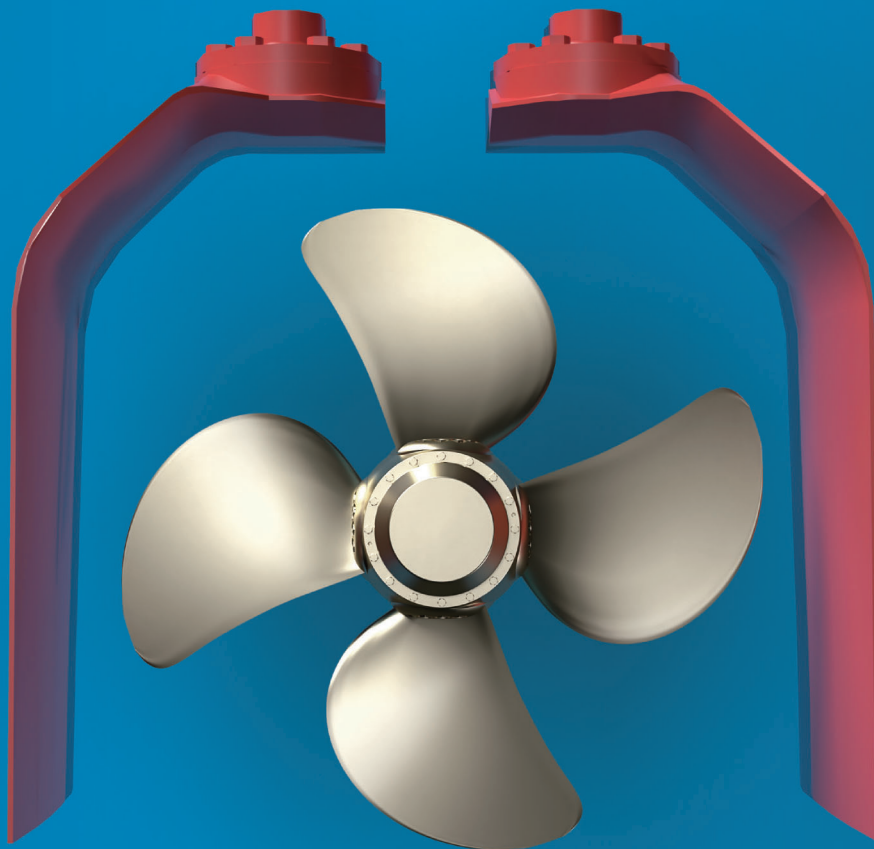


A New Energy Saving System:  
Confirming **14%** Energy Saving On Actual Ship



 **GATE RUDDER<sup>®</sup>**

**S Y S T E M**

by **KAMOME PROPELLER**

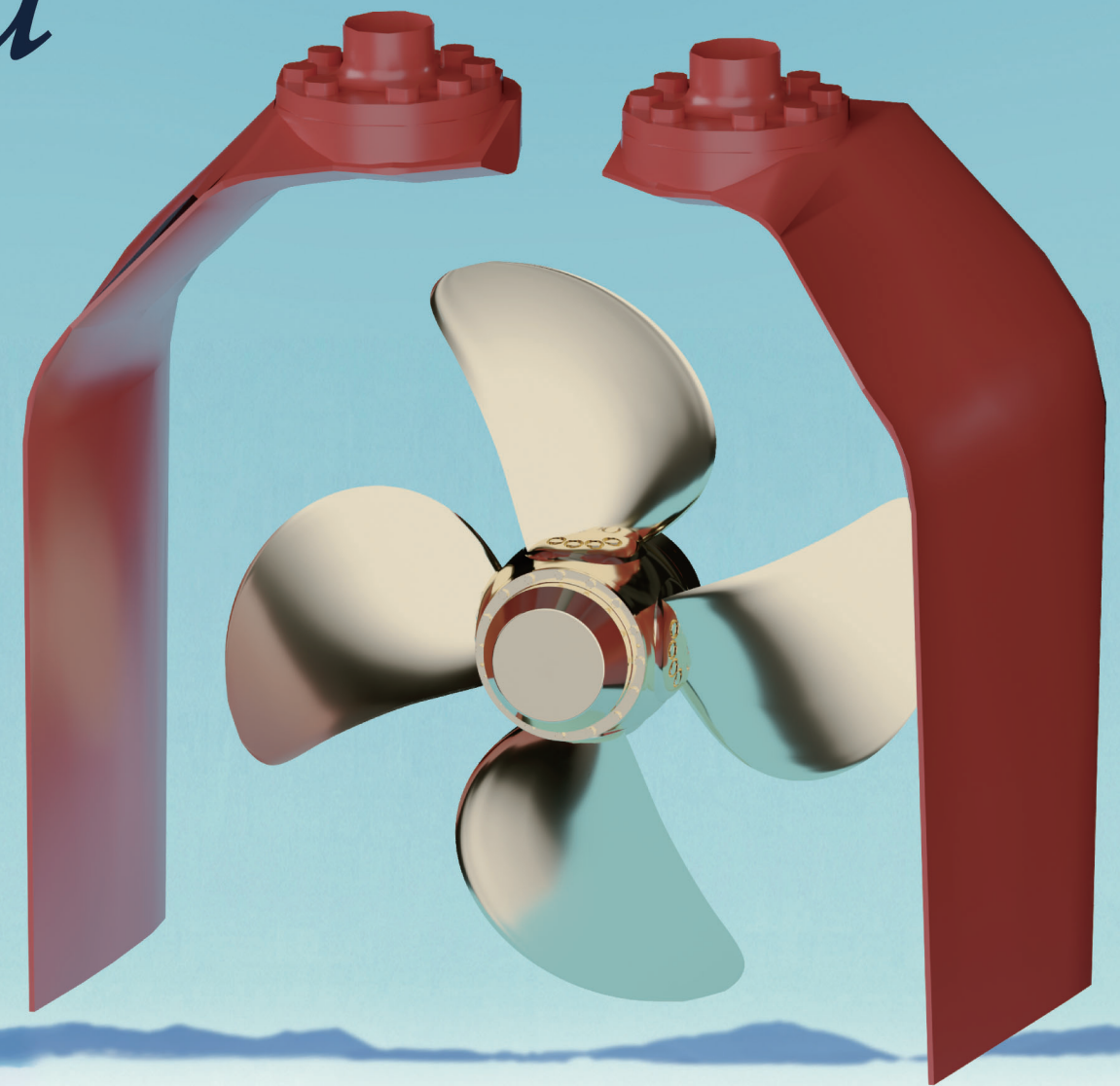
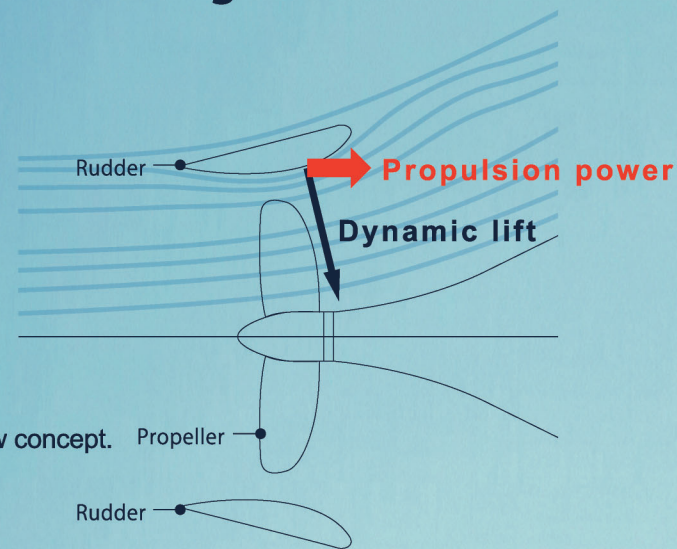
# Steer to the new era

## GATE RUDDER® SYSTEM

Completely new concept rudder creating the thrust

The GATE RUDDER® consists of two uniquely shaped rudders placed in parallel either side of the propeller instead of placing behind the propeller, which reduces resistance of rudder and create thrust to improve the energy consumption of 14% during the sea trial of the vessel.

