# Shipbuilding & Ocean Development Business Presentation Meeting

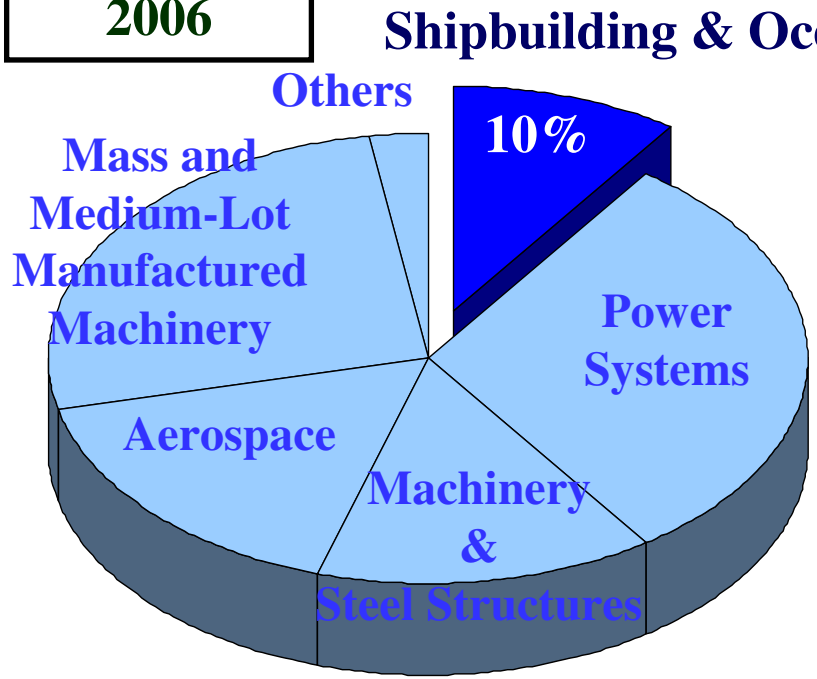
March 12, 2008

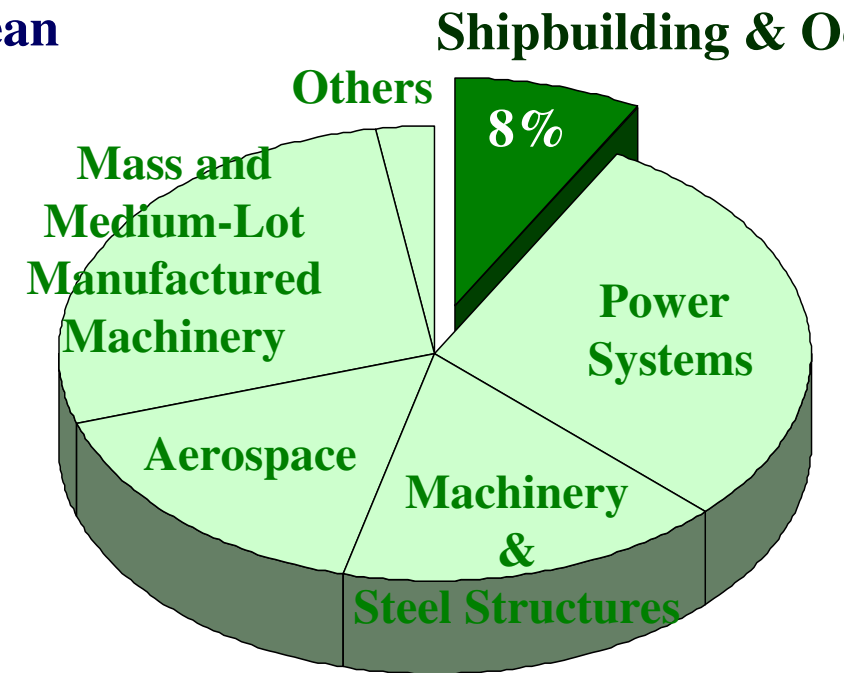
**Shiro Iijima**
**Director, Executive Vice President and General Manager ,**
**Shipbuilding & Ocean Development Headquarters**

# 1. Positioning of the Shipbuilding & Ocean Development Segment

## (1) Positioning of the Shipbuilding & Ocean Development segment

**2006**

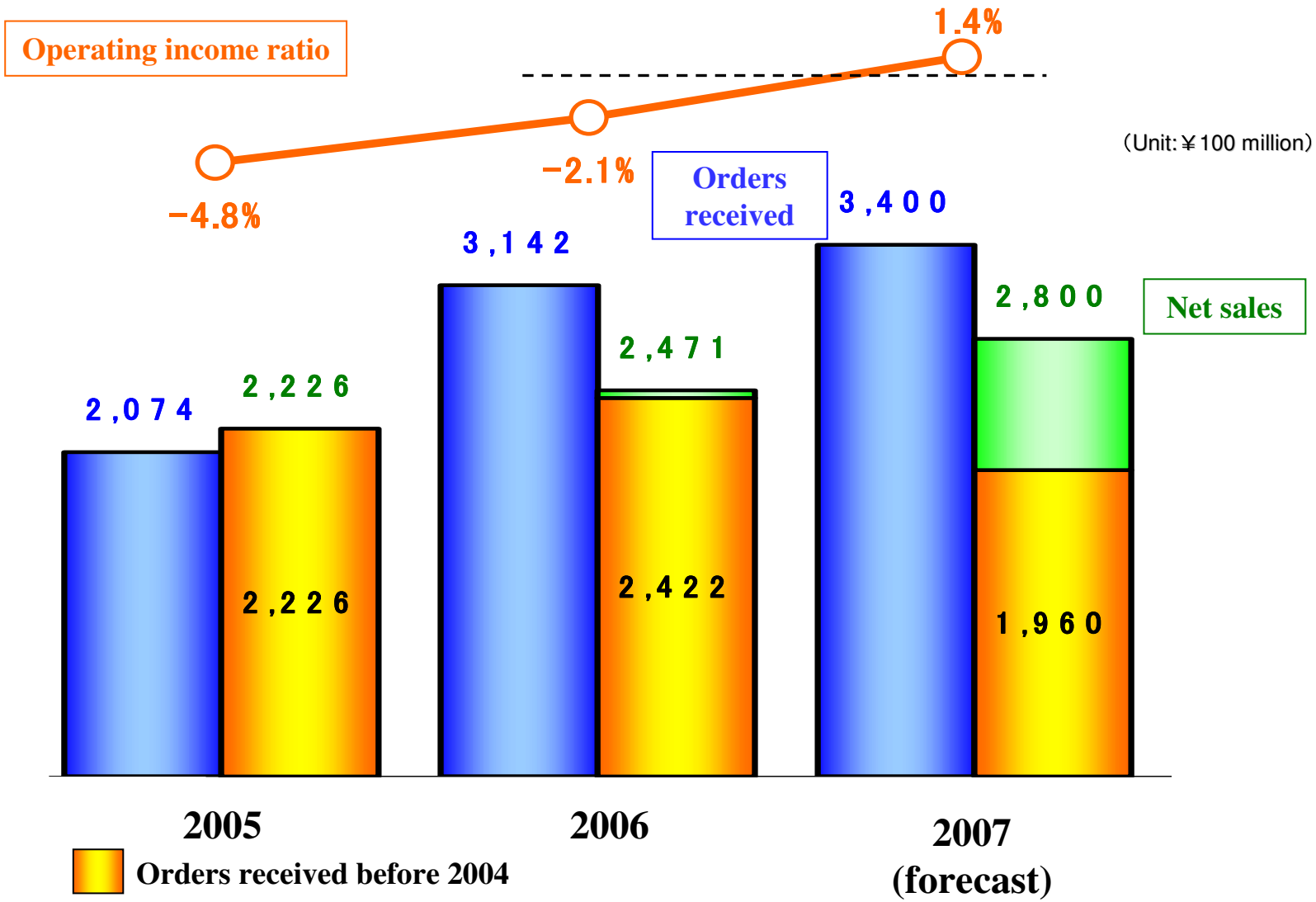



| Consolidated orders received |
| --- |
| Shipbuilding & Ocean Development: ¥314.2 billion |
| **(Figure for the entire company: ¥3,274.7 billion)** |

| Consolidated net sales |
| --- |
| Shipbuilding & Ocean Development: ¥247.1 billion |
| **(Figure for the entire company: ¥3,068.5 billion)** |

