선박조종 시뮬레이터를 이용한 해사교육 및 훈련

김창제*

Maritime Education and Training(MET) by Ship Handling Simulator

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Abstract

Several full mission simulators have been installed since about 10 years ago in Korea. The newly established Marine Simulation Training and Research Center at Korea Maritime University has played a key role for education and training of both cadets and in-service officers trainees, and for research on Korea ports such as Jeju international cruise port, Ulsan SBM and Kwangyang container port and many others.

This study mainly focuses maritime education and training on the ship handling simulation and the bridge resource management conducted by Korea Maritime University.

Key Words : MET(Maritime Education and Training), BRM(Bridge Resource Management) SHS(Ship Handling Simulator)

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1. INTRODUCTION

Most of marine casualties are caused by not only lack of knowledge about navigational equipments or system but also wrong operation of them. Generally these casualties result from crews mental problem or lack of situational awareness.

Ship Handling Simulation training (SHS) is required to practice ship handling to prevent accidents caused by lack of ship handling skill and Bridge Resource Management training (BRM) to manage bridge resource properly and efficiently and cut off the error chain. The best place to practice ship handling seems to be on board the vessel that one will join soon or later.

But if one who is not familiar with ships, practices ship handling training on board the vessel, the vessel may get into trouble because of mistake due to his lack of skill, which means that it is impossible to make a practical ship handling training on a real vessel. Trainees can practise repeatedly until they accomplish their intended goal, even if they brake piers or vessels during simulation.

Marine simulators have been used not only for mariners but also for many kinds of industrial divisions like designs and constructions of break water, wharves and ship buildings and so on.

In these respects, the marine simulation center at Korea Maritime University (KMU) was opened in March 1999 at newly constructed six-storey building with exclusive use of the second- and third floors for the center. There are two bridge mock-ups for Full Mission Ship handling Simulation (FMSS), a Global Maritime Distress and Safety System Simulator (GMDSS), an Engine Simulator System, two LAN connected briefing rooms and supporting facilities. Undergraduate students and in-service officers training for deck officers has respectively been carried out since its opening and september in 1999.

An additional activities have been executed since its opening. First of all, the first Korea-Japan joint workshop on marine simulation research in 2001, and 2002 year spring conference for simulation sponsored by the Korea Society for Simulation were held at the center. And then, several researches have been executed on waterway and fairway designs and harbour developments.

This study aims to describe the recent status of SHS and BRM conducted by KMU and to suggest several recommendations on the effective application of ship handling simulator to maritime education and training.

2. SHIP HANDLING SIMULATOR SYSTEM

Located on the third floor of the center, its two bridge systems are able to simulate either independently or collectively ships operation and manoeuvring characteristics for given exercises. Fig. 1 presents the components and structure of FMSS.

The Center has prepared for twenty domestic and foreign model ports and twenty kinds of model ships up to now, and the model ports and the model ships which the center doesn't hold yet, will have newly been developed.

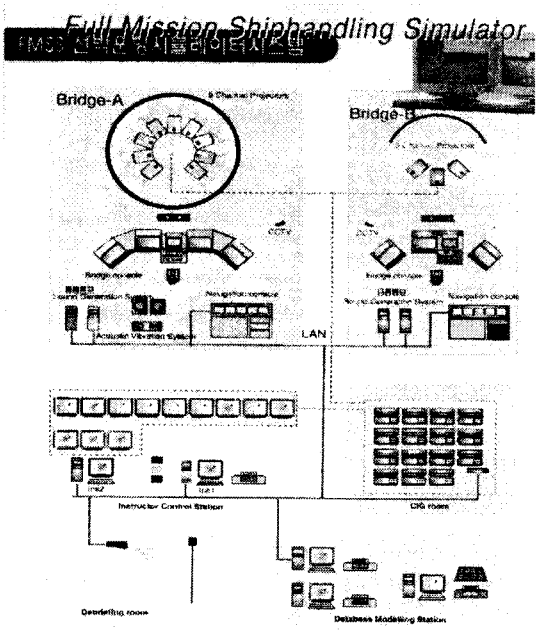

Fig. 1 Components and structure of FMSS

Ship handling simulator system consists in five categories which are Bridge A, Bridge B, Computer Image Generator Room, Instructor Control Station and Debriefing Room.

