MEGURI 2040
Safety Assessment Seminar
(2026.6.29)

Presentation 5:
Study on Competency Requirements for Remote Operators of MASS

5.3 Multi-vessel Monitoring

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Replay-based Experiment

➢ System Configulation

Starlink Business ¦ Maritime

STARLINK

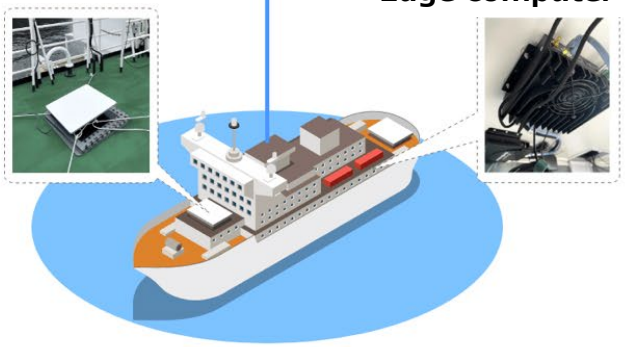
intdash SERVER

Navigation Data

Real-time streaming to multiple locations

Starlink antenna

Edge computer



Ship

Team members

TUMSAT

Visualization in a web browser

Exterior camera/sound

Camera/sound in Bridge

GPS

ECDIS/ RADAR/ AIS

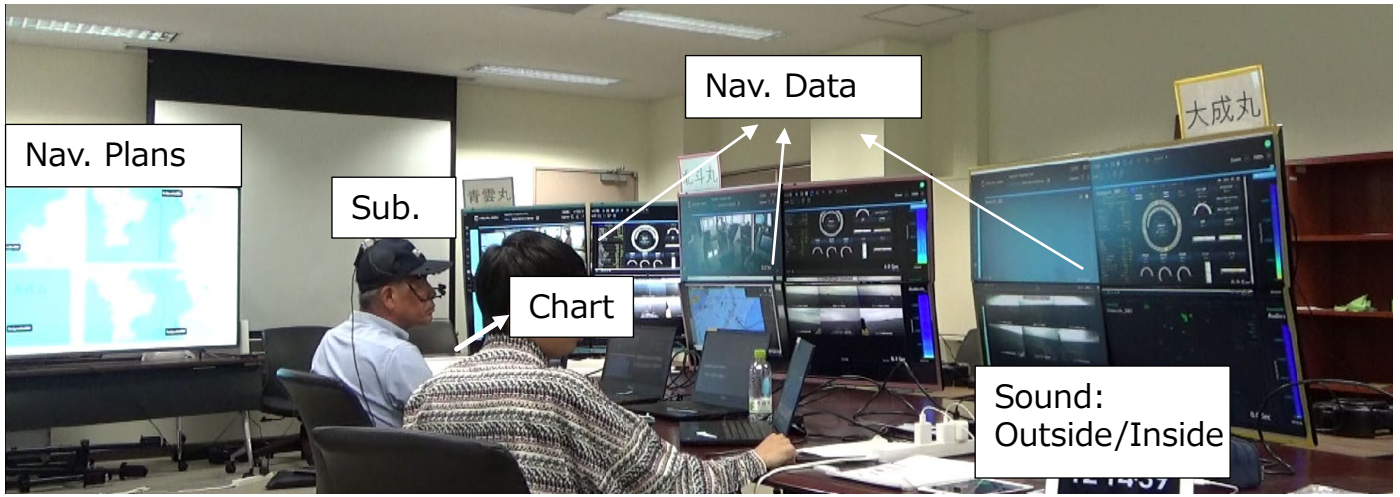
Indicators: co., spd, etc.

VISUAL M2M

Experiment

➢ 4 vessels monitoring

Image of experiment



Subject: great Captain
Sensor: Eye Tracker, Vital sensor: ECG, body acc.

