Ways forward for Utilization of QZSS in Maritime Industry

Japan Marine United Corporation

Hitachi Zosen Corporation

6th February 2018

Outline

1. Outline of Japan Marine United Corporation (JMU)
2. Outline of Hitachi Zosen Corporation (Hitz)
3. Advanced marine technologies from ICT perspective
4. Utilization of QZSS in maritime industry

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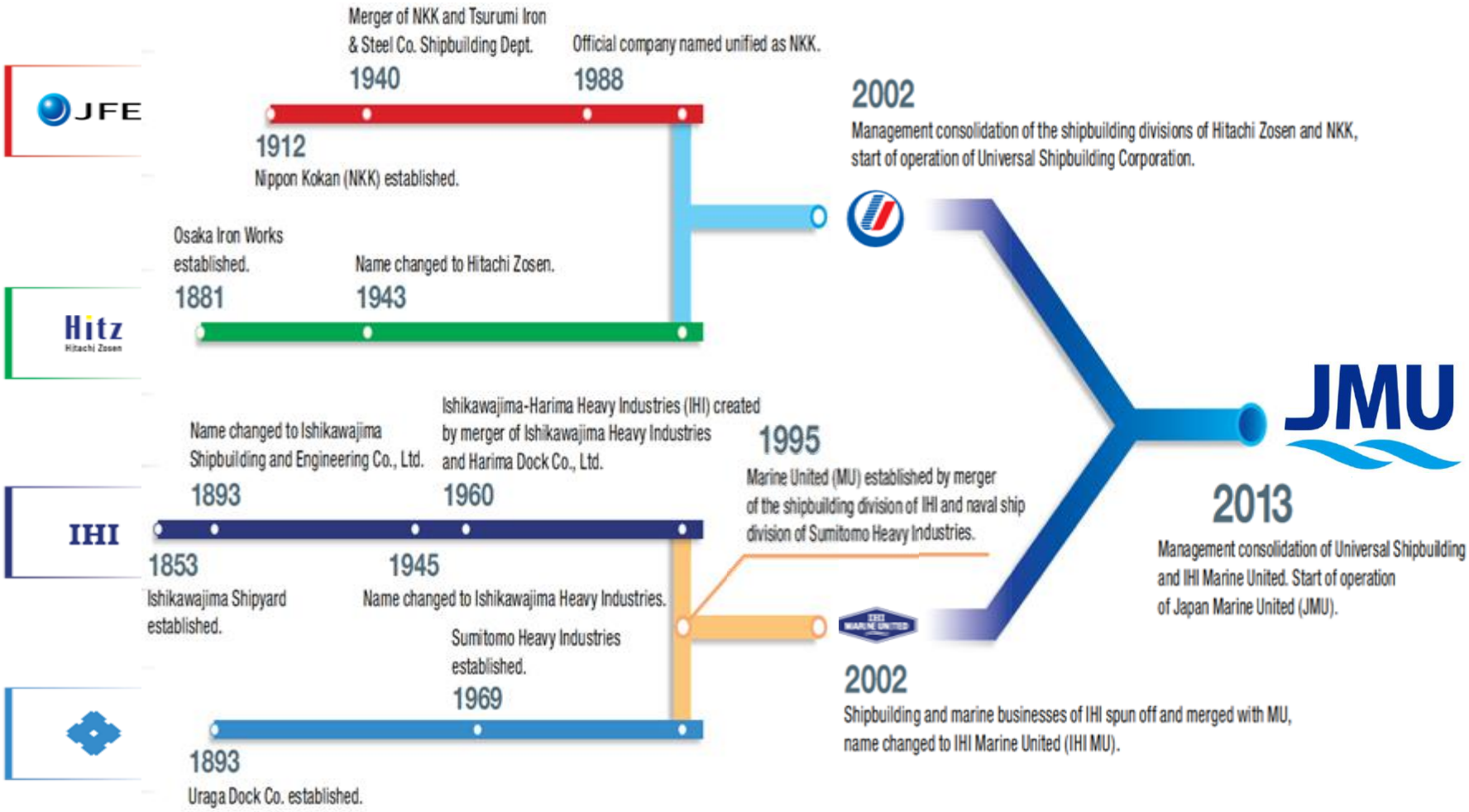
JMU Company History



JMU Shipyard Locations

Maizuru Shipyard
OSV / Kamsarmax BC /
Navy Ship (Repair)

Innoshima Shipyard
Marchant Ship (Repair)

Kure Shipyard
Container Ship / VLCC /
Aframax Tanker / Ultramax BC /
Navy Ship (Repair)

Head Office

Ariake Shipyard
VLCC / VLOC / Capesize BC /
PCTC

Tsu Shipyard
LNGC / LPGC / Suezmax Tanker / Capesize BC / Kamsarmax BC

Technical Research Center

Yokohama Shipyard
(Isogo Works)
Navy Ship / Coast Guard Ship / Car Ferry / Ultramax BC
(Tsurumi Works)
Navy Ship / OSV

