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Towards Enhancing Major Emergency Initial Response Training: A Comparative Study of the STCW and OPITO Standards

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ABSTRACT

Purpose: *The maritime industry has been recognized as a high-risk domain due to its multiple operational risks. This aspect imposes significant challenges to the human element onboard especially in the case of major emergencies when the prompt response of the ship's Master and Officers becomes crucial in controlling the situation and preventing the escalation of threats. In response, the IMO Standards of Training, Certification and Watchkeeping (STCW) 95/2010 convention has developed a range of emergency response competencies. However, data on accidents and incidents in shipping reveal that the human element is still considered a primary factor contributing to most cases of ship loss. Furthermore, several cases have been reasoned for the improper and ineffective management of the emergency. This might raise serious concerns regarding the adequacy of IMO model courses to provide learners with the required knowledge, skills, situational awareness, and confidence to appropriately respond should a real major emergency occur.*

Design/Methodology/Approach: *With the aim of enhancing the current level of maritime emergency management training, the authors of this study intended to identify possible gaps in current STCW training by comparing similar emergency response training standards established by the Offshore Petroleum Industry Training Organization (OPITO). The Qualitative analysis was used to compare three case studies of emergency-related STCW courses with two OPITO-approved courses in terms of their aims, scopes, principles, outlines, number of delegates, outcomes, decision-making processes and assessment criteria. The objective is to assess whether the OPITO emergency response training provides more extensive scope for ensuring the optimum management of an extended range of emergency events rather than the currently presented STCW courses.*

Findings: *The study is concluded by identifying possible gaps and proposing specific modifications to the STCW standards which can be marked as a first step in the direction of establishing effective training for managing and controlling major emergencies onboard.*

Key-words:
Emergency, Response, Training, STCW, OPITO, Comparison.

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1. INTRODUCTION

The maritime industry has been characterized as a high-risk domain because of its various risks and the complexity of its multiple associated operations (Dominguez-Péry C. et al. ,2021).

Recognizing the significant role of the human element in the activities of maritime transport has led to regular improvements in maritime safety training and crew proficiency (Allianz, 2012).

However, the human element has been recognized as a major contributor in more than 75% of maritime accidents (Sánchez et al., 2021). In response, the human element has been acknowledged by the International Maritime Organization (IMO) as a key component of the safety of life on board ships, thus focusing on the human aspect has to be seriously considered for enhancing maritime safety (IMO, 2019a).

Driven by this aim, the Standards of Training, Certification and Watchkeeping (STCW) convention has been adopted by the IMO in 1978 as the first international convention to set the minimum competency requirements for seafarers. Furthermore, realizing that handling major emergencies on ships is a challenging task that could be carried out in very stressful and harsh working conditions, the IMO through its STCW convention has established a wide range of training courses to equip learners with an adequate level of knowledge and skills to timely and effectively respond should a major emergency occur.

In this regard, the ships' Masters and Officers have been given particular attention for their crucial role in managing emergencies on ships without or with limited external assistance in most cases. The convention's objective is to provide the foundations for internationally consistent training standards to enable the Master, being the emergency manager, to carry out his responsibilities for evaluating the situation, defining the appropriate response, and ensuring that the initial action is carried out and a plan is formulated, where the emergency management team must support and back up his decisions (IMO, 2019b).

Recently, in its resolution A.1110 (30), the IMO adopted requirements for human capabilities, limitations and needs in a six-year strategic plan from 2017 to 2023 (IMO, 2017a). However, despite this effort, the human element is still contributing significantly to ships' losses. As demonstrated in Figure (1), the loss of 805 vessels out of 1036 that have been either sunk, wrecked or collided during the period from 2009 to 2018 has resulted from improper ship command, and inadequate bridge team management (Neff, 2020 : P.21). This ratio raises serious doubts regarding the adequacy of IMO model courses to empower learners with the necessary level of knowledge, skills, situational awareness and confidence for performing the appropriate response should an actual major emergency occur.

The number includes only the cases of ships' total losses whereas other accidents that have not led specifically to the loss of vessels have not been counted. This means that the actual number of accidents could be significantly higher. Although there is a decline in ship losses, the number of incidents and accidents is still high (Neff, 2020 : P.21).

