TRAINING: ONBOARD AND SIMULATION BASED FAMILIARISATION AND SKILL ENHANCEMENT TO IMPROVE THE PERFORMANCE OF SEAGOING CREW

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ABSTRACT
Today development of Maritime Education and Training system is a dynamic process under the pressure of rapidly improving maritime technology. An ideal development cannot be achieved by considering the existing practice and internal processes and procedures only and needs to have a wider perspective by reviewing best practices and establish the necessary benchmark.

Research is an effective means of underpinning further and higher education programmes, developing and motivating staff, establishing working relationship with industry and commerce and developing independent and self learning while preparing students for the future. Recent research has shown that the response of International Bodies to address identified deficiencies on STCW content, language competence, automation, emergency situations and environment are generally slow, sluggish and/or lacks resources.

To overcome these deficiencies, TUDEV established a partnership with well-known and well-respected international maritime institutions and universities in UK and in other European Union member states as well in Norway and through working with organisations such as BTEC/Edexcel, MNTB (Merchant Navy Training Board), NVQ/SVQ (National Vocational Qualification) authorities and professional institutions such as IMarEST (Institute of Marine Engineering, Science and Technology) developed a set of most up to date programmes for Deck officers as well as Senior Deck officers and similar programmes for Marine Engineers and senior Engineer officers. These co-operations and partnerships, including staff and student exchanges, not only provided opportunities for collaboration and joint programme and unit design and developments but also initiation of a number of funded European Union projects. These European Union funded projects such as SOS, Train 4Cs I and II, EGMDSS I and II, MarTEL, MarEng Plus, SURPASS and M'AIDER, which TUDEV is either leading or is a partner in, have been used as catalyst for programme and unit development. The outcomes of such projects are reflected in the programme development process which onboard training and use of advance simulators forms the focal part of it.

This paper gives details of how programmes for education and training for merchant navy cadets and officers were developed by TUDEV and their European partners and how these received international recognition with specific references to sea training and use of simulators.

Keywords: MET, Skill enhancement, Advanced simulators, Onboard training

1. INTRODUCTION

Rapid introduction of IT (Information Technology) into navigational equipment and ship operation supporting systems such as AIS (Automated Identification System), ECDIS (Electronic Chart Display Information System), IBS (Integrated Bridge System) or introduction of e-Navigation system requires inclusion of marine-related IT technologies in respective MET (Maritime Education and Training) Programmes. However, there is no doubt that this shall increase the number of dedicated hours of respective units not only for the classroom theoretical training but also for the extensive use of simulators for the familiarization and skill enhancement.

On the other hand, sea training onboard a ship is a must for all seafarers of various types and ranks and plays a very key role in the education and training of cadets officers. However, the training opportunities aboard ships offered by shipping companies have been significantly reduced in the recent years and due to commercial pressures in recent years resulting in minimum manning levels together with then ever increasing level of automation the nature and the quality of training on board has significantly changed for the worse . These have not been good omens for a cadet trainee. The socialization process experienced on the ship would probably also affect one's recognition as to whether one fits the environment and further affect one's intentions to remain in the profession after graduation as it is considered that the fit between one's character and work environment is the basis for one to choose a career [Holland,1997]

Despite all the technological developments and advances, the human being has been the indispensable player of marine design and operations. The increasing diversity of maritime operations and mission specific ship and craft types, fitted with advanced equipments and technologies, depend heavily on the performance of the crew on board. Moreover, the health and safety of people, whether they are passengers or crew is a significant issue in marine design and operation. Both academics and industry around the world have been performing studies and developed technologies and systems to address human related issues in the commercial or non-commercial maritime world to improve human safety and health on board ships and marine platforms and to improve the performance of seagoing crew in order to improve safety and reduce maritime accidents.

Along the course of these developments the education and training of engineering and deck officers are in throes of rapid evolutionary change particularly considering the International Maritime Organization (IMO) recent publications and the work of major players involved with developing, awarding, accrediting and assessing merchant navy education and training (MET) programmes. The emergence and application of new technologies are now increasingly playing a major role in the introduction of new methods and methodologies in this connection.

Each graduate of the maritime institutions should be well educated and trained as an Officer of Watch (OOW) hence well-versed with the operational and management responsibilities on-board an ocean-going vessel. At the same time that s/he must be prepared to fulfil the officer's role ashore. A well developed MET programme must include theoretical and practical education and training in a well-balanced curriculum and must ensure there are well-designed and internationally recognized programmes of education and training leading to higher qualifications and certifications for career progression as well as for job diversification. There is therefore a need for clear education and training pathways recognized internationally with clear progression routes onto degree and higher qualifications in the related subjects.

