

## Simulator application

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**Appendix A**

**VIRTUAL ENGINE ROOM 4.5**

**AND**

**ENGINE ROOM CONSOLE 4.5**

## STCW competencies addressed by Virtual Engine Room 4.5 and Engine Room Console 4.5 simulators.

STCW-95 Reference:	Competence	Capability of VER4.5 / ERC4.5 Simulator
Table A-III/1.4	Maintain a safe engineering watch	Supports this competency. Complete engine room simulation with ME, Electric Plant and Auxiliaries. Automatic log of student actions.
Table A-III/1.6	Operate main and auxiliary machinery and associated control systems	Supports this competency. Alair, start, control, stop, monitor ME, electric plant and auxiliaries.
Table A-III/1.7	Operate pumping systems and associated control systems	Supports this competency. Includes control of pumps and valves for all major fluid systems.
Table A-III/1.8	Operate alternators, generators and control systems	Supports this competency. Includes generators and switchboards.
Table A-III/1.9	Maintain marine engineering systems including control systems	Partly supports this competency. Several PID controllers included. Maintenance functions not provided
Table A-III/1.11	Maintain seaworthiness of the ship	Partly supports this competency. Includes safe engineering watch and response to faults. Includes ballast, trim and stability.
Table A-III/2.1	Plan and schedule operations	Partly supports this competency. Includes engine room operations and management of engine fluid systems.
Table A-III/2.2	Start up and shut down main propulsion and auxiliary machinery, including associated systems	Supports this competency.
Table A-III/2.3	Operate, monitor and evaluate engine performance and capacity	Supports this competency.
Table A-III/2.5	Manage fuel and ballast operations	Supports this competency.
Table A-III/2.6	Use internal communication systems	Supports this competency. Includes Engine Order Telegraph and synthesized speech. Separate communications system can be provided.
Table A-III/2.7	Operate electrical and electronic control equipment	Partly supports this competency. Electric plant included. Top level control system inputs included.
Table A-III/2.8	Test, detect faults and maintain and restore electrical and electronic control equipment to operating condition	Partly supports this competency. Alarms, detection and operational correction of faults are provided. Maintenance functions not provided.
Table A-III/2.10	Detect and identify the cause of machinery malfunctions and correct faults	Supports this competency
Table A-III/2.12	Control trim, stability and stress	Partly supports this competency. Included trim and stability control.
Table A-III/2.1	Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment.	Partly supports this competency.

## Virtual Engine Room 4.5 and Engine Room Console 4.5 Simulators and the Det Norske Veritas Standards for Certification of Maritime Simulator Systems

Requirement	Capability of VER4.5 / ERC4.5 Simulator
<b>Physical Realism</b>	
The simulated engine room shall consist of a typical machinery found on merchant ships. The following main components shall be simulated and all necessary sub-systems are to be included. <ul style="list-style-type: none"> <li>• Main engine with shaft generator</li> <li>• 2 Auxiliary diesel generators</li> <li>• lubrication oil separator</li> <li>• fuel oil separator</li> <li>• steam boiler</li> <li>• 2 air compressors</li> <li>• steering gear system</li> <li>• fire pump</li> </ul>	Simulation of generic slow speed diesel engine room. Simplified main control console with complete graphic display of system controls and indicators (ERC4.5 only). Includes all listed systems.
The simulated main engine shall replicate a system working according to on of the following principles: <ul style="list-style-type: none"> <li>• Diesel combustion</li> <li>• Steam turbine</li> <li>• Gas turbine</li> </ul>	Simulates a typical slow speed diesel propulsion system with a fixed pitch propeller.
<b>Engine Control Room</b>	
Equipment and consoles are to be installed, mounted and arranged in a ship like manner.	Graphic representation of controls, indicators and alarms on a sub-system basis. Physical control console for Main Engine (only ERC4.5)
The control room consoles shall include control and monitoring of the main engine, auxiliary engines and electrical power generation, steam boiler, pumps, compressors and all other alarms	Includes all of these functions in interactive graphical displays of controls, indicators and alarms.
The remote monitoring and control systems shall be in compliance with the functional requirements of the classification societies for periodically unattended machinery spaces (UMS)	Includes system indicators, alarms and control systems. Does not include bridge console for UMS. Focus of the simulator is on engine control room operations.
The main engine remote control console shall include command functions and status indication normally found on board ships	This capability is provided by the controls and indicators on the desk top console and the associated graphical displays.
The electric power generation shall be under automatic control. Such system shall constantly monitor demand and supply. When deviation from pre-set limits arises, the system shall act in order to normalize the situation. The system shall perform continuous control of the freq. and load sharing.	Electric plant simulation includes automatic and manual control of the electrical plant.
The electric power supply system shall be operated either from the control room console	Graphical display of the main switchboard with interactive controls and indicators. Includes all listed