The characteristics of each mock-up or room are as follows.

2.1 Bridge A.

- Bridge : 6.2m in diagonal length of octagon shape with cockpit typed Integrated Bridge System (IBS)
- Screen : 16m in diameter with 360° cylinder typed full screen
- Projectors : front projection projectors with nine channels and 270° in projected angle
- Navigation equipments : ARPA, ECDIS, NID, Steering Stand, VHF, Interphone, DGPS, Decca, Loran-C, RDF, Echo Sounder and Speed Indicator
- Sound System
- Acoustic Vibration System
- CCTV

A photograph of Bridge A with Opera House for a background at night is shown in Fig. 1

Fig. 2 Bridge A

2.2 Bridge B

- Bridge : squared shape (7.3m wide and 6.0m long) with conventional typed bridge system
- Screen : 8m in diameter with 135° cylinder typed screen
- Projectors : front projection projectors with three channels and 135° in projected angle
- Navigation equipments : ARPA, ECDIS, NID, Steering Stand, VHF, Interphone, DGPS, Decca, Loran-C, RDF, Echo Sounder and Speed Indicator
- Sound System
- CCTV

2.3 Computer Image Generator Room

- Visual computer system with fourteen channels
- Lockheed Martin real 3D-graphic engines

2.4 Instructor Control Station

- Server network computer
- Multi monitor synchronized visual system
- Data and voice record equipment
- Extension telephone and interphone

2.5 Debriefing Room

- One large sized screen projector
- 100 inch wide electro-motive screen

Korea & foreign states's Ship handling simulator system are described in Table 1 & 2.

Table 1 Ship Handling Simulator system operation in Korea

Place	Company
KMU	Norcontrol
KIMFT	Stn-Atlas
MMU	Norcontrol
GSNU	Norcontrol

KMU : Korea Maritime University
KIMFT : Korea Institude of Maritime and Fisheries Technology
MMU : Mokpo National Maritime University
GSNU : GyeongSang National University

Table 2 Ship Handling Simulator system operation in Foreign states.

Country	Place
USA	MSI, CMA
Netherland	MSCN
Sweden, Norway	IDESS
UK	SI
Finland	SSC
Philippines	NTC
Japan	TUMM, KUMM
Singapore	PSA
China	SMU

MSI: Marine Safety International
CMA: California Maritime Academy
MSCN: Maritime Simulation Center Netherlands
IDESS: The International Development and Environmental Shipping School
SI: Southampton Institute of Higher Education
SSC: Ship Simulation Center
NTC: Norwegian Training Center
TUMM: Tokyo University of Mercantile Marine
KUMM: Kobe University of Mercantile Marine
PSA: Port of Singapore Authority
SMU: Sanghai Maritime University

3. SHS AND BRM EDUCATION AND TRAINING

The education and training is intended for undergraduate students and in-service officers. The undergraduate students course for SHS intended for senior students is scheduled for two hours a week as a regular curriculum of one credit. In-service officers course is composed of two kinds of training such as SHS and BRM

3.1 SHS education and training

SHS training courses are divided into several different ones. Each course is designed to develope the specific knowledge and skills required to perform trainees grade. The characteristics of each course are shown in Table 3.

Table 3 Each course for SHS

Course	Trainee	Period Person
Undergraduate	Students	2 hours a week for 15weeks 100
Preliminary	Officers prior to first embarkation	3 days 8
Basic	Junior officers	3 days 8
Advanced	Senior officers & masters	4 days 8
Custom tailored	All officers including masters	1 ~ 2 days 1~ 2

As seen from Table 1, a graded training is executed according to trainees ability and level. Each course consists in incorporating classroom lecture, simulator exercises and debriefing except the custom tailored course which is accomplished by full simulation training and debriefing. At clients request, custom tailored course is intended for promoters in rank, masters and deck officers scheduled to be transferred to a different typed vessel, masters and deck officers who have engaged in shore based professions for a long time and dock masters. The preliminary course means a sort of familiarization training with vessel which is able to go through prior to reporting on board vessel after the university graduation. Sometimes, pilots training for well defined areas is carried out irregularly. Every course carries out simulator exercises more than 50% in total. Trainees more than 400 have completed the SHS course at the center.