This is a completely new type of rudder system developed by new concept.



### ADVANTAGE

Comparatively high energy saving  
Excellent course keeping and turning performance  
Enhance silence

### MECHANISM

Reduce: resistance of rudder,  
Suppress cavitation, Counter-steering

### SAFETY

Crabbing mode made Turn around & Move horizontally Available  
Redundancy achieved by one rudder.

# ADVANTAGE

## A New Energy Saving System Confirming 14% Energy Saving On Actual Ship

By the speed difference of the stream facing to the duct with unique cross-section surrounding the propeller create dynamic lift, which is utilized as propulsion power. 14% of less energy consumption during the sea trial of the real ship and some other superior features were achieved.

## 3 property was confirmed by comparing with the sister ship

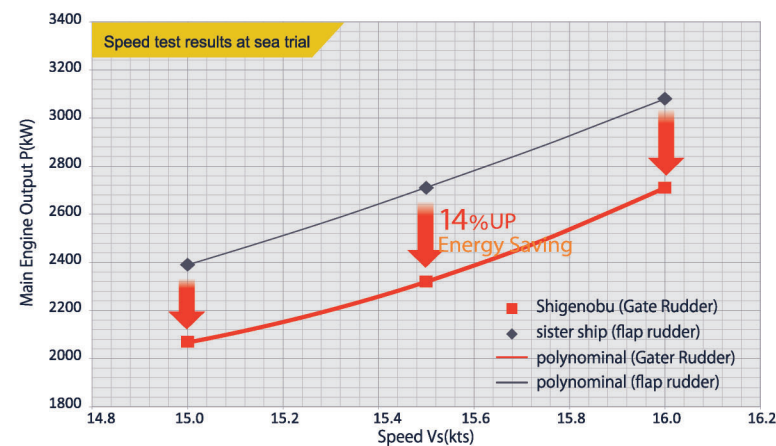
By comparing the data of MV SHIGENOBU equipped with the Gate Rudder System and its sister ship equipped with a flap ladder, several excellent performances were confirmed.



## 1 Comparatively high energy saving

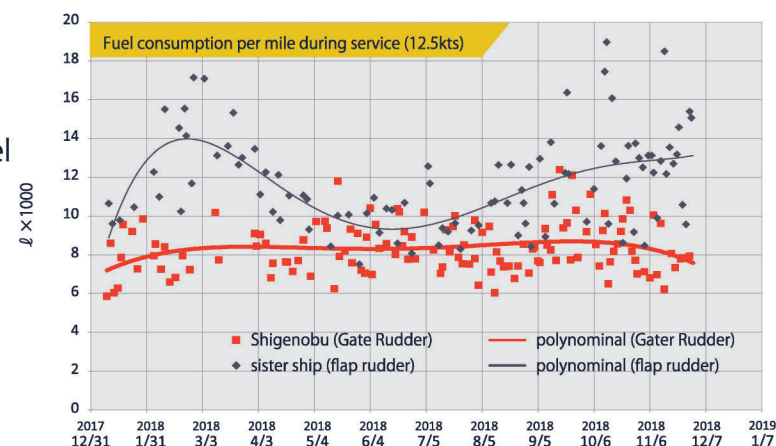
### 14% Energy Saving during the sea trial

Comparing the sister ship during sea trial at the same ship speed, it is achieved that main engine output was 14% lower, which is really significant.



### 20% yearly Energy Saving on the actual commercial operation of the vessel

Energy saving of the vessel with GATE RUDDER® was achieved steady regardless of the season, and confirmed about 20% less per year than the sister ship with the flap rudder.