JMU Products

- ✓ Cargo ships
  - Container ship, bulk carrier and pure car carrier
  - Crude oil tanker and liquefied gas carrier

- ✓ Cruise ship and car ferry
- ✓ Offshore structure and support vessel

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Hitachi Zosen Corporation


Head office (Osaka, Japan)

Date of founding	April 1, 1881
Date of establishment	May 29, 1934
Head office	Osaka, Japan
Chairman	Minoru Furukawa
President & CEO	Takashi Tanisho
Capital	403 million U.S. dollars
Net sales	3,434 million U.S. dollars
Number of employees	9,825 (As of March 31, 2016)

Environment, Energy & Plant Business


Environmental Systems


Water Treatment Systems


Desalination plant

Infrastructure, Machinery Business


Steel Bridge


Electro chlorination systems

Hitachi Zosen - Corporate Chronology

1881 E.H. Hunter, of England, founded shipyards, 'Osaka Iron Works'

1936 Hitachi Ltd., acquired Osaka Iron Works.
1943 The name was changed to Hitachi Zosen Corporation.
1946 Left Hitachi Group, became Independent.

2002 Consolidation of Shipbuilding Operation with NKK Corp (Now JFE Steel Corporation), newly established 'Universal Shipbuilding Corporation'.
2010 Acquired European Refuse Incineration Plant Maker, 'AE&E Inova A.G'. (Now Hitachi Zosen Inova AG)

2011 Celebrated 130th Anniversary

Hitachi Zosen - Business Domain

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Hitachi Zosen Business Domains

The Hitachi Zosen Group is leveraging its technological expertise to evolve into a company with the no.1 public recognition
in the business domains of Green Energy, Social Infrastructure, and Disaster Prevention.

Business domain 1 Green Energy

- Energy-from-Waste systems
- Renewable energy
- Biomass technology
- Energy systems
- Environmental purification systems

New Business and New Fields

- SCR system for marine engines
- Offshore wind power generation
- Hitz Dehydration System *HDS®* by zeolite membrane element
- Solar heat power generation system
- Eco-agriculture systems
- Vegetable oil-fired biomass power facilities
- OLED production systems

Business domain 2-1 Social Infrastructure

- Environmental preservation systems
- Power generation facilities
- Infrastructure
- Machinery for food and medical industries
- GPS systems
- Plants and process equipment
- Industrial machinery
- FPD and semiconductor production equipment
- Electronic control systems

Business domain 2-2 Disaster Prevention

- GPS Comprehensive Oceanographic Monitoring System (GCOMS)
- Movable flap-gate type breakwater
- GPS remote monitoring system
- High-precision GPS system
- Bridge maintenance and earthquake protection
- Marine civil engineering

Hitachi Zosen - Global Network

Facts & Figures of Hitachi Zosen Corporation

Japan
2 Head Offices
8 Domestic Offices
8 Works Locations

Overseas office
Total 17 Overseas Offices

Overseas Subsidiaries & Affiliates
42 Overseas Subsidiaries & Affiliates

Satellite Positioning Business

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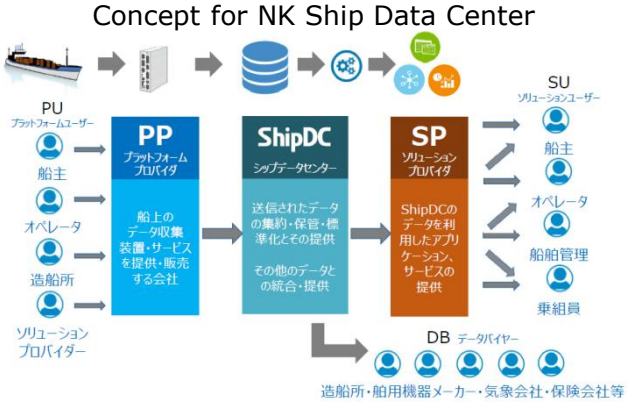
Rapid development of Computer and Network Technology

- ✓ Continuous improvement of computer performance
- ✓ Development of ICT
  (Information and Communication Technology)
  - IoT (Internet of Things)
  - AI (Artificial Intelligence)
    Machine learning, deep learning
  - Big data analysis



http://classnk-rd.com/pdf/katsudou201704_E.pdf

- ✓ Development of Infrastructure
  Data center, cloud computing, communications infrastructure
- ✓ Increase of access speed/capacity and improving cost-performance in ship and shore communication

Japanese Government's Project

i-Shipping Project promoted by MLIT

(Ministry of Land, Infrastructure, Transport and Tourism)

i-Shipping (design)

