Maritime Safety and Security Challenges – 3D Simulation Based Training

C. Felsenstein & K. Benedict
Hochschule Wismar, University of Applied Sciences – Technology, Business and Design, Germany

M. Baldauf
World Maritime University Malmö (WMU), Sweden

ABSTRACT: Maritime Safety and Security on board ships very much depends on well trained crews. That is why training and exercising emergency response procedures as well as efficiency in reliable management are extremely necessary. On the other hand research as well as technological development in safety and security, tools and other kinds of technical and organizational systems contribute to further improvement and guarantee high levels of safety and security in maritime transportation. Simulation facilities are essential for both exercising and training but also for research and technological development. This paper introduces the innovative concept of a safety and security training simulator (SST) and describes research work related to the implementation of training scenarios. Selected results of a case study will be presented. A shorter version of this paper was originally presented at the International Conference on “Marine Navigation and Safety of Sea Transportation” at Gdynia in June 2013.

1 INTRODUCTION

Maritime Safety and Security requires adequate response to any kind of emergency, quick and reliable planning and assignment of crew resources and finally, efficient crisis management. These themes are some of the most important in maritime education and training and STCW Manila Amendments applied since 2012 (see [4]-[6]) reflect a major priority for training ship’s officers and crews of cargo and passenger ships in sufficient skills and appropriate procedures. The best way to attain experience and to gain the necessary skills are practice runs on specially designed simulators which realistically represent the complex ship conditions on board such vessels after an emergency alert occurs.

Although there are many rules and regulations already in place – e.g. SOLAS, STCW, ISM, and ISPS - it is still necessary to ensure a permanent process of correction and improvement in safety and security precautionary measures both in port as well as at sea. This is done by testing and improving modern safety and security equipment and also includes a constant review of training and drills. Training is vital for creating a permanent high level of safety and security awareness on board to guard against human complacency on duty and to better motivate ships' crews.

In their collaborative research work of Wismar University’s research group (HSW-ISSIMS) and the Maritime Simulation Centre in Warnemuende (MSCW) with the World Maritime University's Maritime Risk and System Safety (MaRiSa) research group are improving training possibilities, e.g. with the development and integration of simulation based modules into training units and course schemes. Furthermore other studies, e.g., to investigate the effectivity of safety and security plans and planning
procedures or new safety devices, are carried out to assess how they stand up under varying conditions and during different courses of events in a selected series of simulation runs. To this end a Safety & Security Training simulator (SST) was developed and is used also in combination with other simulators.

2 SIMULATION ENVIRONMENT FOR SAFETY &SECURITY TRAINING AND RESEARCH

The Maritime Simulation Centre Warnemünde (MSCW) is one of the most modern simulation centers worldwide encompassing a full mission Ship Handling Simulator (SHS), Ship Engine Simulator (SES) and a Vessel Traffic Services Simulator (VTSS) as well as a new type of simulator called the Safety and Security Trainer (SST) see Figure 1. This integrated simulation platform complex with four full mission simulators enables the trainee to simulate the entire system ship and offers concrete challenges to officers and crew on board. The simulator arrangement (MSCW) comprises

- a Ship Handling Simulator SHS with four Full Mission bridges and 8 Part Task Bridges,
- a Ship Engine Simulator SES with 12 Part Task stations and
- a Vessel Traffic Services Simulator VTSS with 9 operator consoles
- a Safety and Security Simulator with 10 operator consoles

![Image of simulation center](image)

**Figure 1. Maritime Simulation Centre Warnemünde (MSCW)**

At WMU the combined SST - Desktop SHS is installed and used for training and research into specific human error factors ([11]-[13]).