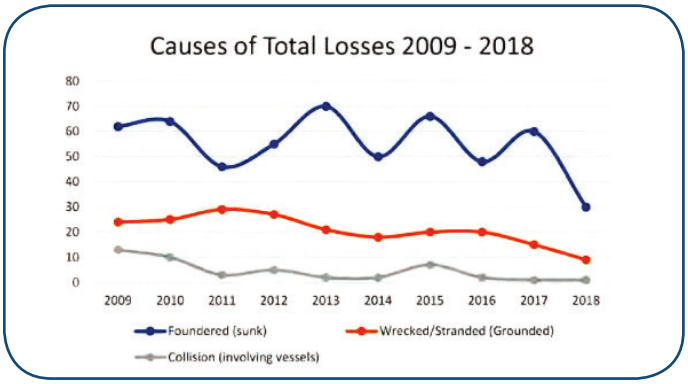

Fig. 1. Causes of total losses of ships (2009-2018)
Source: (Neff, 2020: P.21)

Similarity of Emergency Types in the Oil & Gas and Maritime Industries

In order to enhance decision-making capacities and decrease the likelihood of major ship losses, it is imperative to identify the gaps in current STCW training for emergency management. This could be achieved by analyzing how other high-risk industries prepare their onboard personnel to face similar types of emergencies. In Oil & Gas industry, the Offshore Petroleum Industry Training Organization (OPITO) has established two levels of simulator-based training programs which are specifically concerned with the initial response to a set

of major emergencies encountered onboard oil and gas installations. The two training standards are the Major Emergency Management Initial Response (MEMIR), and the Offshore Installation Manager Controlling Emergency (OIMCE) training. The common objective of both courses is to boost the performance and confidence of participants through a high-fidelity simulation of actual characteristics of emergencies (OPITO, 2019).

When comparing the common types of emergencies in the Oil & Gas industry with those in maritime transport, a significant level of similarity could be observed throughout a wide array of emergency cases as demonstrated in Table (I). The differences could be only spotted in limited specific types of emergencies that reflect the operational nature of each industry. This can be viewed in the drilling and production of offshore installations where the blowout of wells or release of toxic gases would be highly anticipated, or as in the cargo-related emergency types onboard cargo ships.

Table I : Comparison of Applicability of Emergency Types in O&G and Maritime industries

No.	Emergency Types	Oil & Gas	Maritime Transport
1.	**Well control incident**	Applicable	N/A
2.	**Explosion and fire**	Applicable	Applicable
3.	**Helicopter incident**	Applicable	Might occur, but not in the routine operation
4.	**Pipeline incident**	Applicable	Oil spill
5.	**Collision or wave damage**	Applicable	Applicable
6.	**Loss of stability (Flooding)**	Applicable for the semi-submersible units	Applicable
7.	**Hydrocarbon release**	Applicable	N/A
8.	**Scaffold collapse**	Applicable	Applicable
9.	**Security threat piracy**	Applicable, with a low probability	Applicable, with a high probability
10.	**Dropped load or dropped object**	Applicable	Applicable, in port during loading and discharging
11.	**Chemical release (Pollution)**	Applicable	Applicable, in chemical Tankers
12.	**Person overboard, injury or Epidemic**	Applicable	Applicable
13.	**Grounding & stranding**	Applicable, but rarely happen	Applicable
14.	**Main Engine Fails, Steering Fails**	Applicable for Self-propelled or towed rigs.	Applicable
15.	**Cargo Related Emergencies**	Not Applicable	Applicable

Source: (OPITO, 2022A), (RØdseth, 2012)

Inspired by the significant similarity of emergencies in both the maritime and O&G industries, not least the fact that both demand professional and highly qualified command, the authors of this study intended to identify possible shortcomings in the current STCW training standard in terms of initial emergency response training by conducting a comprehensive comparison with a similar globally recognized OPITO training standard established for achieving the same goal.

For a systematic research plan, the authors seek to first analyze the foundational concepts of three STCW courses and two OPITO-approved training courses as case studies in terms of their structures, and main principles. Secondly, compare the contents of each standard's criteria to elucidate similarities and differences in terms of aims, scopes, principles, outlines, decision-making processes, and assessment to subjectively assess the extent of each standard's

requirements. Finally, proposing specific modifications to the current STCW training standards to equip the ship's decision-maker with the optimum emergency response-related skills.

The Emergency Training Criteria for Master as per the STCW Convention

The ship's Master has the overriding authority onboard, he is in command and takes full responsibility for the safety and security of assets, personnel, cargo, and environment. The chief officer might carry all these responsibilities at any time, therefore, should have the same adequate level of training. Figure (2) indicates table A-II/2 for function controlling the operation of the ship and care for the Management Level through four columns: competence, knowledge understanding and proficiency, methods for demonstrating competence, and criteria for evaluating competence (IMO, 2017b : P.124).

STCW COD

Table A-II/2 *(continued)*

Function: Controlling the operation of the ship and care for persons on board at the management level *(continued)*

Column 1	Column 2	Column 3	Column 4
Competence	**Knowledge, understanding and proficiency**	**Methods for demonstrating competence**	**Criteria for evaluating competence**
Maintain safety and security of the ship's crew and passengers and the operational condition of life-saving, fire-fighting and other safety systems	Thorough knowledge of life-saving appliance regulations (International Convention for the Safety of Life at Sea) Organization of fire drills and abandon ship drills Maintenance of operational condition of life-saving, fire-fighting and other safety systems Actions to be taken to protect and safeguard all persons on board in emergencies Actions to limit damage and salve the ship following a fire, explosion, collision or grounding	Examination and assessment of evidence obtained from practical instruction and approved in-service training and experience	Procedures for monitoring fire-detection and safety systems ensure that all alarms are detected promptly and acted upon in accordance with established emergency procedures
Develop emergency and damage control plans and handle emergency situations	Preparation of contingency plans for response to emergencies Ship construction, including damage control Methods and aids for fire prevention, detection and extinction Functions and use of life-saving appliances	Examination and assessment of evidence obtained from approved in-service training and experience	Emergency procedures are in accordance with the established plans for emergency situations