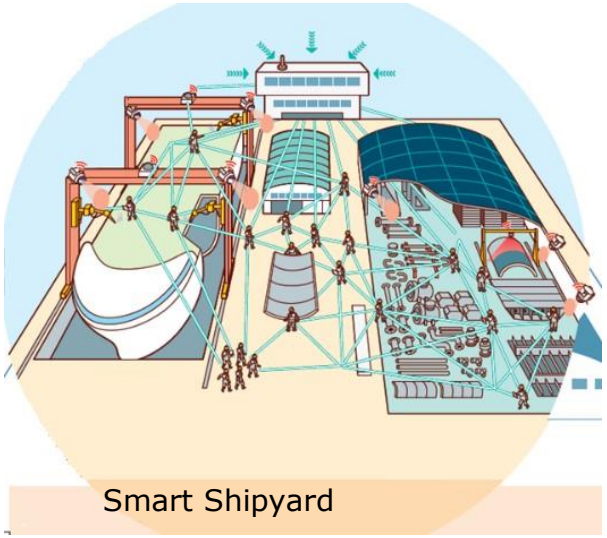
Ex. shorten the lead time
to develop new hull form

✓ i-Shipping (production)

Realize IoT equipped
"Smart Shipyard"

✓ i-Shipping (operation)

Higher life-cycle value
through efficiency, safety and reliability



Smart Shipyard

http://www.mlit.go.jp/common/001171287.jpg

Autonomous Ship Project in EU

- ✓ ReVolt
  DNV-GL
  Fully battery powered
  and autonomous vessel

Source: DNV GL Web

- ✓ MUNIN
  Fraunhofer, Marintek, etc.
  Verification of autonomous ship


Source: MUNIN Web

- ✓ AAWA
  Rolls-Royce, etc.
  Remote controlled vessel

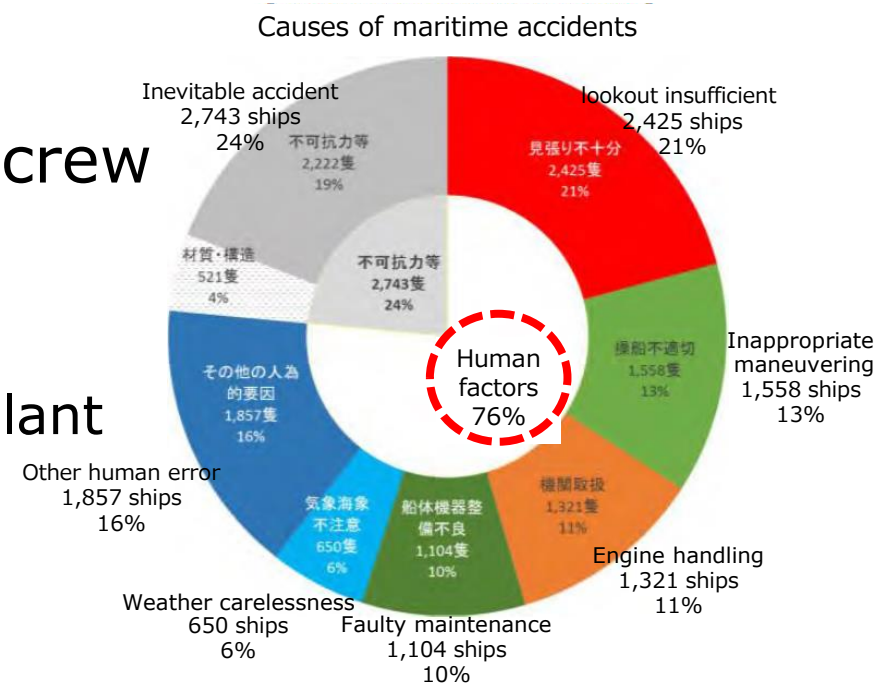

Source: Rolls-Royce Web

- ✓ Other: MAXCMAX, MASRWG, etc.

Improving ship's safety

- ✓ Shortage of ship's crew vis-à-vis ship's tonnage increase
- ✓ Relative erosion of crew's skill due to enhancement of functionality of ship's equipment

- ✓ Support system for ship's crew
  - Ship's maneuvering support
  - Support of operation and maintenance of machinery plant
  - Autonomous ship



http://www.kaiho.mlit.go.jp/info/kouhou/h27/k20150318/k150318-2.pdf

Purposes for using ICT on board

ICT can realize highly developed vessels

- ✓ Avoid accidents caused by human error with maneuvering support
  Ex. watching and warning around ships
  -> improve ship's safety
- ✓ Reduce crew's workload through plant operating support
  Ex. prediction and prevention of troubles
  -> improve quality of ship's operation
- ✓ Optimize ship's operation by using monitored data in actual ship's operation
  -> reduce operation cost

Using ICT on vessels . . .

Step I(Now) - Improve efficiency of ship's operation

Weather routing, trouble prediction, etc.

Step II - Advanced support to ship's operation

Monitoring, improving prediction accuracy by AI, etc.

Step III - Reduce ship's crew

Partially automated system, Collision avoidance system, etc.