## (2) Changes in orders received, net sales, and operating income ratio

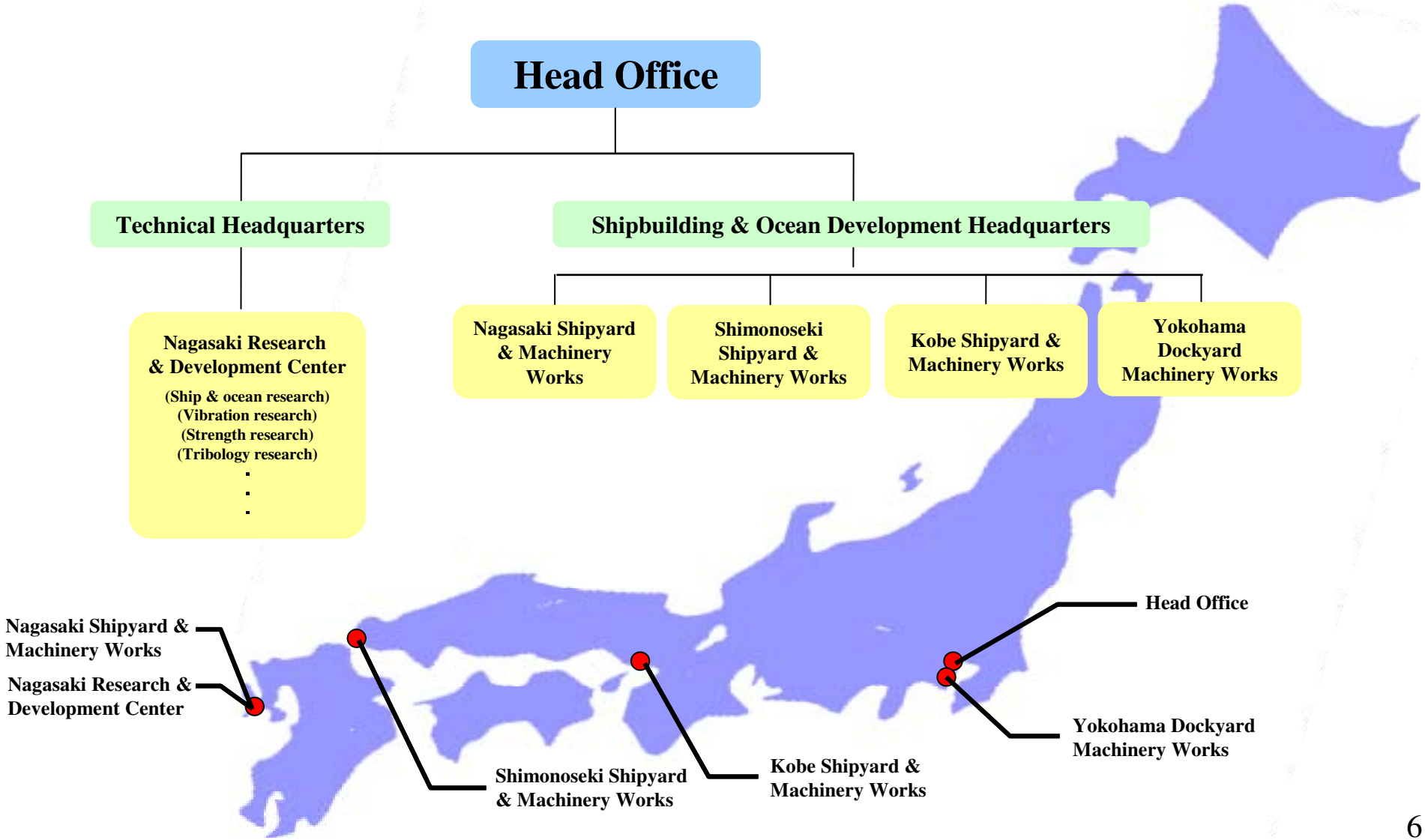


# 2. Situation of the Shipbuilding & Ocean Development Segment

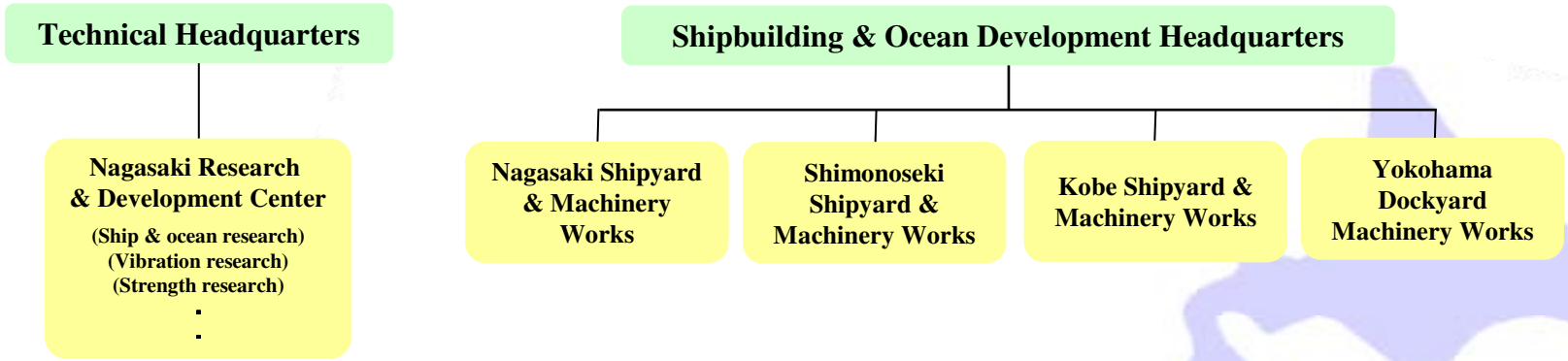
# (1) Structure of the Shipbuilding & Ocean Development segment

**Head Office**

- **Technical Headquarters**
  - **Nagasaki Research & Development Center**
    (Ship & ocean research)
    (Vibration research)
    (Strength research)
    (Tribology research)
    ・
    ・
    ・
- **Shipbuilding & Ocean Development Headquarters**
  - **Nagasaki Shipyard & Machinery Works**
  - **Shimonoseki Shipyard & Machinery Works**
  - **Kobe Shipyard & Machinery Works**
  - **Yokohama Dockyard Machinery Works**



# (2) Employees in the Shipbuilding & Ocean Development segment




*** Employees relating to the Shipbuilding & Ocean Development segment**

| Number of employees | Total number of employees at headquarters | Nagasaki Shipyard & Machinery Works | Shimonoseki Shipyard & Machinery Works | Kobe Shipyard & Machinery Works | Yokohama Dockyard Machinery Works |
|---|---|---|---|---|---|
| Research | 50 * | | | | |
| Design | 1,020 | 562 | 137 | 287 | 12 |
| Manufacturing | 3,704 | 2,222 | 516 | 797 | 169 |
| Others | 146 | 33 | 22 | 21 | 5 |
| Total | 4,870 | 2,817 | 675 | 1,105 | 186 |

**1,100 employees for research and design**

# (3) Overview of Plants and Facilities for the Shipbuilding & Ocean Development segment

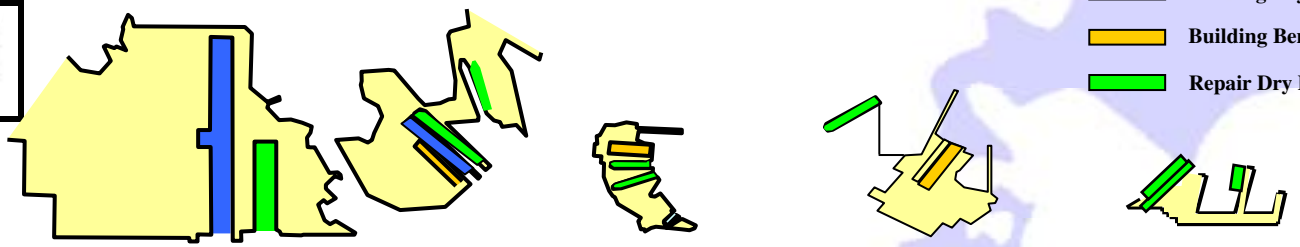
**Technical Headquarters**

- Nagasaki Research & Development Center (Ship & ocean research)