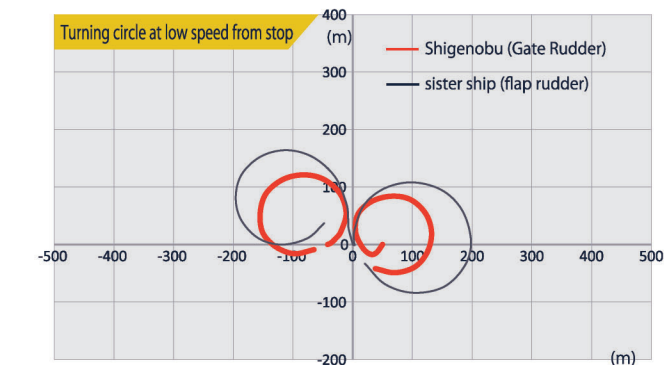
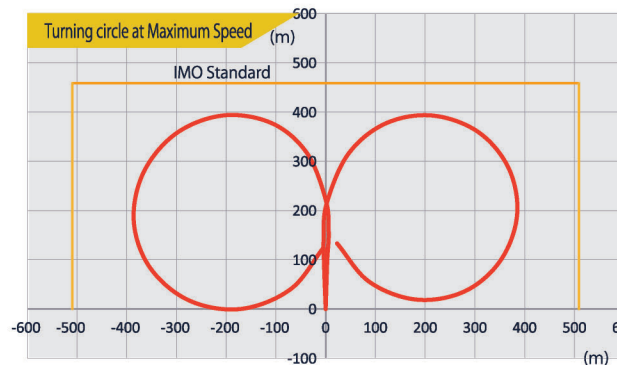
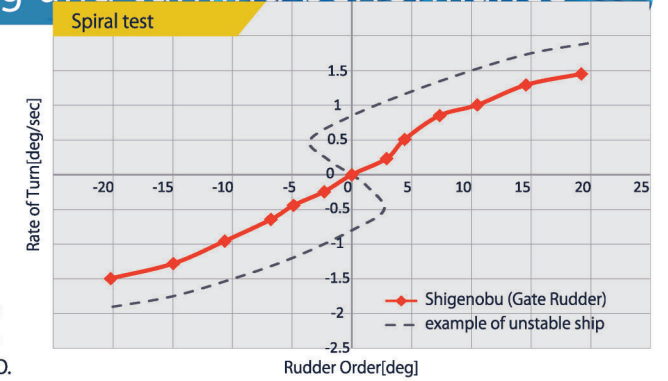
## 2 Excellent course keeping and turning performance

### Excellent course keeping

By steering two unsymmetrical rudders at appropriate angle, at a lower ship speed the turning circle could be smaller comparing with the sister ship with the flap rudder and turn linearly even at small rudder angle.

### Less than the turning radius required by IMO\*

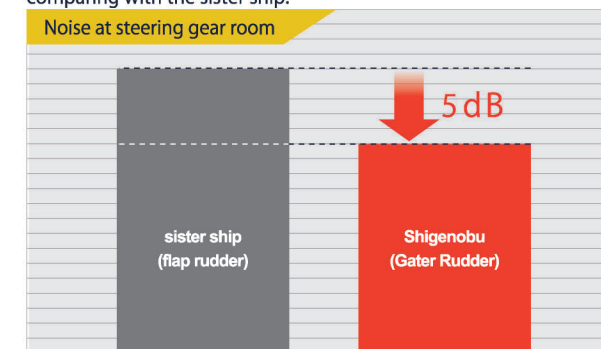
(Considering the operation in harbor, during the test at a lower ship speed the turning circle could be smaller comparing with the sister ship with the flap rudder.) And also, at full speed, the turning circle of the vessel fulfilled the requirement of IMO.