2.1 Integrated use of Safety and Security Simulation for training and research

The new SST simulator was designed by the manufacturer Rheinmetall Defence Electronics Bremen (RDE) in co-operation with Wismar University, Department of Maritime Studies. The simulator was originally designed in a basic 2D version and is now being developed into a 3D interface. The simulator can be specifically used for “stand-alone” exercising as well as for exercises incorporating both the SHS and SES. Together with the full training material set-up, and including all ships safety plans, it was introduced as the “mars” concept [1], [2]. The simulation system can be applied to specific simulation based studies and has the potential to help in upgrading existing safety and security procedures in training.

The situation on board ship regards emergency preparedness is generally affected by the following problems:

- crew capability and experience in the event of „disturbed“ operation on vessels is limited or even non-existent
- multi-lingual crews cause communication problems in an emergency situation
- reduction of crew members causes lack of manning available
- complexity of emergency equipment is permanently developing, but training in emergency handling is not on a par with these developments

New management systems and regulations of the IMO (ISM/ISPS) mean that new methods in technology for emergency training are necessary. HSW offers simulation based training courses in safety and security at varying levels of complexity; for ratings at a basic level, for officers and masters at management level – all in accordance with IMO standards.

2.2 Integration of a new 3D- visualization model into the SST:

One of the most innovative elements at the MSCW is demonstrated on the new three-dimensional draft of a RoPax-ferry M/V (FS “Mecklenburg-Vorpommern”) on the SST7-simulator. The 3D-model application has been created based on the relevant ship’s safety plans and closely adheres to a series of photo sessions taken on the vessel and used for design within the software system “3D studio – max”. For the simulator safety training all available safety equipment on board and safety systems (e.g. CO2, sprinkler system and water drenching system) have been drafted into the 3D visualization. Figure 2 illustrates the ship’s plan of M/V.

![Image of 3D M/V deck](image)

**Figure 2. Visualization 3D M/V deck 9**

In addition to the RoPax ferry another complete model of a container vessel, type CV4500, was drawn up separately as well as a part task model of the passenger vessel “AIDAdiva”. Figure 3 and Figure 4 present a sample visualization of the part task model of the passenger vessel “AIDAdiva” - ship’s bridge and safety & security console behind bridge. The bridge and engine control room (ECR) of all modeled vessels in 3D visualization are equipped with
interactive training consoles on bridge and in ECR. Meanwhile three different types of vessels have been test drafted for complex simulation based Safety and Security training. The modeling process is finished to the highest standard of detailed reality and enables efficient handling of all safety equipment and systems on board and took six months for each vessel.

Figure 3. Visualization Bridge AIDA

Figure 4. Safety-/security console AIDA

2.3 Simulation based modules and system for Safety & Security Training

Generally the SST\textsuperscript{7} is designed for procedure training in emergency management. Two modules have been integrated into the SST\textsuperscript{7}, a complete fire and fire fighting module as well as a water inrush module.

The fire model (visually adapted) has a module with a number of realistic effects for easy orientation incorporated into the simulation. A modern fire alarm management system with smoke detectors and manual calling points is built into the ship’s interior and easily flammable materials are protected by fire resistant A60 walls and doors. This model includes smoke visualization, a fire fighting system with equipment such as fire extinguishers, water hoses and hydrants, breathing apparatus, CO\textsubscript{2} systems and foam. This enables the trainee to simulate a realistic fire fighting situation and interact with support teams as well as the management teams on the bridge and in the engine room. During the simulation a strategic figure’s health condition is monitored with regards to oxygen, smoke, temperature and other health influencing parameter. Both modules, fire- and water inrush module see Figure 5 and Figure 6.

![Figure 5. Fire module in SST\textsuperscript{7} (flash over)](image)

![Figure 6. Stability module in SST\textsuperscript{7} (ballast tanks)](image)

One further feature of the SST\textsuperscript{7} is the module for calculating water inrush and its influence on ship stability. A water ballast system is included and can be called upon during simulation of an emergency in order to stabilize the ship. The trim and stability calculator is adjusted to predict the effect of a water inrush and show the stability parameter. Water-tight doors are built into the modelled vessel. The ballast and stability measuring system can be implemented on the simulator prompting the trainee to take the appropriate counter measures (Figure 6).