An example of the courses at the center is described in Table 4.

Table 4 Training program of basic course

First day	1. Introduction to the course 2. Familiarization with simulator 3. Voyage plan 4. Ship handling simulation (narrowchannel) - normal navigation in congested traffic area
Second day	1. Prevention of collision 2. Response to emergency situation 1 3. Ship handling simulation - restricted visibility channel & night nav.
Last day	1. Response to emergency situation 2. Ship manoeuvrability 3. Ship handling simulation - approaching harbor - berthing, unberthing

As shown in Table 2, simulator exercises are mainly executed on the extreme and severe conditions in restricted and congested

waterways. On the other hand, the advanced course deals with anchoring, entering/departing port and berthing/ unberthing.

Fig. 3 shows a simulator exercise procedure conducted at the center.

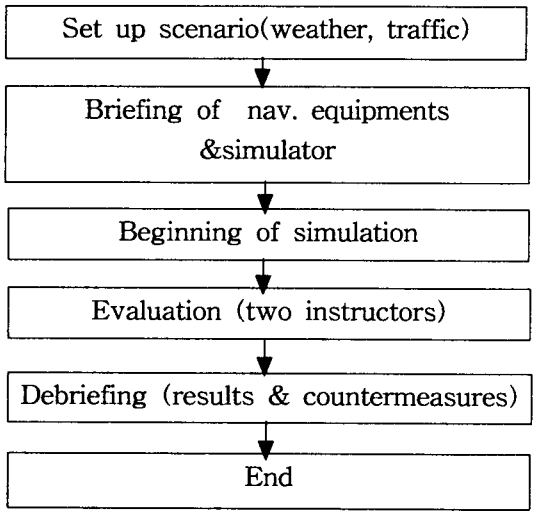

Fig. 3 Simulation procedure

3.2 BRM education and training

BRM course emphasizes on human factors such as team work and leadership. Most of marine casualties result from human errors caused by crews mental problem or lack of situational awareness. Course participants largely covered crew onboard tankers such as crude oil tankers, chemical tankers, LNG carriers and LPG carriers and so on. In addition, crew onboard other vessels except tankers have been educated recently. The center has prepared for two kinds of course, that is three day course and five day course. The three day course of BRM is presented in Table 5.

Table 5 Three day course of BRM

First day	1. Introduction to the course 2. Conversion of consciousness 3. Efficient communications 4. Voyage plan 5. Optimal use of bridge team & navigation equipments 6. Seminar (cut-off of communications and speeches of self-experience cases) 7. Ship handling simulation(narrow channel) - normal navigation in conjested traffic area
Second day	1. Situational awareness, cut-off of error chain & fault 2. Team work & leadership 3. Efficient application of the bridge team 4. Exchange of objections & their acceptance 5. Ship handling simulation (restricted visibility channel & anchoring)
Last day	1. Rational reponse to emergency situation and cooperation between bridge team and pilot - rudder engine failure - emergency steering - brake down of propulsion or black out 2. Case studies of marine accidents 3. Seminar (marine accidents) 4. Audiovisual education 5. Ship handling simulation (berthing & unberthing) - preparing engine for manoeuvring - preparing navigational for arrival - Pilot on board and disembarking

One of the characteristics of BRM conducted at the center is to incorporate theoretical lectures and simulator exercises amount to about 20%. As seen from Fig. 4, after converting the trainees consciousness, lectures and simulator exercises are given. Simulator exercises are generally conducted in costal area, narrow channel and harbour area required for frequent communications.

