



Inspectie Leefomgeving en Transport
Ministerie van Infrastructuur en Milieu

Guideline for maritime simulators

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1 Introduction

1.1 Motivation

At the beginning of 2005, the Netherlands Shipping Inspectorate (NSI) performed an assessment of simulators at several institutes for the renewed recognition of various STCW training courses. During these assessments, there proved to be a need, both at the Inspectorate and the institutes, for a uniform guideline with regard to simulators used in the Netherlands.

The Netherlands Shipping Inspectorate (NSI) is responsible for the recognition of the various simulators according to the STCW Convention 78, as amended, Regulation I/12 and Section A-1/12. On account of this responsibility, the NSI developed this guideline after consultation with stakeholders.

1.2 Purpose of this guideline

The purpose of this guideline is to provide a **uniform, minimal** set of requirements with which a simulator should comply for the various training courses & activities. After the NSI has assessed whether a simulator complies with the requirements established in this guideline for the relevant training course, this compliance will be indicated on the recognition certificate of the training course in question. This certificate has a maximum validity of 5 years.

1.3 Procedures followed

- The type of simulator required for the compulsory training courses offered in the Netherlands is indicated.
- The following sources have been used:
 - IMO model course 1.22, Ship Simulator and Bridge Teamwork 2002 edition.
 - IMO model course 2.07, Engine room simulator 2002 edition.
 - IMO model course 1.07, Radar Navigation at Operational Level.
 - IMO model course 1.08, Radar Navigation at Management Level.
 - IMO model course 1.27 Operational use of electronic chart display and information systems (Ecdis) 2012 edition.
 - IMO model course 6.10, Train the simulator trainer and assessor. 2012 edition.
 - DNV 2.14 Standard for certification of Maritime Simulator System January 2011.
 - DNV standard for certification no. 3.403 Maritime Simulator Centres February 2005.

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- Regulations + recommendations as specified in the STCW Convention 78, as amended, Regulation I/12, and Sections A-I/12 and B-I/12.
- Navigation, radar and ARPA simulator training, merchant navy training board December 2004.
- Latest IMO performance standards for radar equipment and ARPA.

2 Definitions

2.1 Simulator

A simulator must be able to create realistic situations that provide an opportunity to acquire the required skills, as specified in the STCW Convention 78, as amended, Chapters II (nautical) and III (technical).

2.2 The various types of simulators

1 Simulator for bridge activities. Type: Naut A.

A full mission bridge simulator to be used in order to obtain seagoing service reduction for deck officer cadets.

2 Simulator for bridge activities. Type: Naut B.

A simulator to be used at minimum for the nautical ship management training course.

3 Simulator for radar navigation. Type: Naut C.

A radar simulator to be used at minimum for the radar navigation training course. (Radar navigator management level).

4 Simulator for radar observer. Type: Naut D.

A radar simulator to be used at minimum for the radar observer training course. (Radar navigator operational level).

5 Simulator for ECDIS training. Type: Naut E.

A simulator to be used at minimum for the ECDIS training course.

6 Simulator for Engine-Room activities. Type: Techn A.

A full mission engine room simulator to be used in order to obtain sea going service reduction for engineer officer cadets.

7 Simulator for Engine-Room activities. Type: Techn B.

A simulator to be used at minimum for the technical ship management training course.

8 Simulator for high-voltage training. Type: Techn C.

A simulator to be used at minimum for a high-voltage training course.

2.3 Instructor

An instructor is someone who is qualified to teach a training course on a simulator. The instructor possesses the qualifications and has the experience in accordance with the STCW Convention 78, as amended, Regulation I/6, Section A-I/6, paragraphs 4 and 7, Regulation I/12 and Section A-I/12, paragraph 9. In addition, the instructor meets the requirements described in IMO model course 1.22 Ship Simulator and Bridge Teamwork (staff requirements) as applicable (on the basis of Section A-I/2.6).

3 General requirements

3.1 Simulator equipment

- Every piece of equipment installed in the simulator must have the same functionality as a similar piece of equipment that would be available on board of a ship.
- A piece of equipment used in a simulator must comply with the IMO performance standards (functional requirements), insofar as these are available. If no IMO performance standards are available, a piece of equipment must comply with the minimum approval requirements for equipment on board of a ship.
- User manuals for the various pieces of equipment must be available to the training course participants during the exercises.
- Every piece of equipment must have the same functionality as a similar piece of equipment that would be available on board of a regular operated ship. It must be similar in terms of accuracy, reaction time, etc.
- If new pieces of equipment become mandatory on board of ships in the future, and if these are relevant to the training courses, these pieces of equipment must be added to the simulator within a period determined by the NSI.