A graphic display with selected environmental parameter (temperature, oxygen, gas and other parameter) enables the instructor to control the exercise and evaluate the trainee’s awareness and to present his performance after simulation in the replay mode. For implementation of specific scenarios according to emergency management procedures on board, it was necessary to provide a complex process simulation system with a bi-directional interface for the safety simulator and ship-handling simulator. With these features and combining all simulator resources at the MSCW (SHS/ SES/ VTSS/ SST\textsuperscript{7}) it is now possible to visualise the entire complex system ship and to provide training in ship handling and engine simulation processes in 3D quality for most simulation processes in safety and security [3].

2.4 Decision Support System MADRAS

The simulation platform includes a new support and decision system called MADRAS. The system was tailored for the SST simulator and superimposes the sensor data from the SST. The control module
selection contains the following elements for automatic survey: FIRE, EXPLOSIVES, SECURITY, EVACUATION, GROUNDING and FLOODING. In the event of any sensor alarm the Madras menu opens and displays the affected deck/area with the activated alarm sensor. MADRAS is an interactive system and a helpful tool in critical situations for the Master. Both the SST simulator and the MADRAS system were successfully implemented and tested over the last three years within the context of the research project VeSPer (funded by the German Ministry of Education and Research). First pilot courses have been carried out for end-users at the MSCW and are presented in the next chapter.

3  APPLICATION OF TRIAL COURSES ON THE SAFETY & SECURITY TRAINER

In co-operation with the shipping company F.LAEISZ an introductory simulation safety course was held in 2010 and two further trial courses carried out at the MSCW in 2011 and 2012.

3.1 Introductory course for Shipping Co. F.LAEISZ on RoPax TRANSEUROPA in 2010

The aim of the first training course on board was to introduce the Safety and Security Trainer and to carry out trial simulation courses on the SST7 generally. The scenario chosen for this simulation was a fire emergency on a RoPax ship using the available fire extinguishing equipment (CO2, foam, water drenching). The main objective was to offer emergency procedure practice for the officers, crew and service personnel, especially measures needed for communication and the evacuation of passengers.

During the 7-day trip several courses were given to the entire crew and finally a “dry training” was carried out on board, mirroring simulation training at the monitor. The result was that the Captain and his crew were able to appreciate a real improvement in the standard of the dry exercise after their experience from the simulation. The company then booked two further demonstration courses at the MSCW during their ships management courses organized by the Warnemuende Technical Academy (WTA) in 2011.

3.2 Safety Trial courses for F. LAEISZ Shipping Co. at MSCW in 2011 and 2012

Company specific emergency scenarios were chosen for the demonstration courses to F.LAEISZ’ specifications and were simultaneously run together with the SHS as well as a second trial which included the SES (engine simulator). The courses were tailored to improve emergency management organization on board. The courses at the MSCW with more than 60 participants per course were organized and conducted by MSCW staff in conjunction with a student team and in co-operation with network partners ISV and MARSIG, tailored to requirements of the shipping company (Figure 7). The training was conducted as recommended by the STCW Convention, Manila Amendments and developed and using the required Standard Marine Communication Phrases (SMCP), [4] - [7].

The Emergency Management Course was carried out using prepared scenarios. As a sample the schedule of a fire scenario is described starting with an emergency plan tailored for the CV 4500 prompting trainees to follow the safety regime during the exercise exactly. Standard materials were provided to each trainee when performing simulation exercises. Event Schedule Fire Auxiliary E.R.

![Figure 7. Briefing SHS, bridge 1](image)

![Figure 8. Concept Emergency Plan](image)
training was carried out according to Emergency Plan (Figure 8).