**Shipbuilding & Ocean Development Headquarters**

- Nagasaki Shipyard & Machinery Works
- Shimonoseki Shipyard & Machinery Works
- Kobe Shipyard & Machinery Works
- Yokohama Dockyard Machinery Works

| Facilities | |
|---|---|
| | Towing tank |
| | Seakeeping &maneuvering basin |




| Major shipbuilding facilities | | Koyagi Plant | Main Plant (Tategami) | | | |
|---|---|---|---|---|---|---|
| | Site (m²) | 1,200,000 | 350,000 | 130,000 | 210,000 | 150,000 |
| Dock | Length (m) x width (m)<br>Capacity (deadweight tons) | 990.0 x 100.0<br>1,000,000 | 375.0 x 56.0<br>225,000 | 164.1 x 23.8<br>17,000 | 301.5 x 43.7<br>160,000 | 350.0 x 60.0<br>270,000 |
| | | 400.0 x 100.0<br>500,000 | 350.0 x 56.0<br>300,000 | 217.0 x 32.0<br>40,000 | | 270.0 x 60.0<br>120,000 |
| | | | 276.6 x 38.8<br>95,000 | 82.8 x 16.3<br>4,000 | | 180.0 x 30.0<br>38,000 |
| Berth | Length x width<br>Capacity (deadweight tons) | – | 324.0 x 56.0<br>80,000 | 185.9 x 53.2<br>33,000 | 305.0 x 61.4<br>310,000 | – |
| | | | | | 136.0 x 12.0<br>24,500 | |
| Crane | G: goliath J: jib | G: 1,200t x 1<br>G: 600t x 2<br>J: 50t x 1 | G: 300t x 2<br>G: 150t x 2<br>J: 150t x 4 | J: 150t x 1<br>J: 80t x 1<br>J: 50t x 3 | J: 200t x 1<br>J: 120t x 1<br>J: 100t x 4 | J: 80t x 3<br>J: 40t x 1<br>J: 16t x 6 |

# Nagasaki Shipyard & Machinery Works -Koyagi Plant-

**Site: 1,200,000 m²**


⑪ Steel treatment shop
⑫ Steel cutting shop
⑬ No.3 south quay
⑭ Midbody sub-assembly shop
⑮ Bow & stern assembly shop
⑯ Pipe shop
⑰ No. 1 east quay
⑱ Sewage disposal plant
⑲ Panel shop
⑳ Special painting shop
㉑ Final assembly & outfitting shop
㉒ 600-ton goliath crane
㉓ Building dock
㉔ No. 2 east quay
㉕ Waste oily-water treatment plant
㉖ Repair dock
㉗ No. 3 east quay
㉘ Wind turbine generator

# Nagasaki Shipyard & Machinery Works
## -Main Plant (Tategami) -

**Site: 350,000 m²**


① Port entrance
② Steel unloading wharf
③ Assembly shop
④ Assembly shop
⑤ Assembly shop
⑥ No. 1 & No. 2 building berth
⑦ Special painting shop
⑧ Final assembly yard
⑨ No. 1 dry dock
⑩ No. 2 dry dock
⑪ Tategami quay
⑫ Unit module shop
⑬ Hachikenya quay
⑭ Hachikenya dock house
⑮ No. 3 dry dock
⑯ Pipe shop
⑰ Main gate
⑱ Main office
⑲ Mukojima quay

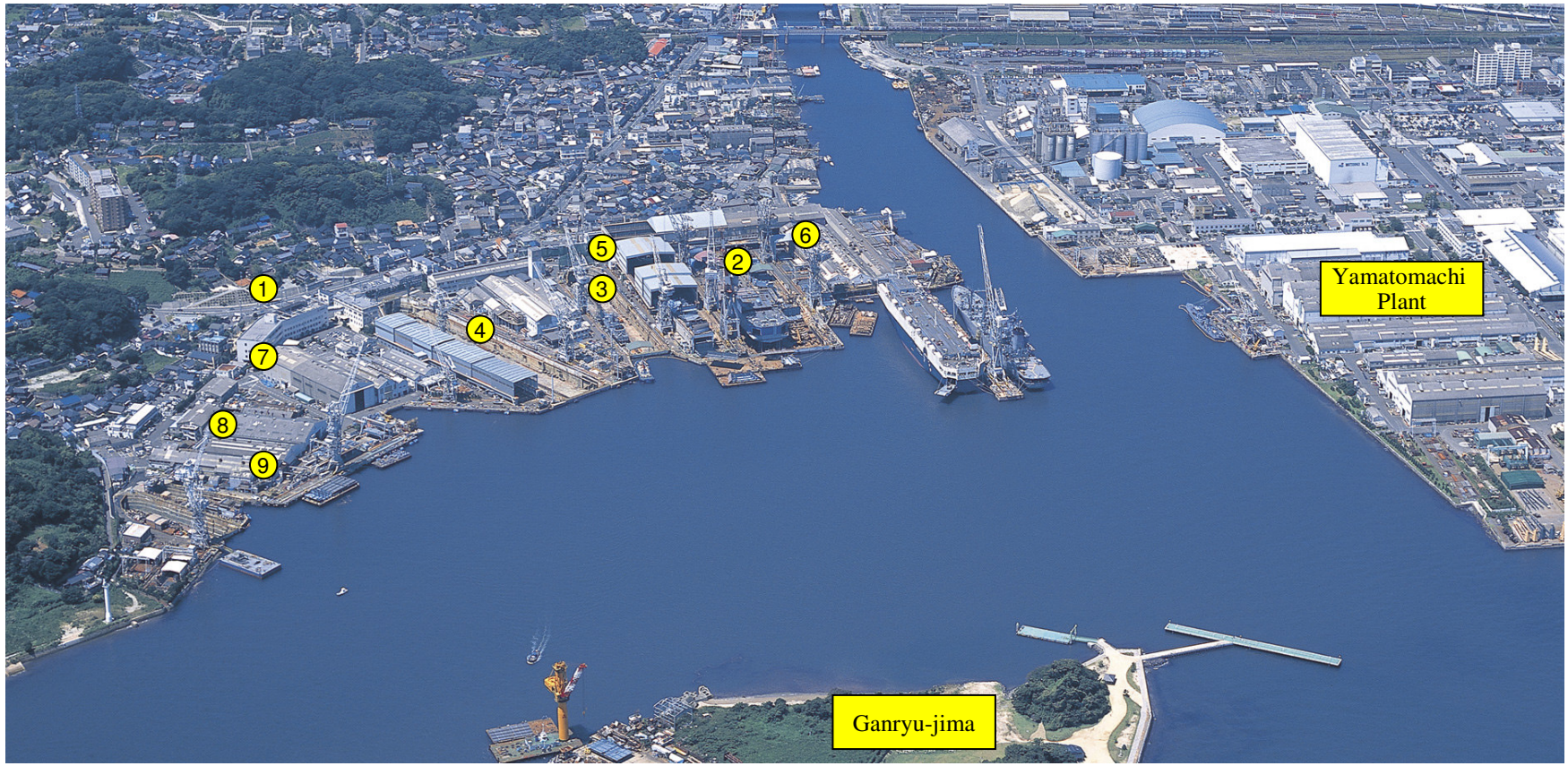
# Kobe Shipyard & Machinery Works
## -Main Plant-

**Site: 210,000 m²**


① Main building
② Engineering center
③ Steel fabrication and assembly shop
④ No. 3 shipbuilding berth
⑤ No. 4 shipbuilding berth
⑥ No. 1 dry dock
⑦ No. 4 dry dock

# Shimonoseki Shipyard & Machinery Works -Enoura Plant-

**Site: 130,000 m²**




① Office
② Berth
③ Dock No. 1
④ Dock No. 2
⑤ Assembly and welding shop
⑥ Interior shop
⑦ Aluminum-alloy boat shop
⑧ Unit cabin shop
⑨ Pipe shop

# Yokohama Dockyard Machinery Works -Honmoku Plant-

**Site: 150,000 m$^2$**


① Office
② No. 1 dry dock
③ No. 2 dry dock
④ No. 3 dry dock

Nagasaki Research & Development Center

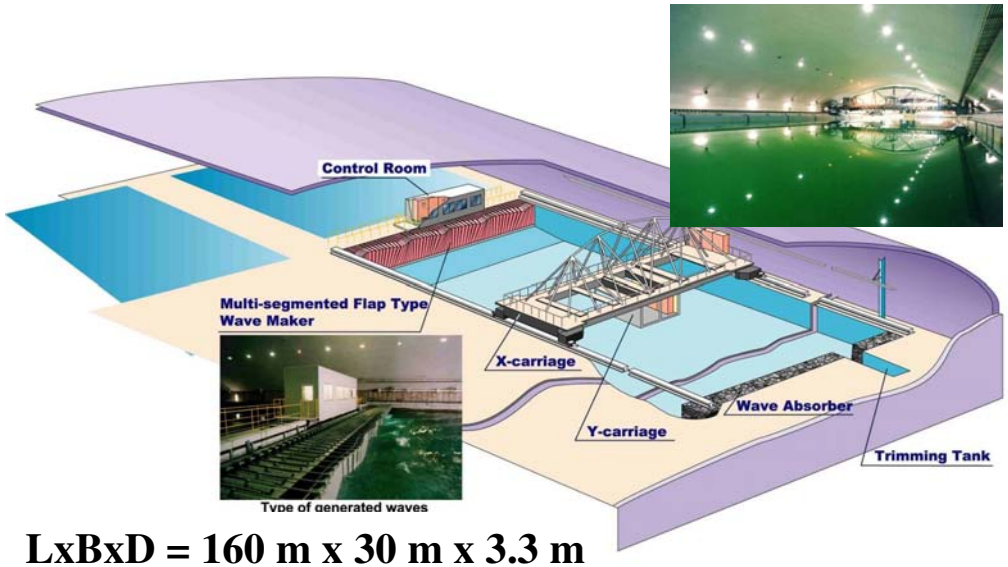
## Fukahori Area


① Seakeeping & maneuvering basin
(LxBxD = 160.0 m x 30.0 m x 3.3 m)