3.2 Simulator for seagoing service reduction

The Netherlands published equivalent arrangement – IMO STCW.2/Circ.7, dated 12 November 2001 – stating that a reduction of required seagoing service can be obtained after training on a full mission bridge simulator (type: Naut A).

The Netherlands published equivalent arrangement – IMO STCW.2/Circ.55, dated 24 March 2014 – stating that a reduction of required seagoing service can be obtained after training on a full mission engine-room simulator (type: Techn A).

3.3 Facilities for the instructors

The following facilities and options must be available to an instructor:

1. Start, stop, reset and restart of an exercise.
2. Changing the simulated environmental circumstances during the exercise.
3. Communication with the training course participants as if they were on another vessel, their own ship's crew (bridge, ECR, steering-gear room, etc.) or shore station in the exercise.
4. Being able to follow the conversations taking place in the simulator room during the exercise.
5. Being able to visually monitor the progress of the exercises.
6. Graphical display of the executed exercises.
7. Triggering alarms and simulating a breakdown of each piece of equipment in the simulator.
8. There must be a physical separation between the instructor and the training course participants.

It must be possible for each exercise to be replayed entirely after its completion. Both accelerated and in slow-motion, so that one can learn from the exercise.

4 Nautical simulator.

4.1 General

The requirements that a simulator must meet are indicated in the column of the relevant type. An explanation regarding the type is mentioned under Definitions in Chapter 2.2 of this guideline.

4.2 Table A: Skills which a training course participant shall be able to perform on the simulator

Required skill specified per nautical type of simulator						
STCW-78, as amended table	skill	A	B	C	D	E
A-II/1.1	Plan and conduct a passage, and determine position.	X	X			X
A-II/1.2	Maintain a safe navigational watch.	X	X	X		X
A-II/1.3	Use of radar and ARPA to maintain safety of navigation.	X	X	X	X	X
A-II/1.4	Use of ECDIS to maintain safety of navigation.	X	X			X
A-II/1.5	Respond to emergencies.	X	X	X		
A-II/1.6	Respond to a distress signal at sea.	X	X	X		
A-II/1.9	Manoeuvre the ship.	X	X			
A-II/2.1	Plan a voyage and conduct navigation.		X			X
A-II/2.2	Determine position and assess the accuracy of resultant position fix.		X			X
A-II/2.3	Determine and allow for compass errors.		X			
A-II/2.4	Coordinate search and rescue operations.		X	X		
A-II/2.5	Establish regulations and procedures for maintaining a safe watch.		X			
A-II/2.6	Use of radar, ARPA and modern navigation equipment to aid decision-making with regard to maintaining safe navigation.		X	X		X
A-II/2.7	Use of ECDIS and modern navigation equipment to aid decision-making with regard to maintaining safe navigation.		X			X
A-II/2.10	Manoeuvre and handle a ship in all conditions.		X			
A-II/2.11	Operate remote controls for propulsion and other relevant engineering systems.		X			

- STCW table A-II/1 is applicable to navigation officers on ships larger than 500 GT
- STCW table A-II/2 is applicable to captains and chief mates on ships larger than 500 GT

4.3 Table B: equipment

Required equipment						
<i>Item</i>	<i>Description</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
A	Consoles and equipment must be installed in such a way that the most realistic bridge possible is created.	X	X			
B	Controls of propulsion plant, bow and stern thrusters. Propeller speed and pitch indicators, etc., must also be available.	X	X			
C	Controls of propulsion plant			X		X
D	Controls of propulsion plant to be used during berthing and unberthing. It must also be possible to see the ship side and quayside from the simulator.	X				
E	Helm position with possibility to switch from manual to automatic steering, and rudder position indicator + design with double steering gear, including alarms.	X	X	X		X
F	Steering compass and bearing compass.	X	X			X
G	Steering compass.			X		X
H	Radar and ARPA in accordance with STCW Code A-I/12 part 1 radar simulation and ARPA simulation.	X	X	X	X	X
I	Communication equipment consisting of at least 2 VHF.	X	X			
J	Communication equipment consisting of at least 1 VHF.			X		X
K	Onboard ship communication consisting of telephone and portable VHF equipment/PA system.	X	X			
L	Electronic charts (ECDIS) + paper charts.	X	X	X		X
M	GPS, echo sounder, log, AIS.	X	X	X		X
N	Wind direction and speed indicator.	X	X	X		
O	Navigation light panel.	X	X			
P	Fire detection panel with different zones, fire alarm and general alarm buttons.	X	X			
Q	Electronic charts: ENC		X			X