3.2.1 Scenario description:

On board the container vessel CV4500, Pos. Singapore Strait westbound, loading condition C6 (Hand Out), break out of fire after oil leakage in generator engine room deck 04 PS forward. Ship/ shore communication SST carried out by VHF channel 13. Fire alarm is indicated on the alarm panel on the Bridge (SST7 & MADRAS-system) and ECR. Internal communication held between Bridge and ECR (Master/ 2nd Officer/ Ch.Eng. and 2nd Eng.) with reference to preparation of fire fighting team wearing protective equipment (breathing apparatus, heat protection suit). Check that fire dampers are closed. Ventilation of affected area cut off to prevent fire spread.

From control point ECR follows advice to start fire fighting. Simultaneously bridge starts preventive evacuation of superstructure while preparation of water and foam supply begins (e.g. fire hoses). VTIS Singapore has to be informed immediately after fire break out via VHF channel 13. VTIS gives order to leave TSS in north direction and for anchorage at „E- Boarding Ground“. After the fire fighting team is set up (report ECR to Bridge) fire fighting begins in the engine room. Due to fire spreading intensely (as simulated based physical model indicates) further measures are necessary, e.g. fire fighting with foam. After failure of bilge pump 1 respectively fire pump 1 (malfunctions) start of replacement pumps and repair work (ECR and SST7).

Due to intense fire spread the control point (ECR) gives order to the bridge to start evacuation. The fully equipped crew sent to assembly station EGR aft of superstructure. After evacuation is completed in alignment with communication and evacuation procedures according to Bridge Resource Management (BRM) and Crisis Management, crew gathers at assembly station with personal protective suit/life vest. Crew roll call made by 3rd NO and the master gives order to release CO2. In the event of missing persons a search team is sent throughout all decks. After a delay of two minutes the engine room is doused with CO2. Using the graphical model and Fire Editor (SST) as well as from the MADRAS working station (ECR) several parameters (temperature, fire spreading, fire fighting) can be checked and adapted. After report back of „fire is extinguished“ and an adequate time lapse (20min) the area is checked by a fully equipped fire fighting team (after ventilation of area CO2), before the signal “all clear” can be given. Further fire watches must be set up.

Depending on training standards and different human element risks and in order to insure awareness for a better understanding of team emergency management on board applicants should repeat simulation exercise with exchanged duties and replaced roles in security implementation at different SST stations and with reference of EUS MADRAS system to be followed up, see chapter 2.4, 4.3 and Table 2.

Tab. 1 gives an overview about a combined emergency simulation exercise tested at the SST7/ SES. Tab. 2 illustrates the overview of the integrated decision support system MADRAS. Both tables give the trainees support and are used as a guideline to follow up during the exercise procedure.

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**Table 1. Overview Scenario**

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Arrangement</th>
<th>Use stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stations</td>
<td>1 Instructor + 6 SST; workstations incl. Communication</td>
<td>4 ECR/ ER workstation</td>
</tr>
<tr>
<td>Objective</td>
<td>Management + fire fighting measures after fire outbreak: D04 PS GR room forward, POS: Spore Strait, W-bound</td>
<td>ECR camera view D04 PS, control of fire fighting, supervisory EUS – system</td>
</tr>
</tbody>
</table>

**Table 2. Master tree – EUS system MADRAS**

<table>
<thead>
<tr>
<th>MADRAS – Master Tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigation situation on site</td>
</tr>
<tr>
<td>Feedback – extension of fire, what is on fire?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yes</th>
<th>Fire extinguished?</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clear location</th>
<th>Fire alarm</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Fire watch</th>
<th>Closing procedures</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Ventilation</th>
<th>Protection suits</th>
</tr>
</thead>
</table>
to be dealt with by the trainees self-sufficiently. The procedure is exercised according to precedents listed in the ship’s articles (Muster List). Communication on board and external communication [6], organization/procedures for using safety equipment and systems (CO₂ system) found as indicated in the safety plan. After the fire has been successfully quenched and the area examined (after sufficient ventilation) the simulation exercise is complete.