<p>or from the main switchboard. The following commands shall be available:</p> <ul style="list-style-type: none"> <li>• Remote start/stop of auxiliary diesel generators</li> <li>• Operations of shaft generators</li> <li>• Connect/disconnect of all generators</li> <li>• Automatic and priority selection</li> <li>• Non essential systems trip</li> <li>• Constant frequency mode</li> <li>• Different control modes of load sharing</li> </ul>	functions.
The main switchboard shall be a full-scale model of a real switchboard, and comprise all controls and indicators usually available on real switchboards.	Graphical display of main switchboard with interactive controls and indicators.
The main switch board (graphics for Class C) shall include: <ul style="list-style-type: none"> <li>• Two separate auxiliary diesel generators</li> <li>• Synchronizing section</li> <li>• Shaft generator section</li> <li>• Separate emergency generator section</li> <li>• One separate section for miscellaneous consumers</li> </ul>	Graphical display of main switchboard with interactive controls and indicators. Includes all listed sections.
<p>The pump and compressor control must include control of the following equipment:</p> <ul style="list-style-type: none"> <li>• ME lubricating oil pumps</li> <li>• ME fresh water cooling pumps</li> <li>• ME sea water cooling pumps</li> <li>• ME Auxiliary blowers</li> <li>• Fuel oil system and pumps</li> <li>• Air compressors</li> <li>• Steering gear pumps</li> <li>• Fire pump</li> </ul> <p>Each of the above individual units shall allow manual start and stop from the control room console. It shall also be possible to use automatic start and stop where applicable.</p>	All listed systems have been implemented. Manual and automatic start capabilities are included.
The alarm monitoring system shall consist of a combination of a visual display unit with keyboard, indicator lamps and push buttons. This visual display unit shall allow for inspection of switch status, PID control status, alarm units, general numeric indication and for semi graphic trending	Visual and sound alarm indicators are provided for all systems. PID control status and semi graphic trending are not included.
An alarm shall be announced by sound and flashing light in the control room.	Provided
A printer or a computer in the engine control room shall be used as an alarm log and event log	Computer generated alarm and event log is provided.
<b>Machinery Spaces</b>	
The simulated machinery spaces shall at least include one dedicated room for this purpose	Not applicable to desk top system

<p>At least the following main components of the machinery spaces shall be graphically presented or represented by mock-ups (to illustrate physical presence) in the simulated machinery spaces:</p> <ul style="list-style-type: none"> <li>• Main engine</li> <li>• Auxiliary diesel generators</li> <li>• Steam boiler</li> <li>• Fire pump</li> </ul>	<p>The desktop console (only ERC) and/or associated graphic control and indicator displays represent all these components.</p>
<p>The facilities for local operation in the simulated machinery space shall consist of local operating stations for each system. Each station shall be furnished with start/stop (open/closed) buttons and status lights, various numbers of pressure, temperature indicators, etc. The local operating stations shall at least give means to operate the following:</p> <ul style="list-style-type: none"> <li>• Main Engine (ME)</li> <li>• ME lubricating oil system including separator</li> <li>• ME fresh water cooling system</li> <li>• ME sea water cooling system</li> <li>• ME auxiliary blowers</li> <li>• 2 auxiliary diesel generators</li> <li>• steam boiler</li> <li>• fuel oil system (diesel and heavy fuel oil) including separator</li> <li>• 2 air compressors</li> <li>• steering gear system</li> <li>• bilge water system</li> <li>• fire pump</li> </ul>	<p>Not applicable to desktop system.</p>
<p>The facilities for local operation in the simulated machinery spaces shall consist of one or more operating stations. The local operating station(s) shall at least give means to operate the following:</p> <ul style="list-style-type: none"> <li>• Main Engine (ME)</li> <li>• ME lubricating oil system including separator</li> <li>• ME fresh water cooling system</li> <li>• ME sea water cooling system</li> <li>• ME auxiliary blowers</li> <li>• 2 auxiliary diesel generators</li> <li>• steam boiler</li> <li>• fuel oil system (diesel and heavy fuel oil) including separator</li> <li>• 2 air compressors</li> <li>• steering gear system</li> <li>• bilge water system</li> <li>• fire pump</li> </ul>	<p>Graphical panels with interactive controls and indicators are provided for all of the listed systems.</p>
<p>An alarm shall be announced by sound and flashing light in the machinery space</p>	<p>Graphical and sound simulation provided for all alarms.</p>

<b>Behavioral Realism</b>	
The simulation models shall be able to replicate the dynamic behavior of the machinery systems and all of its vital parameters as well as the interactions between sub-systems	This capability is provided. Modeling is included for the dynamic behavior of all of the simulated systems. The sub-systems interact realistically with each other.
The simulation models shall simulate the engine room components with their processes, as well as modeled controller systems (sensors, controllers, actuators, valves) connected to the processes.	This capability is provided.
When simulating real equipment the behavior of such simulated equipment should behave as identically as possible to the original. Critical parameters of the behavior are to be documented.	The modeling represents generic versions of real engine room equipment. The behavior and display parameters are representative of actual equipment.
<b>Operating Environment</b>	
It shall be possible to adjust the noise level in the simulated machinery spaces infinite from no added noise up to a minimum of 100dB(A). The noise shall have a frequency distribution typical for machinery spaces.	A complete sound simulation is provided. The sound level can be adjusted.
It shall be possible to simulate the sea water temperature at least infinite between +1° C and +30° C.	This capability is provided.

**Appendix B**

**Turbo Diesel 4**

### STCW competencies addressed by Turbo Diesel 4 simulator.

STCW-95 Reference:	Competence	Capability of Turbo Diesel 4 Simulator
Table A-III/1.4	Maintain a safe engineering watch	Partly supports this competency. Only one diesel engine is implemented.
Table A-III/1.6	Operate main and auxiliary machinery and associated control systems	Partly supports this competency. Start, control, stop, monitoring and auxiliary systems.
Table A-III/1.7	Operate pumping systems and associated control systems	Not supported.
Table A-III/1.8	Operate alternators, generators and control systems	Not supported.
Table A-III/1.9	Maintain marine engineering systems including control systems	Supports this competency but for the diesel engine only.
Table A-III/1.11	Maintain seaworthiness of the ship	Not supported.
Table A-III/2.1	Plan and schedule operations	Partly supports this competency. Includes maintenance planning.
Table A-III/2.2	Start up and shut down main propulsion and auxiliary machinery, including associated systems	Supports this competency.
Table A-III/2.3	Operate, monitor and evaluate engine performance and capacity	Supports this competency
Table A-III/2.5	Manage fuel and ballast operations	Not supported.
Table A-III/2.6	Use internal communication systems	Not supported.
Table A-III/2.7	Operate electrical and electronic control equipment	Not supported.
Table A-III/2.8	Test, detect faults and maintain and restore electrical and electronic control equipment to operating condition	Partly supports this competency. Diesel engine alarms, detection and operational correction of faults are provided. Maintenance functions are also provided.
Table A-III/2.10	Detect and identify the cause of machinery malfunctions and correct faults	Supports this competency
Table A-III/2.12	Control trim, stability and stress	Not supported.
Table A-III/2.1	Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment.	Not supported.