4.4 Table C: degree of reality

Required capabilities of the simulator						
<i>Item</i>	<i>Description</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
A	The simulator should be able to represent at least 5 different ship types.	X	X			
B	The radar simulator must have the capabilities required by the STCW Code section A-I/12 part 1 paragraph 4.2: various weather types, tidal streams, ocean currents, blind sectors, spurious echoes and other special effects. The simulator must also be able to generate coastlines, navigational buoys and search and rescue transponders.	X	X	X	X	X
C	The ARPA simulator must have the capabilities required by the STCW Code section A-I/12 part 1 paragraph 5: - manual and automatic target acquisition. - past track information. - use of exclusion areas. - vector/graphic time-scale and data display. - trial manoeuvres.	X	X	X		X
D	The simulator must, based on reality, be able to simulate the effects of wind, stream and waves on one's own ship in open waters.	X	X	X		X
E	The simulator must, based on reality, be able to simulate the effects of wind, stream, waves, shallow waters and close proximity effects of other ships on one's own ship in confined/restricted waters.	X				

4.5 Table D: environment options

Required operational environment options						
<i>Item</i>	<i>Description</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
A	It must be possible to simulate the presence of at least 10 different types of other ships, with the option of letting those ships navigate under the influence of stream and wind.	X	X			
B	These other ships must be capable of using navigation lights, exhibiting day shapes, using AIS and acoustic signals.	X	X			
C	The simulator must be able to simulate at least 20 other ships in the vicinity of one's own ship.	X	X	X	X	X
D	The outside image must have realistic scenarios with day and night situations. It must be possible to change the different meteorological circumstances during an exercise.	X	X			
E	The outside visual image must be 360°, with a continuous view from the bow up to 120° on either side (SB and PS) of the bow, and with the remaining 120° reproduced by a moving camera.	X				
F	The visual image must be able to display everything related to the navigation characteristics on the chart, as well as realistic objects.	X	X			
G	The outside image must be at least 180°, with a minimum continuous view of 120°. The remaining 60° may be reproduced by a moving camera.		X			
H	It must be possible to change the stream effects during the exercise.	X	X	X		X
I	The waters in which the ship navigates during the exercise must be able to have a current pattern that is variable in time, strength and direction. It must also be possible to simulate tidal effects.	X	X	X		
J	It must be possible for other ships in the exercise to use AIS.					X

5 Technical simulator.

5.1 General

The requirements that a simulator must meet are indicated in the column of the relevant type. An explanation regarding the type is mentioned under Definitions in Chapter 2.2 of this guideline.

5.2 Table A: Skills which a training course participant shall be able to perform on the simulator

Required skills specified per technical type of simulator.				
<i>STCW-78 table, as amended</i>	<i>skill</i>	<i>A</i>	<i>B</i>	<i>C</i>
A-III/1.1	Maintain a safe engineering watch.	X	X	
A-III/1.3	The use of internal communication systems.	X	X	
A-III/1.4	Operate main and auxiliary machinery and associated control panels.	X	X	
A-III/1.5	Operate pumping systems and associated control panels.	X	X	
A-III/1.6	Operate electrical, electronic and control systems.	X	X	X
A-III/1.7	Maintain and repair electrical and electronic equipment.	X	X	X
A-III/1.11	Maintain seaworthiness of the ship.	X	X	
A-III/2.2	Plan and schedule operations.		X	
A-III/2.3	Operate, monitor, and maintain the safety and performance of the main propulsion and auxiliary machinery, and associated control panels.		X	
A-III/2.4	Manage fuel and ballast operations.		X	
A-III/2.5	Manage electrical and electronic control equipment.	X	X	X
A-III/2.6	Detect faults and repair electrical and electronic control equipment.	X	X	X
A-III/2.8	Detect and identify machinery malfunctions and correct faults.		X	
A-III/2.10	Control trim, stability and stress of the ship structure.		X	
A-III/2.11	Monitor and control compliance with legislative requirements and measures to ensure safety and the protection of the marine environment.		X	
B-III/2.1.3	Correct faults in a high-voltage system.			X
B-III/2.1.6	Create and implement a procedure for a high-voltage system.			X
B-III/2.1.7	Measure the insulation resistance and polarisation index in high-voltage equipment.			X

- STCW table A-III/1 is applicable to officers in charge of an engineering watch in a manned engine room or to duty engineers designated for this purpose in a periodically unmanned engine room with engine power of 750 kW or more.
- STCW table A-III/2 is applicable to Chief Engineer Officers and second engineer officers on seagoing ships with 3,000 kW of engine power or more.