Step IV - Autonomous ship

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What is QZSS (Quasi-Zenith Satellite System)

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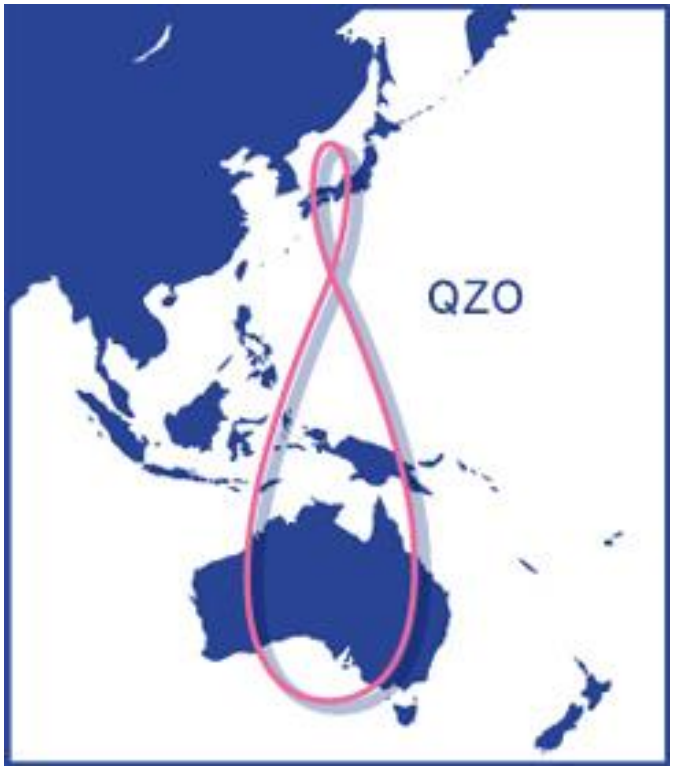
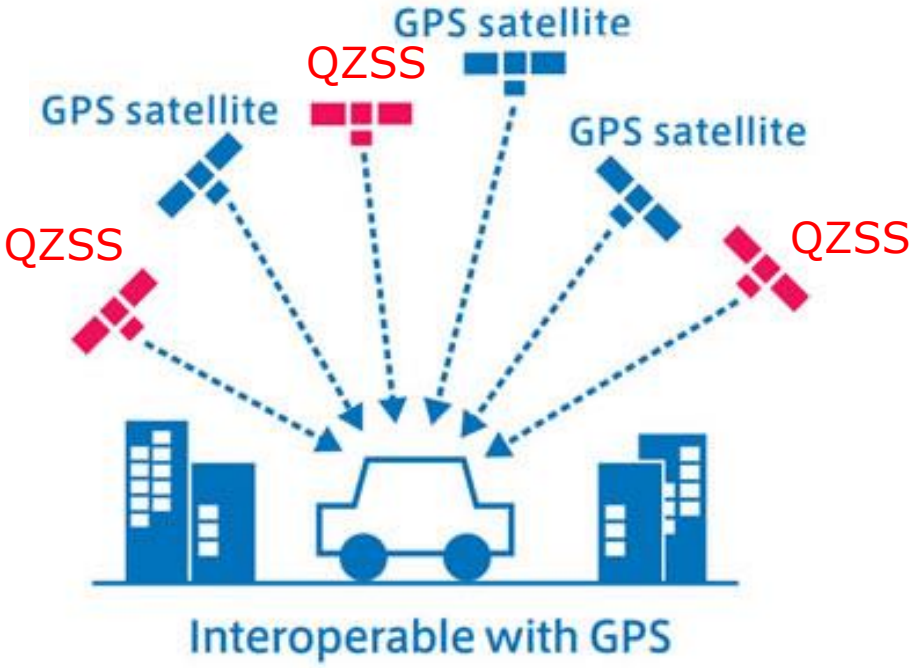
QZSS is a Japanese satellite positioning system composed mainly of satellites in quasi-zenith orbits.

QZSS operates in the Asia-Oceania regions where longitudes are close to Japan, so its servicing regions can be expanded to other countries in these regions as well.

