

MEGURI 2040 Safety Assessment Seminar (2026.6.29)

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

5.1 Assumptions Regarding the Envisioned MASS

Prof. Koichi Kondo

**Senior Director,
Japan agency of Maritime Education and Training
for Seafarers**

Phase 2 of the Seafarer Skills Quantification Project

- ① [JMETs] conducted remote monitoring and navigation experiments using a single-vessel simulator, whilst [TUMSAT & JAMSS] carried out remote monitoring experiments and analysis involving multiple vessels.
- ② Based on ①, [JMETs] derived capability requirements for remote operators (differences in capability compared to crew members).
- ③ Based on ①, [TUMSAT & JAMSS] derived the competency requirements necessary for the remote monitoring of multiple vessels based on task analysis, and further schematised the mental processing of seafarers (FRAM modelling).
- ④ Based on the competency requirements from ② and ③, draft requirements for the skills and training of remote operators and draft curricula were organised; based on these, draft safety guidelines for remote operation skills of MASS were formulated.

Various Future Scenarios

*These future scenarios assume a world in which the necessary legal and regulatory measures have been implemented

Please note that as there are many variations of future scenarios, it is not possible to cover them all.

Convention al vessels

MEGURI

Future A

(B-Zero, all is handled on board)

Future B

(B1, with remote control)

Future C

(B0 and remote)

Future D

(B Zero, the vessel is operated remotely)

Future E

Fully Autonomous Navigation

Future F

Fully remote-controlled navigation

Within the ODD range					(Assuming a gross tonnage of 700 or more) Outside the ODD range
Awareness of the surrounding situation		Communication	Navigational judgement (Planner)	Execution of manoeuvres	
Visual (Camera, radar, etc.)	Auditory and other				
Crew (2 on watch)				Automatic steering system (Autopilot)	
ANS	Crew (2)	Crew (2)	Crew (2)	Autonomous navigation system	Crew (2)
ANS (B-Zero)			Or Outside crew	Autonomous navigation system (B-Zero)	Crew (2)
ANS	Crew (1)	Crew (1)	Crew (1)	Autonomous navigation system	Crew (2)
RO (1)		RO (1)			RO (1)
ANS (B-Zero)			or Outside crew	ANS (B-Zero)	Crew (2)
RO (2)		RO (2)			RO (2)
and land-based personnel will take control remotely (B-Zero)					Crew (2)
Fully automated navigation system (B Zero)					(All is within the ODD range)
Fully remote-controlled by shore-based personnel (B-Zero)					(All is within the ODD range)

Assumptions for this study

Within the ODD range, as the 'watchkeeping' duties are primarily carried out by B1 officers or systems, it is considered that remote personnel (shore-based staff) could be assigned to monitor multiple vessels simultaneously.

During status decline until two-crew system is established.

Assumptions for Future Scenarios B and C

Assumptions

- The system's ODD, ConOps and OE are defined on a ship-by-ship basis.
- When the status is degraded and manual navigation is required, a two-person team comprising both ship and shore personnel is assumed.

Depending on weather and sea conditions, etc., the status can change.

	Status	Role of ANS	Role of RO	Crewing	Bridge Watch (700 gross tonnes and over)
①	M (Manual)	Heading control only or None (= Manual steering)	Monitoring (optional)	As at present	Always B2 (when the autopilot is engaged)
②	TC (Track Control)	Track control only	Monitoring (optional)	As at present	Always B2 (when the autopilot is engaged)
③	MA (Monitoring with Approval)	All functions are used, but crew approval is required sometimes	Monitoring (optional)	As at present	Always B2 (when the autopilot is engaged)
④	MM (Monitoring Mind ON)	All functions are in use, but occasional crew attention is required	Monitoring	Crew reduction Under status degraded until 2 bridge crew, 1 on board + 1 onshore (total of two)	B1
⑤	FA (Full Autonomous)	Delegate everything to the system	Monitoring Navigation (Under the status degraded until two-bridge-crew is established)	Crew reduction Under status degraded until 2 bridge crew, 2 onshore	B0
⑥	Fully unmanned ship (Almost always FA, occasionally remote)	Almost constantly during the voyage, everything is delegated to the system	Monitoring Navigation (Under the status degraded until returning to FA)	Zero	Always B0

Assumptions in this study

□ Roles undertaken by remote operators (shore-based personnel)

Level 1: Monitoring and Navigation Assistance

- Appropriate watchkeeping of the vessel and the surrounding conditions
- Detect signs of danger, and report the details with Level 2 and the crew on board
- Perform remote steering operations based on instructions from Level 2

Level 2: Navigation Decision-Making and Evasive Manoeuvres

- Maintain a safe watchkeeping with Level 1 and the crew on board
- Determine when to initiate evasive manoeuvres
- Execute appropriate evasive manoeuvres in a remote operating environment

	Status	Role of ANS	Role of RO	Remote crewing	Bridge Watch (700 gross tonnes and over)
④	MM (Monitoring Mind ON)	All functions are in use, but occasional crew attention is required	Monitoring	Level 1 or above: 1 person	B1
⑤	FA (Full Autonomous)	Delegate everything to the system	Monitoring Navigation (Under the status degraded until two-bridge-crew is established)	Level 1 or above: 1 person Level 2: 1 person	B0

Concept of ODD for Multiple Vessels under Remote Monitoring

ODD of MASS operating **with two-bridge-crew** and **without remote support**

	Vessel A	Vessel B	Vessel C	Vessel D	Vessel E	...
Ship ODD	Within ● km 1 or fewer vessels	Within ● km 3 or fewer vessels	Within ● km 2 or fewer vessels	Within ● km no vessels	Within ● km 3 or fewer vessels	
(e.g., regarding congestion)	Open sea	Outside Tokyo Bay and the Seto Inland Sea	Outside Tokyo Bay	No restricted waters	No restricted waters	

ODD of MASS operating **with B0** and **remote monitoring**

ODD for remote monitoring of a vessel	As above	As above	As above	As above	As above	
ODD for remote monitoring of two vessels	As above	Within ● km 1 or fewer vessels	Within ● km 1 or fewer vessels	As above	Within ● km 3 or fewer vessels	
	Open sea	Open sea	Outside Tokyo Bay		No restricted waters	
ODD for remote monitoring of 3-4 vessels	No vessels within ● km	No vessels within ● km	No vessels within ● km	No vessels within ● km	Within ● km 3 or fewer vessels	
	Open sea	Open sea	Open sea	Open sea	No restricted waters	

The degraded state of **vessel A** is under remote operation with B0 until B2

ODD for remote monitoring of 3-4 vessels	Remote operation by current Level 1 and Level 2	FA with B0 + remote monitoring	FA with B0 + remote monitoring	FA with B0 + remote monitoring	As above	
--	---	--------------------------------------	--------------------------------------	--------------------------------------	----------	--

Immediate handover to different Level 1
and Level 2 operators