5.3 Table B: equipment

Required equipment				
Item	Description	A	B	C
A	The simulated ER must accommodate the machinery and equipment that can usually be found on a merchant ship. It must be possible to simulate the following main components with the necessary associated systems: - Main engine with shaft generator. - Two auxiliary diesel engines. - Lubrication oil separator. - Steam boiler. - Fuel oil separator. - Two air compressors. - Steering gear system. - Fuel oil pump.	X	X	
B	The simulated main engine must exhibit a system in accordance with the following principle: - Internal combustion engine.	X	X	
Note:	<u>Engine Control Room (ECR):</u> Real consoles connected to the computer system (the simulator) are only used for " Techn A ". For " Techn B " software-based display on computer screens will be sufficient.			
C	Equipment and consoles must be installed and arranged according to the situation and/or configuration on board a merchant ship.	X	X	
D	The control panels must contain control, adjustment and monitoring functions for the operation of the main (engines) and auxiliary machinery (engines), the electric system (alternators, generators), boilers, pumps, compressors, etc., including all associated alarms. Also including all other alarms.	X	X	
E	The monitoring and control systems must conform to the performance standards of the classification societies with regard to unmanned engine rooms. Note: A watch alarm system and UMS panel with adjustment options for watch engineers and forwarding of the alarms must be incorporated (including the alarm periods of 27 minutes + 3 minutes)	X	X	

F	The remote control system of the main propulsion system must have commands/orders and status indicators, as is customary on a merchant vessel.	X	X	
G	The electric system must be fully automatic, whereby supply and demand must continuously be monitored. If deviations arise with respect to the set values, the system must correct itself. The system must also continuously monitor the frequencies and load distribution.	X	X	
H	It must be possible to operate the electric power supply from the ECR or the main switchboard. The following options must be available: - Remote start/stop of auxiliary diesel engines. - Operation of the shaft generator. - Engaging/disengaging of all generators. - Automatic and priority circuit selection. - Non-essential users system trip. - Steady frequency mode. - Various control options for the load distribution.	X	X	
I	The main switchboard must be a full-scale model of a real switchboard, and must have all operational capabilities and indicators that are usually available on a main switchboard. <i>Note</i> <i>The real switchboard connected to the computer system (the simulator) will only be used for "Techn A".</i> <i>For "Techn B" software-based display on computer screens will be sufficient.</i>	X	X	
J	The main switchboard shall comprise: - Two separate auxiliary engine sections. - Synchronisation section. - Shaft generator section. - Separate emergency generator section/connection. - Separate section for various users.	X	X	
K	The operation section of pumps and compressors must comprise the following equipment: - Main engine lubricating pumps. - Main engine freshwater cooling pumps. - Main engine seawater cooling pumps. - Main engine auxiliary blowers. - Fuel oil systems and pumps. - Air compressors. - Steering gear pumps. - Fire pumps. It must be possible to manually start each of the above-mentioned units from the ECR console. If applicable, automatic starting/stopping must also be possible.	X	X	
L	The alarm monitoring system must comprise a combination of a display unit with keyboard, indicator lamps and push buttons. By means of the display unit, it must be possible to read out/monitor switch possibilities, PID control	X	X	

	status, alarm set points, numerical data and trend analyses.			
M	An alarm must go off in the ECR both acoustically (Techn. A must be a horn and Techn. B may be a headphone) and visually (Techn. A must be a rotating light and Techn. B may be displayed on a computer screen).	X	X	
N	In the ECR, a printer or computer must be used to display alarms and occurrences.	X	X	
Note	<u>Engine Rooms (ER). (O to R)</u> <i>The requirements only need to be met "physically" for "Techn A"; the equipment must be connected to the computer system (the simulator). For "Techn B" software-based display on computer</i>			
O	The simulated engine rooms must at least have a room specially designed for this purpose.	X	X	
P	In this simulated engine room, the following principal machinery must be either "visually" present or be shown by means of a model (in order to illustrate the physical presence): - Main engine. - Auxiliary engines. - Steam boiler. - Fuel oil pump.	X	X	
Q	In this simulated engine room, local operating facilities (control panels) must be present for each individual system. Each control panel must have start/stop (open/close) buttons and indicator lamps, various pressure and temperature indicators, etc. From the local control panels, it must be possible to operate at least the following machinery: - Main engine. - Main engine lubrication oil systems, including the lubrication oil separator. - Main engine freshwater cooling system. - Main engine seawater cooling system. - Main engine auxiliary blowers. - Two auxiliary engines. - Steam boiler. - Fuel oil system (diesel + heavy fuel oil), including the separator. - Two air compressors. - Steering gear system. - Bilge system. - Ballast system. - Fuel oil pump.	X		
R	In this simulated engine room, one or more local operating facilities (control panels) must be present. From the local control panels, it must be possible to operate at least the following machinery:		X	

