ASEF

Asian Shipbuilding Experts' Forum
for International Maritime Technical Initiative

Current Development of Shipbuilding Technology - Japan

Dave (Hiroshi) IWAMOTO
Chairman of International sub-Committee, SAJ

THE SHIPBUILDERS' ASSOCIATION OF JAPAN

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IHIMU Environmentally Friendly Ship
eFuture Series

30% reduction of GHG is attained by integrating the technology of IHIMU

eFuture 13000C
(Container Vessel)

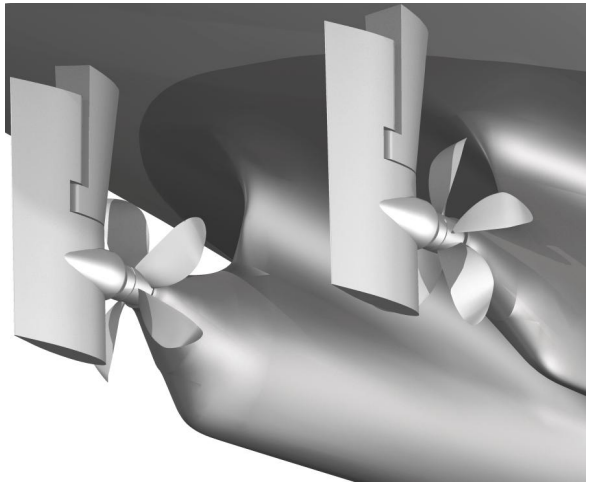
eFuture 310T
(VLCC)

eFuture 56B
(Bulk Carrier)

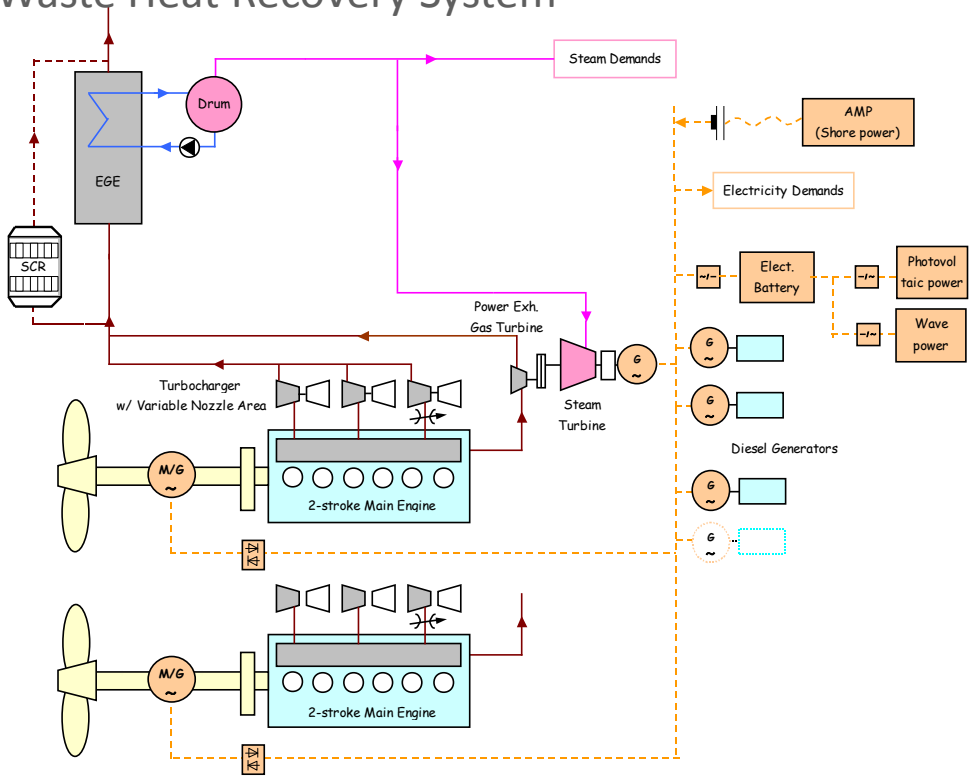
eFuture 13000C

- Twin-skeg Hull Form
- Tip Raked Propeller and Rudder Bulb
- Front Bonnet
- Waste Heat Recovery System
- Photovoltaic Panel and Lithium Ion Batteries

Tip Raked Propeller and Rudder Bulb

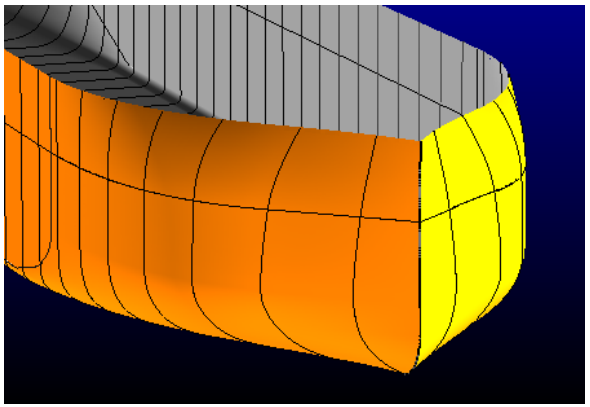


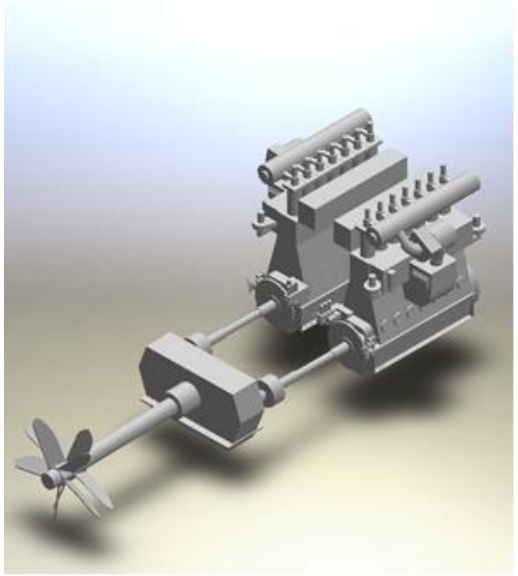
Waste Heat Recovery System



eFuture 310T, eFuture56B

- Advanced Contra Rotating Propeller
- Tip Raked Propeller, Rudder Bulb and Semicircular Duct
- Waste Heat Recovery System
- Whaleback Bow
- AR Vane





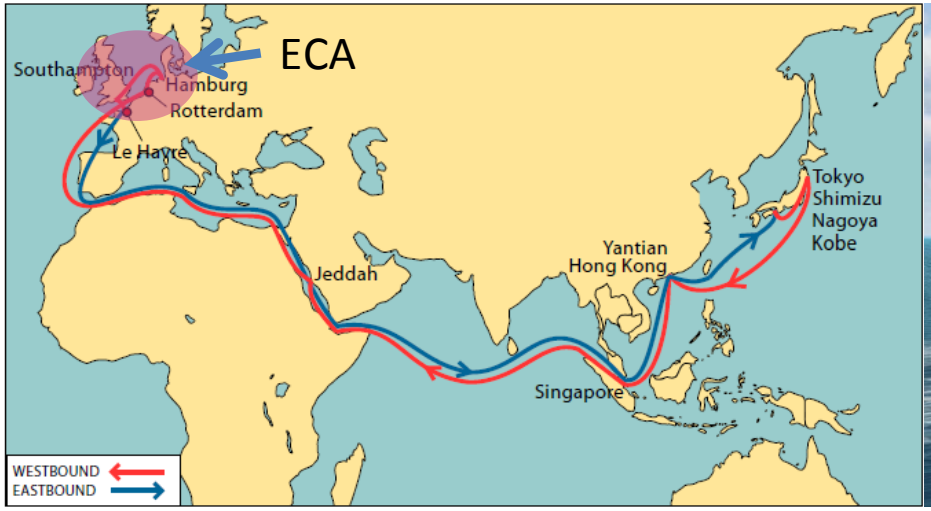
LNG-Fuelled Large Container Vessel (1)

Approval in Principle

IHIMU has obtained GL AIP for LNG Fuelled 13,000 TEU eFuture Container Ship

Concept

- **Service route : Far East - North Europe**
- **Fuel : LNG for ECA abt.2,000miles, Fuel Oil for Global abt.18,000miles**
- **LNG tank room and compressor room are arranged to minimize container losses**



Service Route

LNG Fuelled 13,000TEU Container Ship

LNG-Fuelled Large Container Vessel (2)