**The Det Norske Veritas Standards  
for Certification of Maritime Simulator Systems  
are not applicable for Turbo Diesel 4**

**Appendix C**

**STEAM ENGINE ROOM**

**AND**

**STEAM ENGINE ROOM CONSOLE**

## STCW competencies addressed by Steam Engine Room and Steam Engine Room Console simulators.

STCW-95 Reference:	Competence	Capability of SER / SEC Simulator
Table A-III/1.4	Maintain a safe engineering watch	Supports this competency. Complete engine room simulation with ME, Electric Plant and Auxiliaries. Automatic log of student actions.
Table A-III/1.6	Operate main and auxiliary machinery and associated control systems	Supports this competency. Alair, start, control, stop, monitor ME, electric plant and auxiliaries.
Table A-III/1.7	Operate pumping systems and associated control systems	Supports this competency. Includes control of pumps and valves for all major fluid systems.
Table A-III/1.8	Operate alternators, generators and control systems	Supports this competency. Includes generators and switchboards.
Table A-III/1.9	Maintain marine engineering systems including control systems	Not Supported
Table A-III/1.11	Maintain seaworthiness of the ship	Partly supports this competency. Includes safe engineering watch and response to faults. Includes ballast, trim and stability.
Table A-III/2.1	Plan and schedule operations	Partly supports this competency. Includes engine room operations and management of engine fluid systems.
Table A-III/2.2	Start up and shut down main propulsion and auxiliary machinery, including associated systems	Supports this competency.
Table A-III/2.3	Operate, monitor and evaluate engine performance and capacity	Supports this competency.
Table A-III/2.5	Manage fuel and ballast operations	Supports this competency.
Table A-III/2.6	Use internal communication systems	Partly supports this competency. Includes Engine Order Telegraph. Separate communications system can be provided.
Table A-III/2.7	Operate electrical and electronic control equipment	Partly supports this competency. Electric plant included. Top level control system inputs included.
Table A-III/2.8	Test, detect faults and maintain and restore electrical and electronic control equipment to operating condition	Partly supports this competency. Alarms, detection and operational correction of faults are provided. Maintenance functions not provided.
Table A-III/2.10	Detect and identify the cause of machinery malfunctions and correct faults	Supports this competency
Table A-III/2.12	Control trim, stability and stress	Partly supports this competency. Included trim and stability control.
Table A-III/2.1	Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment.	Partly supports this competency.

## Steam Engine Room and Steam Engine Room Console Simulator and the Det Norske Veritas Standards for Certification of Maritime Simulator Systems

Requirement	Capability of SER / SEC Simulator
<b>Physical Realism</b>	
<p>The simulated engine room shall consist of a typical machinery found on merchant ships. The following main components shall be simulated and all necessary sub-systems are to be included.</p> <ul style="list-style-type: none"> <li>• Main engine with shaft generator</li> <li>• 2 Auxiliary diesel generators</li> <li>• lubrication oil separator</li> <li>• fuel oil separator</li> <li>• steam boiler</li> <li>• 2 air compressors</li> <li>• steering gear system</li> <li>• fire pump</li> </ul>	<p>Simulation of generic steam turbine engine room. Simplified main control console with complete graphic display of system controls and indicators (SEC only). Includes all listed systems.</p> <p>Turbo generator has been implemented instead of shaft generator. No fuel oil separators. No air compressors.</p>
<p>The simulated main engine shall replicate a system working according to on of the following principles:</p> <ul style="list-style-type: none"> <li>• Diesel combustion</li> <li>• Steam turbine</li> <li>• Gas turbine</li> </ul>	<p>Simulates a typical steam turbine propulsion system with a fixed pitch propeller.</p>
<b>Engine Control Room</b>	
<p>Equipment and consoles are to be installed, mounted and arranged in a ship like manner.</p>	<p>Graphic representation of controls, indicators and alarms on a sub-system basis. Physical control console for Main Engine (only SEC)</p>
<p>The control room consoles shall include control and monitoring of the main engine, auxiliary engines and electrical power generation, steam boiler, pumps, compressors and all other alarms</p>	<p>Includes all of these functions in interactive graphical displays of controls, indicators and alarms.</p>
<p>The remote monitoring and control systems shall be in compliance with the functional requirements of the classification societies for periodically unattended machinery spaces (UMS)</p>	<p>Includes system indicators, alarms and control systems. Does not include bridge console for UMS. Focus of the simulator is on engine control room operations.</p>
<p>The main engine remote control console shall include command functions and status indication normally found on board ships</p>	<p>This capability is provided by the controls and indicators on the desk top console and the associated graphical displays.</p>
<p>The electric power generation shall be under automatic control. Such system shall constantly monitor demand and supply. When deviation from pre-set limits arises, the system shall act in order to normalize the situation. The system shall perform continuous control of the freq. and load sharing.</p>	<p>Electric plant simulation includes automatic and manual control of the electrical plant.</p>
<p>The electric power supply system shall be operated either from the control room console</p>	<p>Graphical display of the main switchboard with interactive controls and indicators. Includes all listed</p>