2. SUFFICIENCY OF IMO MODEL COURSES AND STCW COURSES TO MEET THE REQUIREMENTS OF RECENT DEVELOPMENTS IN TECHNOLOGY, ENVIRONMENTAL AWARENESS AND LEGAL REGULATIONS

Maritime industry is one of the oldest industries of the world and for a maritime country; this industry plays an important role for the advancement of the country itself. Nowadays with the rapid emergence of the new technologies, the ships – main instruments of the maritime industry – are becoming more advanced and sophisticated. These kinds of ships will be required to be manned by lesser number but better educated and trained crew.

Today seafarers are becoming the high-tech group of the industry compared to recent years. The advancement in maritime transportation from the age of sail to the nuclear power plants witnessed higher level of skill and experience needed to man a vessel with such engines. Seafaring evolved to a level of highly qualified profession where specific knowledge and skill are needed to operate this mode of transportation and, experience are needed to ensure safety and efficiency. It has become more a subject of science and not merely an art to sail various types and sizes of ships.

Analyzing the effects of new technologies on the human element, the main ones seem to be caused by navigation and communication related technologies. The effects of technologies related to navigation support and communication (as well as management) support are very similar. The main difference is that the development in information systems on-board a ship for navigation support may lead to more decision-making on-board, while the development of external information systems may lead to less individual decision-making on-board.

The advancement of information and communication technology has reduced the gap between human located in the distance places and this also benefited the shipping industry. It is easier to maintain communication between ship and its owner and this indirectly resulted in more interference in term of ship management. The master of the ship is no longer seem to be in command of his ship, thus the impression of commercial requirement seems to have superseded the safety and security aspects.

One very important development has been the introduction of automation in operating a ship. The modern ships particularly container and fuel carrying vessels are becoming increasingly automated. The automation has brought with it two problems, one concerning the inadequacy of existing seafarers' education and training viz., that if any aspects of automation fails the crew often are not trained to use alternative systems and hence respond to it effectively [IMO MSC 82, 2006; Ziarati, 2007]. The second problem has arisen from the review of the arguments from recent IMO Maritime Safety Committee (reports MSC 82/15/2 and MSC 82/15/3, 2006) namely that the human operators rarely understand all the characteristics of automatic systems and these systems' weaknesses and limitations which have now been found to be the main causes of accidents.

Investigation of several serious and recent accidents at sea due to automation failure has revealed that there is a need to improve the content of all maritime training and that the knowledge, skills and understanding of automation should be included in the basic training of all Chapters of the STCW Code of practice and hence address this very serious issue at source. Furthermore, to address the second problem, it is considered feasible to gather the knowledge for inclusion in the existing seafarer's education and Training in a short course format that can be easily introduced for existing seafarers and hence enabling the seamen currently working at sea and in ports to develop the competence to handle and respond to automation failures.

A paper [Ziarati, 2007] and report to IMO (MCA, 2006) clearly identify a major source of accidents particularly in the future to be the problems with application of automated systems and failures in any aspect of automation. There are two related issues/needs which need to be addressed. One can be highlighted, for example, by a recent report by the Maritime Accident Investigation Branch in the UK (MAIB) concerning the details of the heavy contact made by Savannah Express [2005] with a link span at Southampton docks, after the ship lost astern engine power. The report stated that the engineers on board were experienced and held appropriate STCW certificates but they were unable to correctly diagnose the reason for the engine failure. Lack of adequate training in how to operate and trouble-shoot the automated engine was a significant contributory factor in the accident. What was significant was that STCW training standards for Engineers have not been updated to account for working with such new engines. The second issue can be highlighted by an article in MER [addressing automation, 2007] stating that it is not impossible to bring presently serving seagoing engineers to the standards needed if a course could be devised to include synchro- and cyclo- converters, harmonics, etc. as an add-on to the existing IMO syllabuses. [Ziarati,2007] reports on the need to include instrumentation and control systems including hydraulics and pneumatics in the syllabuses of the programmes for the Engineer and Deck officers. Under STCW there is no specific training requirement for electrical engineering officers on board vessels, and therefore no internationally or European agreed standard by which shipping companies can effectively assess their knowledge.
TUDEV has been working on this issue for some time to develop a new short course programme to address this problem. The project was approved by EU as a major Leonardo TOI (Transfer of Innovation) Project. The proposed course contains some 8 modules in various aspects of automation for:

a. Ratings and for Cadet Officers on automation components,
b. Deck Cadet Officer on automated navigation systems at support and operational levels,
c. Engineering Cadet Officers on automated propulsion systems at support and operational levels,
d. Chief Mates, on integrated navigation on operation and management levels,
e. Second Engineers on automated propulsion and power transmission systems,
f. Chief Engineers on fully integrated and computer controlled propulsion system,
g. Masters/Captains on fully integrated Bridge-propulsion-power transmission system and
h. On team operation, Deck-Engineers interaction and combined scenarios.