Scenario

Day 1

Scenario B

Scenario C

Scenario D

Day 2

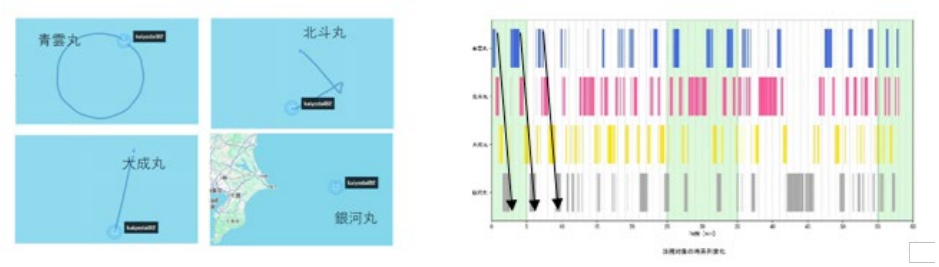
Scenario A

Scenario E

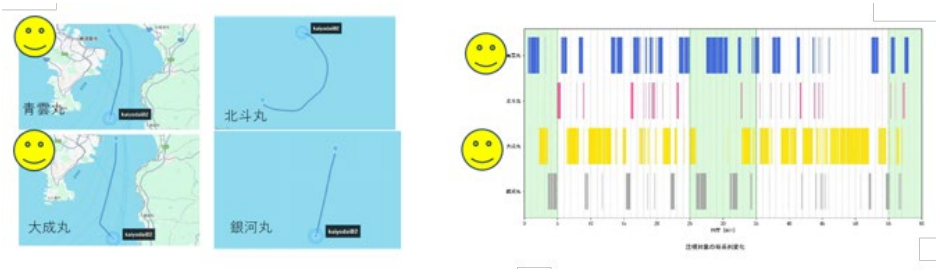
Scenario F

Relationships with other ships

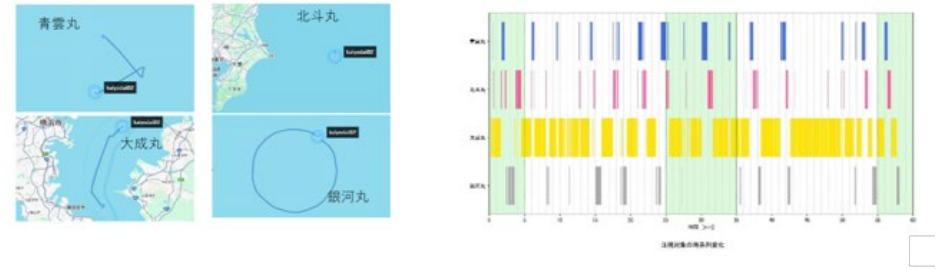
Result : Gaze point



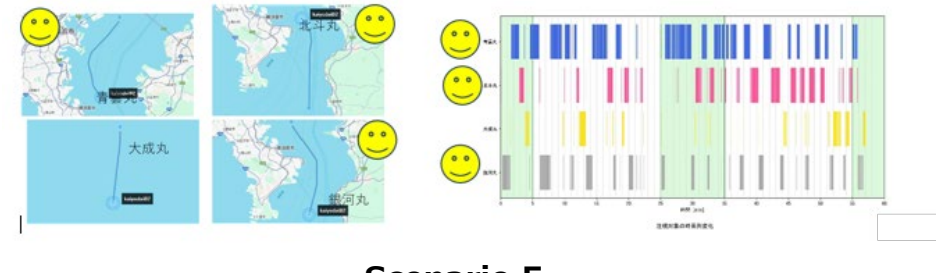
Scenario A



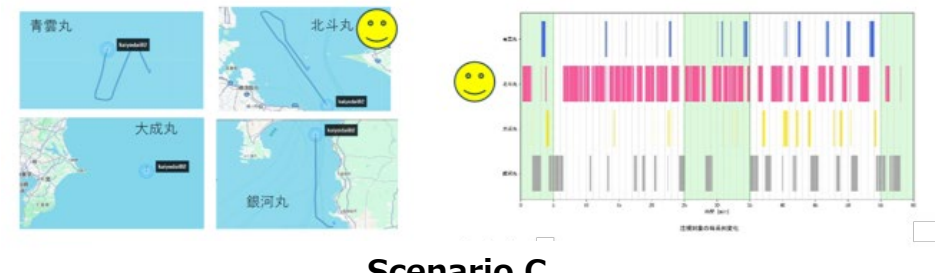
Scenario D



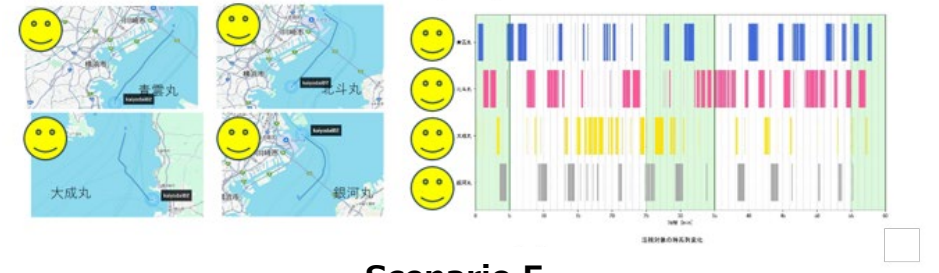
Scenario B



Scenario E



Scenario C

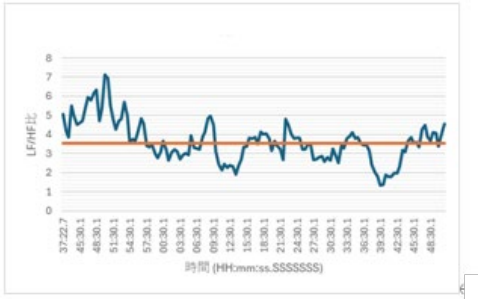


Scenario F

Relationships with other ships

Result : Mental-workload

Scenario A



Scenario B

Scenario C

Scenario D

Scenario E

Scenario F

mean

Data delay

Consideration

- **System ：**
  → Own ship's maneuvering characteristics
  → How to
  → Tele- / Team- communication

- **Gaze point ： depends on the congestion of the sea area**
  → Characteristics of sea area

- **Mental-workload ： stable**
  → Experience of own ship and sea area is required

Competences for monitoring of multiple MASSs

Monitoring of multiple MASSs

.1 Delay in navigation instrument information
.2 Setting and Maintaining Nautical Instrument Information Display
.3 Display and analysis of appropriate navigational information
.4 Monitoring of the internal condition of the MASS
.5 Proper monitoring and limits
.6 Judgment of collision avoidance manoeuvre

Spatial Recognition through Integration of Navigation Information

.1 Ability to fuse navigation instrument information with different delay times
.2 Ability to understand real space from digital information
.3 Understanding of the boundary between medium-term and short-term planning
.4 Ability to distinguish and understand situations based on the trade-off between economy and safety

Competences for monitoring of multiple MASSs

Teamwork

.1 Ability to understand and use standard terminology
.2 Ability to act appropriately as a team within a remote land station
.3 Ability to understand the intentions behind actions
.4 Ability to communicate intentions

General Operation of Digital Navigation Systems

.1 Ability to display and pay attention to navigation instrument information using digital navigation systems
.2 Ability to detect abnormalities in navigation instrument information using digital navigation systems

Competences for monitoring of multiple MASSs

General Operation of Remote Monitoring Systems

.1 Ability to handle and pay attention to remote monitoring systems
.2 Understanding of inspection methods for remote monitoring systems
.3 Ability to detect abnormalities in remote monitoring systems

General Operation of User Interface (UI) in Remote Operation Centre (ROC)

.1 Ability to handle and pay attention to the UI in ROC
.2 Understanding of inspection methods for the UI in ROC
.3 Ability to detect abnormalities in the UI in ROC

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Thank you for your attention !

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Tokyo University of Marine Science and Technology