ANNEX A TO CHAPTER 14 – MASS Operator Competence Tables

SECTION 1 – SUPPORT LEVEL

Standard of Competence

1. Every candidate involved in the operation of a MASS at a support level shall be required to demonstrate the competence to perform the functions as specified in table A-1.

2. The minimum knowledge, understanding and proficiency required of an operator at the support level is listed in column 2 of table A-1.

3. Every candidate for endorsement will be required to complete a period of operational training that follows an approved programme which:
   - *ensures that, during the required period of operational experience, the candidate receives systematic practical training and experience in the tasks, duties, and responsibilities of a MASS Operator,*
   - *is closely supervised and monitored by qualified MASS operators tasked with operating the MASS and/or working with the RCC associated with the MASS on which operational experience is gained; and*
   - *is adequately documented in a training record book or similar document.*

Table A-1: Specification of minimum standard of competence when conducting MASS operations at a support level	
Function: Equipment Operation at the Support Level	
Competence	*Knowledge & Skills*
Contribute to the operation of key vessel systems	■ Identify key components of MASS vessel systems, including; – *propulsions system (Conventional twin/single-screw, azimuth propulsion)* – *tunnel thrusters, azimuth bow thrusters,* – *fuel system* – *hydraulic systems* ■ Operation of MASS specific vessel systems – *operating systems and OEM software* – *communication systems* – *OEM specific data-link equipment*
Operate Camera Systems	■ Classify different camera types ■ Recognise the impact of lighting and how it affects video images ■ Identify the impact of environmental conditions (e.g. rain, wind, snow, fog, temperature changes) ■ Operate camera systems
Operate MASS Local Control Systems	■ Set up a local control system ■ Perform MASS manoeuvres using local control systems
Operate Launch and Recovery Systems	■ Identify the risks associated with launch and recovery operations ■ Explain the procedures for the raising and lowering of an Underwater Retractable Mast or equivalent system ■ Explain the processes for the safe deployment of a MASS using – *A-Frame* – *Crane* – *Davit* – *Ramp/Slipway* – *Intermediate Capture Device* ■ Explain the procedures for the operation of upper deck systems such as a retractable mast ■ Demonstrate the safe deployment of a MASS ■ Demonstrate the safe mobilisation and demobilisation of the MASS for transportation

Competence	Knowledge & Skills
Contribute to Pre-Mission Preparations	▪ Explain payload equipment pre-mission checks ▪ Describe the key components of a LOC ▪ Describe vessel - LOC/ROC Communications ▪ Identify key alerts and alarms as they occur during pre-mission checks ▪ Set up launch and recovery systems ▪ Carry out vessel prestart checks ▪ Carry out fuelling and defueling of vessel
Support Payload Operations	▪ Explain the procedures for the pre-mission inspection of a payload

Function: MASS Manoeuvring at the Support Level

Competence	Knowledge & Skills
Contribute to the safe navigation of the MASS	▪ Define safe passage planning procedures ▪ Outline correct system settings ▪ Recognise the limitations of MASS navigational systems ▪ Describe the methods of compliance with chart carriage requirements ▪ Describe the information provided by the navigation systems, and how this supports the determination of risk of collision ▪ Carry out MASS navigation to maintain the safety of the vessel under supervision ▪ Explain vessel handover and acceptance procedures
Conduct basic MASS Manoeuvring	▪ Describe the berthing and unberthing procedures for a MASS ▪ Describe emergency towing arrangements ▪ Understand the manoeuvring characteristics of a MASS ▪ Carry out MASS berthing and unberthing in benign conditions ▪ Carry out MASS manoeuvres in clear conditions with no traffic
Understand MASS Operational Parameters	▪ State MASS safe operational parameters

Function: Maintenance and Repair at the Support Level

Competence	Knowledge & Skills
Manage Vessel Software	▪ Outline basic software principles
Operate Battery and Hybrid Propulsion	▪ Describe battery maintenance and charging systems including power distribution systems ▪ Describe the operation of hybrid drive systems

Function: Communication maintenance at the Support Level

Competence	Knowledge & Skills
Maintain Communication Systems between the ROC and MASS	▪ Describe the command-and-control structure used in MASS operations ▪ Outline the roles and responsibilities of different personnel involved ▪ Describe the limitations of each control methodology ▪ Describe the principles of various forms of communication, RF, 4G, Satcom

Function: Safety and Security at the Support Level

Competence	Knowledge & Skills
Support implementation of Cyber-protection measures	■ Summarise the basics principles of cyber security. ■ Understand the principles of Networking ■ Understand of IT/OT system architecture
Support implementation of anti-piracy measures	■ Identify areas of likely piracy activity ■ Describe anti-piracy procedures ■ Implement physical anti-piracy measure prior to deployment