## 3 Enhance silence

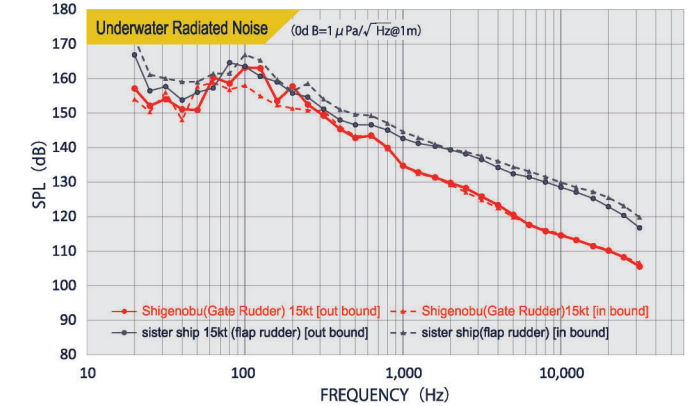
### Inboard Noise reduction

By the equalization effect on the propeller inflow velocity, the occurrence of cavitation volume is suppressed and the noise in the steering gear room could be reduced 5 dB at the same ship speed comparing with the sister ship.



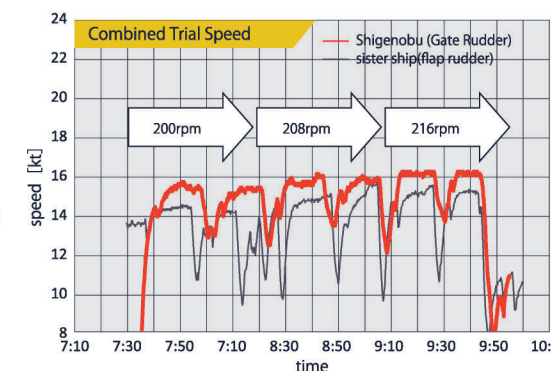
### Underwater Radiated Noise(URN) reduction

Reduced noise levels at high frequencies, which are particularly important for URN. Therefore, the influence to the measurement instrument like sonar and the marine life could be reduced.



### Carried out test run of both sister ships with GATE RUDDER® and flap rudder at the same area and time

On 30th Dec, 2021 off the coast of Kobe, MV SHIGENOBU installed GATE RUDDER® and its sister vessel installed flap rudder had test run to compare the differences. It was confirmed that at the same main engine output, ship's speed of MV SHIGENOBU with GATE RUDDER® was much faster than the sister ship.



MV SHIGENOBU from sister ship

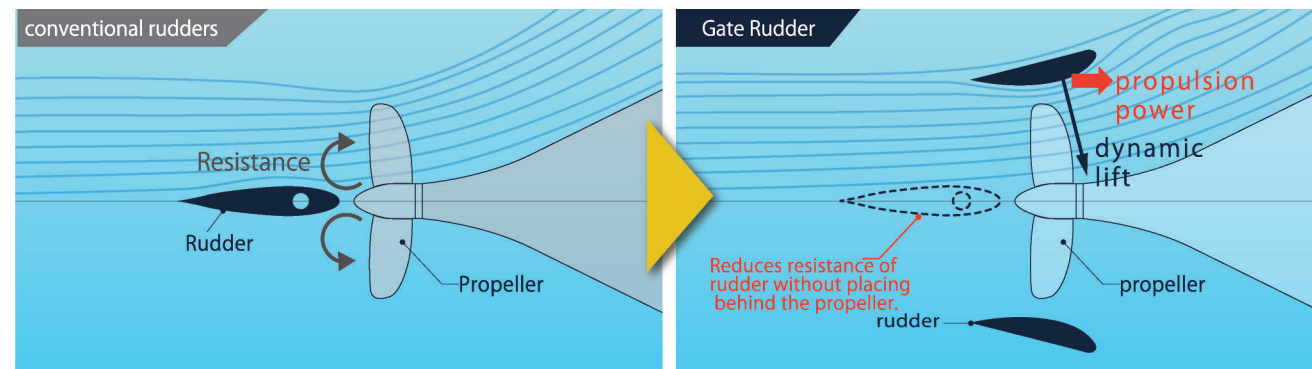
# MECHANISM

## 3 Mechanism of GATE RUDDER® for achieving energy saving

Rudder placed in parallel both sides of the propeller reduce not only the resistance by the rudder, but also cavitation and toe angle of offset rudder (counter-steering) and these advanced mechanism affects multiply during the operation of the vessel to achieve fuel (energy) saving.

