NYK selects Furuno Open Platform (FOP) as the base of Fleet Management System

10th September 2014
at Furuno Press Conference in SMM 2014 Hamburg

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MTI (Monohakobi Technology Institute), NYK Group

Outline

1. Introduction of NYK and MTI R&D

2. Smart Fleet Operation Project and Furuno Open Platform (FOP)

3. Applications - weather routing services

4. Applications – NYK own development

5. Summary

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NYK Corporate Profile

- **NYK LINE (Nippon Yusen Kaisha)**
  - **Head Office： Tokyo, Japan**
  - **Founded： September 29, 1885**
  - **Business Area**
    - **Liner (Container) Service**
    - **Tramp and Specialized Carrier Services**
    - **Tankers and Gas Carrier Services**
    - **Logistics Service**
    - **Terminal and Harbor Transport Services**
    - **Air Cargo Transport Service**
    - **Cruise Ship Service**

NYK Head office in Tokyo

- **Employees : 32,342 (as of the end of March 2014)**

- **Revenues : $ 22 billion (Fiscal 2013)**

NYK Fleet (as of the end of March 2014)

Containerships (including semi-containerships and others)
101 vessels / 5,572,991 DWT

Bulk Carriers (Capesize)
129 vessels / 24,576,302 DWT

Bulk Carriers (Panamax & Handysize)
286 vessels / 17,597,420 DWT

Wood-chip Carriers
49 vessels / 2,580,879 DWT

Cruise Ships
3 Vessels / 21,577 DWT

Car Carriers
125 vessels / 2,230,958 DWT

Tankers
77 vessels / 12,056,781 DWT

LNG Carriers
29 vessels / 2,172,415 DWT

Others
26 vessels / 318,002 DWT

877 vessels
68,036,568Kt (DWT)

5

MTI

- Established - April 1, 2004

- Locations
    – Head office – Tokyo, Japan
    – Singapore branch office - Singapore
    – Laboratory – Yokohama, Japan

- Stockholder - NYK Line (100%)

- Number of employees – 60 (as of April 1, 2014)

- Company president – Mr. Makoto Igarashi

- Business areas
    – R&D of Maritime Technology
    – R&D of Maritime Information Technology
    – R&D of Logistic Technology

    for NYK Line and other partners

Outline

Smart Fleet Operation Project

- Schedule 2013-2017 (5 years)
- Project budget – approx. 6 million USD
- Supported by MLIT(Japanese government) and Class NK
- Commitment
  - 10% fuel consumption and CO_2 emission reduction
- Work items
  1. Optimum fleet operation system
  2. Integrated vessel monitoring system
  3. Data analytics of vessel performance in service
  4. Data analytics of ship motion in weather
  5. Business process innovation
- Project partners
  - NYK, MTI, Furuno Electric, Kawasaki Technology

NYK SIMS
Ship Information Management System

Monohakobi Technology Institute

NYK GROUP

SIMS auto logging data (per hour)
& SPAS electronic abstract
logbook data (per day)
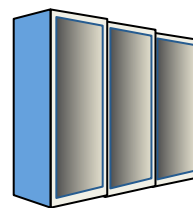
Data Center

Weather routing service provider

FOP Data Collection System Onboard

VSAT/Inmarsat-F/FB

SIMS Monitoring & Analysis System at Shore

Communications via Technical Management

Feedback to captains

Operation Center

Singapore, ...

• GPS
• Doppler log
• Anemometer
• Gyro Compass

FOP unit

121.0
3.81

Viewer

VDR / ECDIS

Data Acquisition and Processing

Motion sensor

<Navigation Bridge>

<Engine Room>

• Main Engine
• FO flow meter
• Torque meter

Engine Data Logger
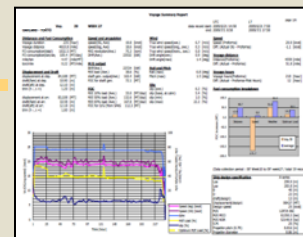
Voyage Analysis Report
Break down analysis of fuel consumption for each voyage

Report

Technical Analysis (MTI)
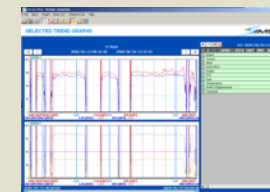
FOP Viewer

-Trend monitoring of speed, M/E RPM, fuel consumption and other conditions per hour