Function: Emergency and Abnormal Operation Response at the Support Level

Competence	Knowledge & Skills
Recognition and response to abnormal situations	■ Recognise how human factors influence response to emergencies ■ Identify the various vessel monitoring systems and potential alarms ■ Identify key vessel systems ■ Understands root causes of fire ■ Perform the initial responses at a local level to emergency scenarios on-board the MASS including; – Loss of navigational equipment – Loss of propulsion – Loss of steering – Dragging anchor – Failure of towed payload system – Grounding – Collision – Fire – Flooding – Piracy Attack
Support Vessel Recovery	■ Describe the procedures for dead-ship recovery ■ Describe the procedures for towing the MASS ■ Perform the recovery of a dead ship

Function: Vessel and ROC Operations at the Support Level

Competence	Knowledge & Skills
Support Operations	■ Explain the role of the ROC in the overall operation of an uncrewed vessel ■ Understand legislation and guidance relating to the operation of the MASS and ROC, including; the development of bespoke legislation the adaption of existing conventions, and the application of non-maritime law to shore-based centres

Function: Use of AI and Advanced Technologies at the Support Level

Competence	Knowledge & Skills
Utilisation of AI / ML / HMT /HMI	■ Explain Human-Machine teaming and how it relates to the operation of a MASS ■ Describe basic definitions used within the fields of Automation, Autonomy and Artificial Intelligence

SECTION 2 – OPERATIONAL LEVEL

Standard of Competence

1. Every candidate involved in the operation of a MASS at an operational level shall be required to demonstrate the competence to perform the functions as specified in table A-2.

2. The minimum knowledge, understanding and proficiency required of an operator at the operational level is listed in column 2 of table A-2.

3. Every candidate for endorsement will be required to complete a period of operational training that follows an approved programme which:

    – *ensures that, during the required period of operational experience, the candidate receives systematic practical training and experience in the tasks, duties, and responsibilities of a MASS Operator,*

    – *is closely supervised and monitored by qualified MASS operators tasked with operating the MASS and/or working with the RCC associated with the MASS on which operational experience is gained; and*

    – *is adequately documented in a training record book or similar document.*

Table A-2: Specification of minimum standard of competence when conducting MASS operations at an operational level	
Function: Equipment Operation at the Operational Level	
Competence	*Knowledge & Skills*
Operate Vessel Functions	■ State the level of automation and autonomy of various MASS systems in use. ■ State what intervention is possible for the different autonomous or remotely operated systems and how this is instigated ■ Identify the levels of system redundancy for the monitoring and control of the MASS ■ Explain the power generation and propulsion systems and their management ■ Operate vessel equipment to effectively achieve the mission aim
Operate Camera Systems	■ Understand video distribution systems between a MASS and ROC ■ Utilise MASS Camera systems to gain and maintain situational awareness ■ Application of different camera types in MASS Operations
Operate Remote Control Systems	■ Understand data transmission principles ■ Knowledge of the impact of environmental conditions (e.g. rain, wind, snow, fog, temperature changes) on control systems ■ Apply the principles of data transmission during remote MASS operations ■ Operate vessel data link equipment
Conduct MASS Launch and Recovery	■ Plan MASS transportation to operational location ■ Plan and execute the launch and recovery of the MASS ■ Plan and execute the launch and recovery of deployable payloads from the MASS
Conduct pre-mission checks	■ Identify safety critical elements and processes ■ Understand pre-mission survey system integrity requirements ■ Describe alerts and visual interactions which may affect the remote set-up integrity ■ Perform payload equipment pre-mission checks ■ Prepare a LOC for operations ■ Establish vessel - LOC/ROC communications ■ Carry out pre-mission checks of the ROC

Competence	Knowledge & Skills
Operate MASS Payload Systems	▪ Liaise with the payload operator to establish the parameters of the mission and develop a suitable plan ▪ Plan and execute the launch and recovery of deployable payloads from the MASS