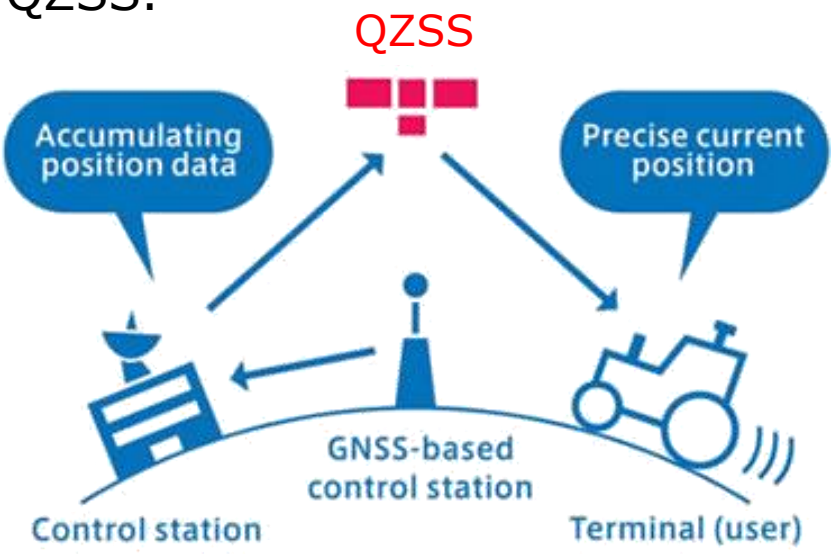


Overview of QZSS

QZSS is meant for combined and integral use with GPS, enjoying use of an adequate number of satellites for stable, high-precision positioning.



To carry out highly precise satellite positioning, calculations are made using the signal data from GNSS-based control stations. Information used to enhance accurate search for one's current position (centimeter level augmentation information) is transmitted by QZSS.



Overview

- ✓ Australia is the world's largest island country
- ✓ The third largest EEZ (Exclusive Economic Zone) – 8,2232,000km2
- ✓ 12,000 islands on the coastline of 60,000 km
- ✓ 23,700 international vessels are calling at 79 ports
- ✓ Handle 10% of world maritime trade
- ✓ Cover 5 of the world's marine climatic zones

Reference
Toby Stone
General Manager, Marine Environment Division
Maritime Emergency Response Commander (MERCOM)
Australian Maritime Safety Authority

Trend and forecasts for Australian container ports

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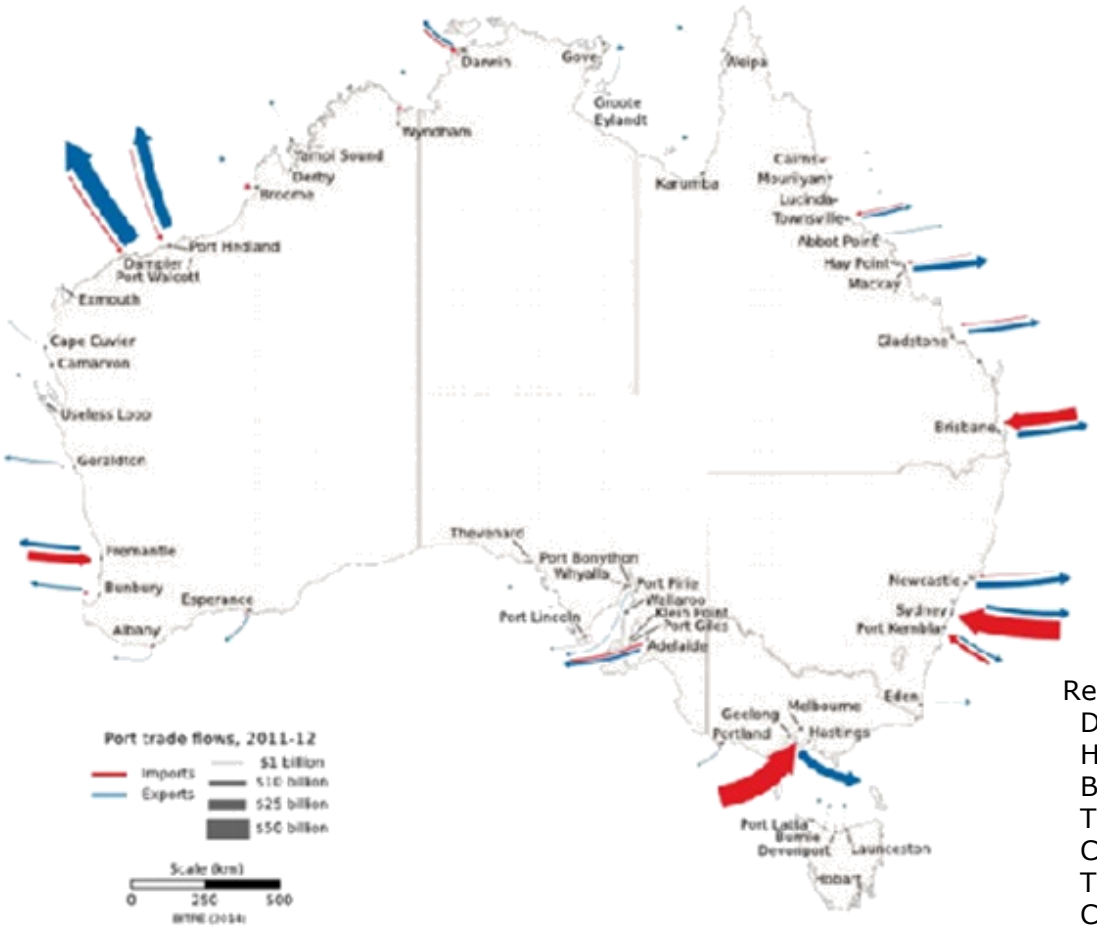
Australian port trade values: 2011-12