A

II

Fig. 2: Management level controlling the operation of the ship as per STCW

Source (IMO, 2017b : P.124)

In column (1) for competence in developing emergency and damage control plans and handling emergencies, the only methods for demonstrating competence are from the in-service training and experience where simulation is not considered as a means of demonstrating competence in decision making for emergency response, which is an important element to be considered.

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SIMULATION TRAINING IN THE STCW CONVENTION

According to the STCW requirement, a wide range of training courses are related to bridge simulation. However, the only mandatory courses are limited to the Automatic Radar Plotting Aids (ARPA) course, and the Radar and Electronic Chart Display and Information Systems (ECDIS) (International Transport Work Federation, 2010 : P.29). Furthermore, either onboard training or onboard experience is accepted by the STCW as evidence of compliance. On the other hand, the simulator could be an equivalent option to cover navigation, ship handling, cargo handling, and Global Maritime Distress Signals System (GMDSS) communication. (International Transport Work Federation, 2010 : P.29). Figure (3) illustrates the Master position with the competency table as per the STCW standard. The evidence of competency might be in the form of a certificate, endorsement, documented proof, or training received while on board. Some positions require revalidation, while others do not (International Transport Work Federation, 2010 : P.29).

Master

NAME OF CERTIFICATE	REVALIDATION	REG.	
National certificate of competence and endorsement	Yes	I/2, II/2,	C/R
Flag state endorsement of recognition	Yes	I/10	E/R
GMDSS endorsement	Yes	IV/2	C/R
Basic safety training - Personal survival techniques - Fire prevention and fire fighting - Elementary first aid - Personal safety and social responsibility	Achieved within previous five years	VI/1	D/P
Medical first aid	No	VI/4	D/P
Survival craft and rescue boats	Yes	VI/2	D/P
Advanced fire fighting	Yes	VI/3	D/P
Medical fitness	Yes	I/9	C/R
Basic safety familiarisation	On assignment	VI/1	T/O
Ship specific familiarisation	On assignment	I/14	T/O
Security familiarisation	On assignment	VI/6	T/O

C/R certificate required. D/P Documentary proof. T/O Training onboard. E/R Endorsement required.

Fig. 3. Master competency table
Source: (International Transport Work Federation, 2010 : P.29)

According to STCW 2010 amendments, in force since the first of January 2017, Ships' Masters and Chief Mates of 500 gross tonnages and above should have adequate knowledge of bridge resource management, in addition to the application of leadership and managerial skills. In this manner, the training courses for emergency management are involving the "Bridge Resource Management" STCW model course (1.22), the "Leadership and Managerial Skills" STCW model course (1.40), and the "Leadership & Teamwork" STCW model course (1.39).

Bridge Resource Management Training

The STCW 1978 convention, as amended in tables A II/1 and A II/2, stated that in order to maintain a safe navigation watch, the duty officer should have adequate knowledge of Bridge Resource Management (BRM). In

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addition, the STCW Code B-VIII, Part 3-1: Guidance on keeping a navigational watch advises shipping companies to implement the BRM concept on board their vessels (IMO, 2017b). Nevertheless, the human factor is still the major contributor to maritime accidents.

In this regard, improving the Non-Technical Skills (NTS) of the human element could be significantly vital for achieving the optimum utilization of bridge resources. To address this issue, one of STCW's main objectives is to equip bridge teams with adequate NTSs for establishing effective bridge management in normal and emergency situations (IMO, 2017b). Driven by this objective, the bridge resource management course emphasizes the development of bridge teams' soft skills as a vital component for the effective performance of technical duties on board.

The BRM objectives are achieved when learners become able to demonstrate the optimum utilization of all available resources, establish effective communication, assertiveness with leadership, situational awareness, and consideration of team experience and navigation familiarization (IMO,2020b). For this purpose, a ship handling simulator is utilized in the BRM training with specific requirements as demonstrated in Table (II).