<p>or from the main switchboard. The following commands shall be available:</p> <ul style="list-style-type: none"> <li>• Remote start/stop of auxiliary diesel generators</li> <li>• Operations of shaft generators</li> <li>• Connect/disconnect of all generators</li> <li>• Automatic and priority selection</li> <li>• Non essential systems trip</li> <li>• Constant frequency mode</li> <li>• Different control modes of load sharing</li> </ul>	<p>functions.</p>
<p>The main switchboard shall be a full-scale model of a real switchboard, and comprise all controls and indicators usually available on real switchboards.</p>	<p>Graphical display of main switchboard with interactive controls and indicators.</p>
<p>The main switch board (graphics for Class C) shall include:</p> <ul style="list-style-type: none"> <li>• Two separate auxiliary diesel generators</li> <li>• Synchronizing section</li> <li>• Shaft generator section</li> <li>• Separate emergency generator section</li> <li>• One separate section for miscellaneous consumers</li> </ul>	<p>Graphical display of main switchboard with interactive controls and indicators. Includes all listed sections.</p>
<p>The pump and compressor control must include control of the following equipment:</p> <ul style="list-style-type: none"> <li>• ME lubricating oil pumps</li> <li>• ME fresh water cooling pumps</li> <li>• ME sea water cooling pumps</li> <li>• ME Auxiliary blowers</li> <li>• Fuel oil system and pumps</li> <li>• Air compressors</li> <li>• Steering gear pumps</li> <li>• Fire pump</li> </ul> <p>Each of the above individual units shall allow manual start and stop from the control room console. It shall also be possible to use automatic start and stop where applicable.</p>	<p>Pump and compressor control and associated alarm and piping systems provided for the listed sub-systems except steering gear and fire pump. Manual and automatic start capabilities are included.</p>
<p>The alarm monitoring system shall consist of a combination of a visual display unit with keyboard, indicator lamps and push buttons. This visual display unit shall allow for inspection of switch status, PID control status, alarm units, general numeric indication and for semi graphic trending</p>	<p>Visual and sound alarm indicators are provided for all systems. PID control status and semi graphic trending are not included.</p>
<p>An alarm shall be announced by sound and flashing light in the control room.</p>	<p>Provided</p>
<p>A printer or a computer in the engine control room shall be used as an alarm log and event log</p>	<p>Computer generated alarm and event log is provided.</p>
<p><b>Machinery Spaces</b></p>	
<p>The simulated machinery spaces shall at least include one dedicated room for this purpose</p>	<p>Not applicable to desk top system</p>

<p>At least the following main components of the machinery spaces shall be graphically presented or represented by mock-ups (to illustrate physical presence) in the simulated machinery spaces:</p> <ul style="list-style-type: none"> <li>• Main engine</li> <li>• Auxiliary diesel generators</li> <li>• Steam boiler</li> <li>• Fire pump</li> </ul>	<p>The desktop console (only SEC) and/or associated graphic control and indicator displays represent all these components.</p>
<p>The facilities for local operation in the simulated machinery space shall consist of local operating stations for each system. Each station shall be furnished with start/stop (open/closed) buttons and status lights, various numbers of pressure, temperature indicators, etc. The local operating stations shall at least give means to operate the following:</p> <ul style="list-style-type: none"> <li>• Main Engine (ME)</li> <li>• ME lubricating oil system including separator</li> <li>• ME fresh water cooling system</li> <li>• ME sea water cooling system</li> <li>• ME auxiliary blowers</li> <li>• 2 auxiliary diesel generators</li> <li>• steam boiler</li> <li>• fuel oil system (diesel and heavy fuel oil) including separator</li> <li>• 2 air compressors</li> <li>• steering gear system</li> <li>• bilge water system</li> <li>• fire pump</li> </ul>	<p>Not applicable to desktop system.</p>
<p>The facilities for local operation in the simulated machinery spaces shall consist of one or more operating stations. The local operating station(s) shall at least give means to operate the following:</p> <ul style="list-style-type: none"> <li>• Main Engine (ME)</li> <li>• ME lubricating oil system including separator</li> <li>• ME fresh water cooling system</li> <li>• ME sea water cooling system</li> <li>• ME auxiliary blowers</li> <li>• 2 auxiliary diesel generators</li> <li>• steam boiler</li> <li>• fuel oil system (diesel and heavy fuel oil) including separator</li> <li>• 2 air compressors</li> <li>• steering gear system</li> <li>• bilge water system</li> <li>• fire pump</li> </ul>	<p>Graphical panels with interactive controls and indicators are provided for all of the listed systems.</p>
<p>An alarm shall be announced by sound and flashing light in the machinery space</p>	<p>Graphical and sound simulation provided for all alarms.</p>

<b>Behavioral Realism</b>	
The simulation models shall be able to replicate the dynamic behavior of the machinery systems and all of its vital parameters as well as the interactions between sub-systems	This capability is provided. Modeling is included for the dynamic behavior of all of the simulated systems. The sub-systems interact realistically with each other.
The simulation models shall simulate the engine room components with their processes, as well as modeled controller systems (sensors, controllers, actuators, valves) connected to the processes.	This capability is provided.
When simulating real equipment the behavior of such simulated equipment should behave as identically as possible to the original. Critical parameters of the behavior are to be documented.	The modeling represents generic versions of real engine room equipment. The behavior and display parameters are representative of actual equipment.
<b>Operating Environment</b>	
It shall be possible to adjust the noise level in the simulated machinery spaces infinite from no added noise up to a minimum of 100dB(A). The noise shall have a frequency distribution typical for machinery spaces.	A complete sound simulation is provided. The sound level can be adjusted.
It shall be possible to simulate the sea water temperature at least infinite between +1° C and +30° C.	This capability is provided.