- Engine monitoring

Application development on Furuno Open Platform (FOP)
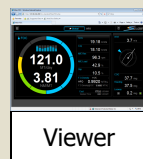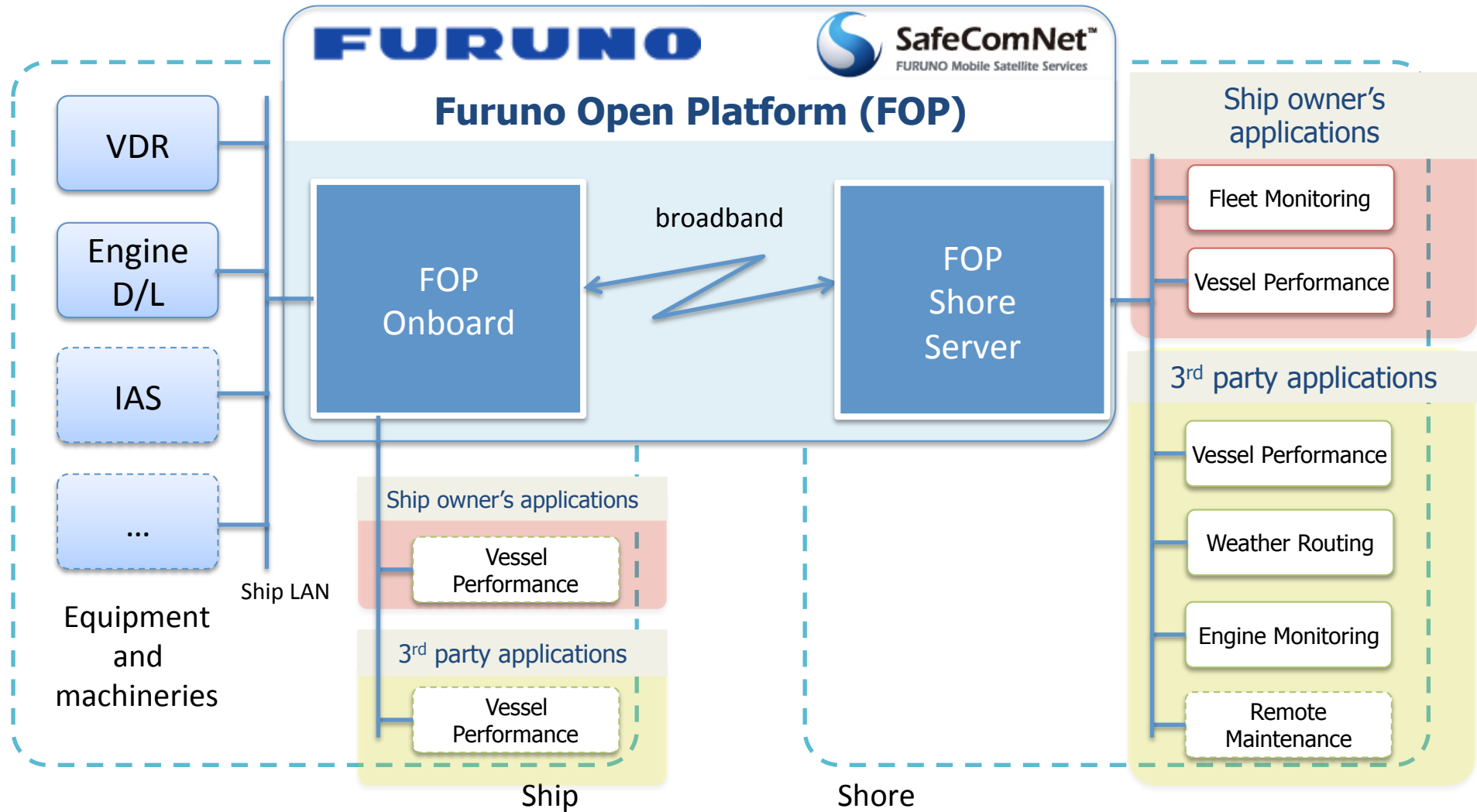
Outline

Optimum weather routing

Major waypoint	DateTime	Nav.	Dist	OG SPD	RPM	Remarks
				(OG SPD:Over Ground Speed)		
Latest Reported Position						
41N/150W	Oct-22nd 1345Z	RL	780	20.7	77	nil
		GC	1445	20.6	77	nil
SW of San Miguel Is.	Oct-25th 1200Z					
		RL	133	17.0	77	nil
LOS ANGELES	-					

Req.Ave.OG SPD:20.2 kts for RTA/remaining distance.