Table II: Requirements of the Simulator

1	Course indicator	7	Relative wind direction & speed indicator
2	Speed indicator	8	One means of positioning
3	Rudder angle indicator	9	One ECDIS connected to the navigation system
4	Rate of turn indicator	10	VHF connected to the instructor
5	Engine RPM indicator	11	Internal telephone to the engine room
6	Propeller & Pitch indicator	12	Means of producing the sound signals

Source (IMO, 2020b)

Furthermore, the simulated ship model should be close in terms of dimensions and manoeuvrability characteristics to the trainee's vessel. The training involves demonstrating the use of engines and rudders in different situations with high traffic and at various speeds. Accordingly, the simulator should match the prerequisites of the target group with a maximum number of five participants to achieve the following outlines (IMO, 2020):

- Resource management
- Effective communication
- Assertiveness and leadership
- Obtaining and maintaining situational awareness
- Consideration of team experience
- Navigation familiarization

Ultimately, the BRM practices are meant to improve decision-making accuracy along with skills, technical knowledge, and experience. However, this could be obstructed by multiple factors such as the uncertainty of the situation due to lack of information, time stress, complexity with multi-risks, and personality.

During practical sessions, it is preferred to have a homogeneous distribution of ranks which provides a more effective environment for discussions. In this manner, lecturers should ensure that all trainees have the opportunity to express themselves regardless of their duty in the bridge simulator. A non-technical skills session should be delivered through workshops rather than in a teaching classroom.

Additionally, the quality of decisions has to be reviewed and the outcomes must be compared to the plan. Arguments for effective decisions and detecting error chains must be discussed. Instructors should also demonstrate the hidden pressure over the decision-making process while ensuring that the three levels of situational awareness; perception, comprehension, and projection have been followed (IMO, 2020b).

Finally, the assessment planning should recognize the "SMART" concept (Specific, Measurable, Achievable, Realistic, and Time-bound) through observations, written assessments, assignments, activities, projects,

tasks/case studies, simulations, and computer-based tests. Familiarization sessions should be conducted in advance to ensure that trainees are familiar with navigation policy requirements and passage plans.

During the assessment process, the behaviour of the bridge team should be analyzed. Briefing and debriefing sessions are conducted for describing the tasks performed during the exercise with an emphasis on the possibility of encountering emergencies during the exercise to identify gaps. Eventually, trainees would be considered competent when they achieve the minimum competence criterion, otherwise, further improvement, guidance, or evaluation are required (IMO, 2020b).

Leadership and Teamwork Training (LTWT)

The LTWT training course is designed for promoting the application of leadership and teamwork at the operational level. The objectives are meant to provide learners with the knowledge and skills needed for carrying out the duties of the Officer of the Watch (OOW). In line with LTWT, operational knowledge for on-board personnel management and training, knowledge of international conventions and national legislations, ability to apply task and workload management, knowledge, and ability to apply effective resource management and decision-making techniques. In order to achieve those objectives, the need for Role Play and simulators are recognized as one of the tools that can be utilized among other physical resources of the course (IMO, 2013). Regarding the number of learners, it depends upon the facilities to allow good interaction between learners and to achieve the following outlines (IMO, 2013):

- Working knowledge of shipboard personal management and training
- Need for international maritime conventions, recommendations, and national legislation
- Ability to apply task and workload management
- Knowledge and ability to apply effective resource management
- Knowledge and ability to apply decision-making techniques
- Self-awareness, personal and professional development

Accordingly, standardized assessment tools should be used to include written, graphic or oral tests, in addition to a work-based demonstration for real-time, and real events using the simulator. The assessment criteria involve the presence of an authorized assessor or examiner, case study and analysis, solutions, and corrective actions. For the application of leadership and team working skills assessment, evidence of competence can be obtained from approved training, in-service experience and practical demonstration (IMO, 2013).

Use of Leadership and Managerial Skills (LMS)

The LMS training aims to enable trainees to perform leadership and managerial skills in controlling the vessel operation and ensuring the safety of all persons on board at a management Level approach. Learners should be able to prove their ability to apply international and national laws, manage human resources onboard and train everyone on effectively carrying out the amount of work, apply professional techniques for decision making, and implement shipboard standard operating procedures. The course objectives are achieved through a delivered set of theoretical and practical sessions (IMO, 2018).

Regarding the theoretical part, all training spaces should be outfitted with the necessary tools that guarantee the training is delivered effectively throughout lectures, exercises, and discussions for a group of trainees ranging from 1 to 24. In terms of practical parts, some of the practical exercises indicate using full mission simulators, yet this could be optional since comparable outcome-based exercises, which do not employ simulators, are accepted to be developed and executed for a maximum of eight participants to achieve the course outlines indicated in Table (III) (IMO, 2018).