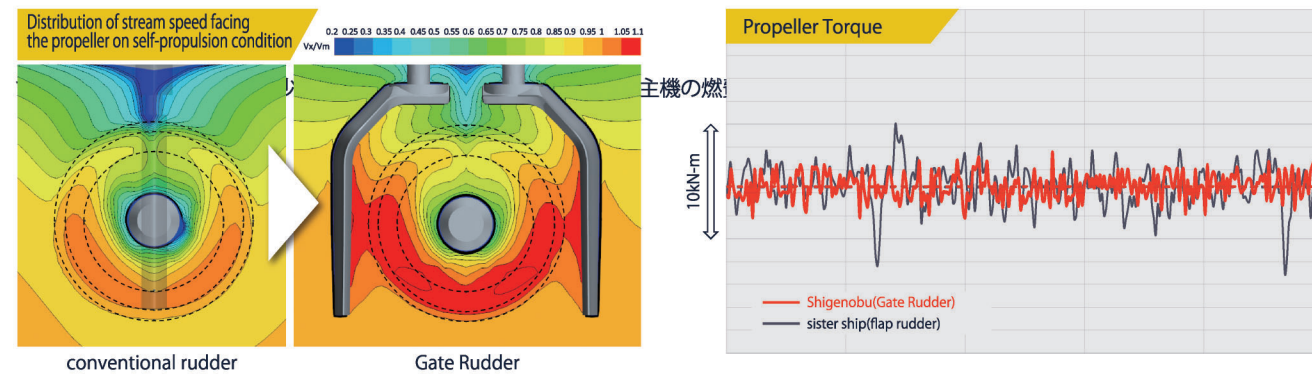
### ① Reduce resistance of rudder

Instead of placing behind the propeller, which is conventional construction, by placing two unsymmetrical rudder blades in parallel both sides of the propeller, reduce resistance of rudder and by the rudder blades create thrust to reduce hull resistance on self-propulsion condition.



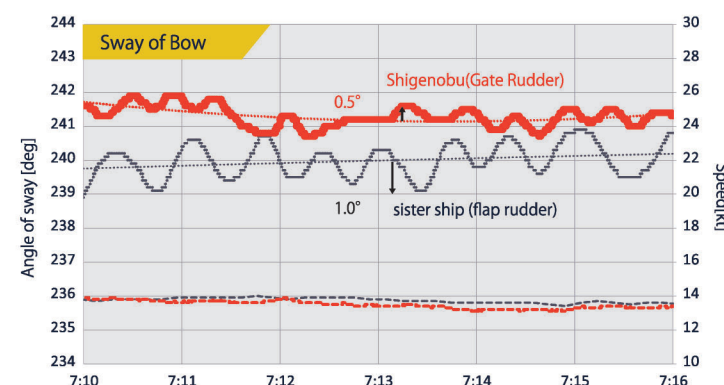
### ② Suppress cavitation

Since GATE RUDDER® SYSTEM could create thrust, necessary thrust of propeller (to make same ship's speed) could be reduced and cavitation could also be reduced. Further more by rectifying the stream facing to the propeller, the occurrence of cavitation is suppressed. Furthermore, since speed of the stream facing to the propeller is also rectified, torque nonuniformity is reduced to improve fuel consumption of main engine.