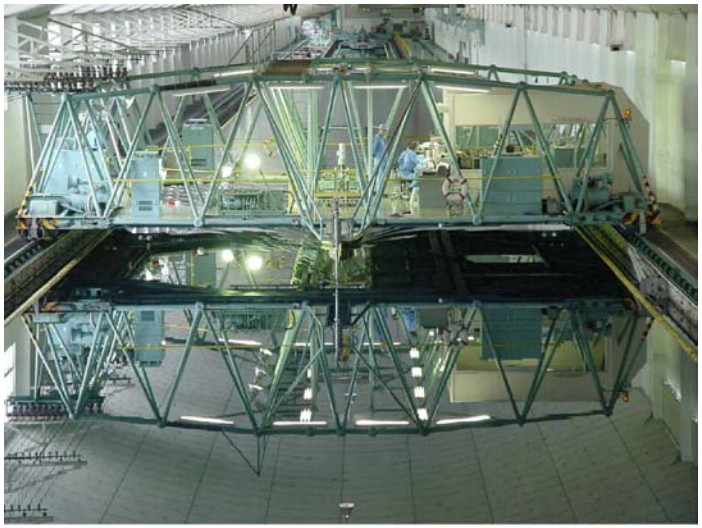
## Urakami Area

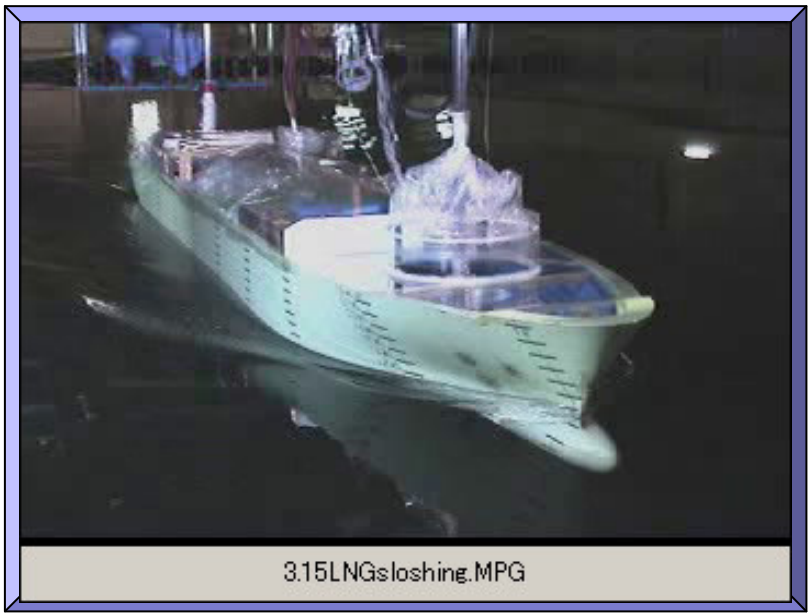

② Towing tank
(LxBxD = 285.0 m x 12.5 m x 6.5 m)

# Nagasaki Research & Development Center




**LxBxD = 160 m x 30 m x 3.3 m**






- **Ship & Ocean Laboratory**
- **Vibration Laboratory**
- **Strength Laboratory**
- **Tribology Laboratory**
- **Chemical Laboratory**
- **Combustion & Heat Transfer Laboratory**

**Total: 410 employees,**
**of which 360 are researchers**

Major products

## ● Large ship: Koyagi Plant of Nagasaki Shipyard & Machinery Works

### Shipbuilding







### Special-purpose vessel


Major products

● **Medium-size ship: Main Plant of Nagasaki Shipyard & Machinery Works and Kobe Shipyard & Machinery Works**

| Shipbuilding | Special-purpose vessel | Japanese defense force ship (Shipbuilding, ship repair) |
|---|---|---|
| Large container vessel (6000 to 8000 TEUs)   |   Deep submergence research vehicle |  Escort ship |
| Pure car and truck carrier  |   Deep sea cruising AUV |  Submarine |
|  Superferry |  Oil recovery vessel | |

# Major products

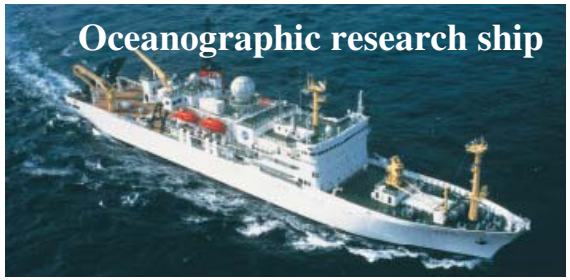
## ● Small ship: Shimonoseki Shipyard & Machinery Works