Automation has been reported to have qualitative consequences and does not simply replace human work with machine work. It changes the task it is designed to support and creates new errors and error pathways and often shifts the error occurrence into some time in the future and may hide the error and make it more difficult for it to be identified and hence rectified [Ziarati, 2003]. This is the basis of many of the automation problems reported in recent publications such as Intertanko report (Safety at Sea International, 2010).

In addition there are non-technical skills which are equally important. In many incident and accidents, the complexity of the automation is the error enforcing condition. To prevent such errors it has been found that it is important to consider resource management, skills such as situational awareness, decision making, work-load management [EUREKA, 1996] Factory of the Future report. Combined Master-Chief Engineer emergency team operations [SOS, 2005] could also lead to a more effective response to a given failure. All these are included in the proposed SURPASS (a new EU Leonardo funded project led by TUDEV commenced in October 2009 and expected to be concluded on September 2011) course consisting of 8 modules of training, one for each class of seafarer and one for team building. Each module has several exercises, these will be developed to cater for known situations and possible scenarios and each partner will bring one specific expertise to ensure a whole range of skills are available.

In addition to technological developments, Legal and Environmental issues are also subject to crucial changes. Maritime transport of goods and passengers involves different types of risk. As a consequence of a maritime accident, loss of life or injury may occur to crew and passengers, damage to the property of ship-owners and the cargo, as well as potential risk to life, health and property of third parties and the natural environment. Over the last decades, the risk of accidents has increased.

Contributing factors are the larger volume of maritime transport, including dangerous or polluting cargos, a higher exposure to third party interests and, finally, the increased recognition of the value of the natural environment. Therefore efforts have been made to reduce the risk through better technology, rules and supervision as well as mechanisms of compensation. As a consequence of a number of high profile accidents, the international community has developed a series of legal instruments to manage liability and compensation. Current environmental training is both limited and inconsistent across Europe. Existing training tends to focus on meeting minimum standards and compliance with legislation. Little attempt is made to explain why environmental regulations are in place and how individual actions can make a difference.

Therefore a proper MET program must aim to include all these changes and updates to develop a certified training programme in environmental awareness for mariners, with the aim of establishing an internationally recognized standard for environmental training. To address this issue TUDEV has been working on another pilot project to update the knowledge, skills and understanding of those working in the water transportation sector. The proposal responds to the needs of the sector for training of employees and employers, paying particular attention to the training and re-training needs of smaller companies and self-employed. The project is divided into three parts.

In part one, a classification system will be developed grouping various short course programmes under specific headings, viz., safety, security, specialized, legal, management, environmental and so forth. Through cross-referencing techniques, developed as part of an earlier European Union (EU) funded project [Eurotecnet,1994], a matrix table will be produced identifying where these courses are delivered within the partner countries and later the courses offered in the surrounding countries would be added to the database, including information such as fees, frequency of delivery, location and other relevant details. Through a harmonization plan, the titles and content of these courses will be examined and a comprehensive set of training programmes will be developed. Learning materials will be gathered together and additional materials developed. Other resources (equipment, simulators, software, charts, manuals, etc) will be incorporated and shared among the partner countries and will be made available to other European Union member states as part of the intended valorisation.

The second part of the project concerns sharing of resources and value added activities manifested in jointly planned and/or joint delivery of these courses, providing a golden opportunity for training the trainers, in an efficient and effective manner.

The third part relates to the development of specific training and re-training courses on newly emerging requirements, particularly relating to national and international conventions and security requirements, specifically those introduced after 9/11, for instance, requirements of USA coastguards or specific ports relating to security. The project provides an opportunity for partners to recognize each others' certificates. This is an important objective of the project.

To ensure these developments are successful, it is proposed to establish a network of partners including the relevant authorities to ensure these programmes received the support needed. The work will commence with the review of an existing needs analysis report and identification of urgent short courses which will incorporate the latest requirements of bodies such as the International Maritime Organization (IMO). There will be a training programme with support from partners for the trainers and their certification in line with European vocational qualifications for trainers/ assessors and those who will be involved with internal and external examinations. It is agreed that a serious attention will be paid to provision of pathways, through 'integrated short course programme', to technician qualifications and also through existing routes to higher qualifications. The reason for this is the anticipated shortages of qualified seafarers in the near future [Ziarati, 2006].

