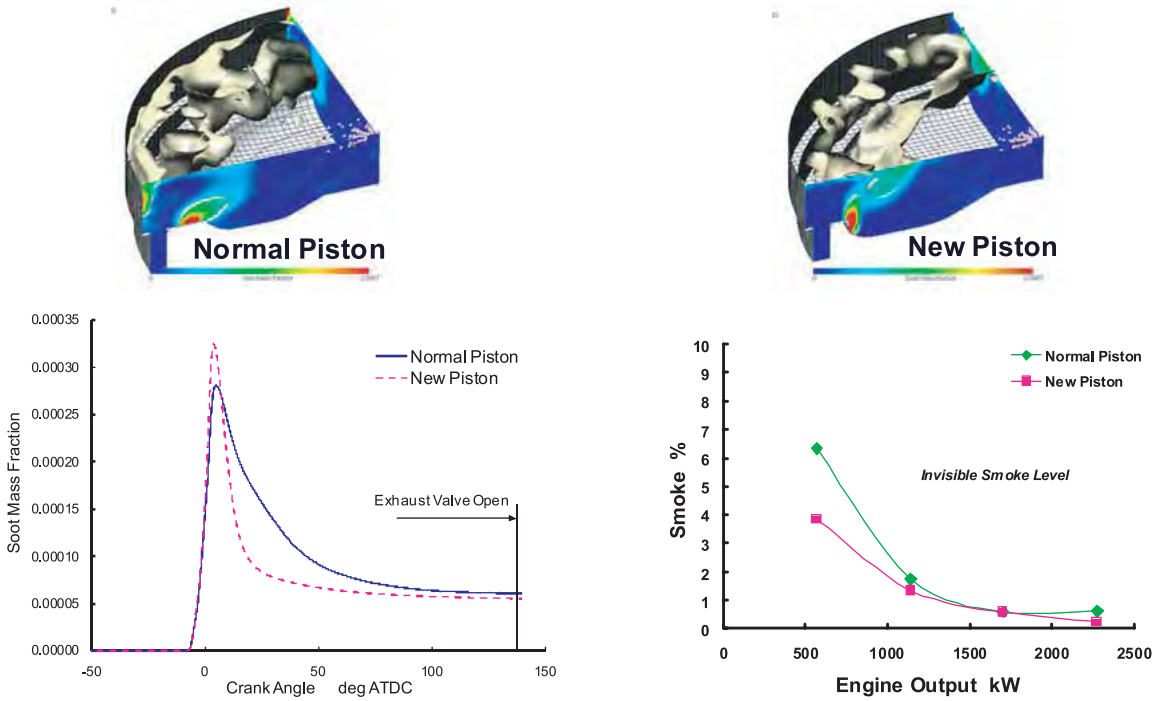
At steady load operation At load change test

Fig. 11 SCR Test On-board

COUNTERMEASURE FOR PM

Option of countermeasures for reducing PM is optimization of combustion. To optimize combustion performance, the combustion chamber shape is one of the important parameter. Here, an example of the smoke improvement analysis is shown in Fig. 12 as a part of PM reduction.

This figure shows that the comparison of combustion chamber shapes on engine performances by the simulation analysis and engine test. Upper left figure shows CFD result by the conventional chamber model and upper right figure shows the result by the optimized chamber configuration. Lower left figure shows the result of calculated soot. This figure shows that smoke by the optimized chamber is oxidized faster than that of the conventional one. Lower right figure shows the engine test results. This figure also shows that the smoke of the optimized chamber is better than that of the conventional chamber especially at low load.



Calculation Result Measurement Result

Fig. 12 Effect of Combustion Chamber Shape on Smoke

GREEN MARINE ENGINE

The new type of marine medium-speed engine (Bore: 280mm, Stroke: 390mm, Output: 2,070 ñ 3,330kW) that achieves the low emission engine. –This engine complies with IMO NOx Regulation Tier II without any fuel consumption and output loss. The engine appearance is shown in Fig. 13.

The engines drive Niigata azimuth thrusters ìZ-pellerî that are installed on a tug boat, supply boat and so on, and the first engine will be delivered in 2010.

Fig. 13 6L28AHX

CONCLUSION

NOx reduction technologies have been reviewed. From the result, it can be said as follows for four stroke medium speed diesel engines.

The injection system, combustion system, valve timing and turbo-charging system should be optimized for each engine to comply with IMO NOx Tier II.

SCR system should be introduced from the view point of present technologies to comply with IMO NOx Tier III.

Latest Technology for High-performance Marine Propeller

Kohei Himei
Design Department
NAKASHIMA PROPELLRE CO., LTD.

LATEST TECHNOLOGY FOR HIGH-PERFORMANCE MARINE PROPELLER

NAKASHIMA PROPELLER CO., LTD.
Kohei Himei
Designer, Propeller Division, Design Department

1) PREFACE

In recent years, the requirements for marine propeller by our customers have been diversified with remarkable manifold due to the general inclination for higher ship speed, the energy-saving oriented, and for the improvement of comfortableness aboard. NAKASHIMA PROPELLER devises the various products and technologies to reward their demands.

2) ABOUT US

NAKASHIMA PROPELLER was established in 1926, and the manufacture of marine propellers begins. At first, we manufactured the small propellers for fishing boats, and then, through the history more than 80 years, the sizes and types of propellers that we can manufacture came to be comprehensive steadily. Now, the various propellers from 18cm to over 10m in diameter are manufactured in 4 factories in Japan and Vietnam. Thus, we can be the leading company of marine propulsion specialists in the world, by utilizing experiences accumulated and advanced technologies.

FPP for Container
(abt. 9m diameter)

3) PRODUCT LINEUP

3-1 Fixed Pitch Propeller (FPP)

The fixed pitch propellers for large vessel are main products in NAKASHIMA PROPELLER. We can correspond to LNG, LPG, Container, Bulk Carrier and all kinds of vessels. We offer a wide selection to meet any need. By precisely matching the shipís hull and engines with equipment tailored for the intended purpose of the ship, we help to ensure smooth and safe marine transportation. Tamashima factory which was built in recent years has enough capacity to manufacture FPPs up to 12m in diameter, and 150tons by weight.

We continue having an inquiring mind to ultrafast too. Our racing propellers play an active part in Japan domestic boat

Racing Propeller

races and F1 world championship. We continue to take on the challenge of being the fastest with our unique racing spirit.

3-2 Controllable Pitch Propeller (CPP)

XS type and XL type are as our CPPís lineup. XS type is for small engine less than about 5,000PS, and utilizes simple system to change propeller pitch. It keeps maintenance costs low. XL type is for large engine more than 5000PS. Its maximum diameter is about 8m, corresponding to about 30000PS engine, so we can supply it for wider range engines compared with the other maker comparatively.

XL Type CPP

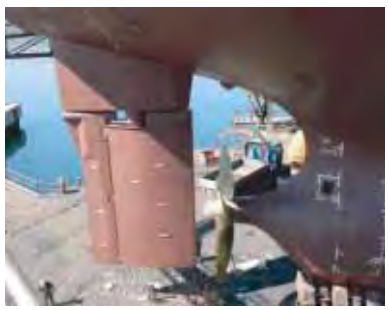
3-3 Side Thruster

We have two kinds of thruster, TFN type and TCT type. TFN type thrusters use fixed pitch propeller, therefore its simple structure enable easy maintenance. TCT type thrusters utilize unique forward-skewed, controllable pitch propellers and have low vibration and noise. They use technology based on the XL type controllable pitch propellers and are simple to upkeep.

TCT Type Thruster

3-4 Special Rudder

In association with the Becker Marine Systems, we have provided over 2500 ships with Becker rudders in Japan. The Becker rudder is different than a conventional rudder in that it utilizes an additional flap on the trailing edge for steering. This allows up to twice the steering power compared to a traditional rudder, translating into a much more maneuverable ship.