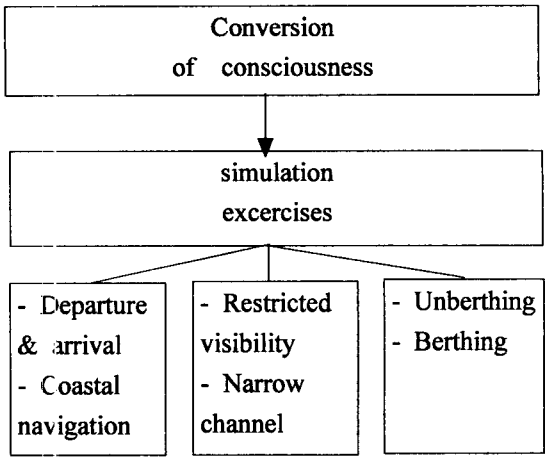

Fig. 4 Concept diagram of BRM

4. EFFECTIVE TRAINING AND ASSESSMENT PROCESSES

The five factors such as simulator facilities, instructors, trainees, training program scenarios and assessment, play an important role in simulator training system. This chapter will deal with instructors, trainees and assessment because the others were relatively well explained in details. And the same contents as conducted by other marine simulation centers will be left out.

There are a lot of references concerning the qualification required for the instructors.

At the center, dual qualified experts who are both experienced masters and Ph. Drs are in charge of simulation training and classroom theory simultaneously. To raise educational effects, the number of trainees should be considered. In case of SHS exercises, four trainees per bridge is a standard unit at the center as presented in Table 1. One of them plays masters role, another does watch officers role, the third does quartermasters role and the fourth does observers role, and they change their roles, alternately. And then in case of BRM exercises, four trainees per bridge is also a standard unit at the center. One of them plays masters role, another does watch officers role, the third does quartermasters role and the fourth does pilots role, and they change their roles, alternately. The observer watches the exercises objectively, and he/she comments to correct their faults, if any. After completion of exercises the results are stored in the trainees Log and can be assessed by two instructors on site. In addition, the items in Tables 6 and 7 are evaluated. Each item is assessed by two individual instructor on the basis of 100 points.

Table 6 Additional assessment(SHS basic)

CORLEG	1. Head on situation 2. Crossing situation 3. Overtaking situation 4. TSS 5. Restricted visibility 6. Nav-aids identification
Maneuvering skill	1. Use of M/E 2. Application of wheel over point 3. Position confirmation 4. Application of parallel indexing 5. Emergency response Training for collision avoidance
Voyage plan	1. Suggestion of an opinion 2. Collection of information & its application 3. Application of safety margin 4. Application of emergency plan
Commucation	1. Inter- bridge team 2. Ship to shore 3. Ship to ship

Table 7 Additional assessment(BRM)

Maneuvering skill	1. Application of CORLEG 2. Proper speed 3. Proper LEE-WAY against external force 4. Use of M/E & Steering Control of tug boat
Reforming thinking	1. Situation awareness 2. Positive mind
Voyage plan	1. Effective uae of all relevant pulication & briefing 2. Application of Parallel index Contingency plan
Mutual understanding	1. Sea speak 2. Clear language & gesture 3. Exchange of objections & their acceptance
Team management	1. Observance of proper procedure & regualtions 2. Effective operation of nav./radio equipments & management of bridge team
Leadership & decision making	1. Proper leadership on various situations 2. Rational decision making 3. Masters harmonious communications with pilot
Emergency response	1. Collection of information and situational judgement to overcome emergencies 2. Application of professional knowledge to emergencies

5. Conclusion

In this study maritime education and training using marine simulator at the center was investigated.

Several new attempts like preliminary course and observers role during SHS exercises were suggested, and their effects are required for further examinations.

The center has conducted a lot of activities such as education, training and research and so on by ship handling simulator installed there since its opening.

In the near future it is anticipated that the center will contribute to an increase of safety and efficiency at sea and will be able to produce a lot of fruitful results.

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● 저자소개 ●

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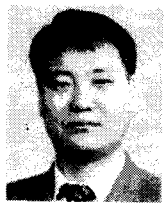

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