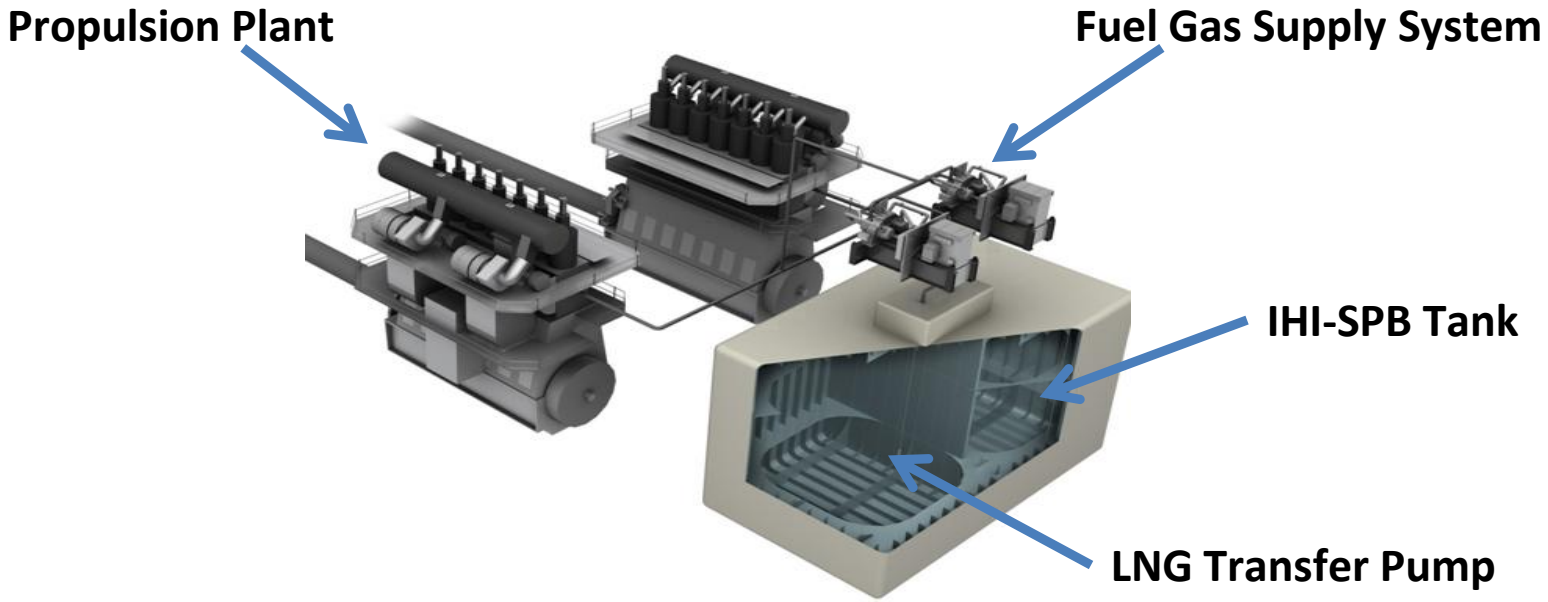
Main dimensions

Loa: 330.0 m, Bm: 48.2 m, Dm: 27.0 m

Minimized Container Loss

Fuel Gas Supply System

-Submerged type LNG transfer pump is provided inside of tank
-Fuel gas supply system is arranged on the tank top
-High / Low pressure LNG supply system can be available
-Boil off rate can be adjustable



Concept Design of LNG Bunkering Ship (1)

Basic idea of LNG bunkering ship

Kawasaki's small scale LNG carrier

+

Special equipment onboard
(in comparison with small scale LNG carrier)

Design issues

1. LNG tank
2. Propulsion system
3. LNG bunkering interface with LNG receiving ships
4. Special equipment onboard

Concept Design of LNG Bunkering Ship (2)

Design issues and solutions

1. LNG tank

Tank type : Type B or Type C ?

Material : Aluminum or Stainless steel or 9% nickel steel ?

Requirement : ・Flexibility in partial cargo loading

・Low cost and weight, etc.

2. Propulsion system

Engine type : DFD mechanical or DFDE or Gas engine etc…

Requirement: ・High efficiency

・Redundancy, etc.

3. LNG bunkering interface with LNG receiving ships

By Loading arm or By Flexible hose ?

4. Special equipment onboard

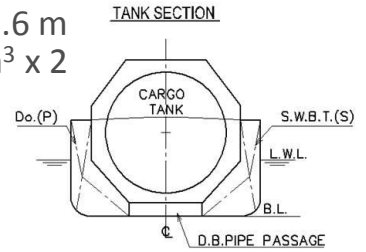
Transferring boil-off gas to main engine(s)

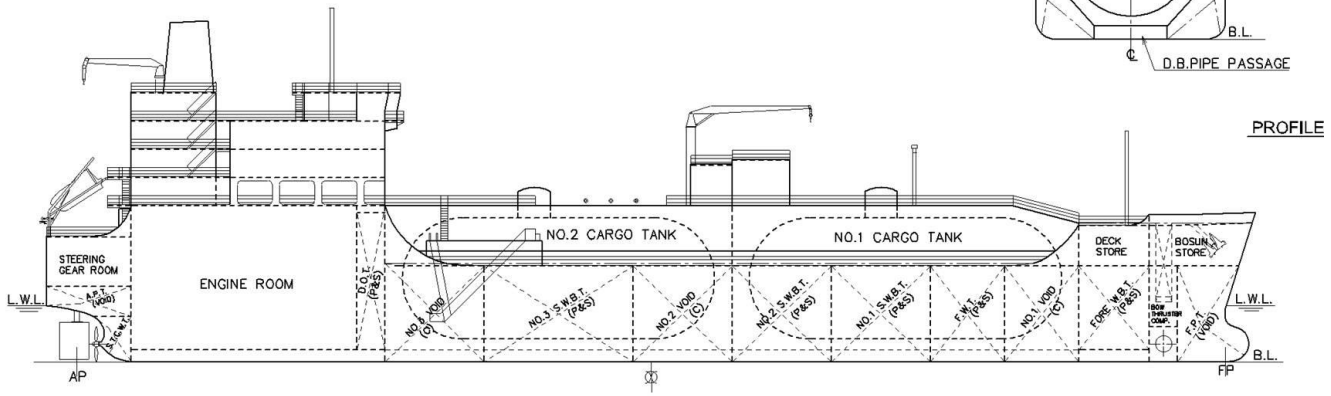
Bunkering LNG fuel to receiving ship

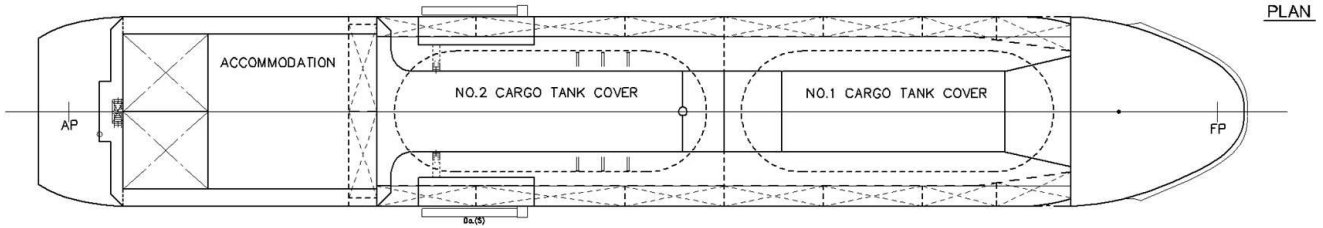
Concept Design of LNG Bunkering Ship (3)

6,000m^3 type LNG fuel bunkering ship

Loa	: about	120.0 m
Lpp	:	114.0 m
Bm	:	18.8 m
Dm	:	9.5 m
Design draft	:	5.6 m
LNG tank	:	3,000 m^3 x 2



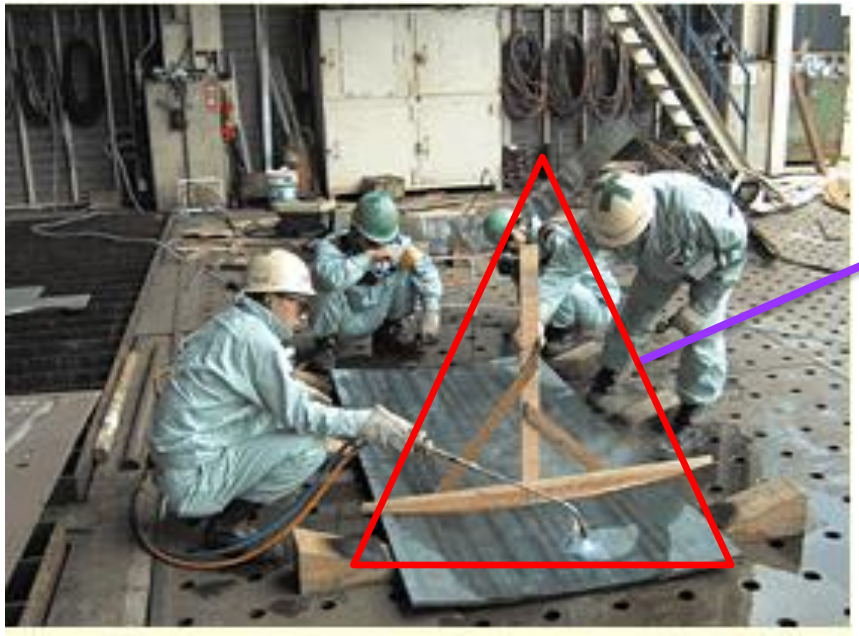




DEVELOPMENT OF THE ALGORITHM FOR ACCURACY EVALUATION SYSTEM FOR CURVED SHELL PLATES BY LASER SCANNER (1)

N.Nakagaki, A.Sugawara,
Sumitomo Heavy Industries Marine & Engineering Co.,Ltd., Japan
K.Hiekata, **H.Yamato**,
M.Enomoto and **K.Takahashi**,
The University of Tokyo, Japan

- Curved shell plates are deformed plastically by application of heat, and water-cooled based on wooden bending templates.
- The accuracy of the measurement depends on experience of craftsman.