3.2.4 De-Briefing:

During de-briefing the trainee performance is individually evaluated as well as the team cooperation. During the replay unsatisfactory passages of the exercise, such as orders not correctly interpreted, may be repeated. Extra emphasis is put on adequate communication skills (internal and external). Communication with VTIS, with other ships as well as with the Shipping Co. (“Emergency Reporting System”) must be conforming to STCW standards and Standard Marine Communication Phrases (SMCP). The data-base stored parameter and recorded processes of the fire fighting procedures are evaluated in replays together with the participants (Tab.3).

<table>
<thead>
<tr>
<th>Questions</th>
<th>Average Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How do you evaluate…</td>
<td>7.4</td>
</tr>
<tr>
<td>2. What was the workshop about?</td>
<td>5.7</td>
</tr>
<tr>
<td>3. Are you satisfied with the performance of the simulator during the training?</td>
<td>1.9</td>
</tr>
<tr>
<td>4. What is the quality of the simulator as an emergency procedure trainer?</td>
<td>1.7</td>
</tr>
<tr>
<td>5. What is the quality of the training itself?</td>
<td>1.8</td>
</tr>
<tr>
<td>6. How is the simulator as an additional training measure?</td>
<td>1.5</td>
</tr>
<tr>
<td>7. How is the simulation of the ship inside the MSU/WS?</td>
<td>3.1</td>
</tr>
<tr>
<td>8. How is the modern equipment and the safety systems?</td>
<td>2.1</td>
</tr>
<tr>
<td>9. How is the fire model?</td>
<td>2.1</td>
</tr>
<tr>
<td>10. How is the water stream model?</td>
<td>3.0</td>
</tr>
<tr>
<td>11. How is the communication system of the SST?</td>
<td>2.2</td>
</tr>
<tr>
<td>12. How is the usage of the SST at management level?</td>
<td>2.1</td>
</tr>
<tr>
<td>13. How is the usage of the SST at basic level?</td>
<td>2.3</td>
</tr>
<tr>
<td>Total Evaluation</td>
<td>15</td>
</tr>
<tr>
<td>Evaluation better than 1.5</td>
<td>Yellow</td>
</tr>
<tr>
<td>Evaluation between 1.5 and 3.0</td>
<td>Green</td>
</tr>
<tr>
<td>Evaluation below 3.0</td>
<td>Red</td>
</tr>
</tbody>
</table>

The analysis, Table 3 (notes in range 1 to 6, best note 1) indicates that the only complaint was the fact that there was not enough time given to fully implement for such a complex simulation exercise. This will be taken into consideration at further courses in future. In summary the SST was well accepted especially at management level.

2014 the HSW has arranged for another training course with well known Shipping Company specifically in security challenges for shipping personnel on management level. The preparation for the forthcoming course is in progress and in close cooperation with the company (CSO) and under surveillance of PPZ (Preventive Piracy Centre Neustadt, Germany), described in chapter 4.
4 SECURITY TRIAL COURSES AT MSCW IN PREPARATION FOR 2014

Specific security scenarios have been developed for further courses at the MSCW in 2014. The following chapter presents a sample of a security scenario which was specifically designed for challenges in maritime security according to STCW and with reference to the Manila Amendments.

4.1 Scenario description:

RoPax Ferry M/V prior to departure Port Rostock. Boarding and checking Passengers, Cars, Lorries, Trailer and Busses. After checking cars (from outside by detector) and spot check of lorries and buses as well as interior of all cars/lorries parked on car and trailer decks 3 to 5 in lane 1 to 5 and segments 1 to 20. All passengers are taken in groups to the cabin decks and public areas decks 5 to 7 (SST). Ship Protection Measures (SPMs) are implemented and ship’s personnel act in accordance with Muster List. Among passengers deck 07 one man carrying a suite case enters Rostock lounge and places the suitcase in a corner. The man leaves the lounge unnoticed. After loading procedure completed and clearance given by Warnemunde Traffic the ferry M/V departs from Rostock Port seawards (SHS). Outside the port the ferry proceeds inside the fairway to buoys No.1.

