

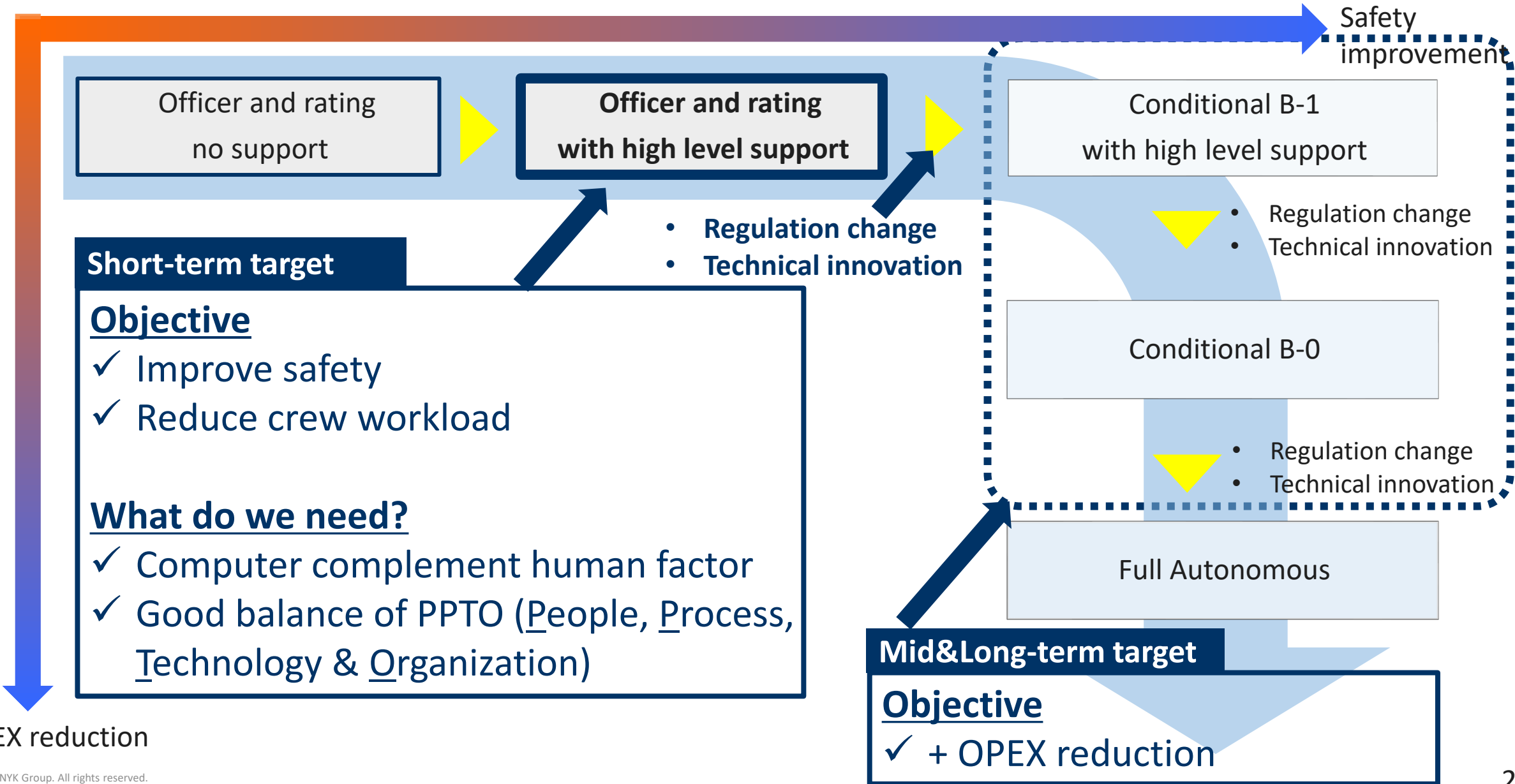
NYK autonomous ship project: Assisting crew

Dr. Hideyuki Ando

Director

MTI (NYK Group)