Reference
Dr Gary Dolman
Head of Bureau
Bureau of Infrastructure,
Transport and Regional Economics
Canberra
Trend and Forecasts for Australian Container Ports

Trend and forecasts for Australian container ports

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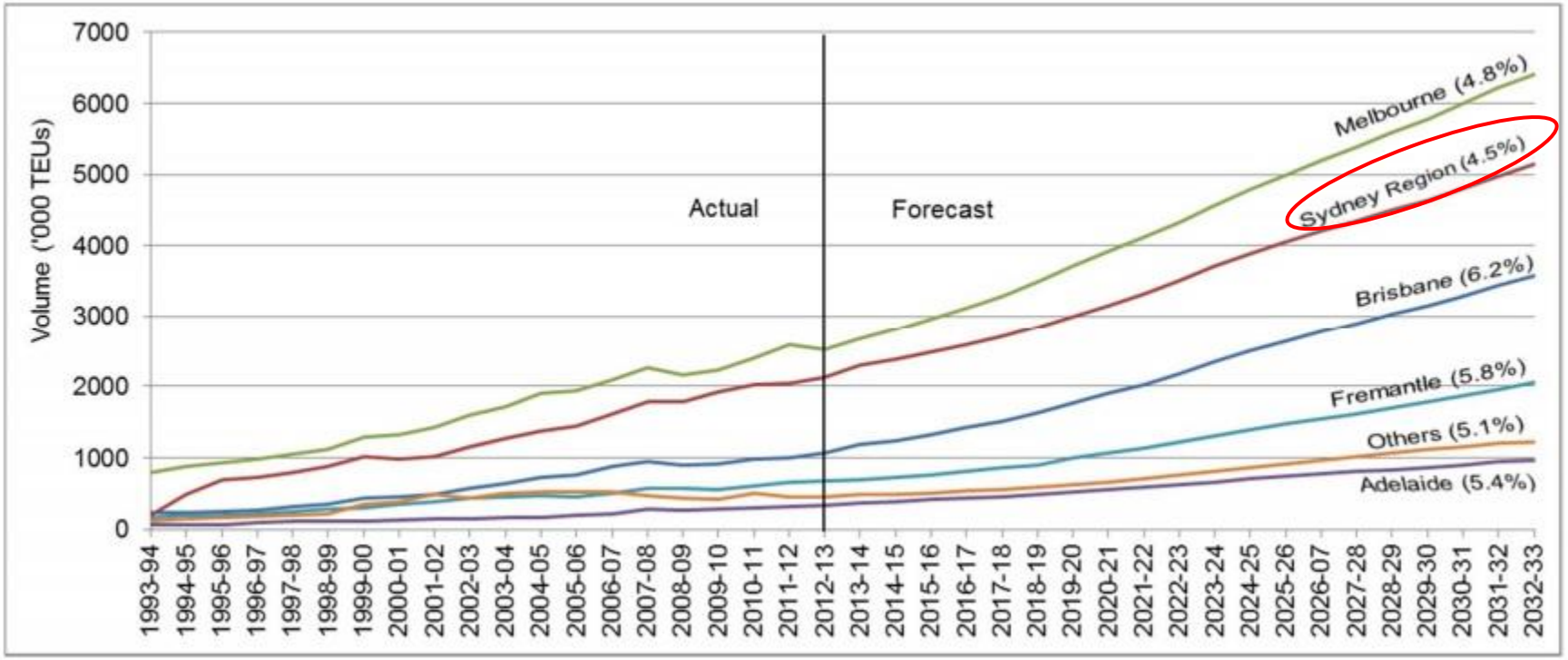
Forecasts: Containerised trade by port



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Maritime needs in Australia

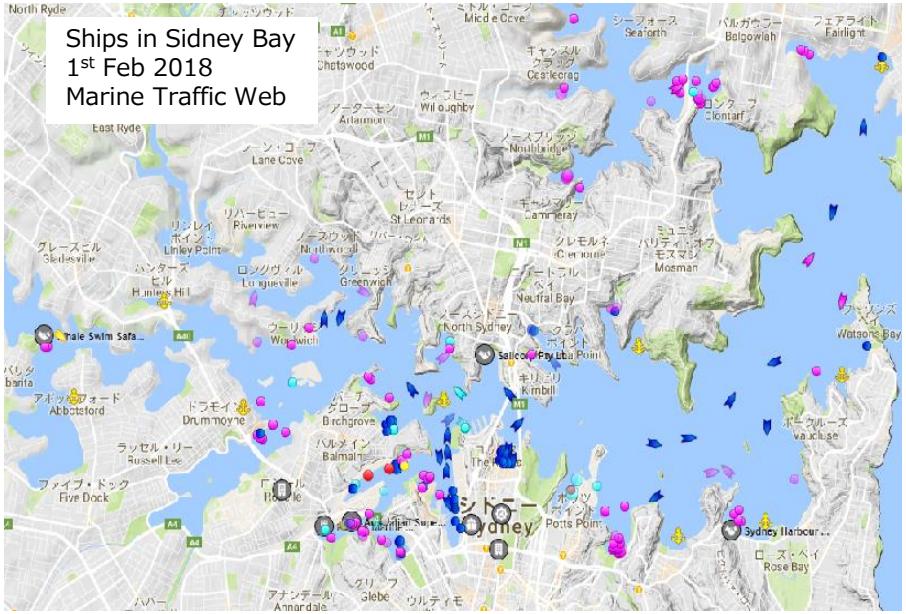
- ✓ As a relatively small open economy, international trade should be particularly important for Australia.
- ✓ Competing internationally will bring in earnings to grow the economy and improve living standards and social welfare.
- ✓ International trade is critical to Australia's economic prosperity.