**Appendix D**

**MEDIUM SPEED ENGINE ROOM 2**

**AND**

**MEDIUM SPEED ENGINE ROOM  
CONSOLE 2**

**STCW competencies addressed by  
Medium Speed Engine Room 2  
and Medium Speed Engine Room Console 2 simulators.**

<b>STCW-95 Reference:</b>	<b>Competence</b>	<b>Capability of MER2 / MEC2 Simulator</b>
Table A-III/1.4	Maintain a safe engineering watch	Supports this competency. Complete engine room simulation with ME, Electric Plant and Auxiliaries. Automatic log of student actions.
Table A-III/1.6	Operate main and auxiliary machinery and associated control systems	Supports this competency. Alair, start, control, stop, monitor ME, electric plant and auxiliaries.
Table A-III/1.7	Operate pumping systems and associated control systems	Supports this competency. Includes control of pumps and valves for all major fluid systems.
Table A-III/1.8	Operate alternators, generators and control systems	Supports this competency. Includes generators and switchboards.
Table A-III/1.9	Maintain marine engineering systems including control systems	Not Supported
Table A-III/1.11	Maintain seaworthiness of the ship	Partly supports this competency. Includes safe engineering watch and response to faults. Includes ballast, trim and stability.
Table A-III/2.1	Plan and schedule operations	Partly supports this competency. Includes engine room operations and management of engine fluid systems.
Table A-III/2.2	Start up and shut down main propulsion and auxiliary machinery, including associated systems	Supports this competency.
Table A-III/2.3	Operate, monitor and evaluate engine performance and capacity	Supports this competency.
Table A-III/2.5	Manage fuel and ballast operations	Supports this competency.
Table A-III/2.6	Use internal communication systems	Partly supports this competency. Includes Engine Order Telegraph. Separate communications system can be provided.
Table A-III/2.7	Operate electrical and electronic control equipment	Partly supports this competency. Electric plant included. Top level control system inputs included.
Table A-III/2.8	Test, detect faults and maintain and restore electrical and electronic control equipment to operating condition	Partly supports this competency. Alarms, detection and operational correction of faults are provided. Maintenance functions not provided.
Table A-III/2.10	Detect and identify the cause of machinery malfunctions and correct faults	Supports this competency
Table A-III/2.12	Control trim, stability and stress	Partly supports this competency. Included trim and stability control.
Table A-III/2.1	Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment.	Partly supports this competency.

## **Medium Speed Engine Room 2 and Medium Speed Engine Room Console 2 Simulators and the Tentative Det Norske Veritas Standards for Certification of Maritime Simulator Systems**

Requirement	Capability of MER2 / MEC2 Simulator
<b>Physical Realism</b>	
The simulated engine room shall consist of a typical machinery found on merchant ships. The following main components shall be simulated and all necessary sub-systems are to be included. <ul style="list-style-type: none"> <li>• Main engine with shaft generator</li> <li>• 2 Auxiliary diesel generators</li> <li>• lubrication oil separator</li> <li>• fuel oil separator</li> <li>• steam boiler</li> <li>• 2 air compressors</li> <li>• steering gear system</li> <li>• fire pump</li> </ul>	Simulation of generic medium speed diesel engine room. Simplified main control console with complete graphic display of system controls and indicators (MEC only). Includes two main engines with gear and CPP. No shaft generator, no steam boiler, no fuel oil separators.
The simulated main engine shall replicate a system working according to on of the following principles: <ul style="list-style-type: none"> <li>• Diesel combustion</li> <li>• Steam turbine</li> <li>• Gas turbine</li> </ul>	Simulates a typical medium speed diesel propulsion system with a controllable pitch propeller.
<b>Engine Control Room</b>	
Equipment and consoles are to be installed, mounted and arranged in a ship like manner.	Graphic representation of controls, indicators and alarms on a sub-system basis. Physical control console for Main Engines (only MEC2)
The control room consoles shall include control and monitoring of the main engine, auxiliary engines and electrical power generation, steam boiler, pumps, compressors and all other alarms	Includes all of these functions in interactive graphical displays of controls, indicators and alarms except of a steam boiler.
The remote monitoring and control systems shall be in compliance with the functional requirements of the classification societies for periodically unattended machinery spaces (UMS)	Includes system indicators, alarms and control systems. Does not include bridge console for UMS. Focus of the simulator is on engine control room operations.
The main engine remote control console shall include command functions and status indication normally found on board ships	This capability is provided by the controls and indicators on the desk top console and the associated graphical displays.
The electric power generation shall be under automatic control. Such system shall constantly monitor demand and supply. When deviation from pre-set limits arises, the system shall act in order to normalize the situation. The system shall perform continuous control of the freq. and load sharing.	Electric plant simulation includes automatic and manual control of the electrical plant.

<p>The electric power supply system shall be operated either from the control room console or from the main switchboard. The following commands shall be available:</p> <ul style="list-style-type: none"> <li>• Remote start/stop of auxiliary diesel generators</li> <li>• Operations of shaft generators</li> <li>• Connect/disconnect of all generators</li> <li>• Automatic and priority selection</li> <li>• Non essential systems trip</li> <li>• Constant frequency mode</li> <li>• Different control modes of load sharing</li> </ul>	<p>Graphical display of the main switchboard with interactive controls and indicators. Includes all listed functions. No shaft generator operation.</p>
<p>The main switchboard shall be a full-scale model of a real switchboard, and comprise all controls and indicators usually available on real switchboards.</p>	<p>Graphical display of main switchboard with interactive controls and indicators.</p>
<p>The main switch board (graphics for Class C) shall include:</p> <ul style="list-style-type: none"> <li>• Two separate auxiliary diesel generators</li> <li>• Synchronizing section</li> <li>• Shaft generator section</li> <li>• Separate emergency generator section</li> <li>• One separate section for miscellaneous consumers</li> </ul>	<p>Graphical display of main switchboard with interactive controls and indicators. Includes all listed sections.</p>
<p>The pump and compressor control must include control of the following equipment:</p> <ul style="list-style-type: none"> <li>• ME lubricating oil pumps</li> <li>• ME fresh water cooling pumps</li> <li>• ME sea water cooling pumps</li> <li>• ME Auxiliary blowers</li> <li>• Fuel oil system and pumps</li> <li>• Air compressors</li> <li>• Steering gear pumps</li> <li>• Fire pump</li> </ul> <p>Each of the above individual units shall allow manual start and stop from the control room console. It shall also be possible to use automatic start and stop where applicable.</p>	<p>Pump and compressor control and associated alarm and piping systems provided for the listed sub-systems except steering gear and fire pump. Manual and automatic start capabilities are included.</p>
<p>The alarm monitoring system shall consist of a combination of a visual display unit with keyboard, indicator lamps and push buttons. This visual display unit shall allow for inspection of switch status, PID control status, alarm units, general numeric indication and for semi graphic trending</p>	<p>Visual and sound alarm indicators are provided for all systems. PID control status and semi graphic trending are not included.</p>
<p>An alarm shall be announced by sound and flashing light in the control room.</p>	<p>Provided</p>
<p>A printer or a computer in the engine control room shall be used as an alarm log and event log</p>	<p>Computer generated alarm and event log is provided.</p>
<p><b>Machinery Spaces</b></p>	