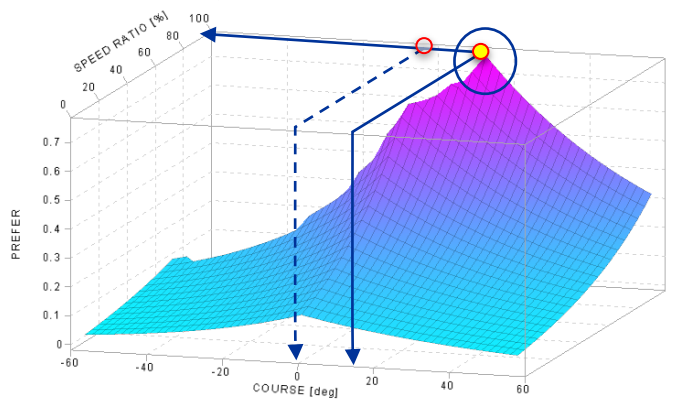
Contribution of Autonomous Ship for Deep Sea



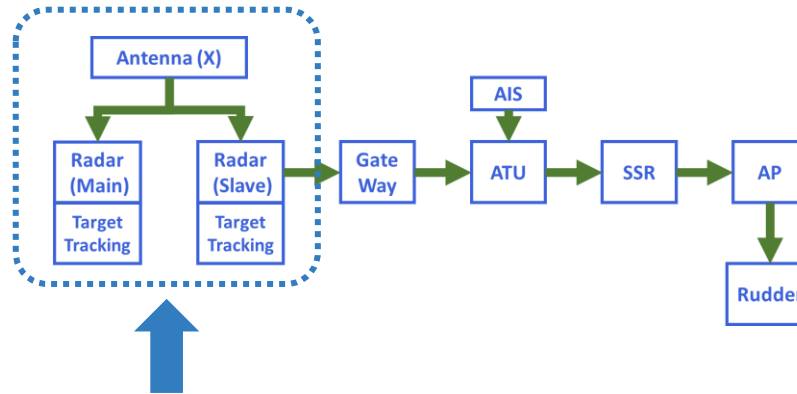
Case 1) NYK conducted world's first trial of MASS in accordance with IMO Interim Guidelines for MASS trials (Sep 2019)



- ▶ IRIS Leader, PCTC (NYK operation)
- ▶ Objective: onboard trial of automatic navigation system
- ▶ Trial schedule
 - Trial #1 ... 14th – 16th Sep (Yonagunijima – Ashizuri)
 - Trial #2 ... 19th – 20th Sep (Nagoya – Yokohama)
- ▶ Automatic navigation system
 - Information collection around ship from navigational devices
 - Calculation of collision risks
 - Automatic determination of optimal routes and speeds
 - Automatic navigation



System composition



Radar echo was used as the main sensor for situational awareness

PANAMA MARITIME AUTHORITY
 Technical Office – Segumar Tokyo
 Seimon Building/F, 2-21-7, Higashi-Azabu,
 Minato-ku, Tokyo, Japan 106-0044

Tel: (81) 3-5585-3661
 Fax: (81) 3-5585-3666
 E-mail: segumar@panamaconsult-tokyo.com

TO: NYK SHIP MANAGEMENT PTE.LTD.
 CC: NIPPON KAIJI KYOKAI (NK)
 DATE: AUGUST 21, 2019
 FROM: GENERAL DIRECTORATE OF MERCHANT MARINE, SEGUMAR-TOKYO
 SUBJ: M/V: IRIS LEADER IMO: 9748019 CALL SIGN: 3FL87
 ADMINISTRATION INTERPRETATION AND POSITION – MARITIME
 AUTONOMOUS SURFACE SHIPS (MASS) TRIALS

OUR REF: SGG 08/19/006

THIS ADMINISTRATION HAS BEEN INFORMED BY MANAGER THAT SUBJECT VESSEL WILL PERFORM MASS TRIAL WITHIN THE JAPANESE WATER FOLLOWING THE INTERIM IMO GUIDELINES FORM MASS TRIAL.