Flap rudder FKSR Type

(Becker rudder)

3-5 Contra-Rotating Propeller (CRP)

CRP is more efficient than conventional single propellers as they eliminate power losses due to rotational flow. We can provide the CRP-POD propulsion system included the hybrid type in. In addition, we supply small CRP made by stainless steel for a outdrive maker.

CRP-POD propulsion system

4) LATEST TECHNOLOGY

Although a propeller may seem rather trivial compared to an entire ship, a well designed propeller makes all the difference in a ship's efficiency, speed and safety. Knowing this, Nakashima propeller strives to create the most suitable design for each individual customer.

4-1 DESIGN TECHNOLOGY

In propeller design, there are three important points that must be considered carefully, they are Efficiency, Strength, and Cavitation. Probably, the propeller that no cavitation occurs while keeping highest efficiency and highest strength will be best, if it is possible. But these points are incompatible. For example, to enhance the efficiency by reducing water resistance, if the blade thickness is designed more thinly, the strength performance will be worse, and if the blade area is designed smaller, cavitation on blades will occur more. Therefore, we always investigate the optimum design result that these three points are harmonized well. For that purpose, we use several latest technologies to confirm these performances.

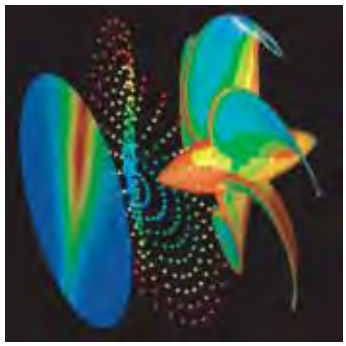
The correlations of three characteristics on propeller design

There is the tank test using model propeller as one of ways to confirm the efficiency and cavitation performance. For confirming the efficiency, we carry out the propeller open test. And for confirming the cavitation phenomena in detail, we carry out the cavitation tunnel test using high-speed video camera can record over 10,000 frames per second.

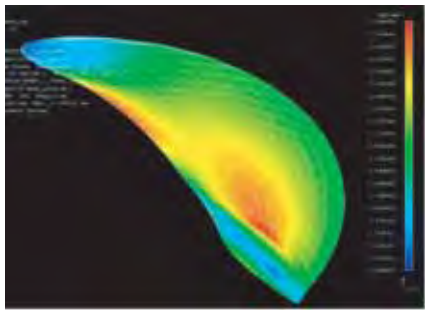
Computational Fluid Dynamics (CFD) and Finite Element Method (FEM) are used as the numerical analytical method. We have large scale PC cluster system for CFD, can analyze about the various parameter distributions and cavitation phenomena in detail

cannot calculate by the conventional method. FEM is used for estimating the blade stress.

Cavitation observation by high-speed video camera



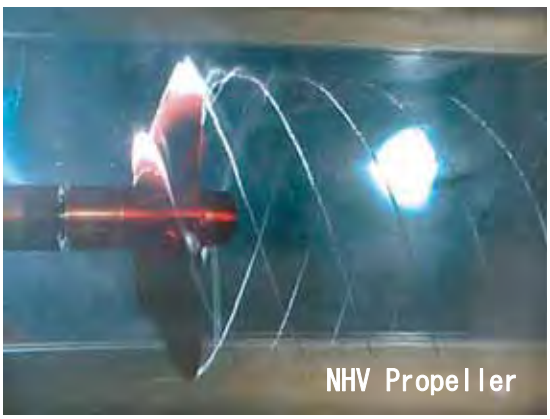
Fluid analysis by CFD

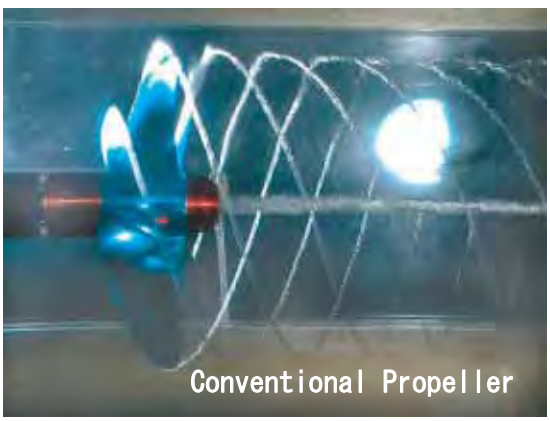


Blade stress analysis by FEM

4-2 NHV Propeller

It is well known that the hub vortex generated behind propeller hub causes energy loss and has the risk to cause the erosion of the rudder. NHV Propeller freed from energy losses by eliminating the hub vortex, is a high efficiency propeller developed by using NAKASHIMAís latest technologies. By optimizing the pressure on blades only, without any special systematic device or appendage, NHV Propeller achieves about 5% efficiency gains compared with conventional propellers without sacrificing its anti-cavitative characteristics, propeller exciting force, and blade strength.





Comparison of Hub-Vortex with NHV Propeller and conventional propeller at the cavitation tunnel test using model propellers

4-3 MANUFACTURING TECHNOLOGY

Propeller manufacturing has become an extremely rigorous task in today's world. Accordingly, being able to predict from theory the actual behavior of a propeller is paramount to creating the optimal shape. Even a 1% difference in calculation efficiency and actual data cannot be accepted. This means that propeller shape must be made

with great precision to ensure that there are no discrepancies. Our high quality propellers are also supported the manufacturing technologies.

With the advent of Computerized Numerically Controlled (CNC) milling machines, the quality of propellers has improved significantly. Our CNC blade milling machine for large-sized propellers is simultaneously controlled at 6-axes with the precision of 1/1000mm, where CAD/CAM systems specializing in propeller manufacture operated by PC automatically processing the propeller manufacturing drawings and NC machining data.

And, the introduction of the turning machine for large-sized propellers brings safe-manufacturing and reduction of man-hours.

CNC blade milling machine of 6-axis simultaneous control

Turning machine for large-sized propellers

Proposal of Environmentally Friendly Products

Keno Ono
General Manager, Marine Business Division, Overseas Business Dept.
TAIYO ELECTRIC CO., LTD.

Taiyo Electric started life in 1917 (in 1943 the business was re-launched as Taiyo Electric Co., Ltd.) set up an electric machinery and equipment manufacturing business. Since then it has continued to grow as a specialist mainly in the manufacture and sale of electric machinery for marine market. Taiyo Electric, a Total Supplier of marine electric machinery, is the only specialist manufacturer in Japan that can provide almost all electric equipment required in a ship from generators and motors to switchboards and control consoles. Based upon our valuable experience and wealthy knowledge with the unique solution as "TOTAL SUPPLIER", Taiyo Electric has a favorable reception from shipyards & ship owners of various countries in the world.

Main Product (1) Generators

Taiyo provides variety of generators from small vessels to large vessels with high reliability & long life that is made by careful selection of composition materials and most up-to-date production technology. It is designed for easy maintenance/inspection and high generator efficiency lead to light weight & compact.

Main Product (2) Thyristor Inverter Type Shaft Generator

Taiyo's shaft generating system has been developed by fully utilizing the supreme techniques and knowhow accumulated over many years by TAIYO. This system has high performances and high quality and can always supply constant frequency and voltage even through the speed of the main engine greatly fluctuates, thereby assuring the saving energy and labor. (See more details in below)

Main Product (3) Electric Propulsion System

Fuel consumption can be decreased by automatic power management of the optimal number of generators with operating in the most efficient fuel consumption range according to necessary propulsion load. The electric propulsion system also contributes to improve environment of accommodation space by lower vibration & noise and it has great operability.