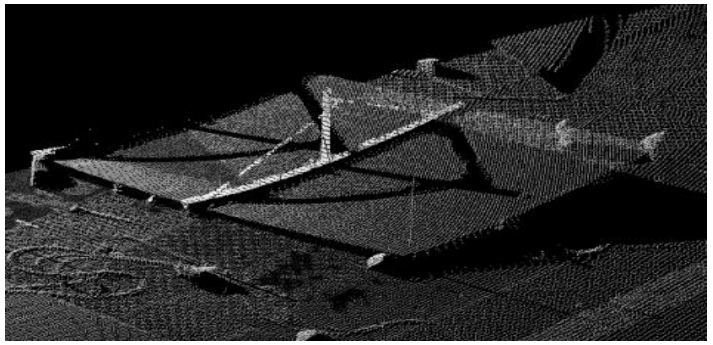
DEVELOPMENT OF THE ALGORITHM FOR ACCURACY EVALUATION SYSTEM FOR CURVED SHELL PLATES BY LASER SCANNER (2)

- The laser scanner is able to measure a multiple number of points at a time.
- It requires a little measurement cost in range of desired accuracy.

	FARO Photon 80
Type	Phase-based
Scan rate	120,000 points/sec
Laser Class	3R
Range	0.6m-76m
Distance Error	±2mm at 25m

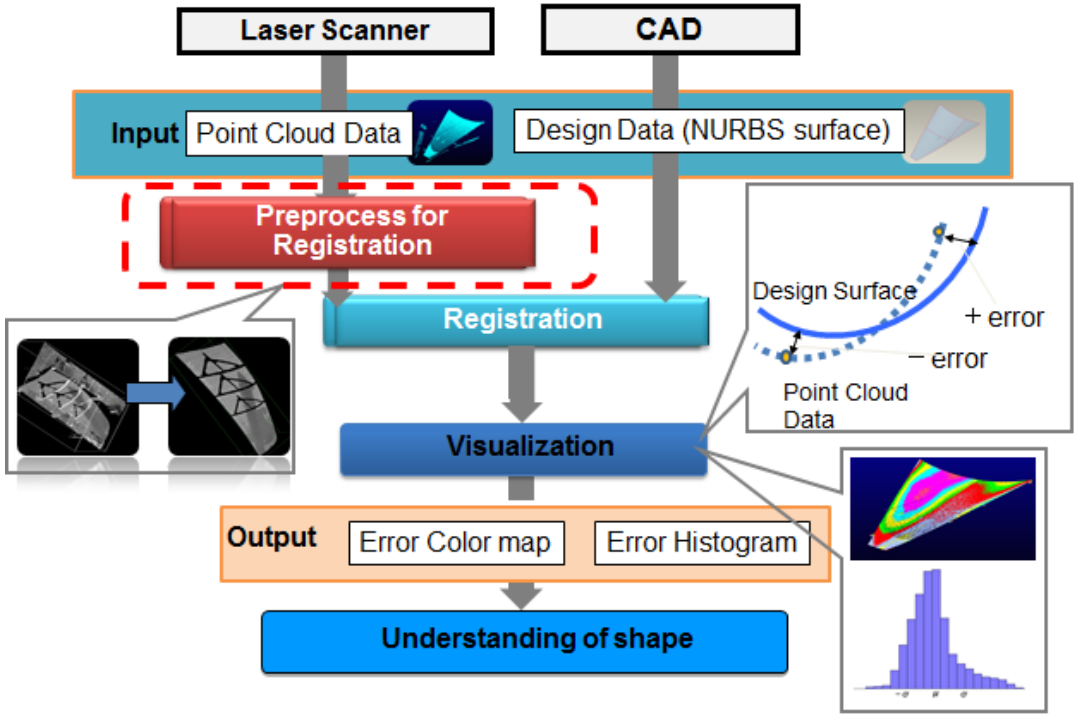
— Accuracy (±2mm @25m distance)
— able to get whole surface at one time

Output: Point Cloud Data



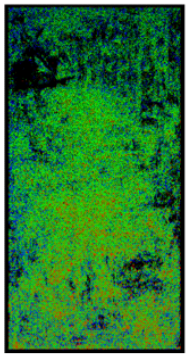
DEVELOPMENT OF THE ALGORITHM FOR ACCURACY EVALUATION SYSTEM FOR CURVED SHELL PLATES BY LASER SCANNER (3)

- Improve the accuracy evaluation system for curved shell plates using laser scanners
  - Employ new algorithm based on ICP(Iterative Closest Point) for comparison of measured data and design data
  - calculation and visualization of the error
- Verify the proposed system in practical use through experiments at a shipyard.

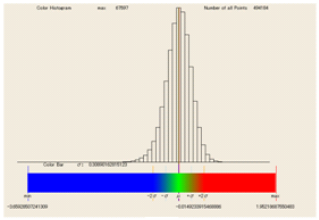


DEVELOPMENT OF THE ALGORITHM FOR ACCURACY EVALUATION SYSTEM FOR CURVED SHELL PLATES BY LASER SCANNER (4)

- An accuracy evaluation system for curved panel plates using design data and point cloud data was developed.
- Validity of the proposed system in practical use is demonstrated.
  - ICP algorithm is used for registration, and it made the process of calculation simple and robust.



a

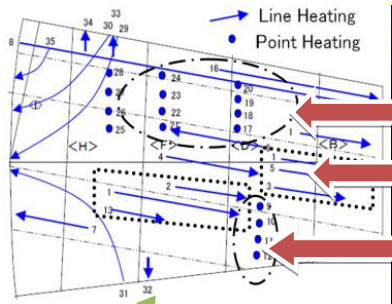


b

Number of points	494,184
Max error (positive)	1.95mm
Max error (negative)	−3.66mm
Average of error	−0.015mm
Standard deviation	0.31mm

c

99.7% (-3 σ to 3 σ range) of all the points is within the -0.932mm to +0.929mm range.



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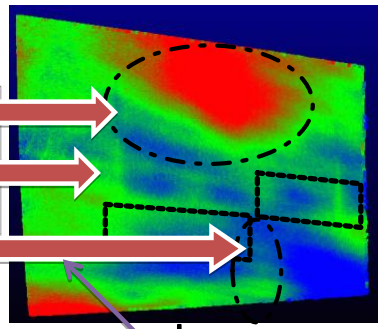