Approved by Panama Maritime Authority for conducting MASS trial in accordance with IMO interim guideline

CONSIDERING THAT THIS TRIAL WILL BE INFORMED TO LOCAL AUTHORITIES, THE TRIAL WILL PERFORM ACCORDING TO INTERIM GUIDELINES FOR MASS TRIALS (MSC.1/CIRC.1044) AND THAT VESSEL WILL FULLY MANNED AS PER REQUIRED ON MINIMUM SAFE MANNING CERTIFICATE ISSUED BY THIS ADMINISTRATION.

THIS ADMINISTRATION WILL SUPERVISE THIS TRIAL IN THE JAPANESE WATER AS LONG AS COMPLY IMO AND GMDSS REQUIREMENTS FROM LOCAL AUTHORITIES.

THIS AUTHORIZATION IS VALID UNTIL SEPTEMBER 30, 2019.

THE ACCEPTANCE OF THIS LETTER WILL BE HIGHLY APPRECIATED.

BEST REGARDS,

Samuel Guevara
ENG. SAMUEL GUEVARA
 SENIOR TECHNICAL OFFICER
 PANAMA MARITIME AUTHORITY
 SEGUMAR-TOKYO

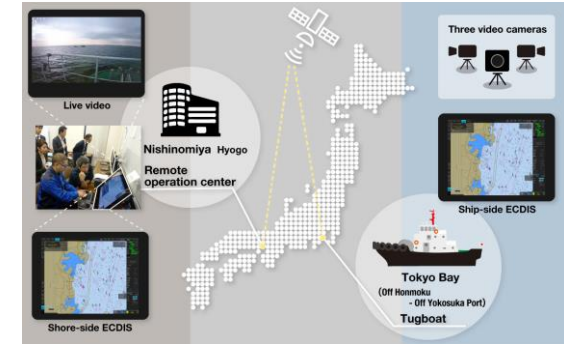
▶ Xinsha, China ~ Nagoya, Japan ~ Yokohama



Case 2) Remote Operation Demonstration in Japan t/w MLIT

- ▶ Objective: Demonstrate Remote Operation Concept
- ▶ Target ship: Tug boat “Yoshino Maru” (Shin-Nippon Kaiyosha)
- ▶ Project period: 2018.4 – 2021.3
- ▶ Project members: company name (role)
 1. MTI (project coordinator/concept design)
 2. JMS (project coordinator/simulator)
 3. NYK (project coordinator/ship owner)
 4. IKOUS (ship owner)
 5. Furuno Electric (navigation equipment)
 6. Japan Radio (navigation equipment)
 7. Tokyo Keiki (navigation equipment)
 8. BEMAC (DPS)
 9. Keihin Dock (shipyard)
 10. Mitsubishi Shipbuilding (engineering)
 11. Sky Perfect JSAT (satellite communication)
 12. NTT DoCoMo (4G/5G network)
 13. NTT (system provider)
 14. Niigata Power Systems(propulsion)
 15. ClassNK (verifier)
 16. NMRI (risk assessment)

Objective: Demonstration of the developed technology in i-Shipping (operation) project (2016-2020) and feedback to MLIT for their guideline & rule making

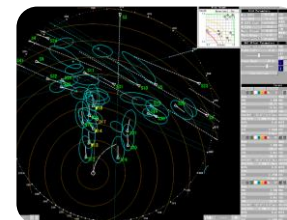
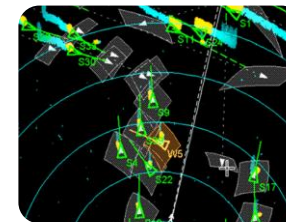
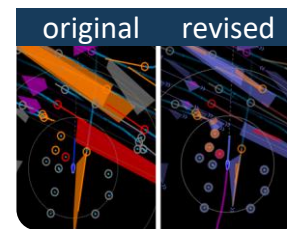


1st demonstration was conducted on 22nd January 2020.
2nd demonstration will be conducted on 3rd December 2020.