Main Product (4) Induction Motor

According to generator capacity on the vessel, Taiyo marine motors comply with various kinds of starting methods such as Direct on Line, Star-Delta, Compensation Starting and Inverter Starting (Speed Control). As Taiyo marine motors are exclusively used in ships, a wide variety of model matching the uses and characteristics of various auxiliary machineries have been prepared upon the basis of our long years experience.

Main Product (5) Inverter Speed Control System (VVVF)

Stepless speed control of induction motors now become possible by changing the voltage and frequency with an inverter. Taiyo's inverter speed control system greatly contributes to save energy, labor cost, and maintenance cost. (See more details in below)

Main Product (6) Ventilation Fans

In accordance with customer needs, Taiyo has a wide variety of fans such as Axial flow Internally motor driven/Externally motor driven, Turbo type, Multi-blade type, and etc.

Main Product (7) Switchboard/ Starters

Designed to cope with the diverse conditions that affect ships, with particular emphasis on resistance to vibration, moisture, and heat. Our technology and experience allows us to select the very best components and thus guarantee long life and high efficiency. Optimal arrangement of components makes maintenance extremely simple.

Main Product (8) Control Console (with Alarm Monitoring System)

Available in various types based on respective alarm and monitoring systems, such as TML (using group annunciators), TMA (using card cassette type annunciators), and TMC (using CRT systems and LCD touch panel systems), tailored to suit your budget and requirements.

[THYRISTOR INVERTER TYPE SHAFT GENERATING SYSTEM]

We developed this Thyristor Inverter Type Shaft Generating System by our own technology on 1983. Since then, we have been developing this system in accordance with escalation of electricity demand on vessels such as mega container vessels, PCCs, and etc. Today, our largest supply record is capacity 3500kW for mega container vessels and total supply record has been accumulated to more than 270 ship sets.
This shaft generating system is most suitable to ships which require large electricity during navigation and have long navigation length.

Features

Comparing from other type shaft generator, this thyristor inverter type shaft generator has almost no consumable parts and much less maintenance and inspection is required so that energy and labor saving are realized. Main merits are as below.

1) F.O. COST SAVING 2) MAINTENANCE COST SAVING

3) LABOR SAVING 4) EMISSION CONTROL COUNTERMEASURE
5) SUSTAIN EXTRA SEA-MARGIN (Motor mode is possible by optional order)
6)EMERGENCY TAKE HOME FUNCTION

Details of System Configuration & Principle

AC power from a shaft generator with a fluctuating frequency due to revolution of main engine is converted into DC power with no relation to frequency by means of thyristor converter. DC power is smoothed by DC reactor (DCL) and then inverted to AC power with a constant frequency by means of thyristor inverter.

Even if the rotating speed of propeller fluctuates in a wide range of 60% to 110%, power can be fed continuously and efficiently. Also, frequency and voltage characteristics at the time of a sudden change in load are almost the same as those of the auxiliary diesel generator, and thus the system can be always operated in parallel with other generators. When the functions of automatic synchronizing, preferential tripping and automatic start of an auxiliary generator are added, a continuous power source corresponding to the maneuvering situations of a ship can be secured, and thus this system can be applied to low-cost fixed-pitch propeller-driven vessels.

As a power source on the vessel, each classification society provides permissible system output voltage harmonic distortion level. Since our system decrease distortion of voltage wave form which is occurred on thyristor by duplex type reactor, it is possible to improve power source voltage harmonic distortion level theoretically as 0%.

SHAFT GENERATOR MAJOR MODELS

MODEL SIG: To be built in intermediate shaft between M/E and propeller.
MODEL SHG: To be coupled with the fore end of main engine as over hanged.
MODEL SFEK: To be coupled with the step up gear box.

FREQUENCY CONVERTER PANEL (FCP)

Frequency converter panel (FCP) is consisted of four (4) major parts as follows.
1) Converter Part: Convert AC power to DC power
2) DC Reactor: Smooth DC power
3) Inverter Part: Invert smoothed DC power to constant voltage & frequency AC power.
4) AC Reactor: Improve voltage wave form
* Converter and inverter are controlled by thyrisotr, and then provide active power to the BUS. Digital control is applied to all control and protection function.

SYNCHRONOUS CONDENSER (SC)

The construction of Synchronous condenser (SC) is same as that of ordinary generator; however, SC is coupled with starting induction motor.
The functions of SC are as follows.

1) Provide reactive power to BUS. 2) Provide reactive power to inverter
3) Provide sustained short-circuit current in case of BUS short-circuit

[INVERTER CONTROL SYSTEM (VVVF)]

VVVF stands for Variable Voltage Variable Frequency. Variable speed control of induction motors become possible by changing the voltage and frequency with inverter.
The possibility to apply VVVF system is manifold to induction motors on vessels. Superior control and energy saving comparing from conventional valve or hydraulic oil control are realized by controlling speed of induction motor with an inverter.

Major Advantages of VVVF system are as follows.
1) Energy saving 2)High input power factor
3) Stepless speed control 4)Easy check and easy maintenance
5)Soft start

Major Usage of VVVF System

	Usage	Output (kW)
1	Low/Duty (L/D) Gas Compressor (for LNG ship)	150~450
2	Cargo Oil Pump	200~800
3	Bow Thruster	75~600
4	Electric Deck Machinery	15~132
5	S.W. Service Pump, M/E C.S.W. Pum	30~132
6	Dredge Pump	300~1,000
7	Electric Propulsion System	350~2,000
8	Others (Fan, M-G set etc.)	10~40

* We have 723 sets supply record of VVVF for above major usages (10kW - 2000kW).

Incase of applying VVVF system to deck machinery

Induction motor driven deck machinery is consisted of inverter panel (VVVF), induction motor, resistor box, and controller. Speed of drum on deck machinery is controlled steplessly by handle on controller. Energy that is occurred at the time of reeling out anchor

from windlass is consumed by resistor box and revolution speed is controlled.
Since high speed operation (three times) is possible, it is possible to reel up mooring winch with high speed at the time of leaving port.

Below table shows comparison between VVVF control and hydraulic oil control

Comparison Item	Inverter (VVVF) control	Hydraulic oil control
Efficiency	Total Effi. Approx. 90% AC Motor Effi. 95% Inverter Effi. 97% Electric wire Effi. 99%	Total Effi. Approx. 60% Oil pres unit drive Motor Effi.92% Oil pres unit Effi. 85% Oil pres Motor Effi. 85% Oil pres piping Effi.90%
Starting Torque	150%	50~95%
Torque Response	10~20msec	100~200msec
Environmental pollution	None	Concern about oil leaking
Preparation to operation	No warm-up is required	Warm-up is required
Maintenance & Inspection	Almost no consumable parts Easy maintenance	Periodical inspection for cooler, strainer, and LO are required. Observation of oil temp. and quantity are necessary. Removing drain in pipe is required. Countermeasure against incorporation bubble and water into LO are required.

Mitsubishi two-stroke diesel engine -UE-

Hironori Sakabe
Manager, Licensing & Planning Section, Marine Diesel Engine Business Unit
MITSUBISHI HEAVY INDUSTRIES, LTD.

Mitsubishi two-stroke diesel engine - UE -

1. Introduction

The UE engine is original engine of Mitsubishi Heavy Industries, Ltd. (MHI) and MHI is only marine two-stroke diesel engine licensor in Asia. More than a half century has passed since the first UE engine was developed, as shown in Fig. 1 and MHI has long experience both as licensor and manufacturer. The advantages of the UE engine are its high economy, high reliability, and environmental friendliness.