b

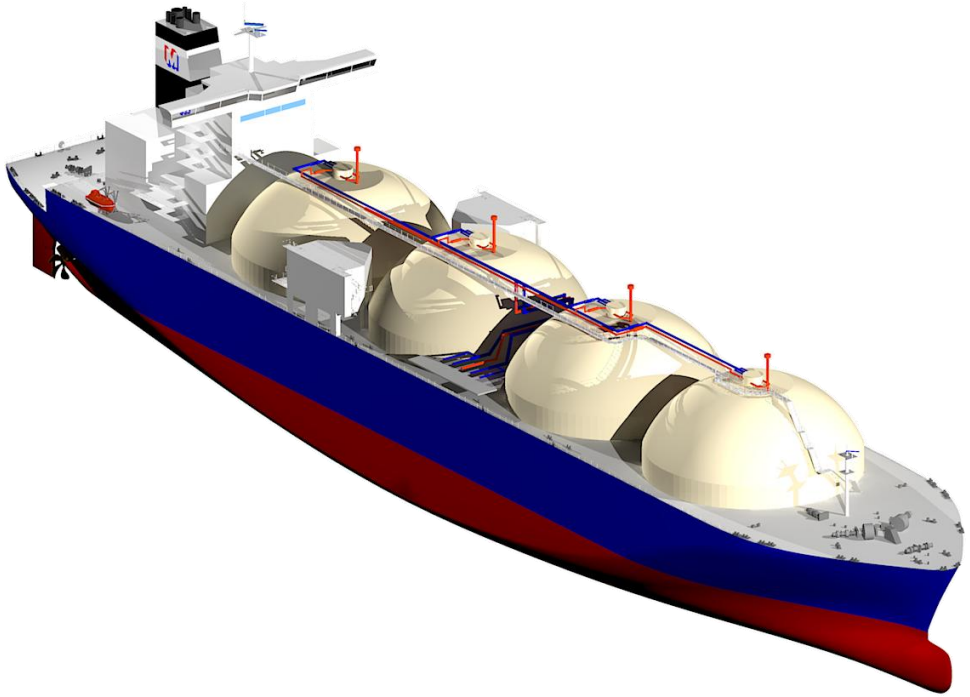
- heating log

correspondence between the heating log and the result figure of our system

Mitsui New Generation LNG Carrier

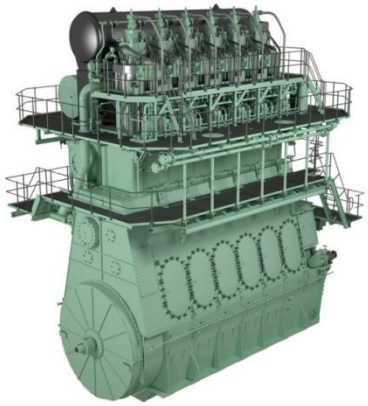
Double Eco MAX

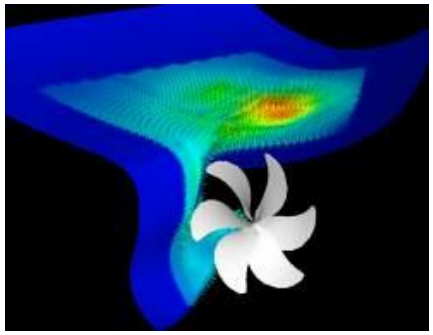
Economical & Ecological LNG Carrier evolves the LNGC market !!

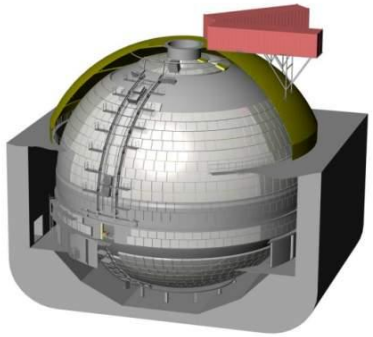


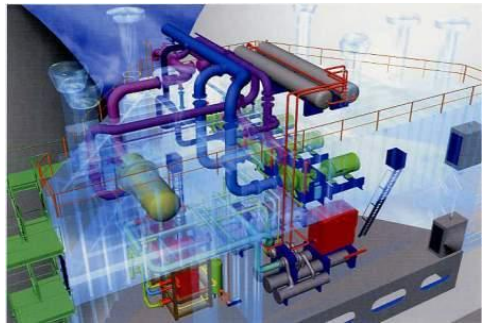
Technical Feature of Double Eco Max

- Excellent hull form and highly efficient propeller is applied
- Cargo Capacity -> max. 180,000 cm3
  - with MOSS spherical or stretched 4 tanks
- Propulsion system -> MEGI – Slow Speed Dual Fuel Engine
  - Highly efficient engine with proven technology
- Boil off gas -> 0.1 % /day boil off
  - TiG Panel System – environmental friendly material is applied.
- Boil off gas Treatment -> Reliquefaction system
  - 100% gas recovery even at lower main engine low load operation
  - with High Pressure Fuel Supply System to MEGI





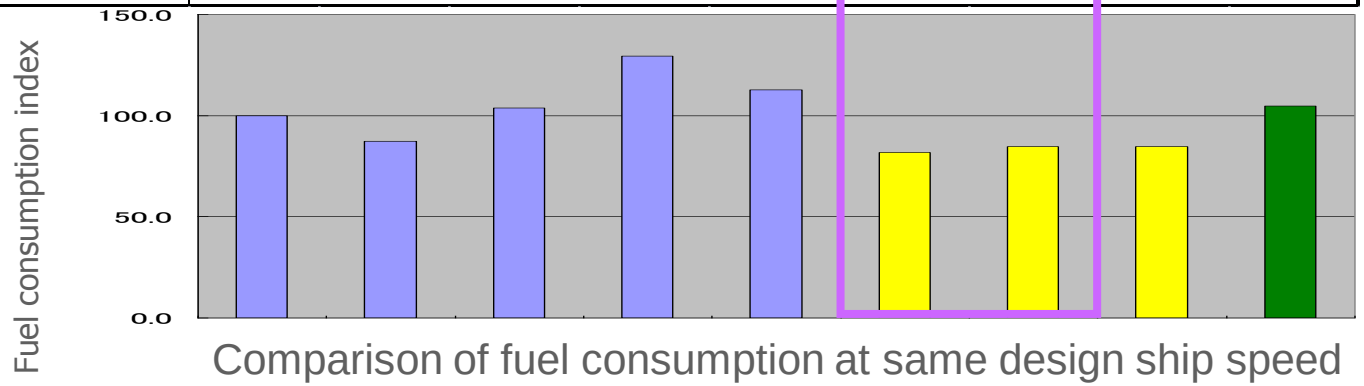




(Hamworthy)

Comparison of fuel consumption between propulsion systems

Cargo Cap. (Cub.m, 100%)	147K		155K (STR)	180K					
L_{OA} x B x D(m)	289.5 x 49.0 x 26.5			300.0 x 52.5 x 28.0					
d(m)	11.3		11.8	11.5					
BOR (%/day)	0.15			0.10					
Prop. Plant	CST	AST	CST	CST	AST	ME-GI	GI+RL	D+RL	DFDE
Shaft No.	1			2					

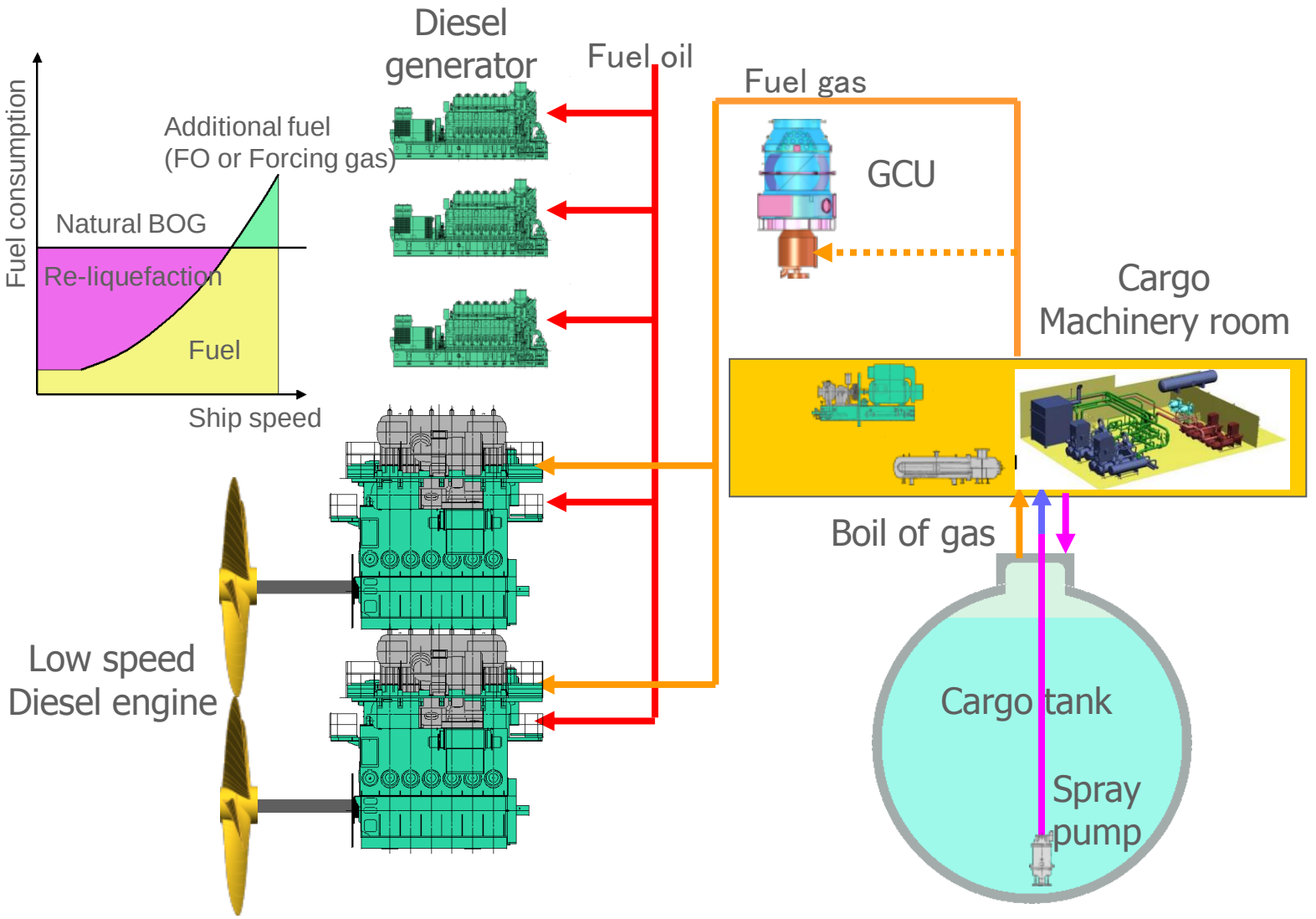


Comparison of fuel consumption at same design ship speed
(Index 100=147K(CST), HFO base)