[Major Waypoints of Route 1]

Way points

- Role of weather routing
  - (past) Avoiding severe weather
  - (now) Optimum weather routing
    - Best balance of
      - Safety
      - Schedule keep
      - Economy
      - Environment

- Necessary technology for optimum weather routing
  - Ship performance model
    - RPM – speed – fuel consumption
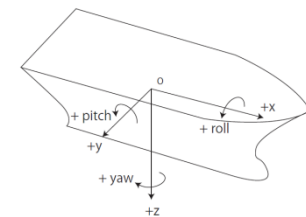 - Ship motion and performance in severe weather
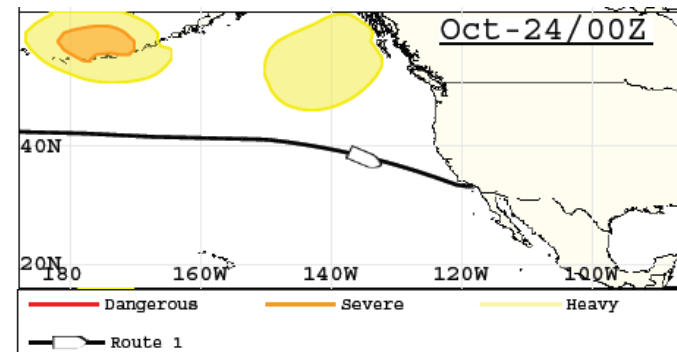
Routes and weather

Optimum weather routing with real time monitoring data

Weather Routing（PLAN）
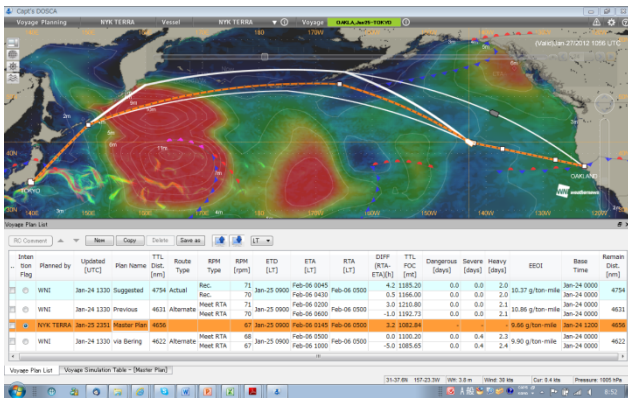
Furuno Open Platform

Monitoring（CHECK）

• Voyage plan

  + course, speed, RPM, FOC, weather

  + ship performance model

Feedback

• Voyage actual

  + actual speed – RPM, RPM - FOC

  + actual weather
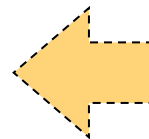
Ship model and weather forecast are inherently include errors.

But feedback loop by monitoring can make this system work better.