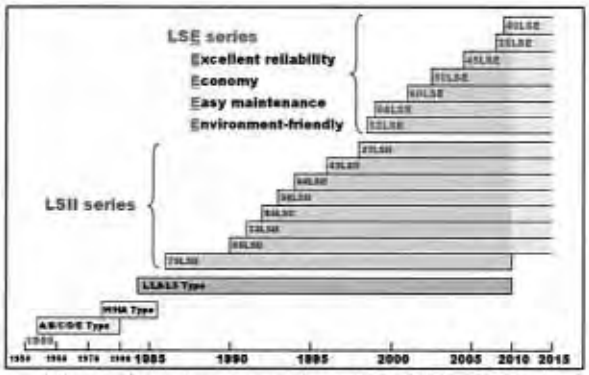


Fig. 1 Development history of UE engines

The crude oil price is keeping high level though it temporally decreased. This means that shipowners have to pay higher operating costs for both fuel oil and lubrication oil. The high economy of the UE engine can contribute to saving those costs.

Needless to say, high reliability is the key issue for the marine two-stroke engine. UE engines received high evaluations from world-wide users at CIMAC conferences.

In addition, IMO-NOx Tier I regulation were implemented in 2005, and the Tier II regulation will come into force in 2011. Of course, all UE engines are fully complied with Tier I regulation and with Tier II regulation except for old type engines. Furthermore, technologies that meet Tier III regulations are continuously being developed.

In addition, UE engine can be installed easier to the ship. Because MHI has in-house shipyard and their demand can be reflected to the design. Also UE engine has better construction to produce, since MHI is not only licensor but manufacturer. Therefore, UE engine is designed to be taken into account the know-how of easy production, which is obtained through manufacturing the engine.

2. Engine Program

Table 1 shows the latest UE engine program. The LSE series, which features excellent reliability, economy, easy maintenance, and environmental friendliness, is being expanded. The LSE engines are more compact and have higher output in order to meet the demands for recent larger and faster ships. Total orders for the LSE series are currently 190 sets, and they are increasing rapidly.

The UEC52LSE is the first engine of the LSE series, and has had a good service record for about eight years. UEC52LSE engines are mainly used for the main engines of 1100 TEU class container ships, Ro-Ro vessels, and Pure Car (Truck) Carriers (PC(T)Cs). UEC68LSE engines are operated as the main engines of Capesize BCs, Aframax tankers, and 2500 TEU class container ships. The UEC60LSE has the appropriate particulars for 1700 TEU class container ships, PC(T)Cs, Panamax BCs, Aframax tankers, etc. We developed the UEC50LSE in collaboration with Wartsila Switzerland in 2005. That was the first collaboration in new engine development between Wartsila Switzerland and MHI. The UEC45LSE is the successor to the UEC52LA and suits Handysize BCs with six cylinders. The first UEC45LSE was completed in Aug. 2008. The UEC35LSE and the UEC40LSE are under development in collaboration with Wartsila Switzerland, following the success of

UEC50LSE development. The first UEC35LSE will be completed in Feb. 2012.

Table 1. Latest program of UE engines

Series		LSII								LSE						
Bore	cm	33	37	43	50	60	75	85	85 C	35	40	45	50	52	60	68
Stroke/ Bore	-	3.2~3.5			3.7~3.9				2.8	4.4		4.1		4.0		
BMEP	MPa	1.7~1.8								2.1	1.96	2.1		1.9		
Piston Speed	m/s	≦ 8.3								8.6	8.0	8.5				

Table 2. shows the latest production record. Totally 4,126 engines are on the order books including licensees. More than 3,800 engines have been already delivered.

Table 2. Production Records of UE Engine

As of Jun. 2009

Engine Type	Ordered	Delivered	Year
A/B/C/D/E	1,406	1,406	1955 ~ 1979
H/HA	429	429	1979 ~ 1985
L	77	77	1984 ~ 1985
LA	1067	1038	1985 ~
LS/LSA	342	329	1986 ~
LSII/LSC	615	511	1987 ~
LSE	190	54	2001 ~
Total	4,126	3,844	–

3. Licensing

The Fig.2 shows world wide UE family network. MHI has been expanding UE family in the world and currently having two licensees in China, one licensee in Vietnam outside Japan. India is one of the most promising areas for future licensing.

Fig. 2 UE Licensing Family

4. Excellent economy

4.1. Low fuel oil consumption

One of feature of UE engine is low fuel oil consumption. Thanks to MHI cutting-edge technologies such as the latest analysis method, Mitsubishi MET turbocharger etc., UE engine can achieve lower fuel oil consumption than other brand engine as shown in Fig. 3. Therefore, shipowners can save running cost by UE engine.

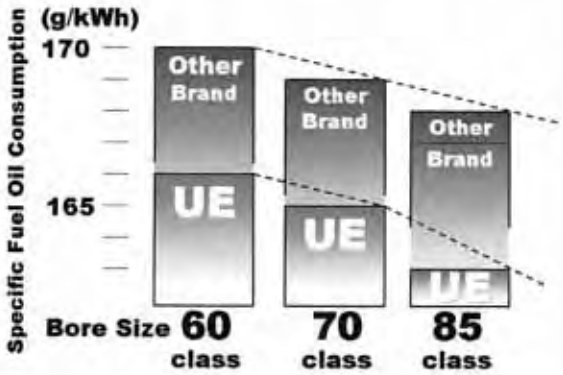


Fig 3. Excellent Fuel Economy of UE engines

4.2.Low Cylinder oil consumption

Shipowners are strongly requesting ways to reduce the cylinder oil feed rate due to high crude oil price. To meet such a demand, ECL system, an electronically controlled cylinder lubricating system, was applied to UE engines. At present, 35 sets of engines that implement the ECL system are already in service.

The ECL system can reduce cylinder oil consumption dramatically via the effective injection to piston ring package. Injection quantity and timing are accurately controlled by solenoid valves. In addition, because of injection mode based on B.M.E.P., cylinder oil consumption at partial load can be reduced in comparison with mechanical cylinder lubricating system. Use of the ECL system can achieve a reduction of the ring and liner wear rate, improvement of the ring and liner condition, and a reduction of particulate matter. Actually, service results have confirmed the good performance. Fig. 4 shows the trend of cylinder oil feed rate for UE engines.

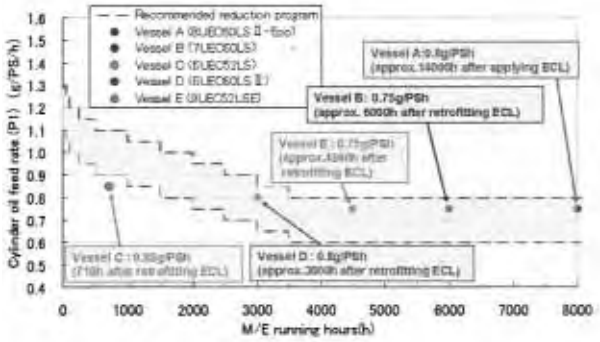


Fig.4 Trend of cylinder oil feed rate

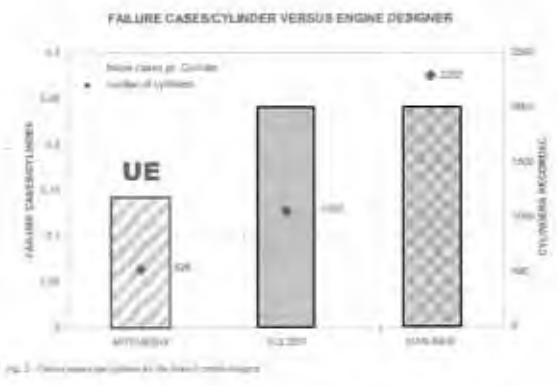


Fig. 6 Failure rate between three brands

5. High reliability

MHI is one of the biggest multi heavy equipments manufactures in Japan, and has more than 700 products such as nuclear power plant, air plane, rocket, ship, etc. In order to develop such products, there are 6 research and development (R&D) centers with 2,000 researchers in house. These R&D centers support to develop the UE engine with the latest technologies. In addition, Mitsubishi MET turbochargers, which greatly contribute to the engine performance, are developed and manufactured in-house as MHI original brand as well as UE engine.