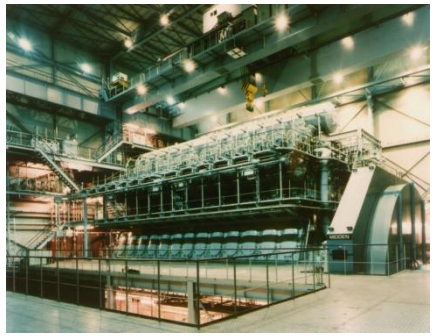
Abbreviations

- Conventional steam turbine (CST)
- Advanced Re-heat steam turbine (AST)
- Dual fuel slow speed gas injection diesel engine (ME-GI)
- ME-GI with Re-liquefaction system (GI+RL)
- Oil burning slow speed diesel with Re-liquefaction system (D+RL)
- Dual fuel diesel electric propulsion (DFDE)

Schematic Diagram of the BOG Treatment / Propulsion System

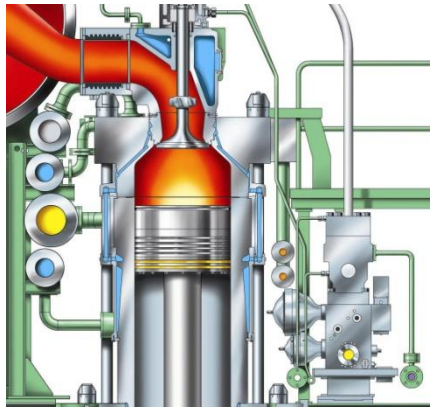


Advantage of MEGI adoption by MES



1. Long run records of 12K80MCGI-S(prototype of MEGI)
   about 20000 hours operation during 1994/2003

2. Technical advantage of MEGI can be highly achieved
   1) Lower SFOC
   2) Direct propeller drive
   3) No knocking
   4) No methane slip
   5) Identical performance of oil & gas burning



3. Risk analysis is on going by MES
   including Fuel gas supply system

4. Full Scale Test of MEGI at MES
   to be planed in March 2013 at Tamano Works

5. Long experience and technical service are utilized as one of top supplier of MAN DIESEL TURBO engines

The Ship of the Year Award 2011

- the world's largest roll-on/roll-off ship "**TØNSBERG** " -

Particulars of the ship

- **Lpp x B x D x d : 250m x 32.26m x 33.22m x 11.0m**
- **Service Speed : abt. 20.25 kn**
- **Gross Tonnage : 74,622**

Capable of carrying high and heavy cargoes

Construction Machinery

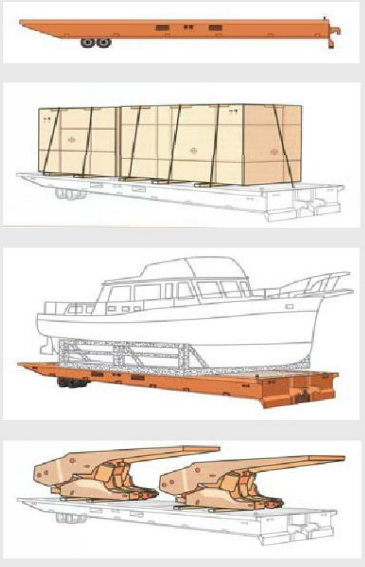
Max. weight 70 t

H&H rolling cargoes on wheel and steel tracks

MAFI trailers

Max. weight 140 t

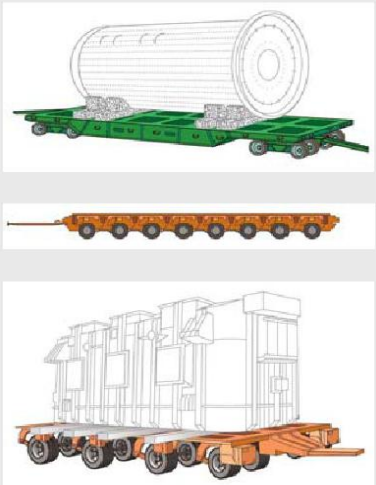
MAFI trailers used to roll non-rolling cargoes onboard. Forklift lifts cargo off MAFI.



Heavy lift trailers

Max. weight 505 t

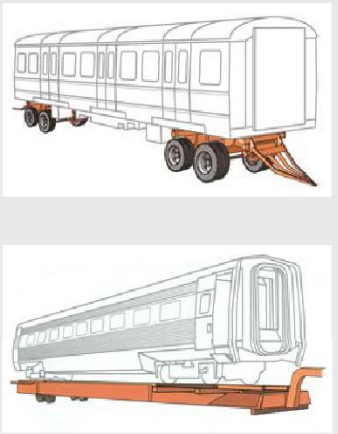
Heavy lift trailers (type Samson, Scheuerle, Cometti etc)