### Shipbuilding




### Special-purpose vessel






## ● Yokohama Dockyard Machinery Works

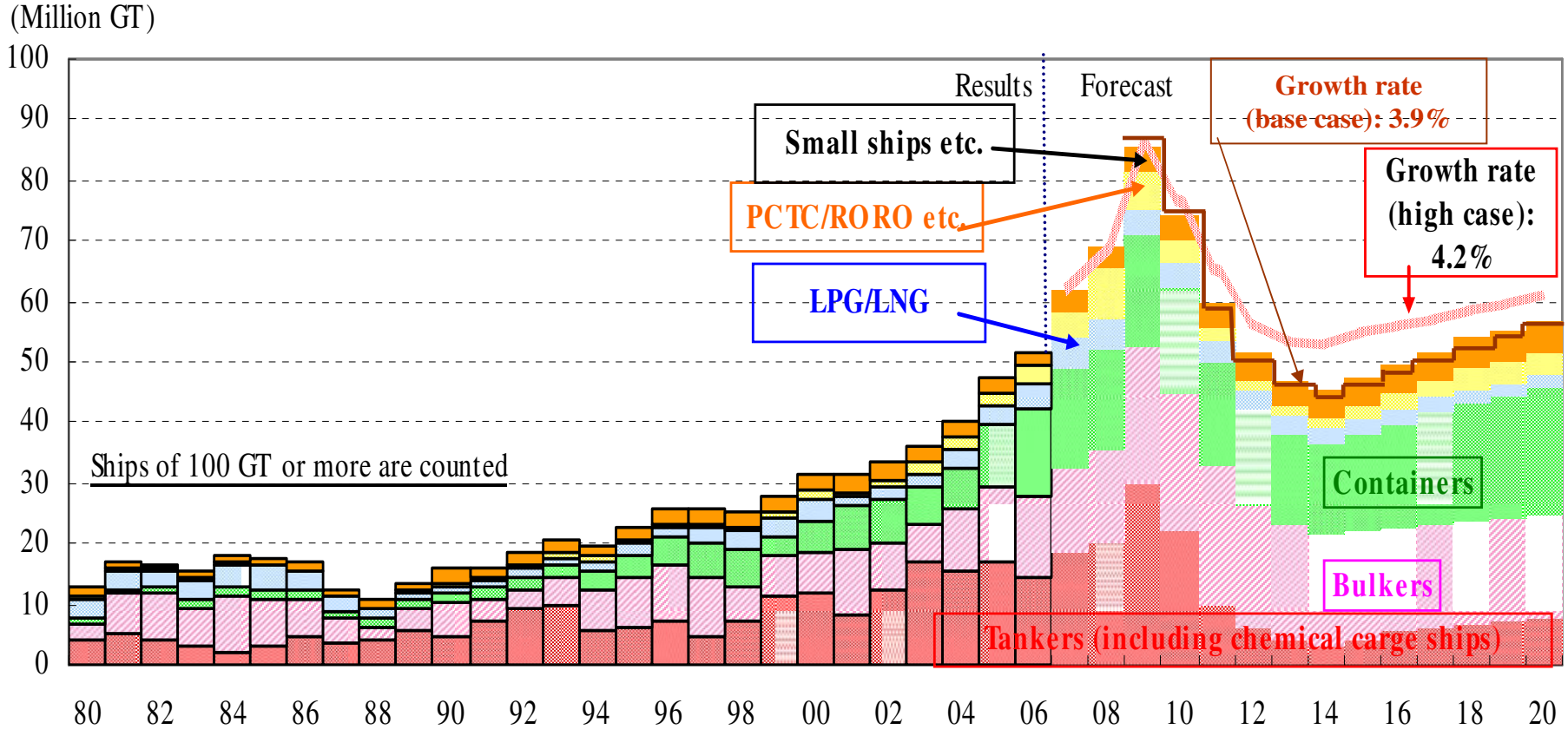
### Alteration, ship repair




# 3. Outlook for the Shipbuilding & Ocean Development Business

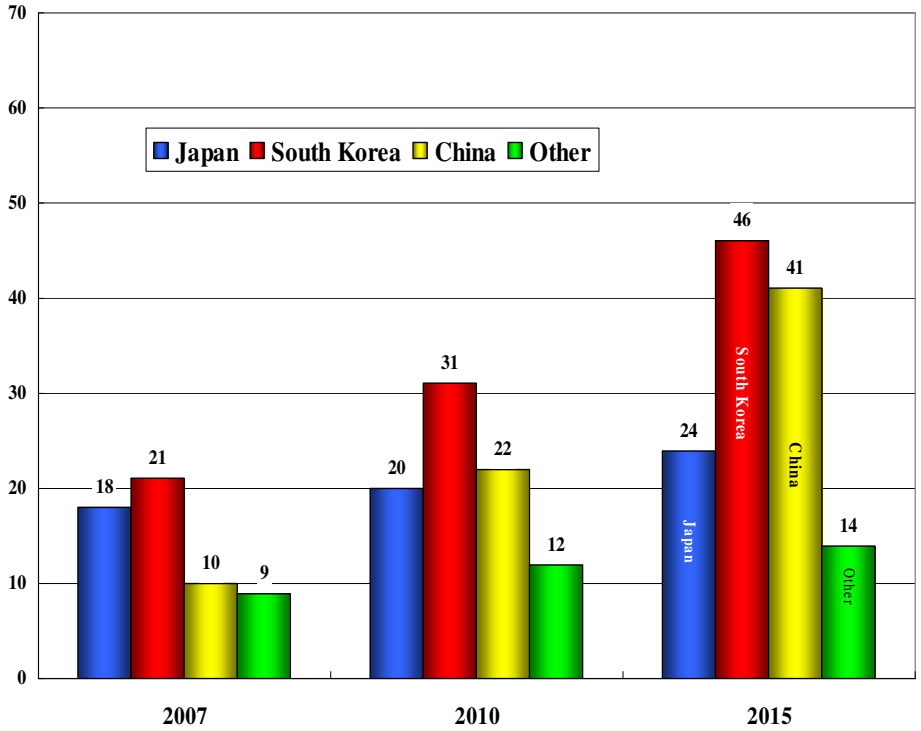
## (1) Shipbuilding demand forecast

- The volume of ships expected to be needed in 2020 is 1.7 to 1.8 times that in 2007, representing an annual growth rate of 3.9% to 4.2% on average across all ship types.



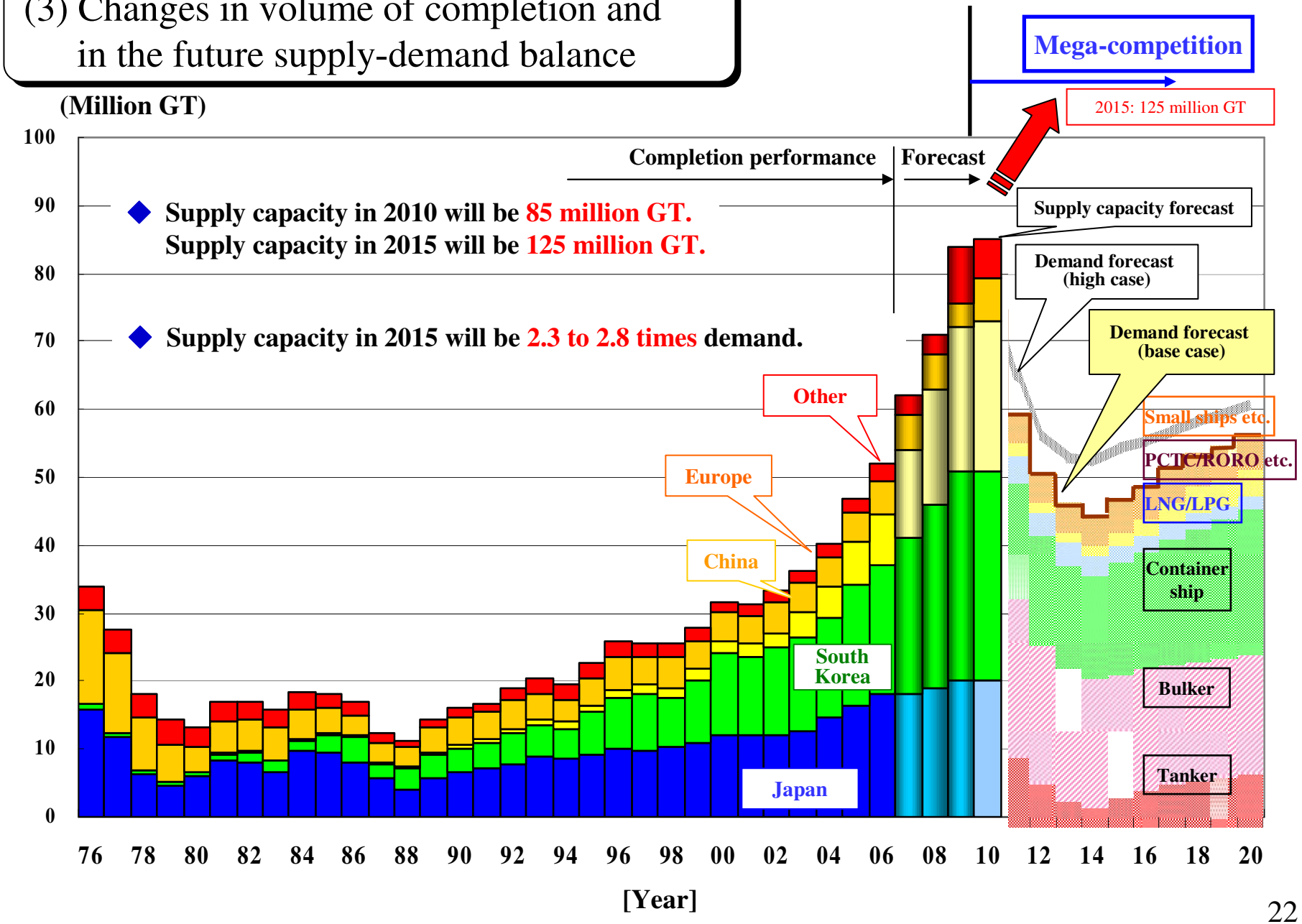
## (2) Plant capacity forecast for 2015

- Worldwide capacity will expand from 58 million GT now, to 85 million GT in 2010. When facilities being constructed or planned in South Korea and China begin operating by 2015, the capacity will increase to 125 million GT.




| | 2007 | | 2010 | | 2015 | |
|---|---|---|---|---|---|---|
| | Million GT | Share | Million GT | Share | Million GT | Share |
| Japan | 18 | 31 | 20 | 24 | 24 | 19 |
| South Korea | 21 | 36 | 31 | 36 | 46 | 37 |
| China | 10 | 17 | 22 | 26 | 41 | 33 |
| Other | 9 | 16 | 12 | 14 | 14 | 11 |
| World-wide | 58 | 100 | 85 | 100 | 125 | 100 |

# (3) Changes in volume of completion and in the future supply-demand balance



# 4. Business Strategy for the Age of Mega-Competition

# (1) Changing market environment and changing strategies

## ● Structural recession (1975 to 1984)

- Shipbuilding demand was minimal
- Fuel cost: 100 to 200 dollars/ton
- Environmental regulations: None
- Shipyards in accordance with the environment