<p>The simulated machinery spaces shall at least include one dedicated room for this purpose</p>	<p>Not applicable to desk top system</p>
<p>At least the following main components of the machinery spaces shall be graphically presented or represented by mock-ups (to illustrate physical presence) in the simulated machinery spaces:</p> <ul style="list-style-type: none"> <li>• Main engine</li> <li>• Auxiliary diesel generators</li> <li>• Steam boiler</li> <li>• Fire pump</li> </ul>	<p>The desktop console (only MEC2) and/or associated graphic control and indicator displays represent all these components.</p>
<p>The facilities for local operation in the simulated machinery space shall consist of local operating stations for each system. Each station shall be furnished with start/stop (open/closed) buttons and status lights, various numbers of pressure, temperature indicators, etc. The local operating stations shall at least give means to operate the following:</p> <ul style="list-style-type: none"> <li>• Maine Engine (ME)</li> <li>• ME lubricating oil system including separator</li> <li>• ME fresh water cooling system</li> <li>• ME sea water cooling system</li> <li>• ME auxiliary blowers</li> <li>• 2 auxiliary diesel generators</li> <li>• steam boiler</li> <li>• fuel oil system (diesel and heavy fuel oil) including separator</li> <li>• 2 air compressors</li> <li>• steering gear system</li> <li>• bilge water system</li> <li>• fire pump</li> </ul>	<p>Not applicable to desktop system.</p>
<p>The facilities for local operation in the simulated machinery spaces shall consist of one or more operating stations. The local operating station(s) shall at least give means to operate the following:</p> <ul style="list-style-type: none"> <li>• Maine Engine (ME)</li> <li>• ME lubricating oil system including separator</li> <li>• ME fresh water cooling system</li> <li>• ME sea water cooling system</li> <li>• ME auxiliary blowers</li> <li>• 2 auxiliary diesel generators</li> <li>• steam boiler</li> <li>• fuel oil system (diesel and heavy fuel oil) including separator</li> <li>• 2 air compressors</li> <li>• steering gear system</li> <li>• bilge water system</li> <li>• fire pump</li> </ul>	<p>Graphical panels with interactive controls and indicators are provided for all of the listed systems.</p>
<p>An alarm shall be announced by sound and flashing light in the machinery space</p>	<p>Graphical and sound simulation provided for all alarms.</p>

<b>Behavioral Realism</b>	
The simulation models shall be able to replicate the dynamic behavior of the machinery systems and all of its vital parameters as well as the interactions between sub-systems	This capability is provided. Modeling is included for the dynamic behavior of all of the simulated systems. The sub-systems interact realistically with each other.
The simulation models shall simulate the engine room components with their processes, as well as modeled controller systems (sensors, controllers, actuators, valves) connected to the processes.	This capability is provided.
When simulating real equipment the behavior of such simulated equipment should behave as identically as possible to the original. Critical parameters of the behavior are to be documented.	The modeling represents generic versions of real engine room equipment. The behavior and display parameters are representative of actual equipment.
<b>Operating Environment</b>	
It shall be possible to adjust the noise level in the simulated machinery spaces infinite from no added noise up to a minimum of 100dB(A). The noise shall have a frequency distribution typical for machinery spaces.	A complete sound simulation is provided. The sound level can be adjusted.
It shall be possible to simulate the sea water temperature at least infinite between +1° C and +30° C.	This capability is provided.

**Appendix E**

**Engineering CBT Package**

### STCW competencies addressed by Engineering CBT package.

STCW-95 Reference:	Competence	Capability of Turbo Diesel Simulator
Table A-III/1.4	Maintain a safe engineering watch	Not supported.
Table A-III/1.6	Operate main and auxiliary machinery and associated control systems	Supports this competency. Following auxiliary machinery has been modeled: steam boiler, diesel generators, refrigerating plant, steering gear, oily water separator, fuel separator, water pumps, hydrophore installation, fresh water generator, piston compressor, biological sewage treatment plant, controllable pitch propeller simulator.
Table A-III/1.7	Operate pumping systems and associated control systems	Not supported.
Table A-III/1.8	Operate alternators, generators and control systems	Not supported.
Table A-III/1.9	Maintain marine engineering systems including control systems	Not supported.
Table A-III/1.11	Maintain seaworthiness of the ship	Not supported.
Table A-III/2.1	Plan and schedule operations	Not supported.
Table A-III/2.2	Start up and shut down main propulsion and auxiliary machinery, including associated systems	Supports this competency for auxiliary machinery only.
Table A-III/2.3	Operate, monitor and evaluate engine performance and capacity	Not supported.
Table A-III/2.5	Manage fuel and ballast operations	Not supported.
Table A-III/2.6	Use internal communication systems	Not supported.
Table A-III/2.7	Operate electrical and electronic control equipment	Not supported.
Table A-III/2.8	Test, detect faults and maintain and restore electrical and electronic control equipment to operating condition	Partly supports this competency.
Table A-III/2.10	Detect and identify the cause of machinery malfunctions and correct faults	Supports this competency for the modeled auxiliary machinery only.
Table A-III/2.12	Control trim, stability and stress	Not supported.
Table A-III/2.1	Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment.	Not supported.