Function: MASS Manoeuvring at the Operational Level

Competence	Knowledge & Skills
Plan and execute MASS Navigation	▪ Identify the limitations of the navigational systems in use onboard MASS ▪ Apply proper passage planning methodology to MASS mission planning ▪ Evaluate different approaches to electronic navigation and the voyage planning interface. ▪ Evaluate the information provided by navigational sensors to determine if a risk of collision exists and the action that should be taken ▪ Identify and respond to loss of critical navigational sensors. ▪ Carry out chart updating procedures ▪ Set-up the navigation systems for safe passage ▪ Use electronic navigational equipment and other navigation aids when engaged in pilotage. ▪ Perform vessel handover as per SMS procedures
Conduct MASS Manoeuvring and Berthing	▪ Explain the impact of external forces on MASS manoeuvres ▪ Describe the pivot point and its impact on MASS handling ▪ Demonstrate hand-camera-eye co-ordination ▪ Demonstrate MASS manoeuvring utilising different propulsion methods
Operate MASS Safely in prevailing conditions	▪ Interpret observed meteorological conditions ▪ Interpret sea-state conditions from camera projections
Identify and respond to hazards	▪ Utilise all available systems to gain and maintain situational awareness ▪ Utilise all available systems to make a full appraisal of the situation and take appropriate action to avoid a Collison ▪ Identify potential threats to the MASS and take appropriate action mitigate these in a timely manner ▪ Interact and co-ordinate with other traffic to maintain vessel safety

Function: Maintenance and Repair at the Operational Level

Competence	Knowledge & Skills
Manage Vessel Software	▪ Describe software uploading procedures ▪ Explain the importance of software maintenance and upkeep ▪ Maintain software configuration logging ▪ Demonstrate the software testing process and evaluate the results ▪ Perform software rollbacks
Operate Battery and Hybrid Propulsion	▪ Perform routine maintenance on battery & charging systems including power distribution systems ▪ Perform routine maintenance on hybrid drive systems

Function: Communication maintenance at the Operational Level

Competence	Knowledge & Skills
Operate mission Communication Systems	▪ Describe the impact of environmental conditions on communications systems ▪ Perform diagnostic procedures on Command-and-Control Systems ▪ Maintain command and communication systems

Function: Safety and Security at the Operational Level

Competence	Knowledge & Skills
Operate Cyber-protection Measures	■ Identify a potential cyber-attack and take appropriate initial actions ■ Implement and monitor cyber-security protection measures
Respond to Piracy Attacks	■ Describe procedures for deletion of sensitive data. ■ Describe the emergency procedures to be undertaken if vessel is subject to piracy attack ■ Respond to physical piracy attack, taking appropriate defensive measures

Function: Emergency and Abnormal Operation Response at the Operational Level

Competence	Knowledge & Skills
Respond to Abnormal and Emergency Scenarios	■ Identify critical systems onboard the MASS ■ Describe vessel failure modes and vessel capabilities ■ Initialise back-up or secondary systems to maintain vessel safety ■ Maintain control of the vessel during an emergency scenario ■ Respond to emergencies within the RCC, including; – Loss of communications – Receipt of a distress call – Cyber Attack – Emergency within the RCC – Incapacity of Operator ■ Respond to vessel alarms, taking appropriate initial responses ■ Respond to emergencies within the RCC
Safely Recover the Vessel	■ Respond to a dead-ship occurrence, taking appropriate initial responses

Function: Vessel and RCC Operations at the Operational Level

Competence	Knowledge & Skills
Conduct MASS Operations	■ Explain the organisational structure within the RCC and the key roles and responsibilities therein ■ Describe the challenges involved in conducting multi-vessel operations ■ Maintain the security of the RCC ■ Prepare a watchkeeping schedule for missions based on the qualifications of personnel and the nature of the work being undertaken. ■ Monitor remote processes onboard vessel, evaluate data, and implement appropriate response.

Function: Use of AI and Advanced Technologies at the Operational Level

Competence	Knowledge & Skills
Utilisation of AI / ML / HMT / HMI	■ Understand Human-Machine Teaming and its incorporation into effective working patterns ■ Understand different AI models (Symbolic / Neural Networks etc) and their practical use cases ■ Understand the integration of AI processes within a RCC ■ Explain the manner in which automated system gather data about the operating environment ■ Demonstrate an understanding of the limitations of AI processes when used in decision making for the avoidance of collisions

SECTION 3 – MANAGEMENT LEVEL

Standard of Competence

1. Every candidate involved in the operation of a MASS at a management level shall be required to demonstrate the competence to perform the functions as specified in table A-3.

2. The minimum knowledge, understanding and proficiency required of an operator at the management level is listed in column 2 of table A-3.