### ③ Reduce counter-steering

During the operation in the ocean, it has turned out that there is a certain tendency for bow of vessel with GATE RUDDER® not to sway from side to side, which reduce the counter steering and contribute save energy operation of the vessel.



# SAFETY

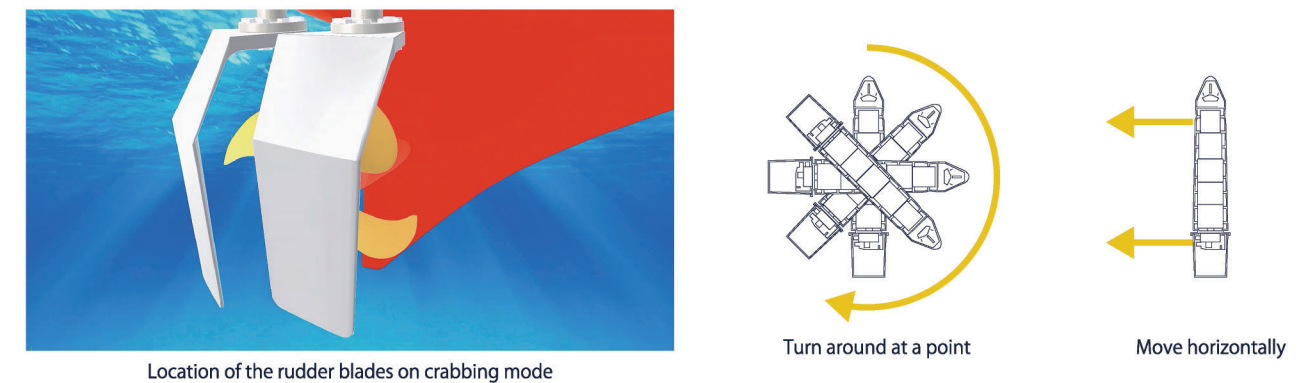
## Create High safety operation

GATERUDDER®SYSTEM create excellent safety

Location of the rudder blades on crabbing mode made turn around at a point and move horizontally available.

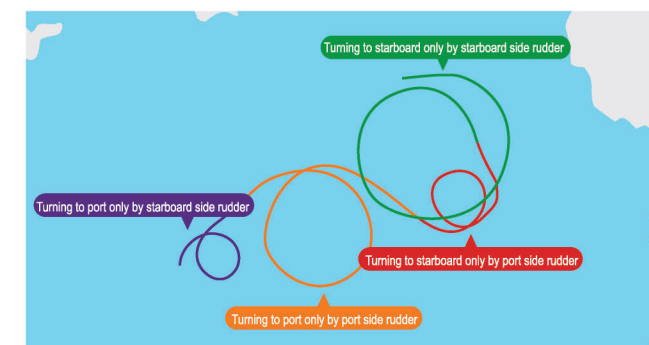
### Crabbing mode made Turn around & Move horizontally

By crabbing mode of GATE RUDDER®, one of standard modes, which two rudder blades are turned behind the propeller, vessel could be turned around on the spot and also move horizontally. If vessel operate bow thruster together with crabbing mode, it is easier to birthing and unberthing in the harbor.



### Vessel could be operated with only one rudder blade working

Even if one side of rudder is out of order, vessel could turn around even with only one rudder blade working normally.



Turning test of MV SHINKO installed GATE RUDDER® (working one rudder blade only)

### Structural design considering safety

In order to have safe and appropriate structure, FEM\* is applied for the calculation. the strength calculation of the rudder (rudder blade and rudder stock) has been approved by Class NK.



\*Finite Element Method

\*By newly dedicated Auto pilot, the vessel equipped GATE RUDDER® could be maneuvered in the same way as other vessels with ordinary rudder

Auto pilot (dedicated by Tokyo Keiki Inc.) controls two rudder blades to have best performance of the vessel operation.

The crew of the vessel (installed GATE RUDDER®) can operate the vessel without any special feeling because of two rudder blades to reduce the stress-of the crew.