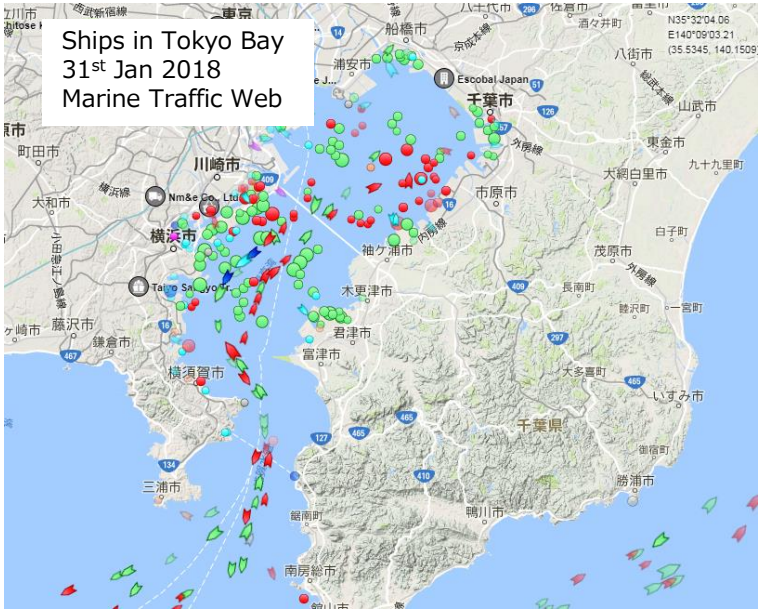
- ✓ The efficiency of ports and the transport infrastructure that strengthens the link to various markets is vital in reducing import and export costs.
- ✓ Efficiency measures - such as better management of terminal containers, maximization of crane use, and the introduction of more automated handling equipment - provide opportunities to improve port efficiency and eases or mitigates capital investment for expansion.

Requirement of exact ship position

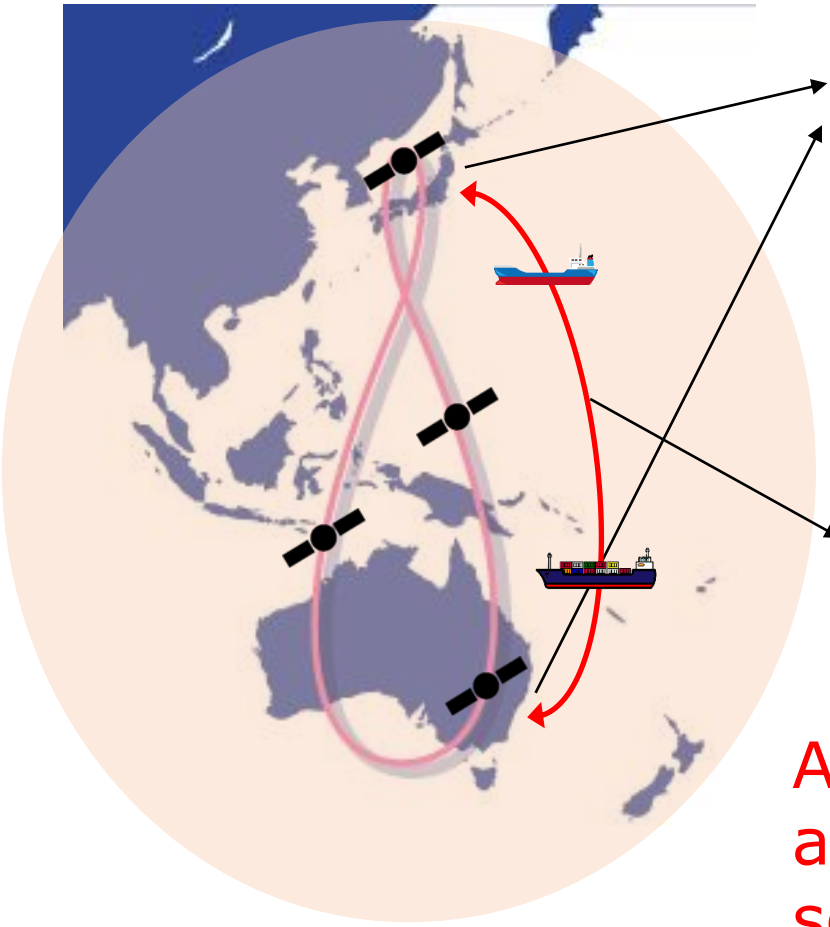
Ships need to be operated very carefully when the ship passes coastal area and berths to terminal.