Railcars

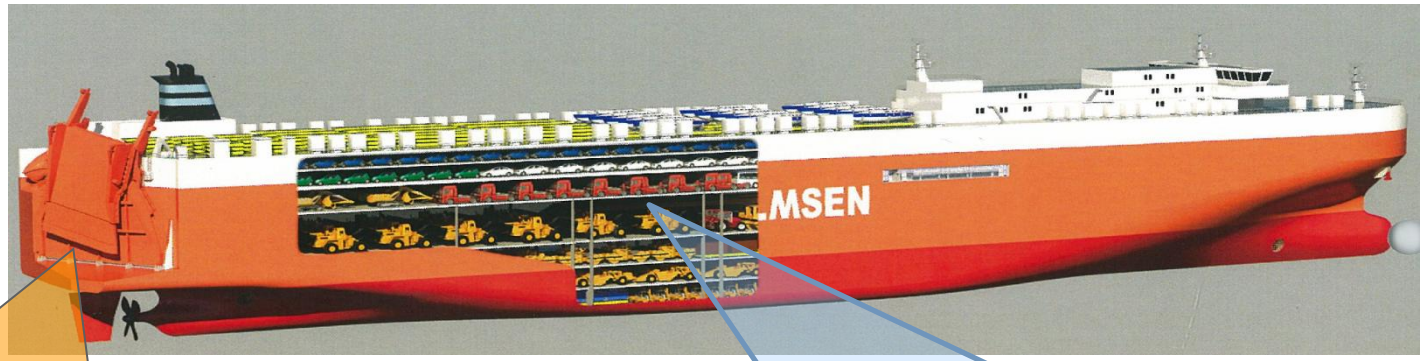
with/without boogies

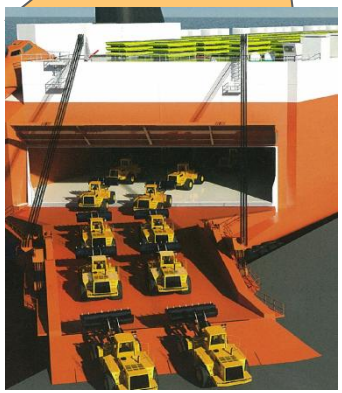
Railcars with or without boogies



Overall Layout & Special Features

Overall Layout

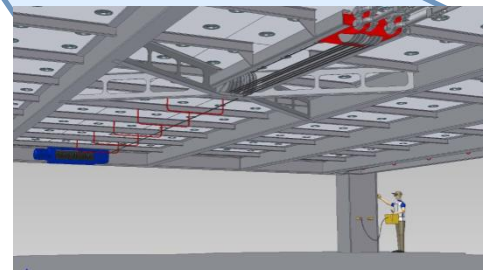




Jumbo Stern Ramp

505 tons of capacity

12m width



Hoistable deck

by electric motor winch

Next Generation Spherical Tank type LNGC - SAYAENDO -

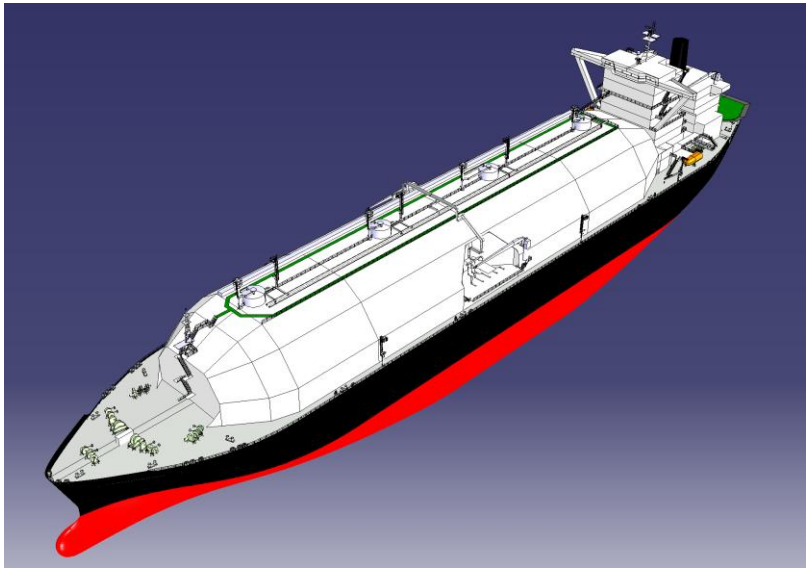
Particulars of Continuous Tank Cover LNGC

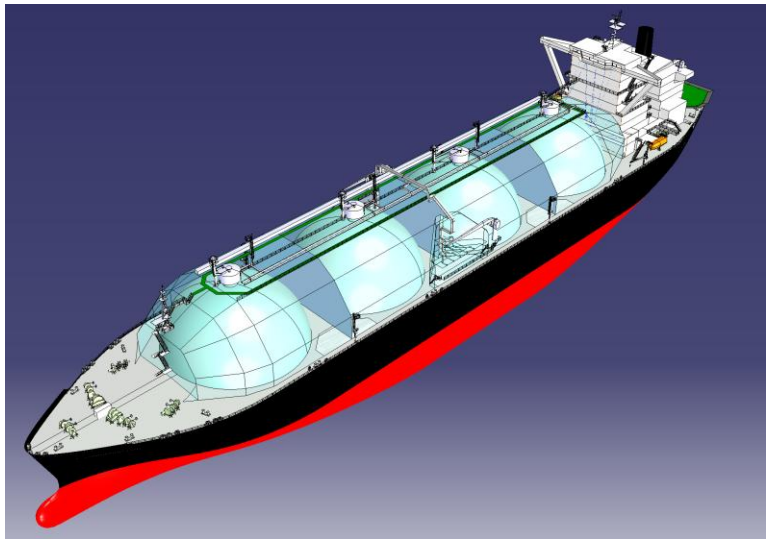
- **Cargo Tank Capacity : abt. 155,000 m3**
- **Service Speed : abt.19.5 kn**
- **Main Engine : Reheat Steam Turbine (UST)**

SAYAENDO Concept

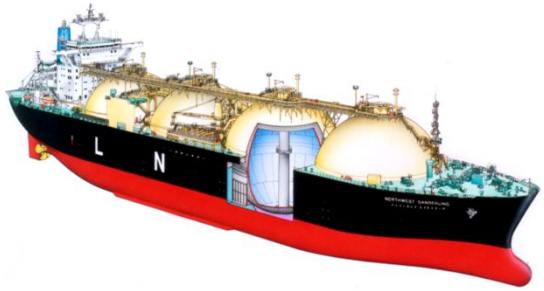
- Nickname “SAYAENDO”
- Proven Moss spherical tank type
- Light structure weight
- Better propulsion performance
- Better maintainability

SAYAENDO





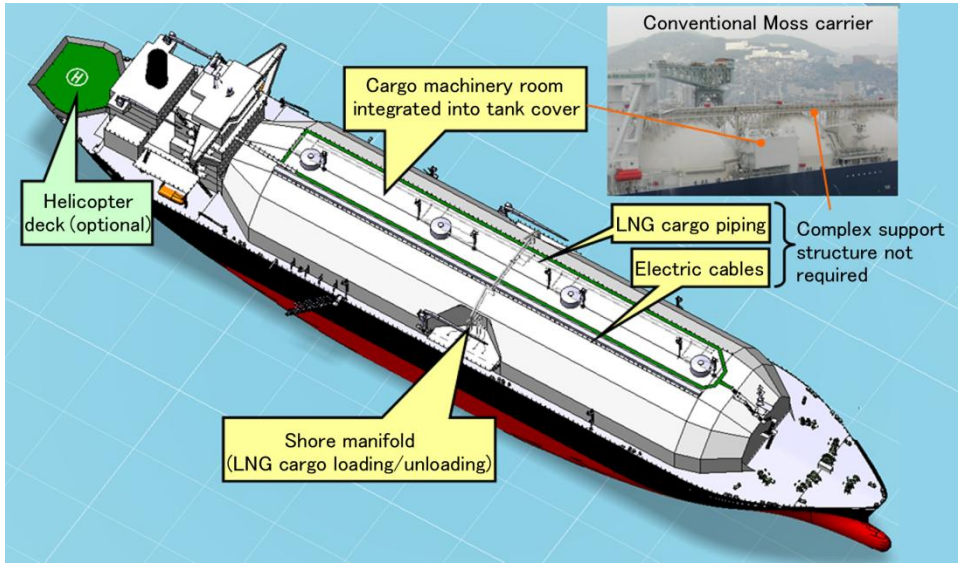
Continuous Tank Cover LNGC (Perspective Image)



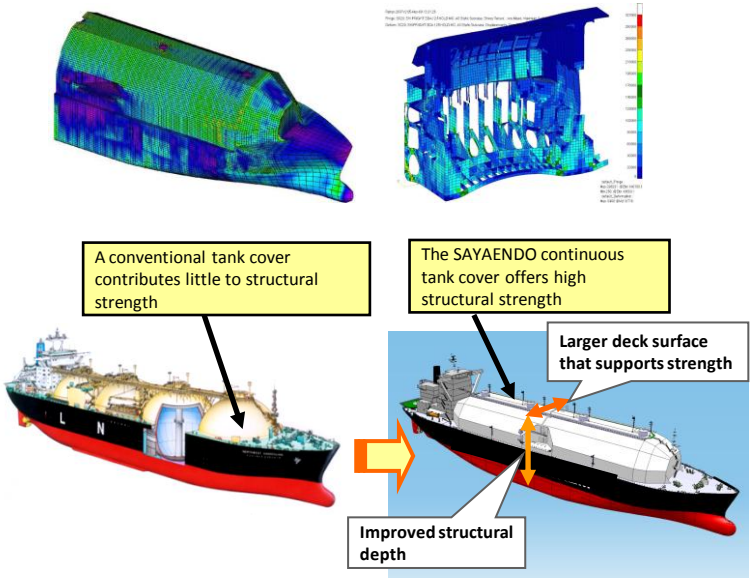
Conventional Tank Cover Moss LNGC

Overall Layout & Technical Evaluations

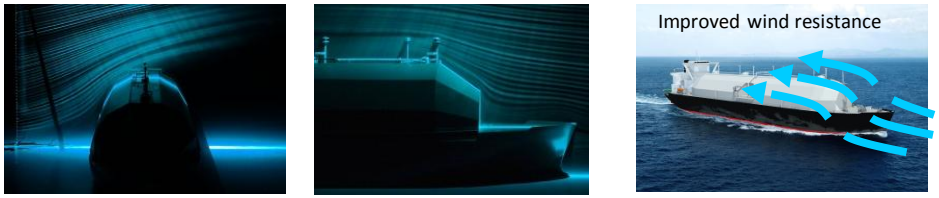
Overall Layout



Structural Assessment



Wind Tunnel Tests



6400RT Car Carrier with Hybrid Power Supply system

Hybrid Power Supply system

- **160kW** Solar Generation system
- **2.2MWh**(Potential Power)
  Lithium-ion Batteries
- Diesel powered generators

Vessel under way

Electricity generated by Solar Generation system ➔ stored in Lithium-ion Batteries