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Fleet monitoring
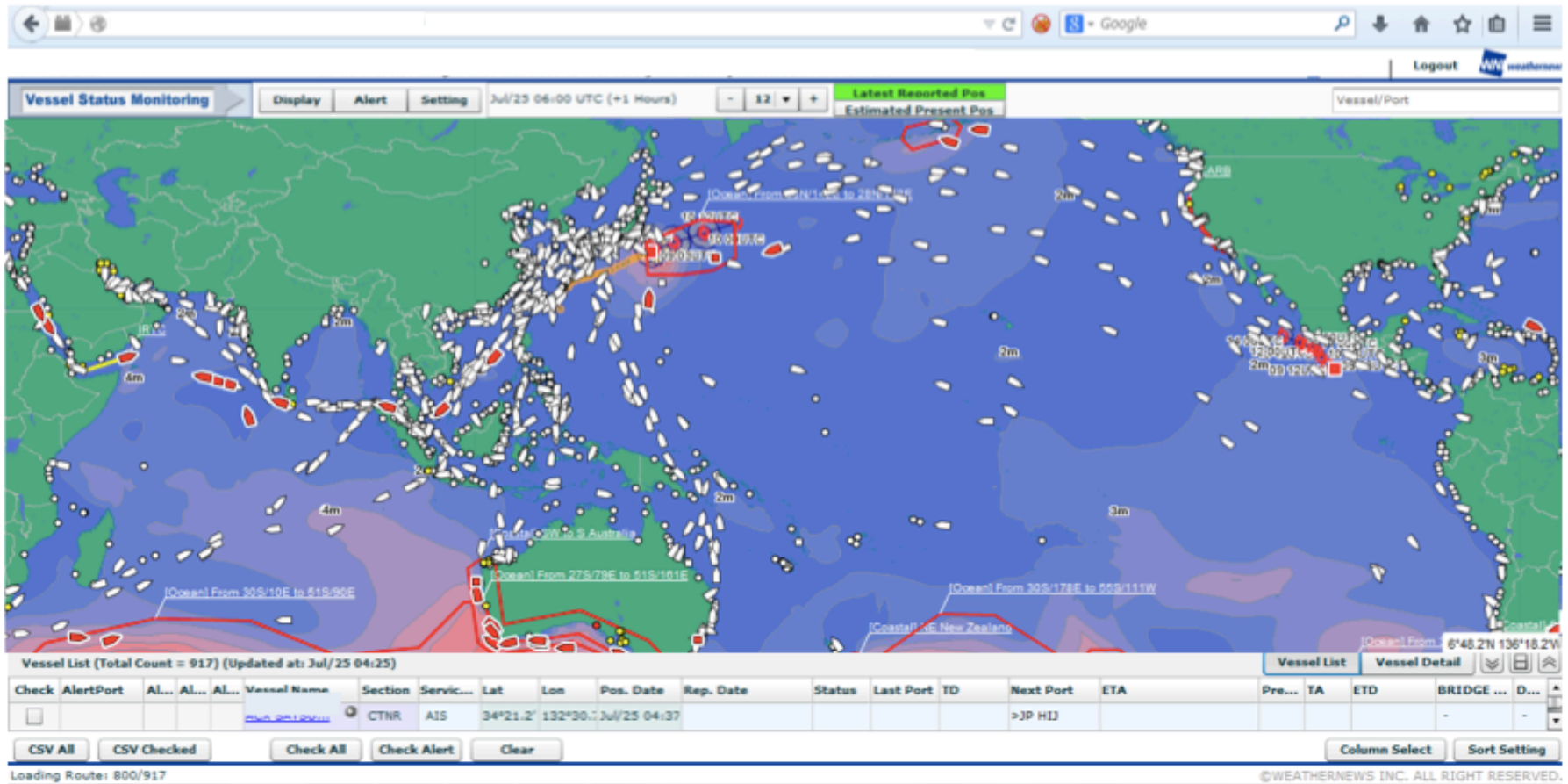
- Ship position and voyage schedule
- Weather forecast information is overlapped