**Low-cost competition only**

## ● Age of mega-competition

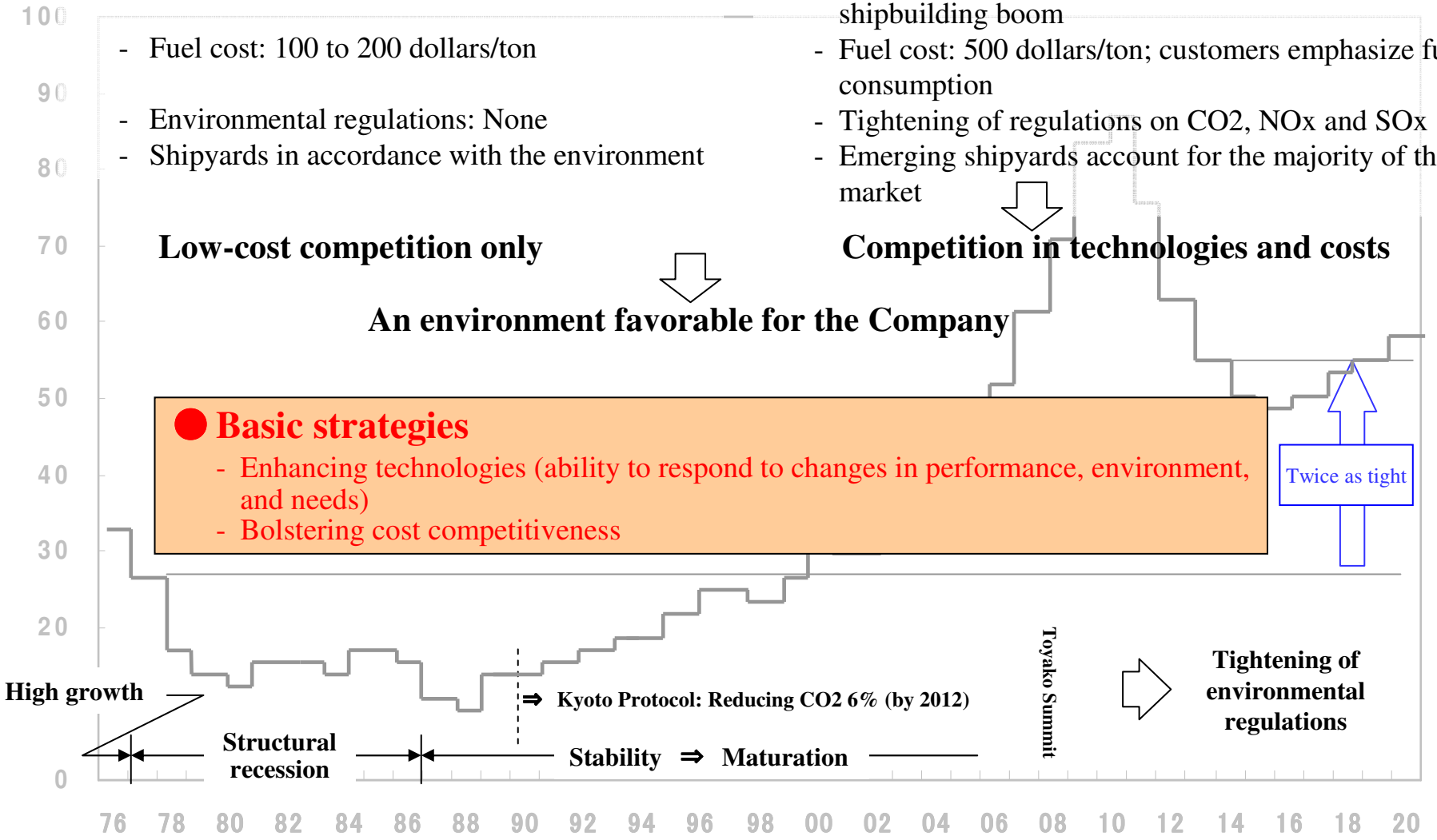
- Demand is about twice that at the time of the shipbuilding boom
- Fuel cost: 500 dollars/ton; customers emphasize fuel consumption
- Tightening of regulations on CO2, NOx and SOx
- Emerging shipyards account for the majority of the market

**Competition in technologies and costs**

**An environment favorable for the Company**

## ● Basic strategies

- Enhancing technologies (ability to respond to changes in performance, environment, and needs)
- Bolstering cost competitiveness



(2) Technical strategy

## Bolstering the overall ability of the Company to improve fuel efficiency and respond to environmental regulations

### ● 1,000-strong design-related employees → bolstering a development-oriented structure

- A structure consisting of product planning teams by ship type

### ● Strengthening collaboration with other Company headquarters

- Technical Headquarters (obtaining support in basic technologies)
- Power Systems Headquarters
  (collaboration in turbine technology, diesel technology, SCR (DeNOx), and desulfurization technology)
- Machinery & Steel Structures Headquarters
  (collaboration in desulfurization technology)

## (2) Technical strategy (specific initiatives)

### (1) Product planning

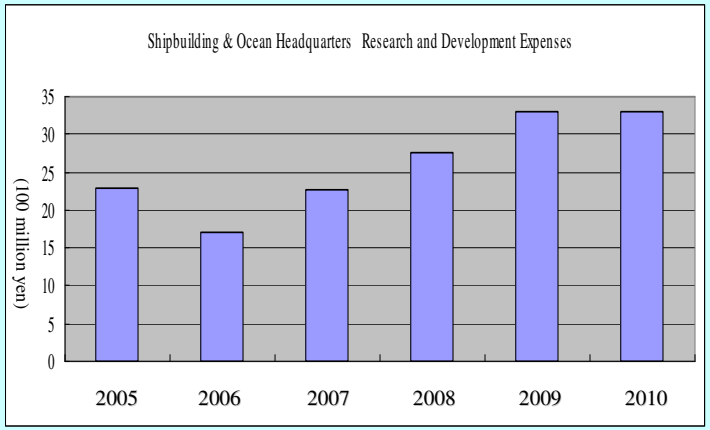
**View rising fuel costs and the tightening of environmental regulations as opportunities to differentiate our technical capabilities from those of competitors**

Using and reinforcing technical resources

Design staff: 1,020 employees

Research staff: 50 employees

Research facilities: towing tank etc.




(Note) Figures for 2005 and 2006 are results stated in financial reports.
Figures for 2007 and afterwards are forecasts stated in financial reports.

Collaboration with other headquarters

Power Systems Headquarters
(turbine, diesel, and SCR(DeNOx)technologies)

Machinery and Steel Structures Headquarters
(desulfurization technology)

**Product planning team by ship type**

**Sales** — **Design** (Head office)

**Manufacturing** **R&D centers**

(2) Technical strategy (specific initiatives)

## (2) Fuel efficiency

| | | |
|---|---|---|
| Large ferry |  | Fuel efficiency competitiveness<br>Superior comfort |
| Pure car and truck carrier |  | Fuel efficiency competitiveness<br>Superiority in loading efficiency |
| Container ship |  | Fuel efficiency competitiveness<br>Superiority in heavy container ships |
| LNG carrier |  <br>  | Continue to build MOSS LNG carriers that offer superior safety<br>Competitiveness by enhancing fuel efficiency 15% or more |

(2) Technical strategy (specific initiatives)

## (3) Enviornmental action

### ★ $CO_2$ regulations

- **IMO began examining regulations in 2003. Regulations will come into force as soon as the next few years**

→ **The Shipbuilding and Ocean Development Headquarters and Power Systems Headquarters plan to jointly start a project to achieve a 30% reduction.**

### ★ NOx regulations

- **Being tightened in stages from 2005 to 2015**

→ **The Power Systems Headquarters plans to develop an SCR system to be embedded inside the ship within a few years**
**The Shipbuilding and Ocean Development Headquarters is considering an efficient plant structure**

### ★ Sox regulations

- **Being tightened in states in stages in 2005 and in 2010**

→ **The Power Systems Headquarters and Machinery and Steel Structures Headquarters are considering the introduction of a desulfurization system to be embedded inside the ship.**

(3) Cost competitiveness strategy

**Transforming facilities and production processes and using external resources**

## ● Bolstering infrastructure

- Work in docks → on the ground
  (Larger hull blocks → bolstering the capacity of cranes)
- Equipment in accordance with changes in rules (blasts and coating)

## ● Production process transformation (introducing MATES in manufacturing facilities)

- Shipbuilding facilities: rough estimates → eliminating losses through IT and digitization
- Improving block dimensional accuracy → laser cutting, welding, and measurement
- Using external resources

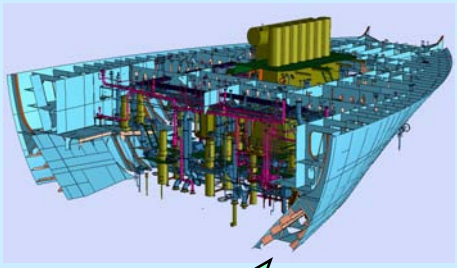
## ● Enhancing education

## (3) Cost reduction

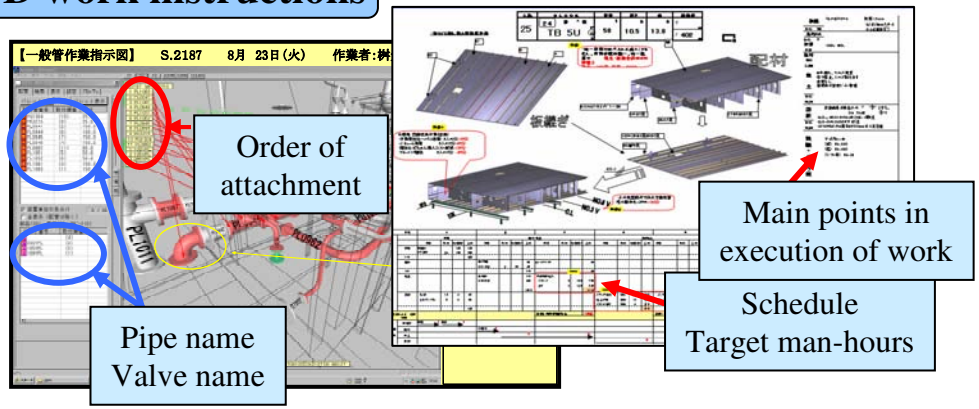
# (1) Making work instructions and understanding easier