Consequently, in-house technologies mentioned above leads high reliable engine shown as Fig. 5.

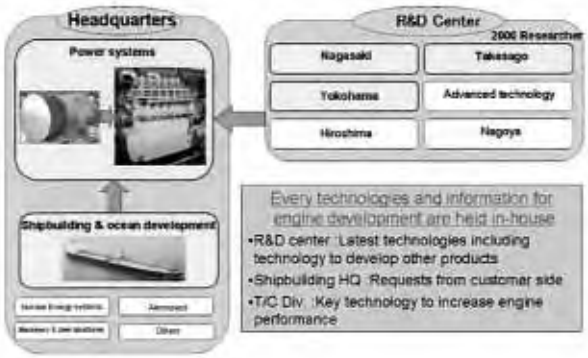


Fig. 5 Development scheme of UE Engine

Fig. 6 shows the failure rate between three brands of two stroke marine diesel engine reported by worldwide major ship owners in CIMAC 2004, Kyoto. It clearly says that failure rate of UE engine is lowest. This means UE engine has higher reliability.

6. Environmentally Friendly

IMO-NOx Tier II regulation will come into force on Jan. 1. 2011. Application technologies to comply with Tier II regulation are shown in Fig. 7. Regarding Tier III regulation, various technologies are being developed, and candidates are also listed in Fig. 7. Selective Catalytic Reduction (SCR) after turbocharger is most practical technology at the moment.

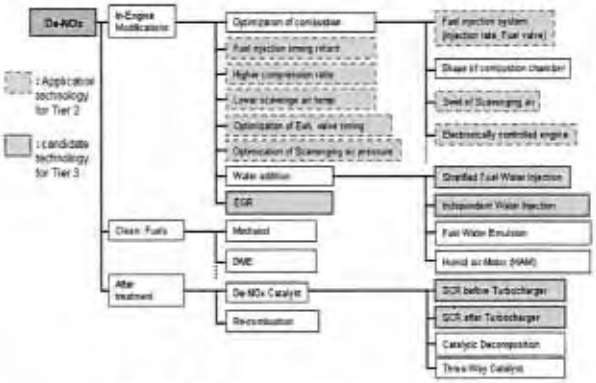


Fig.7 NOx reduction technologies

Electronically controlled engine named UEC Eco-engine is effective to reduce NOx emission, UEC Eco-engine has been developed since 1988, and the first UEC Eco-Engine, the 8UEC60LSII-Eco, entered service in June 2005 as the main engine of a PCTC, as shown in Fig. 8 and Fig. 9. It features smokeless operation, low fuel oil consumption, and stable operation for all load ranges in addition to low NOx emission.

Fig. 8 The first UEC Eco-Engine;
8UEC60LSII-Eco

Fig. 9 PCTC installed with 8UEC60LSII-Eco

The UEC Eco-Engine controls fuel injection quantity and timing by solenoid valves instead of the camshaft. Also, the exhaust valves and starting air are controlled by solenoid valves. Timing control of fuel injection and exhaust valve opening/closing greatly contribute to the engine performance in terms of NOx emission and fuel oil consumption for all load ranges.

Thanks to above characteristics, NOx can be reduced by 15% without any fuel oil consumption penalty in case of low emission mode. If the economy mode is selected, fuel oil consumption can be reduced at below normal load range with the same level of NOx emissions as conventional engine.

Smokeless and stable operation is another advantage of the UEC Eco-Engine, especially at low load. Since the UEC Eco-Engine can inject fuel oil at a higher pressure than conventional engines at low load, combustion characteristics can be improved. As a result, smoke can be significantly reduced, as indicated in Fig. 10. Also, the engine can be operated stably without engine speed fluctuations even at low load.

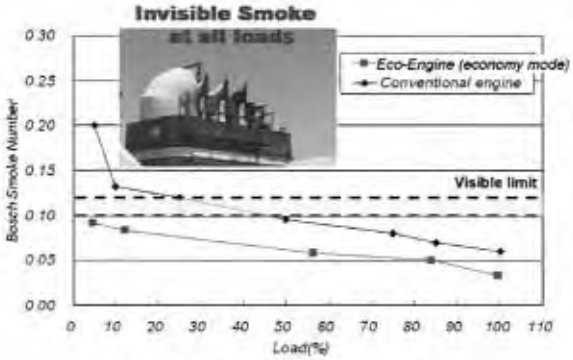


Fig. 10 Smokeless operation
by UEC Eco-Engine

The first UEC Eco-Engine, the 8UEC60LSII-Eco, has been operating without any serious problems. Some small problems that arose at initial stage were resolved, and no shut downs have occurred so far, as shown in Fig. 11.

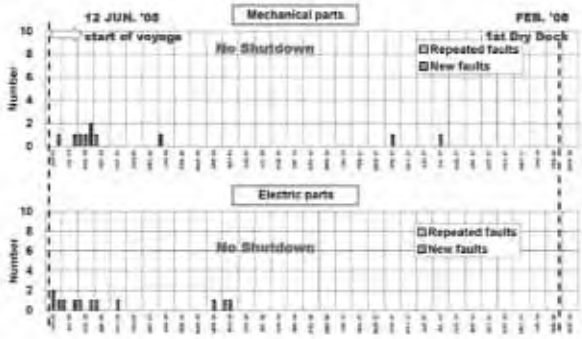


Fig. 11 Failure record of first UEC Eco- Engine

7. Conclusion

Mitsubishi UE engine features;

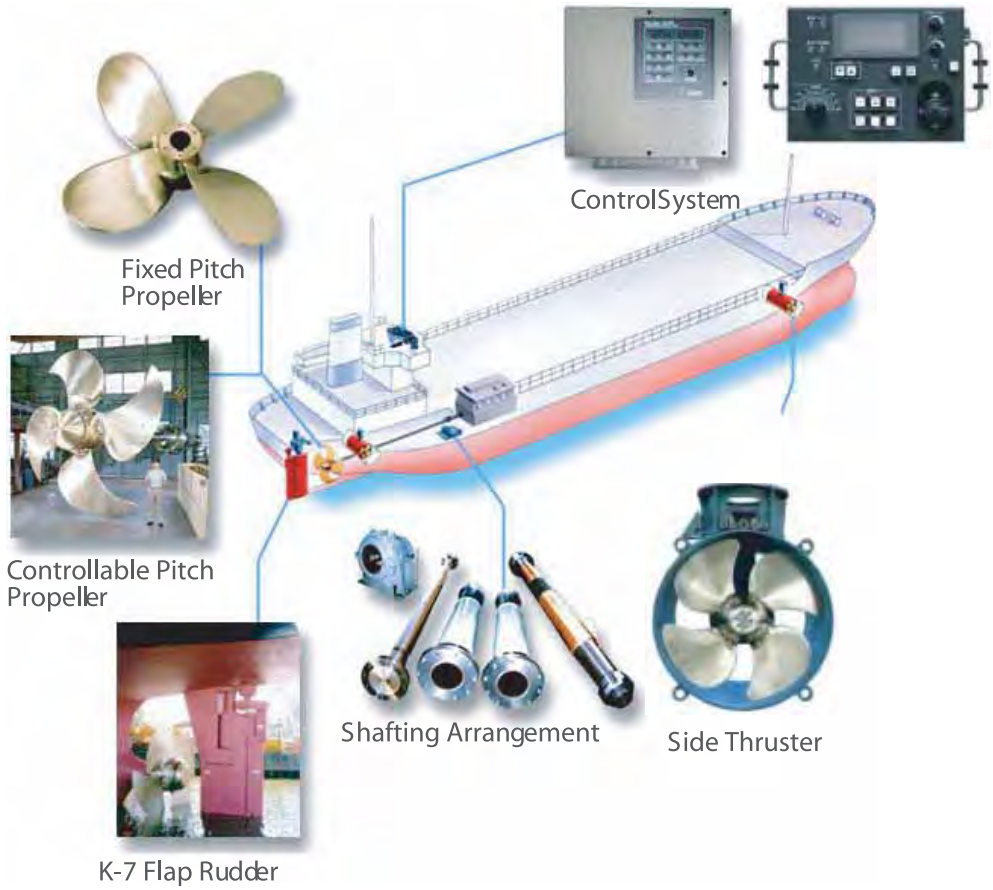
-.Long history and sufficient experience
-. High economy and High reliability
-. Eco friendly engine for green earth

Indroduction of Kamome Propeller and Applications

Hiroshi Itazawa
President
KAMOME PROPELLER CO., LTD.