Vessel Performance Monitoring

6500TEU Container Ship

Wave height 5.5m, Wind speed 20m/s, Head sea

Propeller rev. 55rpm

  <Calm sea performance>

  speed: 14 knot

  FOC: 45 ton/day

  <Performance in the rough sea>

  speed: 8 knot

  FOC: 60 ton/day

<Factors of performance change>
1. Wind and wave, 2. Ship design (hull, propeller, engine), 3. Ship condition (draft, trim, cleanness of hull and propeller, aging effect)
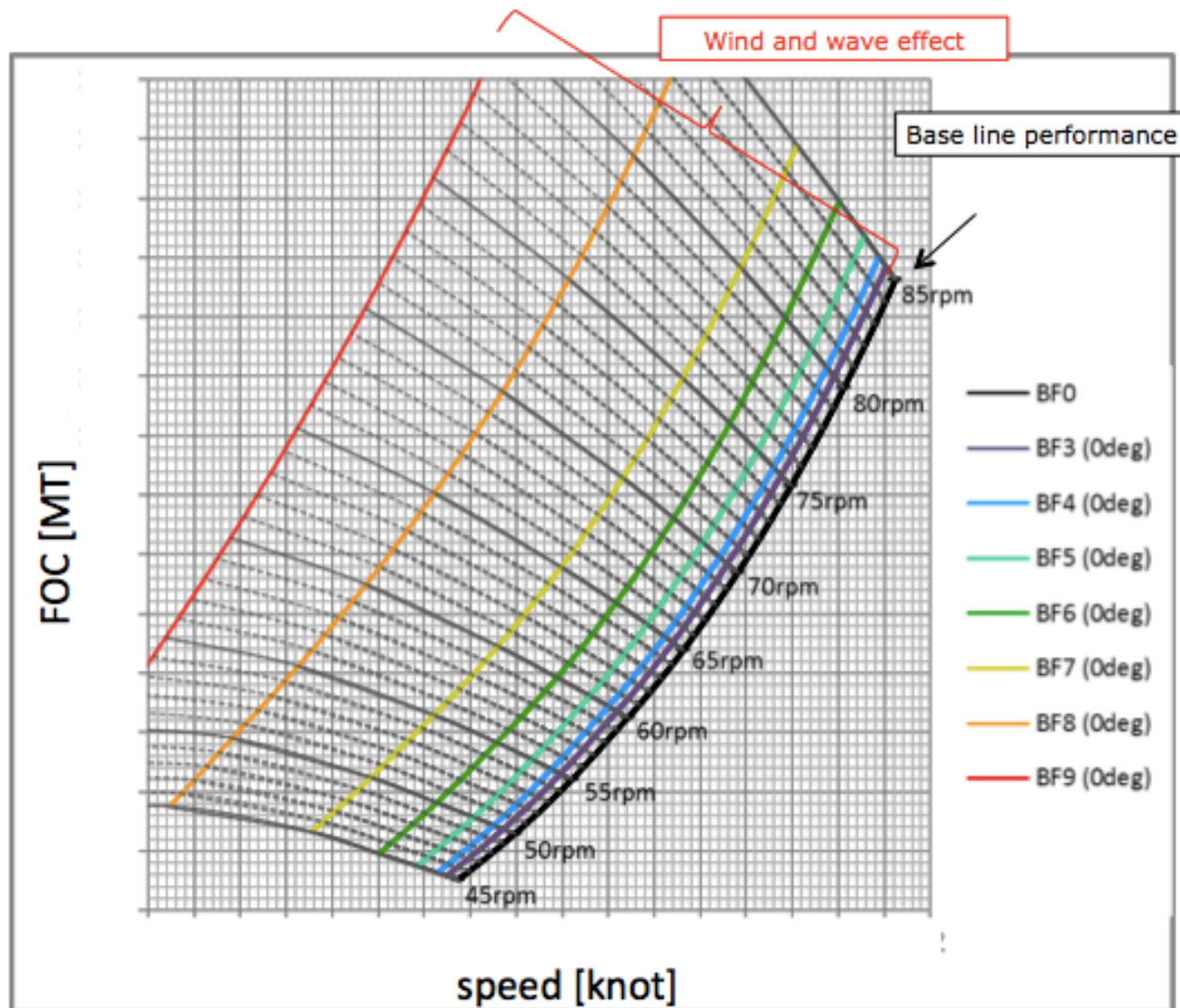
Vessel Performance Monitoring