Table III : Course Outline and Timetable for IMO Model Course 1.40

	Subject area	Time allotment (in hours)	
		Theoretical	Demonstration/ Practical work
	Course Introduction		
1	Related international maritime conventions and recommendations, and national legislation		
2	Shipboard personnel management and training		
3	Task and workload management		
4	Effective resource management		
5	Decision-making techniques		
6	Development, implementation, and oversight of standard operating procedures		
Conclusion			
Total training hours		**40.0**	

Source: (IMO, 2018)

Based on the fact that practical assessment is a focal point of the assessment process, tasks are divided into four main assessment criteria as follows (IMO, 2018):

- **Shipboard personnel management and training:** The assessment focuses mainly on performing an effective operation using an assigned crew, where performance should be aligned with national/international rules, operating standards, and accepted behaviour. The training objectives should be fulfilled whilst taking into account the operational requirements and the learner's current competence and capabilities.
- **Task and workload management:** The learner is to be informed about his duties as a crew member. Furthermore, expected standards of work and attitude to be followed in line with the learner's duties.
- **Effective resource management:** The learner should be assessed on how he/she prioritized the use of resources to perform vital tasks with the presence of planned operations in advance.
- **Decision-making techniques:** Learners should demonstrate effective leadership behaviour and the essential team should understand precisely the current and expected state of the vessel regarding operation and external environment and the decision taken during the training should be the most effective for the situation.

The OPITO Emergency Response MEMIR Training

The MEMIR training has been established by OPITO to equip learners with emergency management techniques to boost their confidence when performing emergency duties in the event of a major incident. The course aims to deliver formal training on how to perform a command, control, communication and stress management during major emergencies and provides initial emergency management training to staff as a prerequisite for being emergency managers. The training objectives are concerned with the preparation, response and control of a dynamic emergency event through effective communication while recognizing the impact of stress on decisions. The number of participants is limited to six delegates with the support of common physical resources at an Emergency Control Centre (ECC), Emergency Response Plan (ERP), generic or a company procedure, relevant Permits to Work (PTW), alarms, telephones, radios, information boards, systems tools, public address (PA), and simulated background noise for distraction (OPITO, 2022b).

Following the brief classroom instruction, the learners join a "Command Centre Simulator" where they individually experience the realism of numerous major events in the capacity of an emergency manager for at least two scenarios. The learners are then debriefed

about their points of weakness and strength. In this regard, an appraisal report should be provided with feedback on the strengths and flaws of the individual and team performances. Upon completion of training, participants are awarded a MEMIR certification in addition to a documented analysis of observed gaps in the form of an appraisal determining the recommended further training required to boost bridging those gaps (OPITO, 2022b).

The course total contact time is 26 hours divided into 35% theoretical, and 65% practical simulation including debriefing sessions. The theoretical part demonstrates multiple types of major emergencies and indicates the role and responsibilities of the emergency manager. The sessions include a familiarization tour of the ECC followed by a brief explanation of stress and how to deal with it. Various examples of a pre-planned and maintained state of readiness within the learner's installation are demonstrated with an explanation of the value of being prepared and ready for emergencies at all times. The practical parts of MEMIR are mainly based on appraising the following nine outcomes (OPITO, 2022b):

- Review, manage, and assess the information available in an emergency promptly
- Establish priorities and take effective action
- Implement pre-determined emergency plans and procedures in the context of the current emergency
- Efficiently communicate information and instructions
- Effectively communicate with all appropriate external agencies
- Monitor and control resources
- Evaluate progress and communicate changes in plans and priorities
- Effectively delegate authority and manage individuals and teams
- Effectively manage themselves and the team during a major emergency including supervising the effects of stress on themselves and others

Additionally, the training is based on three scenarios and the decision should be compatible with how the scenario was written; type (A) Controllable major emergency; type (B) Controllable major emergency with the potential to escalate; and Type (C) Uncontrollable emergency leading to the evacuation (OPITO, 2022b). To assess learners, all theoretical learning outcomes should be informed and understood while the assessment should be carried out through group or individual discussions, oral or written questions, scenarios, or virtual simulations. In addition, the practical assessment plan shall be achieved by using a simulator (OPITO, 2022b).

Accordingly, after each practical scenario, the learner should be debriefed with feedback on his/her individual and team performance. Training scenarios should cover a threat to life, the environment, or the installation. Scenarios should include a suitable combination of the following events (OPITO, 2022b):

- Evacuation, escape or abandonment
- Injured or dead personnel
- Missing personnel or Person Overboard (POB)
- Loss of communication or loss of Containment for the emergency
- Many casualties
- Loss of evacuation facility, muster points or temporary muster points
- Stressed personnel
- Extreme weather and environmental effects
- Loss of effective facilities or essential members
- Information overload
- The unit is unable to keep its operational position

Finally, after completion of the practical training, an appraisal should be handed over to the learner, this appraisal shall include any gaps to be covered by the learner in attending additional training and drills at the learner's workplace according to the decision of the learner's company (OPITO, 2022b).

The OPITO Emergency Response OIMCE Training

Following the MEMIR training, OPITO offers another training not targeting the appraising of the learner, but targeting the assessment of learners who had the potential to be an OIM or an Emergency Manager (EM). The training is constructed based on the recommendations of the appraiser raised during the previous MEMIR training and the duty holder proposals for their employees (OPITO, 2022a).