Suddenly a detonation occurs in Rostock Lounge D07. Fire starts and spreads to other cells all over the area. Passengers escape immediately from the affected area to outside open decks. Fire alarm sounds on Bridge (SST & MADRAS system) and in ECR. All officers are equipped with portable radios. Internal communication between Bridge, Fire fighting team, support team and ECR carried out according to Emergency Management. Fire Squad equipped with BA and heat protection suits proceed to affected area for fire fighting with water. Some water flooding caused by continued fire fighting in engine room and bilges. Bilge pumps are activated. On scene commander (with gas detector) detects high gas penetration in the lounge and reports to Master. The fire is now under control and can be extinguished after a few minutes. Gas concentration in the affected area increases. Master releases General alarm and activates ventilation. Advice from Bridge: passengers and crew have immediately to proceed to the assembly stations (with life jacket and survival suit). Communication and evacuation procedure carried out according to BRM and emergency procedure regulations. 1. NO checks roll call. In case any person missing search team sent to search all over decks. No missing persons confirmed by I.NO.

The fire fighting procedure is monitored at the fire editor (SST) in graphic mode and controlled at the MADRAS working station inside the ECR. After report “fire extinguished” crew has to wait outside the affected area and sufficient time is given for ventilation (20 min). After the area is checked by fire watch team (with BA, heat protection suit and gas detector) the “all clear” may be given. Telemax (remote controlled) integrated to the scenario (deck 07) for optional transport and disembarkation the suspicious suitcase over board (object “disabled”). Further boarding GSG9 by Helicopter and checking procedure according to clipboard (see 4.4). The scenario is designed for six SST working stations and in combination with the Ship Handling Simulator (SHS) including MADRAS.

Support documentation material provided to Trainees, see 4.2. Overview Scenario presented in Table 4.

<table>
<thead>
<tr>
<th>Table 4. Overview Security Scenario RoPax</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MV:</strong></td>
</tr>
<tr>
<td>Chapter</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td><strong>Stations:</strong></td>
</tr>
<tr>
<td><strong>Objective:</strong></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
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<tr>
<td><strong>Affected area:</strong></td>
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<td></td>
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</tbody>
</table>
4.3 MADRAS Questionnaire:

- Explosion and fire in Lounge Rostock
- Investigate situation on site
- Report: location, size and type of fire
- Start fire fighting pumps
- Try to extinguish with portable fire extinguisher
- Is fire extinguished?
  - No
    - Release general alarm
    - Shut down ventilation / close all fire flaps
    - Prepare and put on fire protection equipment
    - Fire pumps activated (bridge/ECR)?
    - Internal / external communication
    - Report of readiness of fire fighting unit
    - Preparation of support measures
    - Ensure power supply
    - Survey fire parameters in MADRAS
    - Action of fire fighting and support unit (fire fighting and cooling)
- Is fire extinguished?
  - Yes
    - Analyse situation in affected area
    - Clean up
    - Arrange fire watch
    - Ventilation
  - No
    - Prepare extinguishing with foam
    - Shut down ventilation / close all fire flaps
    - Ensure completeness of crew on assembly station
    - Release CO2 / monitoring fire parameters and CO2 concentration
- Is fire extinguished?
  - Yes
    - Place fire watch
    - Clean up
    - Start ventilation (to reduce gas concentration)!!
  - No
    - Prepare evacuation of the vessel
    - External communication
    - Clean up
    - Place fire watch
    - Influence after damage and flooding WI in engine room area
    - Release general alarm
    - Closing of watertight doors
    - Start bilge pumps