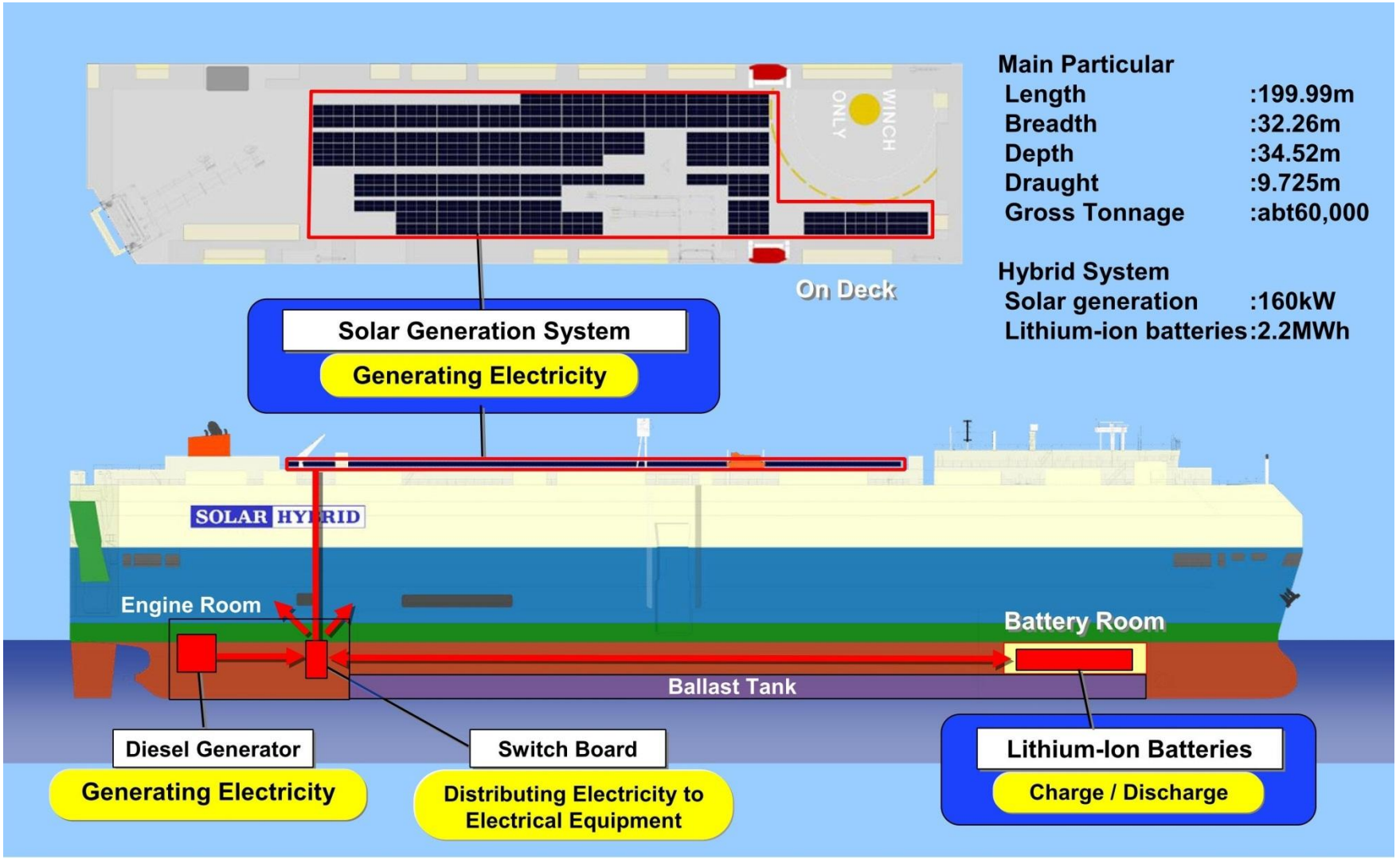
Vessel while rest in port

Electricity stored in Lithium-ion Batteries ➔ supplied for all of vessel's power needs

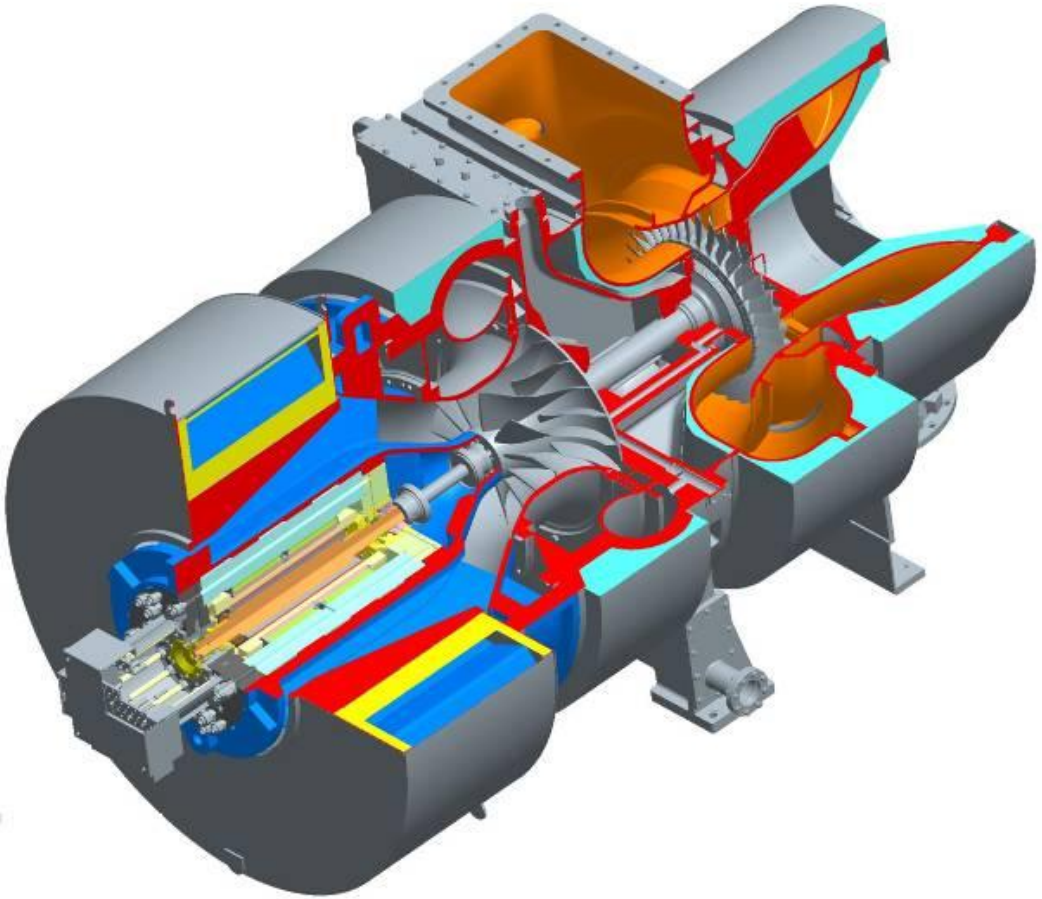
ZERO EMISSION while rest in port

The *vessel was* jointly developed by MOL, MHI and Panasonic, subsidized by the Ministry of Land, Infrastructure, Transport and Tourism as a project to help reduce CO2 emissions from ocean-going vessels, and received support from Nippon Kaiji Kyokai as a cooperative development project to reduce greenhouse gases produced by ocean shipping operations.

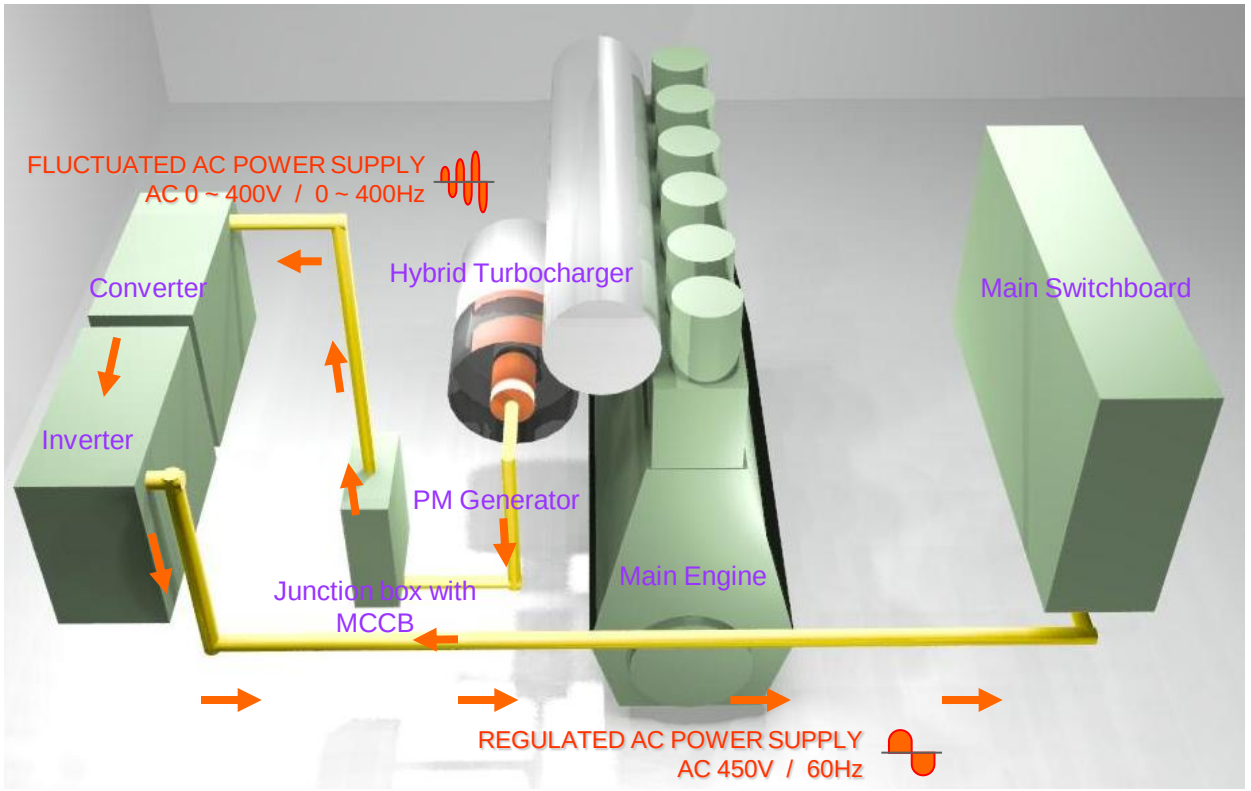
6400RT Car Carrier with Hybrid Power Supply system