More accurate ship position than the ones provided by DGPS will be required to realize advanced operation support or autonomous operation of ships.





Utilization of QZSS on ships



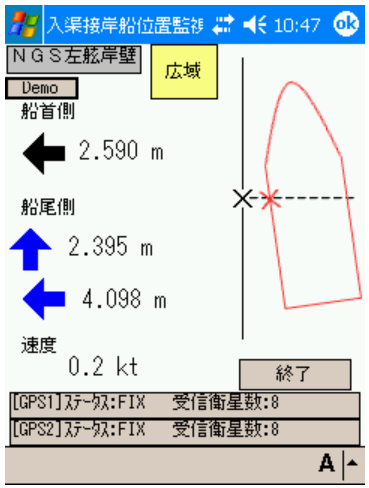
- ✓ Ship's berthing operation
- ✓ ship's canal passage operation
- ✓ Monitoring ship's motion

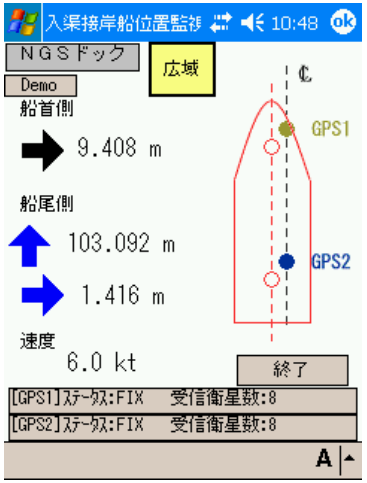
Australia ⇔ Japan
a lot of regular shipping services

Utilization of QZSS on ships in port

Ship’s crews pay close attention to berthing the ship to shore, avoiding collision that will cause damages to the ship, crew, cargo, passengers, etc.

Information of ship’s exact position with QZSS will be helpful to enhance ship’s berthing operation.





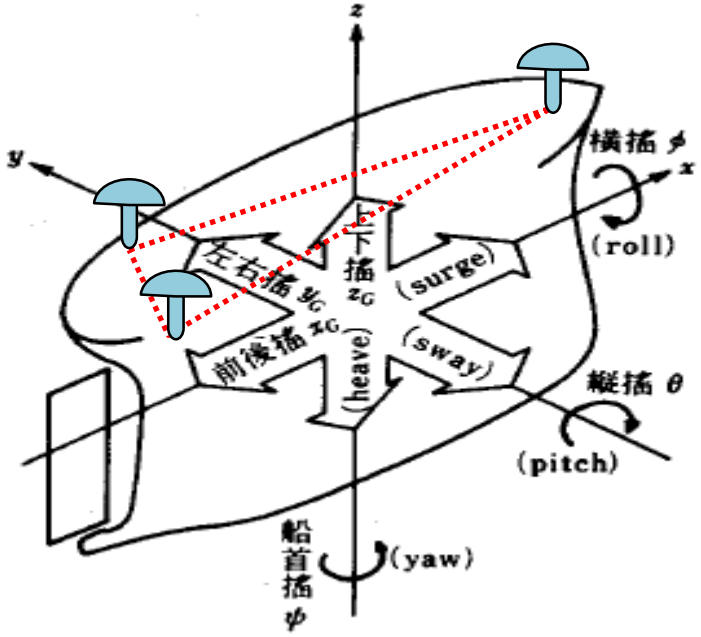
Utilization of QZSS on ships in port

Ship berthing support system using exact ship's position of QZSS may be characterized by the following features:

- ✓ Safer ship berthing operation
- ✓ Time saving of berthing operation
  It reduces ships speed and fuel consumption during ocean going.
- ✓ Easing of traffic congestion in harbour.

Further possible usage of QZSS on ships

- ✓ Support to ship's canal passage operation
- ✓ Monitoring ship's motion (roll, pitch, heave, etc.) and its impact to the ship and equipment



Source: Zosen Sekkei Binran
The Kansai Society of Naval Architects, Japan

Summary - challenges of shipyard

- ✓ Development of ships with ICT and other advance technologies
  - Higher safety and quality in ship's operation
  - Lower environmental load and operational cost
- ✓ Highly accurate ship's position data from QZSS brings higher safety and lower environmental load in maritime logistics.

Contact us - we are here to serve you

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