- Assessment of leakage
- Roll call of crew
- Check vessel stability, WI criteria
- Is bilge pump capacity sufficient?
  - Calculation for bilge pump capacity according to formula Figure 9

\[
\rho \leq \frac{620}{b} < \frac{\alpha_1 \times \rho \times \sqrt{\gamma_{w_1} \times k}}{\rho_{w_1}} \leq \frac{620}{b} \quad \alpha_1 = b + 1 = 0.3 \times
\]

\[
\begin{align*}
&\Rightarrow 1 < \frac{\alpha_1 \times \rho \times \sqrt{\gamma_{w_1} \times k}}{\rho_{w_1}} < 0.3 \\
&\Rightarrow 1 < \frac{620}{b} \times 0.3 \times 3.8 \times 3.8 \times 0.6 \times 0.4 < 0.3 \\
&\Rightarrow b \geq 2 \times \frac{0.3 \times 3.8 \times 0.6 \times 0.4}{620 \times 0.3} = 2.2 \times 0.3 \times
\]

Figure 9. Volume calculation to check capacity Bilge pumps

- Yes
  - Ensure manoeuvring ability, leak sealing, pump out water
- No
  - GMDSS distress call
  - Be aware of loss of manoeuvrability
  - Guide vessel out of traffic zone (anchorage?)
  - Monitor free surfaces
  - Permanent check of adjacent spaces

4.4 Clipboard Time Slot

The preparation and design for a clipboard time slot helps the instructor to control the quality of trainee’s performance during the simulation exercise and indicates the time frame for emergency procedures, which should not exceed the allotted time (Table 5).

4.5 Debriefing:

Sufficient time (20 to 30 min) should be calculated for De-Briefing including evaluation, assessment and replay of exercise. The De-Briefing should be followed according to the Clipboard time slot (Table 5). The participants should recognize that permanent simulation training and training on board would improve standards for the Safety- and Security-Regime on board and will encourage a safety culture among the team on board. The result of the training
should be to raise seafarer awareness of risks in Safety and Security with reference to the policy of

- Accept Security
  - Applying risk management
  - Contemporary security knowledge

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**Table 5. Overview Security Scenario RoPax Clipboard time slot**