Company Profile & Products

Kamome Propeller Co., Ltd., founded in 1924, has a long history of over 85 years, specialized in manufacturing marine propellers, including controllable pitch propellers, fixed pitch propellers, side thrusters and shafting equipment and control software for propulsion and maneuvering systems. Kamome C. P. Propellers have been obtaining a greater market year after year, and since 1961, over 5,000 units have been delivered for all kinds of ships.



Fixed Pitch Propeller (FPP)

The Kamome Fixed Pitch Propeller has a history of over 85 years along with the improvement of ships. Efficiency, economical performance, safety, and livability are the indispensable factors for modernized ships, and propeller are supporting the factors from invisible under the water.

Indeed, our propeller is the result of a collection of Kamome's techniques. Careful design is made for each ship, taking special needs into consideration based on thorough data. Our traditional casting technique and the modern equipment of the NC Blade milling machine are used to further process the products, and finally they are given finishing and grinding with care.

In addition, the blades of CPP are processed by exclusive use NC milling machine, only one of its kind in Japan.

Manufacturing Scope

Diameter : 6,000mm
Finished Weight : 15,000kg
Material : CAC703 (Ni-Al bronze), CAC301 (Mn bronze)

Controllable Pitch Propeller (CPP)

Assembling all of Kamome's original techniques, we developed the Kamome Controllable Pitch Propeller in 1961. For over 48 years, as we listened to our customer's needs, we continued improving and developing the product. This has made it possible for us to supply over 5,000 sets propellers for all varieties of ships, from small ship to large-sized 25,000ps/18,388kW ships. We thank you for your support for our achievements.

Features

1. **Easy to handle**
   Supported by our extensive experience, it is simple and easy to handing of operative performance and construction.
2. **Easy maintenance**
   The propeller is strongly built and thoughtfully designed for assembly and maintenance.
3. **Excellent Economical performance**
   An original control system is operating as the largest condition.
4. **Variety**
   Customers can choose control systems according to suitable type and control method for outfit condition of various kind of vessels.
5. **High performance**
   Continuous investigation of the propeller efficiency and anti-vibration/noise promise you safe and comfortable sailing.

Types

CPC-A, F, BF
Standard Type (oil supply shaft with easy disassembling oil distribution box, and reliable inboard cylinder)
AF - Hub propeller can split into two parts.
BF - Solid type Hub propeller (cannot split)

CPC-M
Type for small type ship (light, easy to handle)

CPC-R
Type for outfitting concentric type reduction gear (easily installed to standard type reduction gear)

CPR-V, H
Type for inserting non-concentric type reduction gear (made compact by taking advantage of non-concentric reduction geared machinery)

Control System

For the propeller to function and perform at its best, we continue our studies to improve the Kamome Control System. It is now regarded as an essential factor for economical navigation. The Kamome Control System is the solution to these various needs.

Types of control system

Optimum Propulsion Control System (CX-300)
CPP Control System (RCA100)
Thruster Control System (KTC100)
Joystick Control System (MACS-KM)
Engine Control System, and others

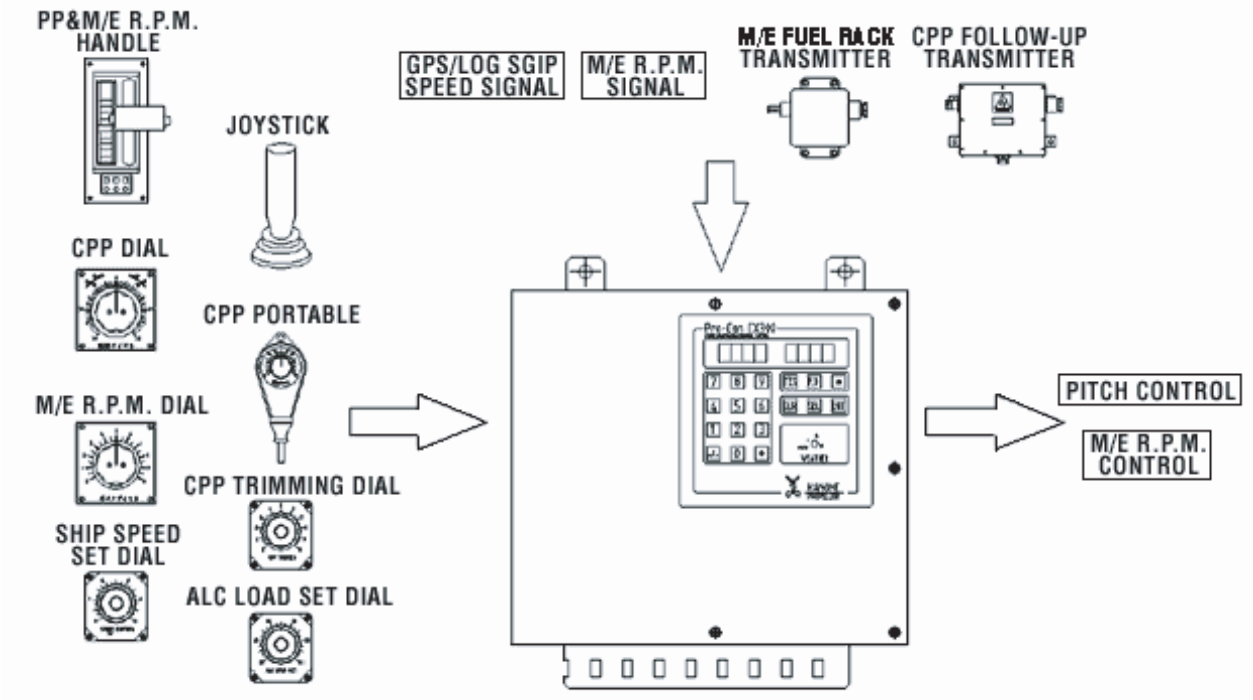
Optimum Propulsion Control System Pro-Con CX300

The Kamome Pro-Con CX300 is designed to perform optimum control of the CPP and as a governor of single CPP per shaft and double CPP per shaft ships.

Features

1. CPP can be controlled at five location, and the main engine at three location
2. Can be easily linked with the Joystick Control System
3. Easy System Expansion
4. Adopts the auto-pilot technique to ALC weather adjustment
5. Alarm code indicator clearly shows parts experiencing trouble
6. Combinator curve corresponds to various navigation modes and can be set for up to 5 modes
7. Governor corresponds to motor-type, air-type, and electronic-type
8. An analog back-up system lets the CPP continue control in times of CPU trouble

Pro-Con CX300



Side Thruster

We have supplied over 3,000 sets of Kamome Side Thrusters since the product was first manufactured in 1966.
Small-sized thrusters are used for working ships and fishing boats, and large-sized units for passenger boats, merchant ships, and various special purpose ship.
We continue to develop our products for special use and conditions, thus making great contributions to the modernization of ships.