It must be recognized that this training is only a part of

a comprehensive training program that should include company and installation-specific training procedures including drills and exercises. The responsibility of the Duty Holder is to ensure the competency of his future OIM but not exclude the simulated conditions as a beneficial tool to be used. It is important to note that such simulated assessments should be firmly placed in the context of the overall process employed by the Duty Holder. This process should include the company selection, training and on-job appraisal, assessment procedures, competence profile of the OIM together with the record of experience particularly controlling real incidents or emergencies (OPITO, 2022a).

The training aims to assess the learner in the OIM position in a simulated environment during an emergency to achieve the following objectives and outcomes; to ensure learners have the competence for assessing situations and taking effective actions, maintaining proper communications, delegating authorities, managing performance and dealing with stress on individuals and teams (OPITO, 2022a). Additionally, the training is an individual assessment for one delegate at a time either with the learner's real team to achieve a higher record of fidelity or with other teams in the ECC room. Furthermore, ECC must be realistically depicting the learner's working facility with an effective process and communication system to allow him to take proper action at an appropriate time (OPITO, 2022a).

Basically, the training is based on three types of scenarios and the decision should be compatible with how the scenario was written. Additionally, realistic emergency scenarios must be established. Each scenario had a clear and justifiable decision-making requirement and intermediate decision-making points or events. Some responses may be critical or mandatory, others may depend on conclusions. The assessor should identify the proper response at each point in the scenario and must have an equilibrium between situations. Furthermore, the assessor should understand and prepare the scenario and acknowledge the decisions during the assessment and should discuss them in the debrief (OPITO, 2022a).

As a rule, assessment guidance for maintaining a state of readiness should be completed using a formal declaration and supporting evidence from the learner's employer confirming that the learner has achieved the performance criteria in his/her workplace, satisfied the core essential knowledge regarding procedures, hardware, information and human factors in addition to the asset type knowledge criteria requirements. Learners are then required to undertake formal assessments for assessing the situation and taking effective action, maintaining communication, delegating authority to act, managing individual and team performance, and dealing with stress on self and others (OPITO, 2022a).

Altogether, the course learning outcomes should be assessed using an observation method involving a simulator for a minimum of three participants and a maximum of four emergency scenarios. The training simulation should reflect the specific type of installations where the trainees work such as fixed and floating Drilling/Production installations, Mobile/Floating Installations, and Normally Unattended Installations (NUI)). The assessment must be formally recorded, and the certificate will only be awarded if the learner is successfully assessed against the outcomes and criteria. Scenarios should include a suitable combination of events and must be designed based on a different major incident from the range specified below (OPITO, 2022a):

- Well-control incident
- Explosion and fire
- Un-ignited hydrocarbon or toxic gas release
- Accommodation fire
- Helicopter incident
- Pipeline incident
- Collision or wave damage causing structural collapse
- Loss of stability (for mobile assets only)
- Foundation failure (for Jack ups)

To sum up, the assessment should be performed through continuous observation by an assessor and a discipline expert from the trainees' company. Nevertheless, the discipline expert could be also assigned by the duty holder or the training centre after being agreed with the duty holder (OPITO, 2022a).

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COMPARISON BETWEEN STCW AND OPITO EMERGENCY TRAINING APPROACHES

General Concept

Referring to the STCW convention and pointing to the emergency management in table A-II/2 columns (1) for competence as shown in Figure 3, it can be observed that relevant methods of demonstrating learners' competence were mainly depending on the in-service training and previous experience while simulation has not been mandated as a vital component of a comprehensive program. This is opposite to the OPITO approach which recognizes simulation as an essential tool for the development and assessment of competencies.

Target Group

According to the STCW Manilla 2010, seafarers at the managerial level should have resource management knowledge; however, as per the BRM course target group, the training was assigned to an operational level, similar to the LTWT course. When compared with equivalent OPITO MEMIR training, it can be noted that the course is targeting the ECC team as an appraisal for learning and a pre-requisite of a follower OIMCE assessment training that has to be achieved before considering a trainee a qualified emergency manager. In the STCW, the sole training targeting the managerial level is the LMS while the OPITO OIMCE is an assessment training that has no equivalent for the Managerial level in the STCW standard.

Physical Resources

As per the OPITO standard, simulators are mandatory requirements for delivering the MEMIR, and OIMCE courses. The aim is to demonstrate a simulated environment that effectively depicts the actual characteristics of the offshore installations where learners are currently performing their duties. On the other hand, the use of simulators is optional as per the STCW standard, even for the assessment of the targeted NTS in BRM, LTWT and LMS courses.

Maximum Number of Learners

The optimum number of participants is the one that reflects the real work environment. On comparing the duties on the bridge and the ECC offshore, the emergency functions that have to be performed by the bridge team and the ECC seem to have a significant similarity as demonstrated in Table IV.