3. Every candidate for endorsement will be required to complete a period of operational training that follows an approved programme which:
   - *ensures that, during the required period of operational experience, the candidate receives systematic practical training and experience in the tasks, duties, and responsibilities of a MASS Operator,*
   - *is closely supervised and monitored by qualified MASS operators tasked with operating the MASS and/or working with the RCC associated with the MASS on which operational experience is gained; and*
   - *is adequately documented in a training record book or similar document.*

Table A-3: Specification of minimum standard of competence when conducting MASS operations at a management level	
Function: Equipment Operation at the Management Level	
Competence	***Knowledge & Skills***
Operate Vessel Functions	■ Monitor the status of vessel systems ■ Verify the maintenance status of the autonomous, remotely operated or remotely supported vessel's machinery systems
Operate Camera Systems	■ Integrate the use of Camera Systems with other sensors to ensure the maintenance of Situational Awareness ■ Assess the impact of environmental conditions on MASS operational effectiveness ■ Monitor the integrity of video distribution systems ■ Prioritise video feeds in relation to bandwidth limitations
Manage MASS Control Systems	■ Oversee the operation of data link equipment ■ Prioritise the recovery of systems when operating in an abnormal manner
Manage the Launch and Recovery of MASS and Payloads	■ Manage the safety of Launch and Recovery Systems ■ Monitor the launch and recovery of the MASS and associated ROV/AUV
Manage Pre-Mission Preparations	■ Assess system integrity prior to mission ■ Survey Equipment pre-mission checks ■ Prioritise safety of personnel ■ Manage process and team to ensure the provision of an operational vessel able to complete a task ■ Evaluate the consequences of alerts and failures. ■ Manage RCC and Vessel mission preparation ■ Analyse settings / readings received from systems prior to deployment
Manage Payload Operations	■ Oversee the MASS team during Payload deployment and operations ■ Monitor the launch and recovery of a payload system

Function: MASS Manoeuvring at the Management Level

Competence	Knowledge & Skills
Manage the safe navigation of the MASS	■ Approve passage plans ■ Monitor the integrity of navigational systems during MASS missions ■ Manage the response to navigational emergencies ■ Assess the potential impact of environmental conditions on MASS operations ■ Monitor the action taken in response to a risk of collision ■ Monitor the interactions of an Uncrewed vessel with other crewed or uncrewed vessels ■ Manage the vessel handover procedure ■ Manage the response to issues arising from a loss of control during a handover
Manage MASS Manoeuvring	■ Monitor prevailing conditions and assess their impact on operational capability
Assess the safety of MASS Operations	■ Monitor prevailing conditions and assess their impact on operational capability
Manage the detection and response to hazards	■ Monitor the effectiveness of situational awareness amongst MASS teams

Function: Maintenance and Repair at the Management Level

Competence	Knowledge & Skills
Manage Vessel Software	■ Inspect the status of vessel software
Manage the use of Battery and Hybrid Propulsion	■ Manage the maintenance and operation of Propulsion Systems

Function: Communication maintenance at the Management Level

Competence	Knowledge & Skills
Manage mission Communication Systems	■ Manage the maintenance and operation of Command-and-Control systems

Function: Safety and Security at the Management Level

Competence	Knowledge & Skills
Manage Cyber - protection measures	■ Implement measures to protect systems from attack ■ Manage the response to a cyber attack ■ Monitor the integrity of cyber protection measures
Manage the implementation and action of anti-piracy measures	■ Manage the response to physical piracy attack

Function: Emergency and Abnormal Operation Response at the Management Level

Competence	Knowledge & Skills
Manage the response to abnormal and emergency situations	■ Manage the response to abnormal or emergency procedures on board ■ Prioritise the restoration of critical systems during abnormal or emergency occurrences onboard ■ Manage the human factors during a response to an abnormal or emergency occurrence ■ Manage the response to an abnormal or emergency scenario within the RCC ■ Assess the impact of the loss of critical systems to the safety of the vessel and others
Oversee the Recovery of a Vessel	■ Manage the recovery of a dead ship, ensuring the completion of risk assessments and identification of most appropriate methods

Function: Vessel and RCC Operations at the Management Level

Competence	Knowledge & Skills
Manage Operations	■ Apply the principles and Best Practice relating to the operation of a RCC and an autonomous vessel ■ Manage the personnel within the RCC, ensuring appropriate certification is held in accordance with company SMS ■ Develop an effective training programme to ensure the readiness of MASS team to respond to a range of scenarios and emergencies ■ Manage watchkeeping schedules to ensure the fitness of personnel and safety of operations ■ Write standing and night orders to ensure the continuity of behaviour within MASS /RCC team ■ Ensure the adherence to all applicable legislation relating to a shore-based establishment ■ Ensure adherence to all applicable legislation relating to the operation of a MASS ■ Manage multi-vessel operations, ensuring that all personnel are cognisant of their roles and responsibilities ■ Establish effective security procedures for the RCC ■ Maintain and review the SMS and all SOPs/RAs relating to the safe running of the RCC

Function: Use of AI and Advanced Technologies at the Management Level

Competence	Knowledge & Skills
Utilisation of AI / ML / HMT / HMI	■ Integrate processes for the validation of information received from AI or autonomous sources ■ Oversee the interaction of AI or automated systems with VTS or other management/control systems/instruction