**Transforming production processes using MATES (i)**

**Product model (3D product information)**



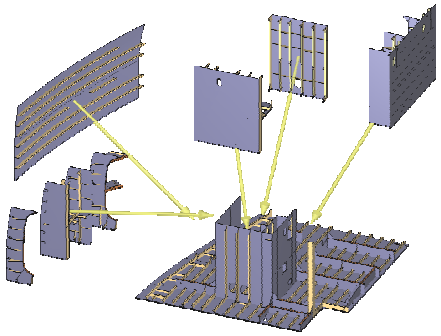
**3D work instructions**




**3D model detabase unique to shipbuilding**

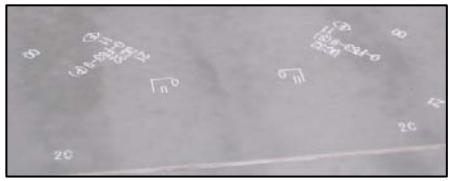
**3D display**

**Assembly sequence**



**Marking-off on steel plates**
**(automatic marking-off of work instructions on steel plates)**

**Steel plates marking facility**



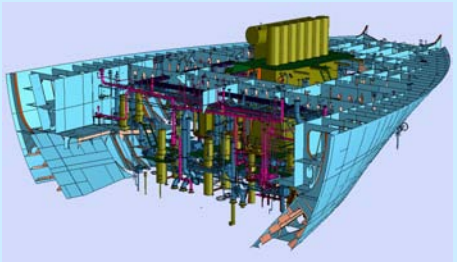
**Steel plate**

(3) Cost reduction

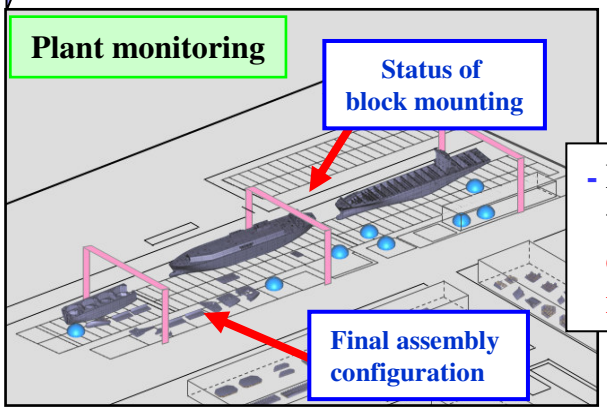
Transforming production processes using MATES (ii)

## (2) High precision production management

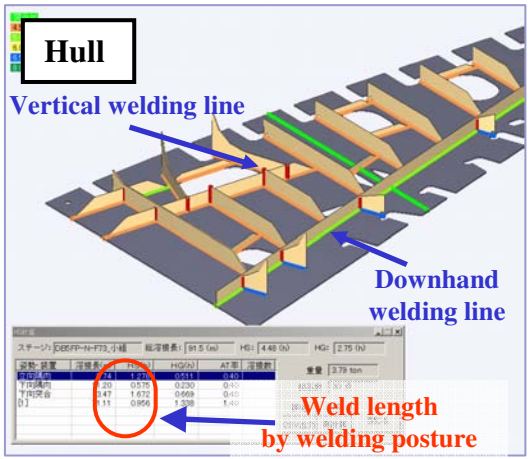
Product model
(3D product information)

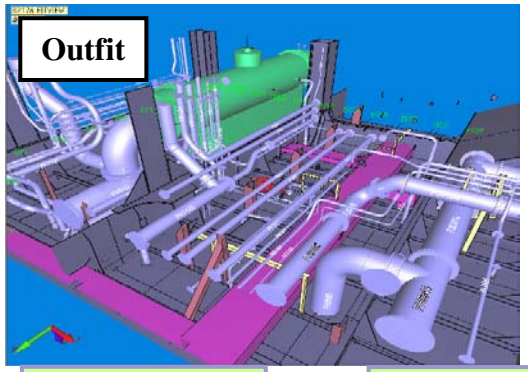


Production management innovation




Determining quantity and standard time




Pipe/outfit Quantity by stage → Estimate of work time

<Prompt PDCA cycle>

- Instructions in day-to-day work for each person

Performance

- Monitoring progress in the plant using consolidated schedule management every day

Instructions

Plan

- Production planning and manning management based on a highly accurate workload
(Schedule for each stage)

- Calculating standard hours per work element from the 3D model
  - Hull : Weld length by welding posture
  - Outfit: Number of outfits x standard time

(3) Cost reduction

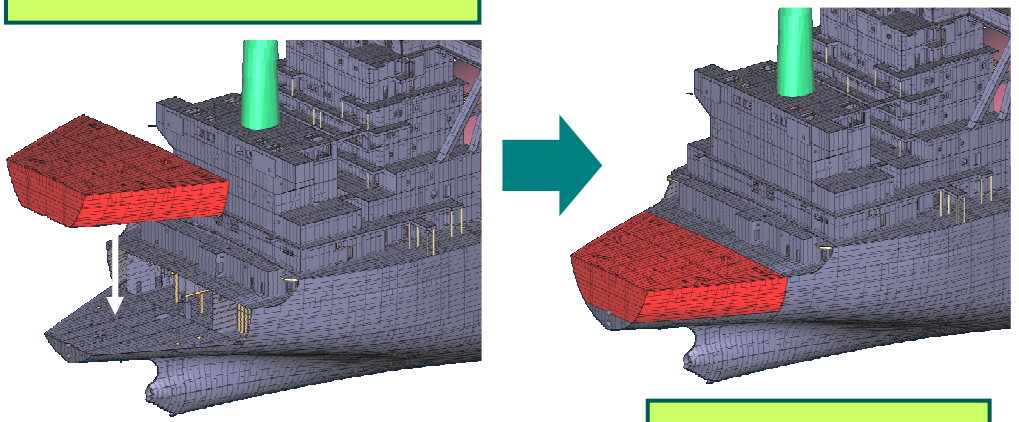
## (3) High precision manufacturing

**Transforming production processes using MATES (iii)**

### ☆ Improving dimensional accuracy

Improving the dimensional accuracy of parts to shorten time for work within docks and reducing man-hours
→ aiming for high accuracy block manufacturing

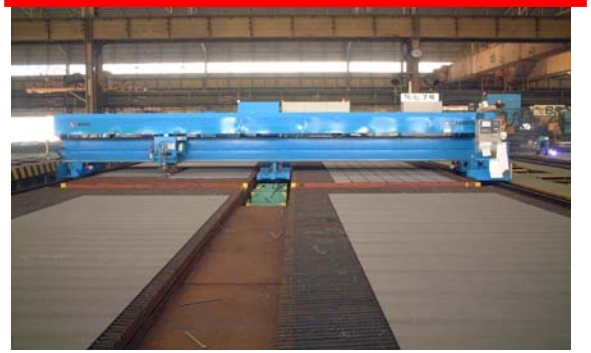
**High accuracy block**



**Fast Just Fit-in**

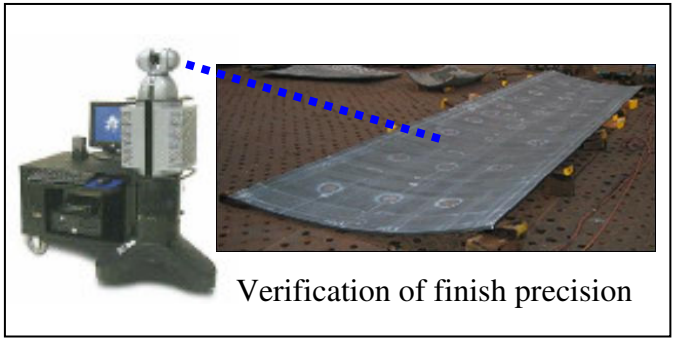
Improving cutting precision and high precision bending, and minimizing welding distortion