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Table IV: Duties in an Emergency from Command Centers

No.	Function	Bridge	ECC
1	**Emergency Manager**	Master	OIM
2	**Technical actions**	N/A from the bridge (Technical team by radio)	Control Room Operator (CRO)
3	**External Communications by telephone**	Master	OIM
4	**External Communication by Radio**	Master or Bridge Officer/OOW	Radio Operator
5	**Internal Communication by Radio to Control Teams**	Master	Deputy and plotted on a board the location of the emergency with resources used in a real-time
6	**Internal Communication and Log for Mustering**	Master	Muster Checker on a board
7	**Key event logging**	N/A owing to the presence of a Voyage Data Recorder (VDR)	Key Event Personnel on a whiteboard
8	**Logistics log**	N/A (VDR) and OOW	Radio Operator on whiteboard
9	**Wheel Steering**	AB or OOW	N/A
10	**Navigational equipment**	OOW	N/A
11	**Look out**	AB or OOW	N/A

Source: (Authors, 2022)

Table IV summarized the responsibilities of both command centers. Concerning the bridge team, three positions are listed; Master, OOW, and AB. However, certain tasks such as wheel steering and lookouts need to be separated, especially in an emergency event in a crowded sailing area, so its interpretation is that in such a case, one more bridge member would be needed bringing the total up to four.

On the other hand, it is preferable to split between external and internal communications to avoid stress resulting from information overload. In this manner, an increase in the bridge team by one more member would be needed. The advantage is to have the Master relieved for decision-making towards safe navigation and emergency control. On the other hand, the ECC requires six persons as per the OPITO standard with at least four Notice-Boards.

This supporting tool for demonstrating the update of data could be significantly vital for providing real-time events in front of the decision-maker. Subsequently, the stress could be decreased as the Master's level of situational awareness is enhanced. The bridge simulator in the STCW training is one step ahead with the ability of maneuvering, steer and control the dynamic environment surrounding the vessel, yet still would be furtherly improved by utilizing the Notice-Board tool during emergencies. Accordingly, the optimum number of the bridge team would be a maximum of five participants as stated in the BRM model course. However, for the LMS, the number is accepted to be raised to eight participants while the LTMT has not been identified, which could be unreliable for achieving the intended learning outcomes of the emergency training.

Outlines and Outcomes

The studied five courses provide resource management, effective communication, stress management, decision-making, and situational awareness. However, theoretically, the BRM briefly explained the situational awareness skill. On the other hand, the MEMIR intensively demonstrates the importance of pre-planning and maintaining a state of readiness. Regarding the practical outlines, the OPITO outcome is concise in only nine

outcomes for MEMIR, and five for the OIMCE leading to the "SMART" assessment concept, especially when there is a differentiation between the practical and theoretical outcomes. This is achieved only in the LMS training but without having the simulator compulsory for assessment purposes.

Decision-Making Process

With a particular focus on the assessment of decision-making through the outlines or outcomes, decision-making skill has been covered by all the studied courses in variable scopes but with a relatively broader scope in the cases of OPITO-approved MEMIR and OIMCE courses. This would provide a learning environment that is effectively flexible to allow increasing the integration of multiple types of emergency scenarios thusly boosting the trainees' decision-making skills.

Assessment Plan

Regarding the theoretical assessment, multiple techniques have been widely used in all STCW Courses including observation, written assessments, assignments, activities, projects, tasks and/or case studies, simulations, computer-based tests, writing reports, and drawing sketches. For the MEMIR training, the theoretical assessment is carried out through group or individual discussions, oral or written questions, scenarios, virtual simulations, and online learning. The practical part is executed using the simulator. In the OIMCE there are not any theoretical sessions as only the practical assessment using a simulator is utilized.

Assessment Criteria

In the BRM, the simulator is used to identify whether the learner is (Unsatisfactory, Needs Improvement, or Meets Expectations). For the LTWT, learners could be assessed either by an approved training or approved in-service experience or practical demonstration using a simulator to ensure that they achieved the learning outcomes while the LMS is to be observed in the simulator to ensure that the intended learning outcomes are fulfilled.

The use of the simulator is similar in MEMIR and OIMCE. In the case of OIMCE, more focus is placed on increasing the variety of scenarios and types of emergencies that might affect the installation including well control incidents, explosion and fire, hydrocarbon or toxic gas releases, accommodation fires, helicopter incidents, pipeline incidents, collision or wave damage causing structural collapse, loss of stability of mobile installations, and foundation failure of jack-up rigs.

Furthermore, this is integrated with a combination of different events including evacuation, escape or abandonment, injured or dead personnel, missing personnel or person overboard, loss of communication or loss of containment for the emergency. In addition, the escalation of the emergency is simulated by increasing casualties, loss of evacuation facilities, new muster points or temporary muster points, stressed personnel, extreme weather effects, environmental concerns, loss of effective facilities or essential members, and information overload. Deciding that the unit is unable to keep its operational position depends upon a written approved scenario to simulate if the emergency case is controllable or uncontrollable.

PROPOSED MODIFICATION TO THE ASSESSMENT IN THE STCW STANDARDS

Simulation is a part of a wider development program; thus the assessment of the Master should have two parties involved; an independent assessor, and a discipline expert from the learner's company. Based on the learner's knowledge, technical skills, and experience, the assessment decision should be taken based on the integration of future needs of the industry through a reliable and innovative assessment method to ensure that the Master can cope with dynamic changes in an emergency.