**The Tentative Det Norske Veritas Standards  
for Certification of Maritime Simulator Systems  
are not applicable for Engineering CBT Package**

**Appendix F**

**UNITEST MEDIUM SPEED 3D ENGINE  
ROOM**

**AND**

**UNITEST MEDIUM SPEED ENGINE 3D  
ROOM HARDWARE**

**STCW competencies addressed by  
Unitest Medium Speed 3D Engine Room  
and Unitest Medium Speed Engine 3D Room Hardware simulators.**

<b>STCW-95 Reference:</b>	<b>Competence</b>	<b>Capability of MED3D / MED3DH Simulator</b>
Table A-III/1.4	Maintain a safe engineering watch	Supports this competency. Complete engine room simulation with ME, Electric Plant and Auxiliaries. Automatic log of student actions.
Table A-III/1.6	Operate main and auxiliary machinery and associated control systems	Supports this competency. Alarms, start, control, stop, monitor ME, electric plant and auxiliaries.
Table A-III/1.7	Operate pumping systems and associated control systems	Supports this competency. Includes control of pumps and valves for all major fluid systems.
Table A-III/1.8	Operate alternators, generators and control systems	Supports this competency. Includes generators and switchboards.
Table A-III/1.9	Maintain marine engineering systems including control systems	Not Supported
Table A-III/1.11	Maintain seaworthiness of the ship	Partly supports this competency. Includes safe engineering watch and response to faults. Includes ballast, trim and stability.
Table A-III/2.1	Plan and schedule operations	Partly supports this competency. Includes engine room operations and management of engine fluid systems.
Table A-III/2.2	Start up and shut down main propulsion and auxiliary machinery, including associated systems	Supports this competency.
Table A-III/2.3	Operate, monitor and evaluate engine performance and capacity	Supports this competency.
Table A-III/2.5	Manage fuel and ballast operations	Supports this competency.
Table A-III/2.6	Use internal communication systems	Partly supports this competency. Includes Engine Order Telegraph. Separate communications system can be provided.
Table A-III/2.7	Operate electrical and electronic control equipment	Supports this competency. Electric plant included. Power Management System included. Top level control system inputs included.
Table A-III/2.8	Test, detect faults and maintain and restore electrical and electronic control equipment to operating condition	Partly supports this competency. Alarms, detection and operational correction of faults are provided. Maintenance functions not provided.
Table A-III/2.10	Detect and identify the cause of machinery malfunctions and correct faults	Supports this competency
Table A-III/2.12	Control trim, stability and stress	Partly supports this competency. Included trim and stability control.
Table A-III/2.1	Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment.	Partly supports this competency.

## **Unitest Medium Speed 3D Engine Room and Unitest Medium Speed 3D Engine Room Hardware Simulators and the Tentative Det Norske Veritas Standards for Certification of Maritime Simulator Systems**

Requirement	Capability of MED3D / MED3DH Simulator
<b>Physical Realism</b>	
The simulated engine room shall consist of a typical machinery found on merchant ships. The following main components shall be simulated and all necessary sub-systems are to be included. <ul style="list-style-type: none"> <li>• Main engine with shaft generator</li> <li>• 2 Auxiliary diesel generators</li> <li>• lubrication oil separator</li> <li>• fuel oil separator</li> <li>• steam boiler</li> <li>• 2 air compressors</li> <li>• steering gear system</li> <li>• fire pump</li> </ul>	Simulation of generic medium speed diesel engine room. 3D Visualization of the whole engine room. Detailed main control console with complete graphic display of system controls and indicators (MED3D only). Includes one main engine with gear and CPP.
The simulated main engine shall replicate a system working according to on of the following principles: <ul style="list-style-type: none"> <li>• Diesel combustion</li> <li>• Steam turbine</li> <li>• Gas turbine</li> </ul>	Simulates a typical medium speed diesel propulsion system with a controllable pitch propeller.
<b>Engine Control Room</b>	
Equipment and consoles are to be installed, mounted and arranged in a ship like manner.	3D graphic representation of controls, indicators and alarms on a sub-system basis. Physical control console for Main Engines (only MED3DH)
The control room consoles shall include control and monitoring of the main engine, auxiliary engines and electrical power generation, steam boiler, pumps, compressors and all other alarms	Includes all of these functions in interactive graphical displays of controls, indicators and alarms except of a steam boiler.
The remote monitoring and control systems shall be in compliance with the functional requirements of the classification societies for periodically unattended machinery spaces (UMS)	Includes system indicators, alarms and control systems. Includes bridge console for UMS. Focus of the simulator is on engine control room operations.
The main engine remote control console shall include command functions and status indication normally found on board ships	This capability is provided by the controls and indicators on the desk top console and the associated graphical displays.
The electric power generation shall be under automatic control. Such system shall constantly monitor demand and supply. When deviation from pre-set limits arises, the system shall act in order to normalize the situation. The system shall perform continuous control of the freq. and load sharing.	Electric plant simulation includes automatic and manual control of the electrical plant. Power Management System included.