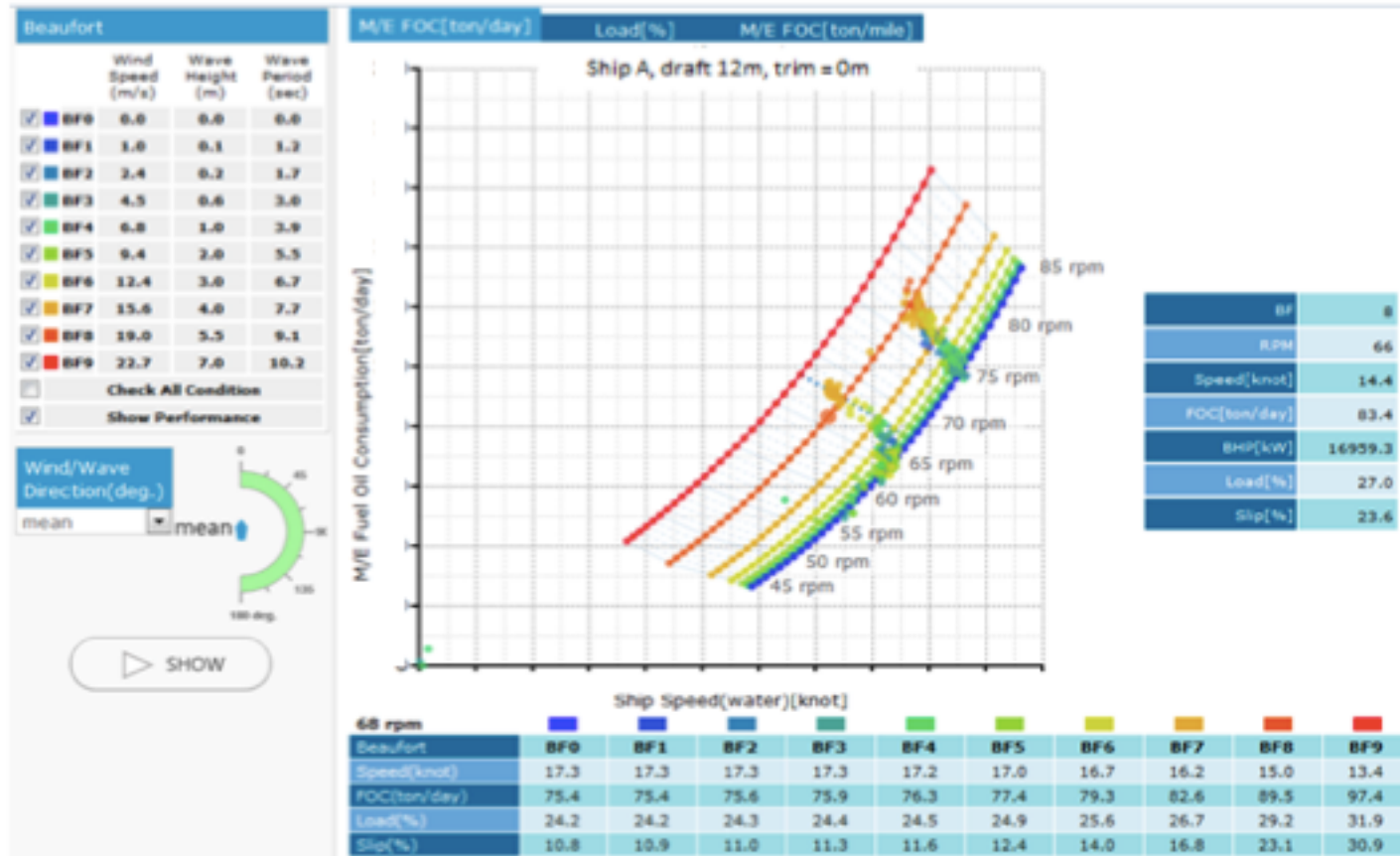<Target vessel>
6500TEU Container
Draft 12m even

Sea condition
Beaufort scale

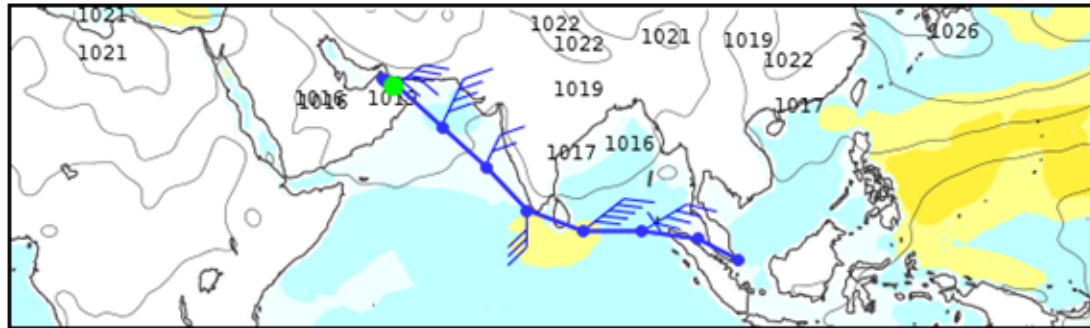|	wind speed (m/s)	wave height (m)	wave period (sec)
BF0	0.0	0.0	0.0
BF3	4.5	0.6	3.0
BF4	6.8	1.0	3.9
BF5	9.4	2.0	5.5
BF6	12.4	3.0	6.7
BF7	15.6	4.0	7.7
BF8	19.0	5.5	9.1
BF9	22.7	7.0	10.2