<table>
<thead>
<tr>
<th>Procedure Simulation Exercise SST:</th>
<th>Script hints</th>
<th>Clipboard time slot</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>To do before exercise:</strong></td>
<td>Master/2.NO with Walkie-Talkie Channel 1/2 for external communication, Instructor Ch.1/2</td>
<td>Sound check</td>
</tr>
<tr>
<td><strong>M/V Engine control to Bridge</strong></td>
<td>SST—stations internal communication head set</td>
<td>6 stations Sound check</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
<th>Done by</th>
<th>SST – remarks</th>
<th>Evaluation – clipboard remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Start exercise</td>
<td>Instructor</td>
<td>Check moderate sound level SST: M/V prior departure from HRO, Check traffic and passengers</td>
<td>M/V prior departure from HRO, Check traffic and passengers</td>
</tr>
<tr>
<td>2</td>
<td>Situation- Action Monitor</td>
<td>Trainees</td>
<td>Orientation ship plan/ Consoles</td>
<td>Cars/lorries parked on car and trailer decks 3 to 5 in lane 1 to 5, segments 1 to 20.</td>
</tr>
<tr>
<td>3</td>
<td>Bridge (SHS and SST):</td>
<td>Master and 2.NO on Bridge, 1./2.Eng. in ECR</td>
<td>Report/ Clearance to/from Traffic Control</td>
<td>Boarding procedure completed, 1.NO/ Bosun close all car decks crew clear all stations fwd and aft</td>
</tr>
<tr>
<td>4</td>
<td>Bridge (SHS and SST):</td>
<td>Master/ 2. NO on Bridge, 1./2.Eng. in ECR</td>
<td>Manoeuvring on Bridge, Control ECR</td>
<td>Departure Port Rostock One passenger* with suitcase to Lounge Rostock (SST1)</td>
</tr>
<tr>
<td>5</td>
<td>Bridge (SHS and SST):</td>
<td>Master/ 2. NO on Bridge, 1./2.Eng. in ECR</td>
<td>Manoeuvring on Bridge, Control ECR</td>
<td>Ferry passes breakwater Public areas crowded. One passenger* leaves lounge</td>
</tr>
<tr>
<td>6</td>
<td>Detonatio Lounge Ristock</td>
<td>Instructor</td>
<td>Fire spreading and Gas penetration</td>
<td>Passengers escape from Lounge Rostock to open decks</td>
</tr>
<tr>
<td>7</td>
<td>General Alarm</td>
<td>Master/ Bridge</td>
<td>Initiate General Alarm. Activate Silent Alarm. Info to RCC</td>
<td>Passengers and Crew advised to proceed to assembly station, Ch. Eng. Informed for reduced speed</td>
</tr>
<tr>
<td>8</td>
<td>Reduce Engine</td>
<td>Master/ 2. NO/ ECR</td>
<td>Info to Traffic control</td>
<td>Advice to OSC to collect gas detector. Fire and bilge pumps activated</td>
</tr>
<tr>
<td>9</td>
<td>OSC: completeness crew at assembly station. Closed status accommodation. confirmed</td>
<td></td>
<td></td>
<td>Procedure?</td>
</tr>
<tr>
<td>10</td>
<td>Navigation Control</td>
<td>Master, 1.NO/Ch.Eng./ CSO</td>
<td>Safe Manoeuvring/ Navigation. Fire Squat Team 1/2 with full safety equipment (BA’s, Heating Suits) collect fire hoses and proceed to lounge. Cooling team prepares/activates cooling around affected area and open decks. Bosun/ 3. Mate/ TO prepare lifeboats</td>
<td>Procedure?</td>
</tr>
<tr>
<td>11</td>
<td>Control camera view</td>
<td>Master/ Ch.Eng./ECR/Instructor</td>
<td>Observing procedure on deck, lounge and assembly stations. OSC checks gas concentration in lounge, increasing. Fire in lounge under control. Ventilation activated. Info to Traffic Control and contact to company acc. to Emergency Reporting System</td>
<td>Procedure?</td>
</tr>
<tr>
<td>12</td>
<td>Info OSC</td>
<td>Completeness all passengers at assembly station!</td>
<td></td>
<td>Procedure?</td>
</tr>
<tr>
<td>13</td>
<td>General Alarm</td>
<td>Master</td>
<td>Coordination Master/ Ch.Eng. Head of operations and fire fighting action with water. F-Squad 2 cooling flanking areas. Stop fire fighting, proceed cooling outside. Crew advised to proceed to assembling stations.</td>
<td>Procedure?</td>
</tr>
<tr>
<td>15</td>
<td>Failure bilge pump 1</td>
<td>2 bilge pumps are still running</td>
<td></td>
<td>Decision and initial action within 10 min</td>
</tr>
<tr>
<td>16</td>
<td>Dismantle bilge pump 1 for</td>
<td>2 bilge pumps are still running</td>
<td></td>
<td>Capacity? bilge pumps</td>
</tr>
</tbody>
</table>

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5 OUTLOOK AND CONCLUSION

The safety and security trainer has provided new impulses for ship’s security while dealing with dangerous accidents in the merchant maritime field. New ideas derived from analytical examination of several research projects can be useful in the future development of the SST7 and encourage improved methods for the integration of security measures and safety awareness on board.

To this end there are on-going studies looking into the potential for simulation-based exercises also taking into account training aspects related to port personnel assigned with security tasks. Among other issues, the studies are dedicated to the SST7 simulation models for the port-ship interface. These tests are performed within the frame of the Lifelong learning Program of the European Union, DG Education and Culture and belong to the LEONARDO Project METPROM (Modular Enhanced Training Programme for European Maritime Security Personnel).

The development and application of simulation-based training supports not only optimization of emergency management training, but also improves team performance and collaborative learning [8] as well. Furthermore sophisticated simulation even allows for the identification of unwanted effects or unforeseen impacts [9] of drafted emergency plans.

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REFERENCES