<p>The electric power supply system shall be operated either from the control room console or from the main switchboard.</p> <p>The following commands shall be available:</p> <ul style="list-style-type: none"> <li>• Remote start/stop of auxiliary diesel generators</li> <li>• Operations of shaft generators</li> <li>• Connect/disconnect of all generators</li> <li>• Automatic and priority selection</li> <li>• Non essential systems trip</li> <li>• Constant frequency mode</li> <li>• Different control modes of load sharing</li> </ul>	<p>3D graphical display of the main switchboard with interactive controls and indicators. Includes all listed functions. No shaft generator operation.</p>
<p>The main switchboard shall be a full-scale model of a real switchboard, and comprise all controls and indicators usually available on real switchboards.</p>	<p>3D graphical display of main switchboard with interactive controls and indicators.</p>
<p>The main switch board (graphics for Class C) shall include:</p> <ul style="list-style-type: none"> <li>• Two separate auxiliary diesel generators</li> <li>• Synchronizing section</li> <li>• Shaft generator section</li> <li>• Separate emergency generator section</li> <li>• One separate section for miscellaneous consumers</li> </ul>	<p>3D graphical display of main switchboard with interactive controls and indicators. Includes all listed sections.</p>
<p>The pump and compressor control must include control of the following equipment:</p> <ul style="list-style-type: none"> <li>• ME lubricating oil pumps</li> <li>• ME fresh water cooling pumps</li> <li>• ME sea water cooling pumps</li> <li>• ME Auxiliary blowers</li> <li>• Fuel oil system and pumps</li> <li>• Air compressors</li> <li>• Steering gear pumps</li> <li>• Fire pump</li> </ul> <p>Each of the above individual units shall allow manual start and stop from the control room console. It shall also be possible to use automatic start and stop where applicable.</p>	<p>Pump and compressor control and associated alarm and piping systems provided for the listed sub-systems except steering gear and fire pump. Manual and automatic start capabilities are included.</p>
<p>The alarm monitoring system shall consist of a combination of a visual display unit with keyboard, indicator lamps and push buttons. This visual display unit shall allow for inspection of switch status, PID control status, alarm units, general numeric indication and for semi graphic trending</p>	<p>Visual and sound alarm indicators are provided for all systems. PID control status and semi graphic trending are not included.</p>
<p>An alarm shall be announced by sound and flashing light in the control room.</p>	<p>Provided</p>
<p>A printer or a computer in the engine control room shall be used as an alarm log and event log</p>	<p>Computer generated alarm and event log is provided.</p>
<p><b>Machinery Spaces</b></p>	

<p>The simulated machinery spaces shall at least include one dedicated room for this purpose</p>	<p>All machinery spaces modeled in 3D virtual reality.</p>
<p>At least the following main components of the machinery spaces shall be graphically presented or represented by mock-ups (to illustrate physical presence) in the simulated machinery spaces:</p> <ul style="list-style-type: none"> <li>• Main engine</li> <li>• Auxiliary diesel generators</li> <li>• Steam boiler</li> <li>• Fire pump</li> </ul>	<p>The hardware console (only MED3D) and/or associated graphic control and indicator displays represent all these components.</p>
<p>The facilities for local operation in the simulated machinery space shall consist of local operating stations for each system. Each station shall be furnished with start/stop (open/closed) buttons and status lights, various numbers of pressure, temperature indicators, etc. The local operating stations shall at least give means to operate the following:</p> <ul style="list-style-type: none"> <li>• Main Engine (ME)</li> <li>• ME lubricating oil system including separator</li> <li>• ME fresh water cooling system</li> <li>• ME sea water cooling system</li> <li>• ME auxiliary blowers</li> <li>• 2 auxiliary diesel generators</li> <li>• steam boiler</li> <li>• fuel oil system (diesel and heavy fuel oil) including separator</li> <li>• 2 air compressors</li> <li>• steering gear system</li> <li>• bilge water system</li> <li>• fire pump</li> </ul>	<p>Modeled in 3D virtual reality.</p>
<p>The facilities for local operation in the simulated machinery spaces shall consist of one or more operating stations. The local operating station(s) shall at least give means to operate the following:</p> <ul style="list-style-type: none"> <li>• Main Engine (ME)</li> <li>• ME lubricating oil system including separator</li> <li>• ME fresh water cooling system</li> <li>• ME sea water cooling system</li> <li>• ME auxiliary blowers</li> <li>• 2 auxiliary diesel generators</li> <li>• steam boiler</li> <li>• fuel oil system (diesel and heavy fuel oil) including separator</li> <li>• 2 air compressors</li> <li>• steering gear system</li> <li>• bilge water system</li> <li>• fire pump</li> </ul>	<p>Graphical panels with interactive controls and indicators are provided for all of the listed systems.</p>
<p>An alarm shall be announced by sound and flashing light in the machinery space</p>	<p>Graphical and sound simulation provided for all alarms.</p>

<b>Behavioral Realism</b>	
The simulation models shall be able to replicate the dynamic behavior of the machinery systems and all of its vital parameters as well as the interactions between sub-systems	This capability is provided. Modeling is included for the dynamic behavior of all of the simulated systems. The sub-systems interact realistically with each other.
The simulation models shall simulate the engine room components with their processes, as well as modeled controller systems (sensors, controllers, actuators, valves) connected to the processes.	This capability is provided.
When simulating real equipment the behavior of such simulated equipment should behave as identically as possible to the original. Critical parameters of the behavior are to be documented.	3D modeling represents generic versions of real engine room equipment. The behavior and display parameters are representative of actual equipment.
<b>Operating Environment</b>	
It shall be possible to adjust the noise level in the simulated machinery spaces infinite from no added noise up to a minimum of 100dB(A). The noise shall have a frequency distribution typical for machinery spaces.	A complete sound simulation is provided. The sound level can be adjusted.
It shall be possible to simulate the sea water temperature at least infinite between +1° C and +30° C.	This capability is provided.