0deg（wind, wave）− head sea

Vessel Performance Monitoring
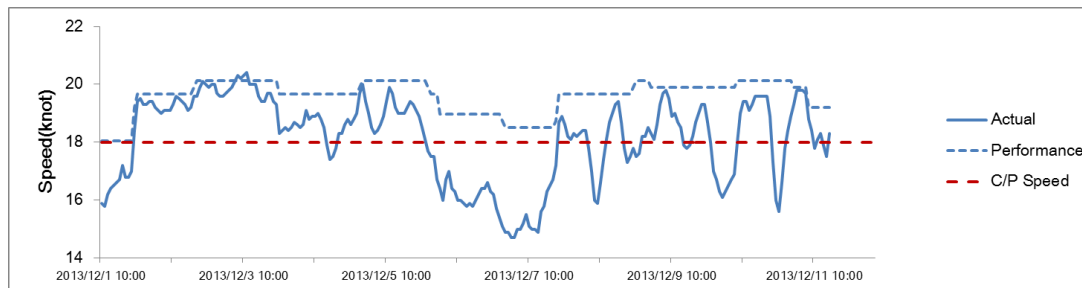

- Vessel performance model and its validation by monitored data
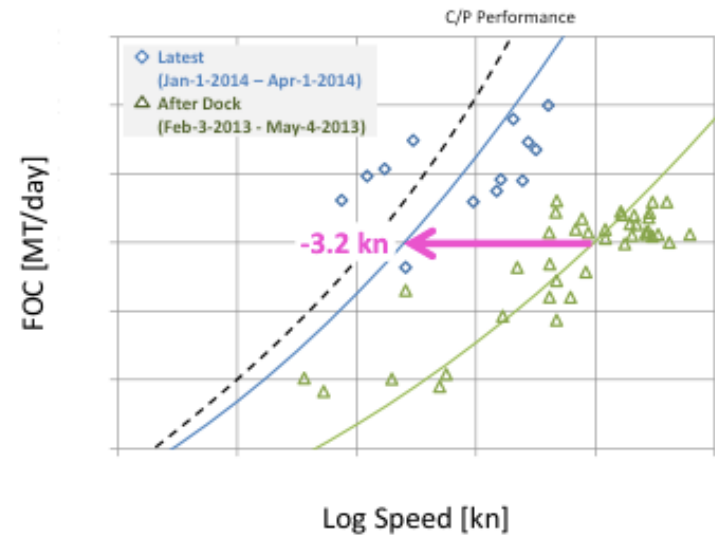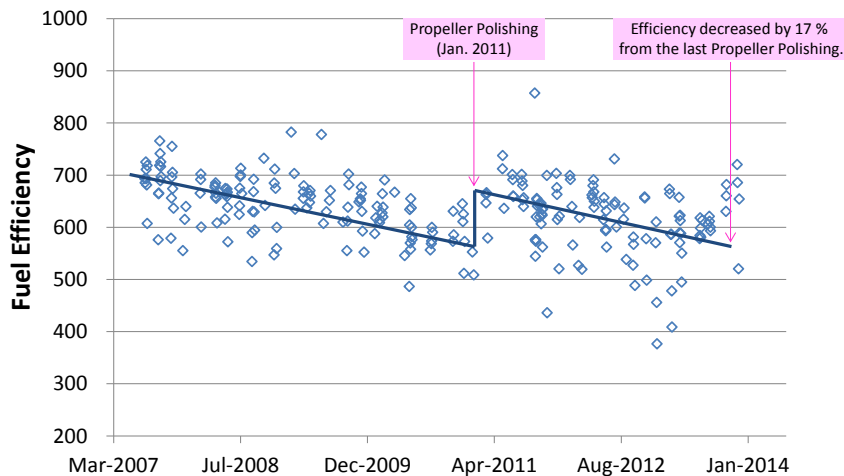
Post voyage analysis

- Post voyage analysis to evaluate energy efficiency in the voyage

Long term analysis

- Aging analysis to evaluate hull/propeller/engine performance degradation

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Summary

- NYK, MTI, Furuno and Kawasaki Technology are cooperatively working on Smart Fleet Operation Project

- Furuno Open Platform (FOP) collects data from onboard equipment and transfer the data to application services

- The following application examples are introduced
  - Weather routing services
  - NYK's own application

- NYK is expecting Furuno as the partner of developing and maintaining our our fleet management system for safety, energy efficiency and to optimize our business

Thank you very much for your attention