Remotely operate tug-boat in Tokyo bay from ROC in Nishinomiya (500km away)

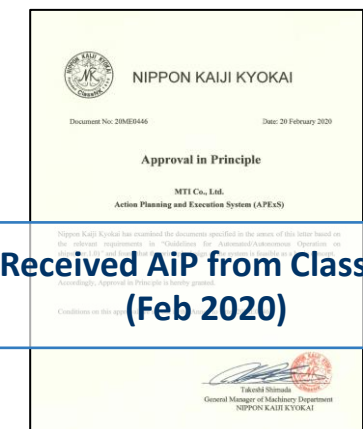
Enhanced situation awareness

- Visualize collision risk



Autonomous Ship Framework

- APEX (Action Planning and Execution System)



**Open Innovation by
Diverse Expertise + Shared Concept + Project Management**

Case 3) DFFAS (Designing the Future of Full Autonomous Ship) Project



Objective

- Demonstrate functions for full autonomous ship

Project consortium & partners

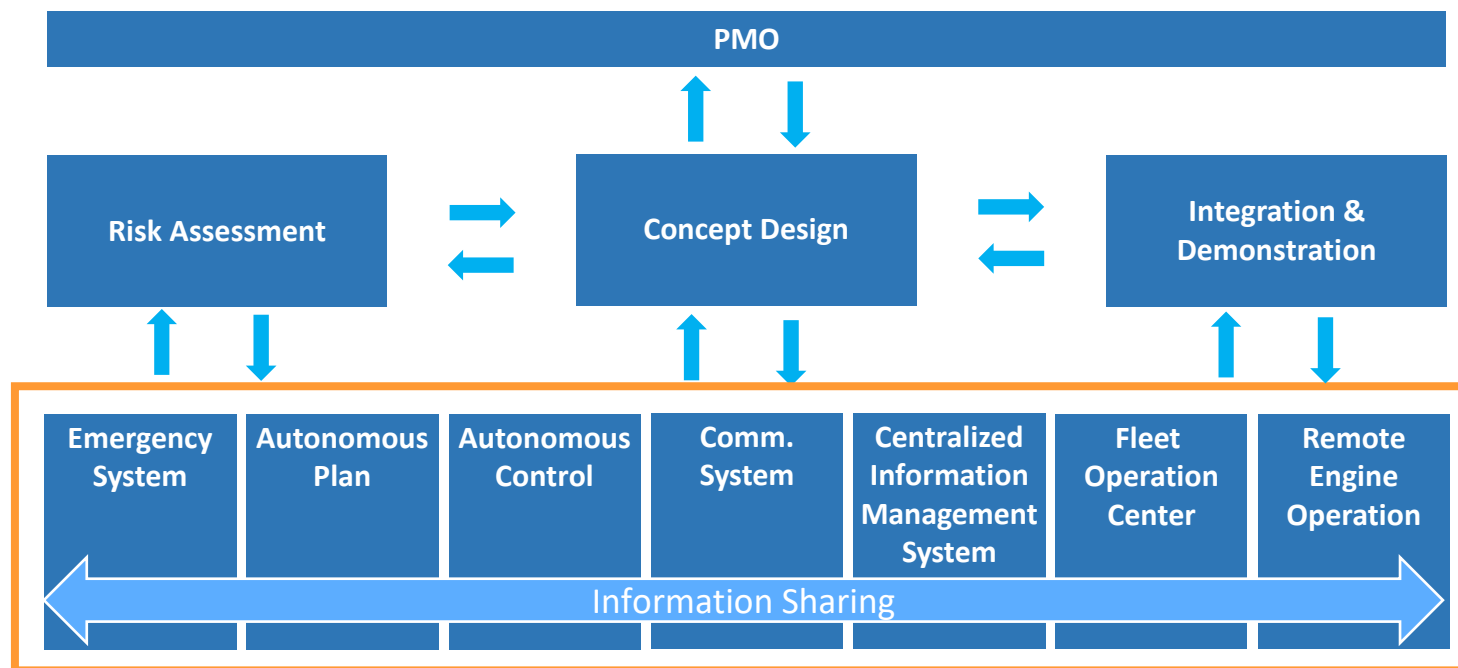
- Consortium: 27 organizations (domestic)
- Partners: 20 organizations (global)

Target schedule

- **Demonstration in Feb 2022 (plan)**



Organization chart of DFFAS PJ



Operation Concept (ConOps), Risk Assessment, Model-based Systems Engineering (MBSE), System Reliability Test by using Simulation and Project Management → Development of Open Architecture & Open Process for Open Innovation for future complex system development & operation



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