Moreover, the simulator should be as close as possible to the real vessel specifications and preferably with the same team operating the original asset. The proposed assessment course, as depicted in Appendix (1), is a proposal for a competence-based assessment process for a proposed STCW training titled Master Controlling Emergency (MCE). The design is mainly based on a mixed selection of all the assessment methods analyzed

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in case study courses by integrating the knowledge of BRM with the proper use of leadership and managerial skills from the master towards himself/herself and his/her team to enhance decision making in any emergency, as to ensure that the Ship's Master had the competent personality and the required NTS that enable him/her to take the proper decision in an appropriate time.

This assessment course should be based on five members in the bridge including the Master with a recommendation for each bridge to have a single whiteboard. In addition, as an emergency duty, one bridge officer should be assigned for performing internal communication along with promptly logging all the data related to the emergency on a whiteboard.

The scenarios used in the simulator should be written and pre-approved by the duty holder and should cover either a threat to life, a threat to the environment, or a threat to the vessel itself. Furtherly, the scenarios should be based on three main categories as follows:

1. Controllable emergency
2. Escalating emergencies
3. Uncontrollable emergency leading to abandonment

In this regard, the scenarios should focus on the worst case of emergencies which might affect the vessel as required in the OIMCE but as a matter of maritime transport domain. Furthermore, the scenarios should be written with a combination of different events as required in the MEMIR training where the assessment of each learner should be based on the outcomes of three scenarios up to a maximum of four different scenarios.

CONCLUSION

Given the comparison outcomes regarding the fundamental approaches articulated in the studied STCW and OPITO courses through their aims, scopes, principles, outlines, decision-making processes, and assessment criteria for each course, it can be recognized that the studied OPITO-approved courses are furtherly appropriate for providing an array of emergencies that adequately depict what can be experienced in real events of complicated emergency scenarios.

This is attributed to several factors including an elevated level of situational awareness, a systematic and adequate approach towards managing a combination of different events, and high-fidelity simulation of actual characteristics of emergencies on offshore installations which significantly enhance the physical, behavioural, and operational realism. Furthermore, the involvement of an independent assessor and a discipline expert from the learner's company enriches the consistency of the assessment process. Given these findings, this study concludes that although both standards are formulated with similar objectives, the OPITO emergency response courses provide a more extensive scope that can benefit the Maritime Education and Training institutions in building a more impactful and innovative training environment.

For improved consistency in the training outcomes, specific modifications to the currently implemented methods of assessment throughout the emergency response-related STCW courses could provide better consistent educational outcomes regarding advanced communication and innovative assessment methods. The proposed modifications include the inclusion of innovative instructional practices and enhanced interaction during both the instructional and assessment processes. Additionally, the assessment must be carried out by a high level of industry experts with the appropriate educational qualifications to ensure that the quality of training and assessment is consistently monitored more clearly and reliably. Ultimately, these modifications could lead to establishing an effective and reliable assessment framework that benefits the accomplishment of the training purpose and objectives while adhering to the preferences and demands of learners, dutyholders , and all other stakeholders in the maritime industry.

APPENDIX 1

Master Controlling Emergency (Simulator Assessment)

Function: Controlling the operation of the ship and care for persons on board at the management level

COMPETENCE-BASED ASSESSMENT PROCESS

Competence:	Develop emergency and damage control plans and handle emergencies
Knowledge-understanding-performance	Assessing situations and taking effective actions, maintaining proper communications, delegating authority, managing the performance of himself/herself and the team, and how to deal with stress for the individual and the team.
Method of evaluation	In-service training, experience, and simulator
Criteria	Agreed scenarios with the duty holder.

Assessment Domains: Cognitive (K), Psychomotor (S), Affective (A)

	Tasks, Knowledge, and Learning Objectives	Education Domain (K-S-A)
1	Assessing the situation	K, S
2	Taking effective action with the optimum use of all available resources	K, S, A
3	Maintain proper internal communication	K, S, A
4	Maintain proper external communication	K, S, A
5	Delegating authorities with feedback	K, S
6	Managing the performance of the Master and the Team	S
7	Control stress for the Master and the Team	K, S, A
8	Maintain a safe navigational watch	K, S

	Task	Weight	Parameters	Grade	Averaged weighted grade
1	Assessing the situation	1	5 min		1
2	Taking effective action with the optimum use of all available resources	1.5	7 min		1.5
3	Maintain proper internal communication	1.5	1 min		1.5
4	Maintain proper external communication	1.5	10 min		1.5
5	Delegating authorities with feedback	1			1
6	Managing the performance of the Master and the Team	1			1
7	Control stress for the Master and the Team	1.5			1.5
8	Maintain a safe navigational watch	1			1
Total		**10**			**10/10**

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