	- Main engine. - Main engine lubrication oil systems, including the lubrication oil separator. - Main engine freshwater cooling system. - Main engine seawater cooling system. - Main engine auxiliary blowers. - Two auxiliary engines. - Steam boiler. - Fuel oil system (diesel + heavy fuel oil), including the separator. - Two air compressors. - Steering gear system. - Bilge system. - Ballast system. - Fuel oil pump.			
S	An alarm must both sound acoustically (Techn. A must be a horn and Techn. B may be a headphone) and it must be shown visually (Techn. A must be a rotating light and Techn. B may be shown on a display screen) in the engine room.	X	X	
T	High-voltage board enclosed with metal and with at least three fields. This must contain at least two power switches; the third field can be a cable field secured with fuses. The power switches must be of a withdrawable type.			X
U	Measurement equipment for high voltage (measurement sticks) and polarisation index, with gauges produced by at least two manufacturers. Dielectric absorption rate and dielectric discharge measurements are optional, but recommended.			X
V	Protective equipment (PPE) for low and high voltage. For example, HRC cat 1 and 3 of at least two different brands.			X

5.4 Table C: degree of reality

Required capabilities of the simulator				
<i>Item</i>	<i>Description</i>	<i>A</i>	<i>B</i>	<i>C</i>
A	The simulator models must be capable of reproducing the dynamic behaviour of the machinery systems, including the vital parameters and interactions between the secondary systems.	X	X	
B	The simulator models must reproduce the machinery systems with their processes and control systems (sensors, regulators, controls, valves) that are connected to those processes.	X	X	
C	When simulating equipment, the behaviour of the equipment must be as identical as possible to the behaviour of the real equipment. Critical parameters concerning the behaviour must be documented.	X	X	
D	The brand and type of the high-voltage board must be used on board.			X

5.5 Table D: work environment

Required operational work environment				
<i>Item</i>	<i>Description</i>	<i>A</i>	<i>B</i>	<i>C</i>
A	It must be possible to infinitely regulate the sound level in the simulated engine room from no added noise to a maximum of 78 dB(A) (maximum level allowed according to the legislation concerning working conditions).	X	X	
<i>Note</i>	<i>The sound must be reproduced as realistically as possible, e.g. starting of engines, changes in rpm, etc. (techn A must be reproduced through a speaker, while techn B may be reproduced through headphones).</i>			
B	It must be possible to infinitely regulate the seawater temperature between at least +1 and +30 degrees Celsius.	X	X	
C	It must be possible to create a physical barrier, so that a room with workstations can be split into two: an ECR and engine room. At least 6 workstations (with display screens) must be available, so that an ECR with 2 workstations and an engine room with 4 workstations can be created. Furthermore, the ECR, engine room and instructor's room must be equipped with a sufficient number of fixed telephones.		X	

6 Changes to versions 2, 3 and 4.

Version 2

- Two steering gear systems required, including alarms and breakdowns.
See Chapter 4.3 table B under E.
- Fire detection panel subdivided into different zones. (Accommodation and engine room). See Chapter 4.3, table B under P.
- Install a bridge watch alarm.
- ECDIS column added to the nautical simulators. See 2.2. + tables.

Version 3

- DNV 2.07 has a new version of page 4.
- The name Transport and Water Management Inspectorate is changed to the Human Environment and Transport Inspectorate/Netherlands Shipping Inspectorate.
- STCW code 95 is changed to STCW Convention 78, as amended.
- IMO model course 6.10 on page 4.
- "full mission engine room simulator" removed from the section regarding the simulator for sea service reduction.

Version 4

- Installation of the bridge watch alarm, as mentioned in the section on the changes in version 2, is cancelled.
- There is now almost global ENC chart coverage. The obligation of ENC and ARCS charts in the simulator was therefore changed to just ENC charts. See Chapter 4.3, table B under Q. Furthermore, column B in table B under Q (ship management) has been marked.
- Simulator C for high voltage added to Chapter 5.
- Table A nautical and technical skills adjusted in accordance with the 2010 Manila amendments in the STCW Convention 78.
- Approval certificate changed to recognition. Page 4.
- The name 'course' will be changed to 'training course'. Page 4 and 7
- Engine room simulator for sea service reduction added. Page 7

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