HYBRID TURBOCHARGER – CROSS-SECTIONAL DIAGRAM



HYBRID TURBOCHARGER – SYSTEM OVERVIEW



Converter & Inverter

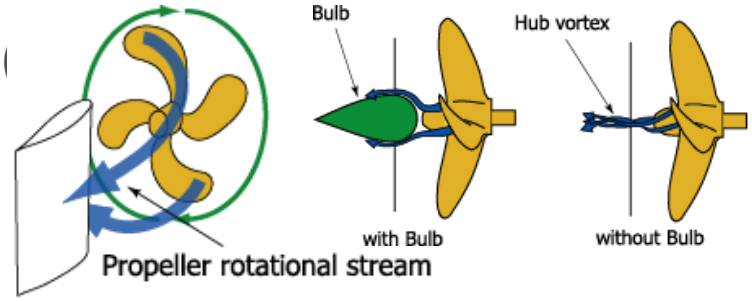
Hybrid Turbocharger

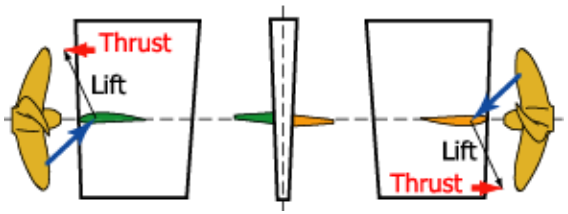
Main Switchboard

Energy Saving Device

SURF-BULB Swept-back Up-thrusting Rudder Fin with BULB

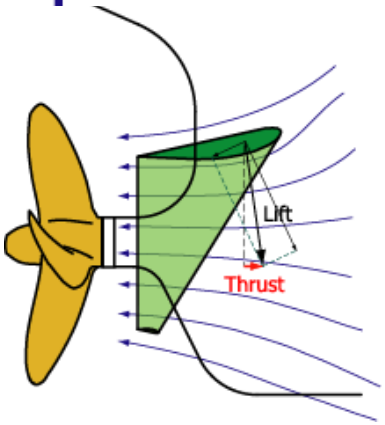
Text (





Fins generate thrust
Bulb smoothes hub vortex
Energy Saving Effect : 3 ~ 5%

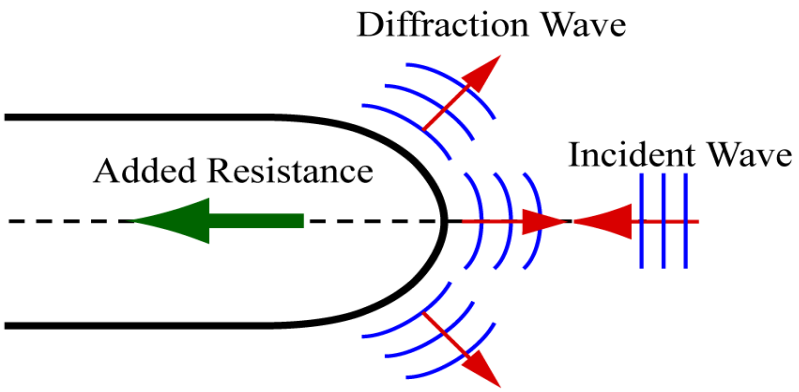
SSD Super Stream Duct



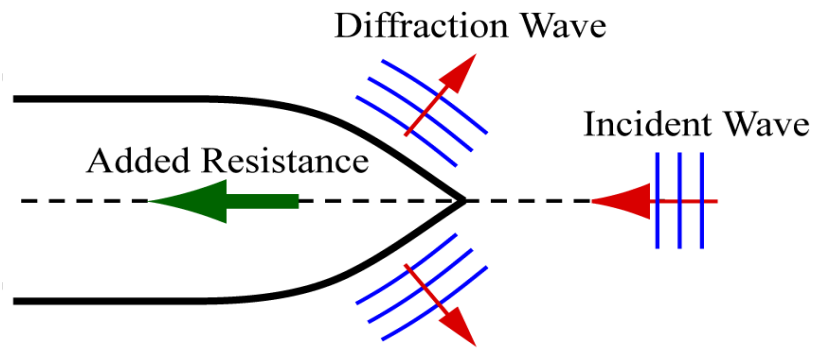
Wing section of duct generates thrust
Propeller inlet flow is stabilized by duct
Displacement effect improves wake fraction factors
Energy Saving Effect : 3 ~ 8%

Bow Shape Improvement

Conventional Full Hull Form Ship



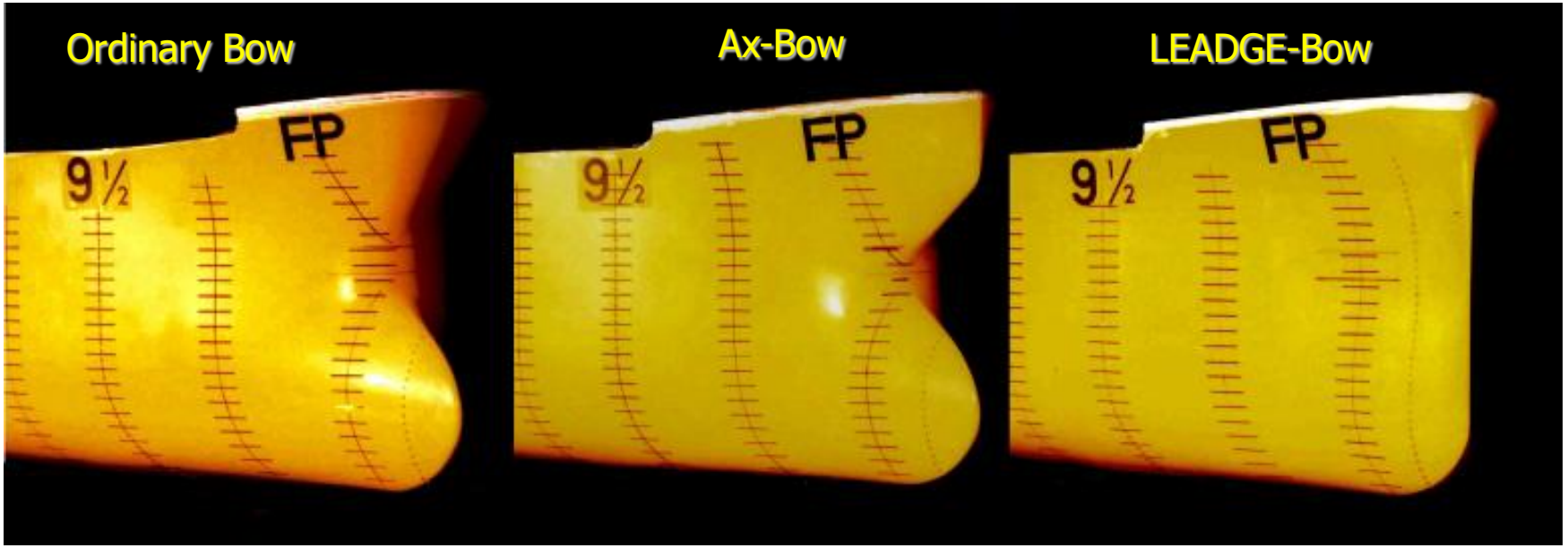
Sharpen Bow Ship



To sharpen the bow shape in order to reduce the diffraction wave

Performance in Waves

Ax-Bow / LEADGE-Bow



Thank you very much