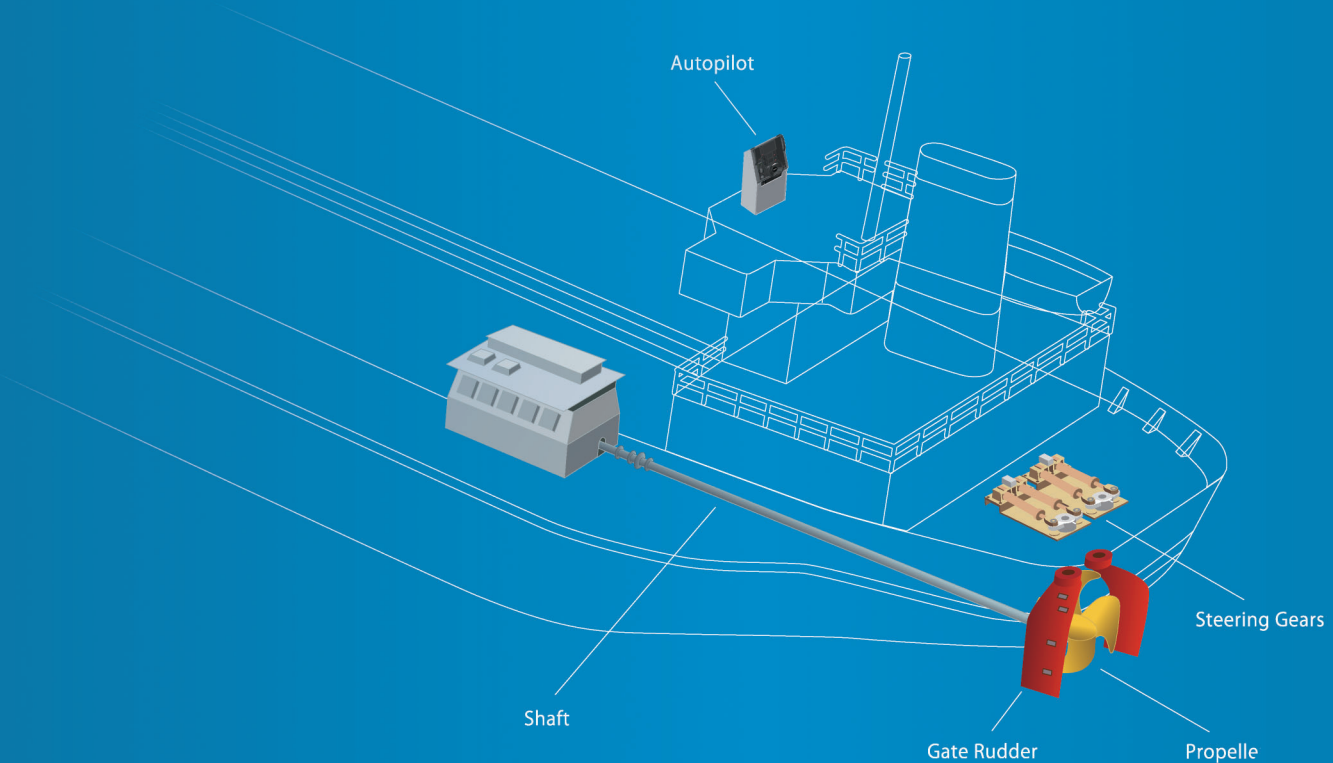
Auto pilot PR-9000-GT specially dedicated for GATE RUDDER® SYSTEM

- To optimize rudder angle of GATE RUDDER
- Dial switch for the crabbing mode is applicable



# Total engineering for **GATE RUDDER® SYSTEM**

In order to optimize the vessel's performance, GATE RUDDER® SYSTEM should integrate GATE RUDDER®, Auto pilot with customized algorithm, steering gear, propeller (either CPP or FPP) and its shafting by total engineering.



**KAMOME  
PROPELLER**

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