**Introducing laser cutting machine**



**Laser welding of hull**

**3D measuring system**



Verification of finish precision

(3) Cost reduction

## (4) Introducing MATES - Mitsubishi Advanced Total Engineering system of Ship -

◆ **A 3D shipbuilding system developed by the Nagasaki Shipyard & Machinery Works (design and manufacturing) over about 30 years**

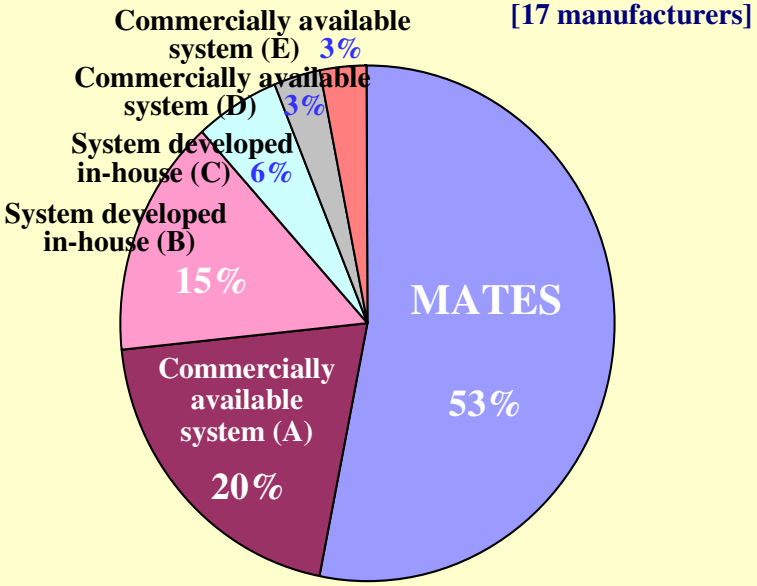
**What is the difference between MATES and commercially available systems?**

◇ **MATES has a broad array of attributes (plate thickness, material types, cross-sections, etc.), and information on those attributes, needed for detailed design and production work support.**

◇ **Even with a broad array of attributes, and information on those attributes, data entry is practical. (Simple input has long been pursued.)**

**Domestic shipbuilding system market share**

(Jan. to Dec. 2007, based on completed GTs) [17 manufacturers]




**MATES can be a key tool for integration of design, production, and management.**

## (3) Cost competitiveness strategy

**Transforming facilities and production processes and using external resources**

### ● Bolstering infrastructure

- Work in docks → on the ground
  (Larger hull blocks → bolstering the capacity of cranes)
- Equipment in accordance with changes in rules (blasts and coating)

### ● Production process transformation (introducing MATES in manufacturing facilities)

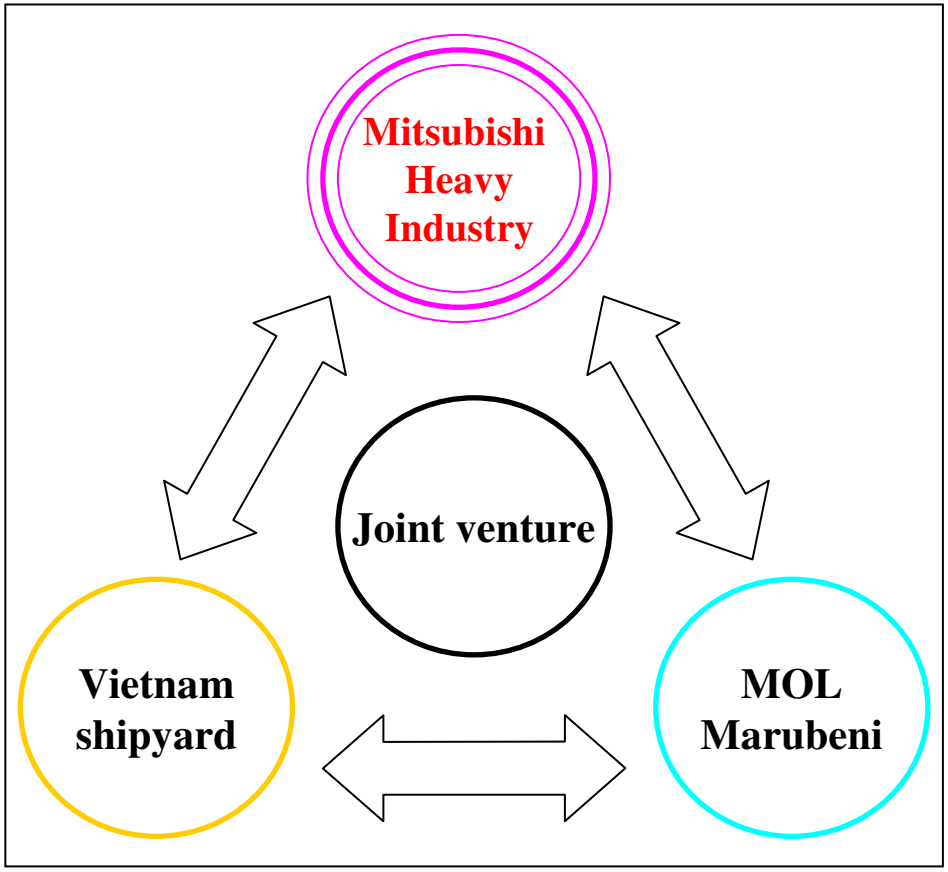
- Shipbuilding facilities: rough estimates → eliminating losses through IT and digitization
- Improving block dimensional accuracy → laser cutting, welding, and measurement
- Using external resources

### ● Enhancing education

(3) Cost reduction

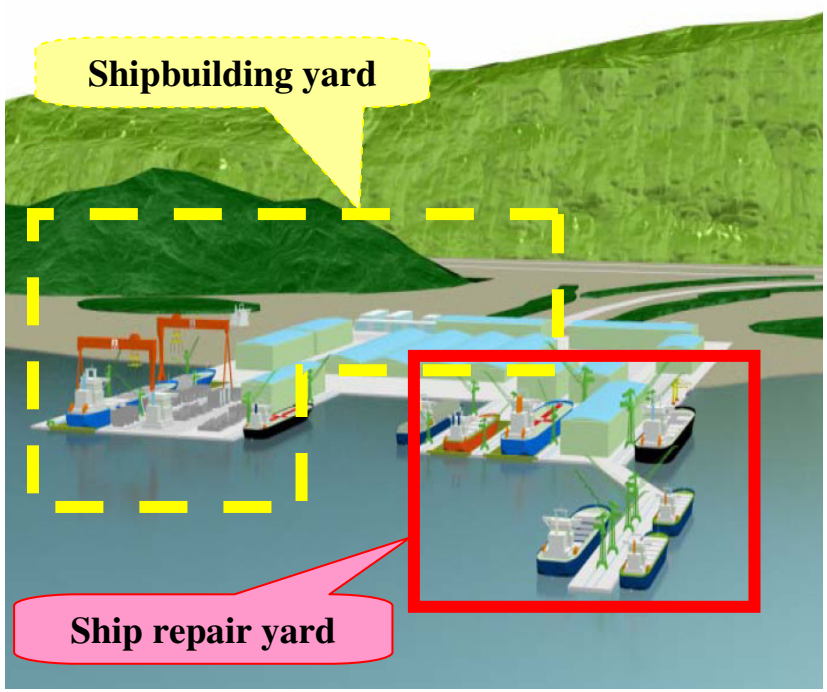
**(5) Using external resources**

## Ship repair in Vietnam (Under FS)




- **Operations are slated to begin in 2010**
- **Shipbuilding operations will be decided based on future market trends**

## Image



## (3) Cost competitiveness strategy

**Transforming facilities and production processes and using external resources**

### ● Bolstering infrastructure

- Work in docks → on the ground
  (Larger hull blocks → bolstering the capacity of cranes)
- Equipment  In accordance with changing rules (blasts and coating)

### ● Production process transformation (introducing MATES to manufacturing facilities)

- Shipbuilding facilities: rough estimates → eliminating losses through IT and digitization
- Improving block dimensional accuracy → laser cutting, welding, and measurement
- Using external resources

### ● Enhancing education

# 5. Direction of the Shipbuilding & Ocean Development Business

## (1) Emphasizing business health

- The shipbuilding bubble, a period during which building more ships meant deriving more profits, will soon end.
  A distended stomach is associated with starvation.
- We aim to have a healthy, 300 billion yen business.

## (2) Competing through innovation in manufacturing centered on technical capabilities

- We will bolster our resources and leverage them properly.
- Our customers will say, “Mitsubishi ships provide better performance and safety even though they cost more.”

## (3) Developing operations overseas and consolidating businesses

- We will broaden our perspective and flexibly pursue a broad range of initiatives.