Features

1. **Great durability**
   An adopted strong unified drive shafting and durable parts for long-term continuous operation.

2. **Easy fitting**
   Adoption of thick plate duct without rib.

3. **Decreased vibrations and noise**
   Specially designed propeller shape and arrangement.

4. **Rational maintenance**
   Easy periodical inspection; seal can be changed without dismantling the shaft.

5. **Easy control system**
   Compact new control system for exclusive use.

6. **Variety**
   Customers can choose control systems according to the ship equipment and driving conditions.

Type TCB

Type TFA

Types

TCB
Controllable Pitch Propeller Type (driving thrust: from 10 kN to 230 kN)
Drive: electric motor, engine, hydraulic
Arrangement: horizontal and vertical types

TFA
Fixed Pitch Propeller Type (Thrust : from 3 kN to 80 kN)
Drive: electric motor, engine, hydraulic
Arrangement: horizontal and vertical types, small type for in-tunnel suspended installation

TFL
Horizontal one-way discharge (suction from the ship's bottom) Type (Thrust: from 3 kN to 20 kN)

Anchor-handling Tug Supply Vessel

Instllation of KAMOME Products	
Controllable Pitch Propeller	CPC-80AVCN-1 (Nozzle Propeller) 2set
Bow Thruster	TCB-90MA (Thrust Power 79.4kN) 2set
Stern Thruster	TCB-90MA (Thrust Power 79.4kN)

Ro-Ro Ship

Build by	Yamanishi Corporation Hull No. 1027
Gross Tonnage	12,700 tons
Length Overall	160.56 meters
Main Engine	15,886kW(21,600PS) 430/160min^{-1}
Instllation of KAMOME Products	
Controllable Pitch Propeller	CPC-160BRN (Dia. 5,400mm)
Bow Thruster	TCA-185S (Thrust Power 176.5kN)
Stern Thruster	TCA-185S (Thrust Power 176.5kN)
K7 Flap Rudder	K7-M1400
Control System	Pro-Con CX-300 & MACS-1111

THE FUTURE OF MARITIME SATELLITE APPLICATIONS

JRC's development of INMARSAT service

Tetsuya Murata
Manager, Business Planning Group, Marine Electronics Division
JAPAN RADIO CO., LTD.

Manuscript of presentation to be held in Mumbai

1. Cover Page (Page 1);

First of all, we appreciate for giving us opportunity to introduce our new product in this seminar.
We are Japan Radio Company and we are handling marine radio & navigation equipments.
My name is Tetsuya Murata. Iím in charge of the marketing working at the Marine Electrical Division of JRC Tokyo.
We would like to introduce Inmarsat Fleet Broadband which is provided the high speed broadband communication on the vessel. This is the latest satellite communication technology.

2. Table of Contents (Page 2);

I would like to talk about Fleet Broadband system.
This is contents of my presentation
- Company overview
- Inmarsat Fleet Broadband (What is the Fleet Broadband.)
- Inmarsat Fleet Broadband FB250
- Inmarsat Fleet Broadband FB500
- Inmarsat Fleet Broadband Typical Maritime Applications

3. JRC's Four (4) Business cores (Page 3);

I would like to introduce for JRC's business core briefly.
We are one of the world's longest established companies in the field of marine electronics since 1915.
We have four business core divisions. JRC supports to whole communication business in Land, Marine and Avionics.
- Communication Equipment Division for Mobile Communication for example.
- Solution Business Division for Water and River Management system for example.
- Special Equipment Division for Defense equipment for example.
- Marine Electronics Division for high seas, light marine and fishing

I'm working in the Marine Electronics Division.
You can understand that JRC covers whole range of the communication business range.

4. Business Domain for Marine Electronics (Page 4);

I would like to explain our business domain for marine electronics.
The vertical line is indicated the market areas. The horizontal line is the business range.
For the market area, we have the High Sea area for Merchant vessels, the fishing area for fishing vessels and the pleasure are for leisure boats. For the business range, we have the communication range such as Inmarsat and radio communications, the Radar/Navigation range such as radar and GPS receiver, the Ocean logy range such as super sonic system and sonar, the Maritime System range such as the on-board network system.
We constantly keep the latest technology. We have the Solid State Radar for example.

5. Inmarsat Fleet Broadband (Page 5);

Inmarsat operates the satellite communications system used by most of the world's merchant shipping fleet. Inmarsat is using the L-band satellite. This is the most stable system for the global maritime mobile satellite system.
And, Inmarsat started Fleet broadband system since 2007 that is the highest speed communication system of the Inmarsat services. This service covers full range maritime applications. So, I would like to explain this fleet broadband system.

6. Next Generation Satellite Communication (Page 6);

This slide shows the Inmarsat satellite. Inmarsat system was started since 1975. The system is

changed from Analogue to Digital. And, the communication speed is increasing from 9.6Kbps to 456kbps such as 0.5Mbps. So, the speed is increasing and the capability is also increasing. However, the air time fee such as the communication price is decreasing. It is very effective to ship's owners and operators.
We have full range Inmarsat productions. The JRC's Inmarsat-A terminal was the most famous terminal in the world.

7. What is FBB (Page 7);

I would like to explain "what is FBB".
- Fleet Broadband (FBB) is Global satellite communication system for vessels.
- Extended system of Land BGAN to maritime.
  (Motion compensation, Automatic antenna tracking, Spot beam hand over, etc.)
- Same services are provided as Land BGAN system.
- Higher data communication rate compare with Fleet system.
  (Fleet :Up to 64Kbps -> FBB: Up to 432Kbps)
- FBB system is distinguished by several characteristics, FB250 & FB500.

8. Service of Fleet Broadband (Page 8);

I would like to explain "Service of Fleet Broadband".
The Fleet Broadband system has the data communication, the voice communication.
The data communication has 3 kinds of the communications. One is the standard IP communication system. This is the packed switched system. The data speed 432kbps for Fb500, 284kbps for FB250. This system is the best effort type. So, the data speed is changeable according to the number of the users. The next is the streaming IP communication system. This is also the packed switch system. This system is using the guaranteed data speed such as fixed speed system. This system is using the video conference usually. The final one is the ISDN communication system. This is the circuit switched communication system that is different from the packet switched system.
This system is using the ISDN applications and the G3 facsimile communication. I would like to say the key point of the G3 fax. The airtime fee of the G3 fax is expensive than the fleet and Inmarsat-B. It is about 3 times higher. Because, the G3 fax system has to need the same bandwidth as ISDN. Of course, the Fleet Broadband supports the voice communication including the GSM Short Message Service such as SMS. The SMS can be managed 160 characters max. The advantage of the Fleet broadband voice communication is simultaneous with data communication.
I would like to explain the airtime fee. How can we calculate? The Standard IP is calculated by the volume charge. The other services are calculated by the time charge.

9. Comparison FB250 and FB500 (Page 9);

There are 2 kinds of system in Fleet Broadband.
The different points are the antenna size, the data speed and ISDN service. For the antenna size, FB250 is 35cm, FB500 is 70cm. Why is the antenna size is different? The reason is that the data speed is different. For the Standars IP, FB250 is 284kbps and FB500 is 432kbps. It's about 2 times difference. For Streaming IP, FB250 is 128kbps max and FB500 is 252kbps. It's also 2 times difference. The FB250 does not support ISDN.

10. Fleet Broadband Coverage (Page 10);

Fleet Broadband system is using the 4th generation Inmarsat satellite such as I4 satellite. I4 satellite cover all over the world by using 3 satellites. 3 satellite locate on America, Europe and Asia Pasific. There are 2 land station to access to satellites. One is located to Hawaii for America satellite and Asia Pacific satellite. One is located to Netherlands for Europe satellite. And, final one is located to Italy for backup.

11. Inmarsat Fleet Broadband FB250 JUE-250 (Page 11);

So far, I explained Fleet Broadband system. I would like to explain JRC production for Fleet broadband terminal. We have 2 types Fleet Broadband terminal, FB250 and FB500. Type of FB250 is JUE-250. And, type of FB500 is JUE-500. I would like to explain the JUE-250 first.
For your information, we already delivered over 500 JUE-250 terminals to the customers.

12. JUE-250 Above Deck Equipment (Page 12);

The Inmarsat antenna technology is one of the unique sales points in JRC. We have been designing the Inmarsat antenna since we started the Inmarsat business. The other manufactures are using the 3rd party's antenna. So, we can provide whole Inmarsat productions made by Japan and JRC. it means that we provide the high performance and the total controlled quality productions to the customers.
This is our JUE-250 antenna. This antenna has the high reliable, In house electrical and mechanical design. The diameter and the height of radome are 35cm each. The weight is 7.4KG. This is very small and right weight antenna. And, the cable between the antenna and below deck equipment is the single coaxial cable. It's very simple installation. This antenna is very simple and easy installation production. The other sales point is no gyro signal. The antenna is tracking to the satellite by the satellite signal strength, the built-in GPS receiver and some sensors.

13. JUE-250 Above Deck Equipment (Page 13);

I would like to show you the demo video for the antenna. We tested this antenna in Tokyo bay.

14. JUE-250 Below Deck Equipment (Page 14);

This is the JUE-250 Below Deck Equipment. The transceiver and the receiver are in this unit. This is also JRC's unique design production. The JUE-250 installs a lot of the connectors for multi communication hub. There are RJ-45 LAN and USB connectors for computers, RJ-11 for telephones. The SIM card slot is located the front cover that is located behind of this picture. The size is 166mm height, 221mm wide and 64mm depth. It's very small terminal such as the data modem. We are using the handset for the voice communication and the system control. This is the multi function telephone unit.

15. JRC Fleet Broadband JUE-250 (Page 15);

This slide indicates the standard configuration wiring of JUE-250. It's very simple wiring. There are the ADE such as antenna, BDE such as Transceiver/receiver, Handset and coaxial cable as standard. For the options, there are the Power Supply Unit, PC, Telephone and Fax. The power source of JUE-250 is DC24V. When the power source is AC, the AC/DC power supply unit has to nee.

16. JUE-250 Launch-Pad Screen (Page 16);

This is the Launch-Pad screen. The Launch-Pad is the operation software that is designed by Inmarsat. The price is free of charge. Inmarsat designed this software for the common operation software for any brands of Fleet Broadband terminal. The Launch-Pad detect the manufacture and the type automatically when the pc is connected to Fleet Broadband terminal.
The operation is not changed even if the customer will change the manufacture from JRC to the others .

17. Installation Example for JUE-250 (Page 17);

This is the installation example for Above Deck Equipment. We installed the container vessel. The JUE-250 is located to the compass deck. The Antenna is very small and light weight. So, you can install the JUE-250 antenna anyplace.

18. Installation Example for JUE-250 (Page 18);

This is the installation example for Below Deck Equipment such as BDE in the bridge. The BDE is very small and light weight also. So, you can install the JUE-250 BDE anyplace.
This slide shows the wall mounted installation example. The BDE can install to the wall mounted installation and the desktop mounted installation.

19. Inmarsat Fleet Broadband FB500 JUE-500 (Page 19);

I would like to explain the Inmarsat Fleet Broadband JUE-500 that is next opportunity for the highest speed broadband communication on the vessel. The data speed is 432Kbps maximum that is the highest data communication system in Inmarsat service. And, the JUE-500 supports ISDN 64Kbps digital data communication and the streaming 256kbps data communication.
The sales points of JUE-500 are the high reliable antenna design and the in-house electrical and mechanical designs.

20. JUE-500 Above Deck Equipment (Page 20);

This is our JUE-500 antenna. This antenna has the high reliable, in house electrical and mechanical design. The diameter of the radome is 70cm. The weight is about 18KG. This is very small and right weight antenna compared with Fleet F77 and Inmarsat-B termnals. And, the cable between the antenna and below deck equipment is the same single coaxial cables as JUE-250. It's very simple installation. The JUE-500 is more effective system and more economical system than the Fleet F77 and Inmarsat-B.

21. JUE-500 Below Deck Equipment (Page 21);

This is the JUE-500 Below Deck Equipment. We design the JUE-500 that has same design concept as the JUE-250 except the external option interface. We understand that the JUE-500 will be installed to the merchant vessels for the new building and the retrofit. So, the JUE-500 has to need more wide range of the external option units. The JUE-500 installs a lot of the connectors for multi communication hub. There are RJ-45 LAN and USB connectors for computers, RJ-11 for telephones. The SIM card slot is located the front cover that is located behind of this picture. The size is 166mm height, 221mm wide and 64mm depth. We are using the handset for the voice communication and the system control. This is the multi function telephone unit.

22. JRC Fleet Broadband JUE-500 Standard Requirements (Page 22);

This slide indicates the standard configuration wiring of JUE-500. We have two options for JUE-500 configuration. One is the standard requirements configuration. The other one is the full requirement. The standard configuration is same configuration as the JUE-250 terminal. When the customer will request the minimum requirement to JRC, we will recommend this configuration.
There are the ADE such as antenna, BDE such as Transceiver/receiver, Handset and coaxial cable as standard. For the options, there are the Power Supply Unit, PC, Telephone and Fax. The power source of JUE-500 is DC24V. When the power source is AC, the AC/DC power supply unit has to nee.

23. JRC Fleet Broadband JUE-500 Full Requirements (Page 23);

This slide indicates the full configuration wiring of the JUE-500. We can provide the Option Interface Unit such as OIU. When the OIU will connect to the JUE-500, the external options such as the external buzzers, remote telephone units are able to connect to the JUE-500. This idea is the most effective for the new buildings and the Inmarsat-B up-garde.

24. Installation Example for JUE-500 (Page 24);

This is the installation example for Above Deck Equipment. We installed the passenger vessel. The JUE-500 is located on the deck. The Antenna is smaller size than the Inmarsat-B and the Fleet F77 antennas. So, you can install the JUE-500 antenna more easily.

25. JUE-250 Communication Vodeo Compare with JUE-410F Fleet F77 (Page 25);

I would like to show you the JUE-250 communication video compare with JUE-410F Fleet F77.
Left side is JUE-250 and Right side is JUE-410F Fleet F77.
The JUE-250's speed is about 284kbps. The JUE-410F speed is about 64kbps.
You can understand what is the different.

26. Inmarsat Fleet Broadband Typical Maritime Applications (Page 26);

The high speed broadband system, Inmarsat Fleet Broadband can use to any maritime applications. I would like to explain the example of the applications. So, how can we use the Fleet Broadband? I would like to explain 3 kinds of the applications. 1st one is the bridge communications such as the common / official communication. There are voice, E-mail, Download the latest weather and electrical map, video conference and the file transfer. 2nd one is the operational communication applications such as the ship's control and maintenance communication. There are the remote access, the engine monitoring, the cargo tracking and the IT maintenance and upgrades. 3rd one is the Social/Crew communication such as the welfare communication. There are the personal voice, E-mail, SMS and Internet access. So, the Inmarsat Fleet Broadband system is able to use any applications on the vessel with cheaper
communication fee.

27. Ending (Page 27);

Thank very much for your listing.
We hope you all understood our Inmarsat Fleet Broadband productions.
Presently, our company provides the clock service for 24hours to our customers by using network among our Tokyo office, Amsterdam branch and Seattle branch.
We believe satisfied equipment quality and services are available.
We appreciate very much if you could consider our Fleet Broadband terminals to your vessels.
We really appreciated your attending this presentation today.