3. ADVANTAGE AND DISADVANTAGES OF DUAL CADET (DECK AND ENGINEER) PATHWAY TRAINING

Recently most of the ships are becoming fully automated with very sophisticated engine control systems. The nature of these systems is also changing the role of traditional engineering officers from technical perspective to managerial levels. The expected raise in the level and extent of training of the engineer ratings such as technical high school/higher school graduates may also alleviate maintenance and operational responsibilities of the engineering officers while allowing them to perform officer of watch duties. The workload of the engineer officers could also be reduced by allowing graduates with engineering knowledge such as mechanical engineers to be utilized onboard as support staff. Of course they should be given certain maritime safety and operational knowledge before they are allowed to serve onboard ship.

On the other hand, deck officers are also required to have better knowledge on the engine systems especially weaknesses and limitations of these systems such as emergency procedures to be

applied in the case of emergencies. With better trained engineer ratings, well planned onboard spares of self trouble shooting systems and centrally available technical advice mechanism under the developing communications systems, it is believed by some programme specialists that any officer graduate of a well balanced 4 - 5 year MET degree based programme can handle both deck and engineering officers roles simultaneously. Sea training period of such a programme may also be divided into two parts for deck and engineer and appointments from deck to engineer or vice versa can be achieved by short adaptation courses which are becoming essential with the introduction of highly sophisticated and expensive systems. However, many are still unconvinced that the role of deck or Engineer officers of watch can be interchangeable and one single person could perform both functions simultaneously as a norm. However, it is feasible, as demonstrated by the EU funded project [SOS, 2005] to introduce Deck cadets to Marine Engineering systems and Engineering cadets to navigation topics so that both types of officers have some understanding of each others' roles and responsibilities. This is particularly relevant to deck officers who eventually have to take responsibilities for a whole vessel and could benefit from the knowledge of Marine Engineering. For further and higher training (master and PhD), these uniform (line) officers may choose either technical or management level studies for employment ashore.

The load of the Master and other management levels officers may also be reduced by the creation of additional position in the form of administrative support so that the workload for paperwork could be monitored by an administrative officer where the person holding this position need no special maritime know-how but a short relevant training instead.

Such a pattern may also provide more reliable pilots in the future. It is not expected that the pilots to be experts on core subjects such as celestial and great circle navigation, cargo handling but more familiar with different shipboard systems and their limitations mainly engine and rudder systems.

However, such a radical shift from traditional MET system, if approved by IMO, will eventually require very carefully planned and well balanced curriculum, adaptation of several short courses, change of duration at sea at each rank for promotion to higher ranks and change of sea farers examination system and certification procedures. Two new proposals (FP 7 ATRACTS-ME, UniMET) and have been formulated to lead the way for future changes to MET content and method of delivery.

4. NUMBER OF HOURS TO BE DEVOTED TO SIMULATORS, SCHOOL SHIPS AND SEA TRAINING

One of the most important factors determining the educational process in maritime academies is the influence of the IMO legislative activity. Its revised STCW Convention represents a very significant step forward, necessitating an improvement in curricula and encouraging the introduction of new didactic tools, among others, simulators. The education of an officer is an extremely expensive process due to the extensive range of theoretical and practical knowledge that must be acquired in order to practice the profession. A number of diverse reasons, including a sought after reduction in the associated costs of education, have seen both the introduction of various kinds of simulators into the training cycle of officers, and changes to the basic curriculum at Maritime Academies. Such significant changes are justified by more than cost reduction alone; other factors which have demanded an evolution in the educational process include the particularly rapid ongoing development in technical innovations which are immediately implemented on ships, combined with limits to the duration of a student's education, as well as the need to comply with the requirements of STCW'95.

From the moment of acceptance into a course, and throughout a student's entire education in the Maritime Academy, schools must use all possible means at its disposal to ensure the development of an officer with the ability to operate present machines and ship devices, and the capacity to understand and adapt to future innovations . Observations so far indicate that training on the simulators produces graduates who are more quickly and better able to operate particular mechanisms, at the same time that they acquire a full appreciation of the processes involved. And of course the consequences of mistakes are substantially reduced. The simulator training also overcomes major drawbacks of on-board training, fault diagnosis, analysis and rectification.

Modification of the curriculum to satisfy the requirements of IMO-STCW 78/95 may also allow reducing the total number of course hours without in fact decreasing the quality of knowledge imparted to students. The introduction of training on the simulators reduces the amount of time necessary for training in laboratories with particular mechanisms, including the main engine and diesel generator, with an advantage to the institute in the reduction of maintenance costs - in terms of use and repair - of these machines.

On the engine room simulator, for example, participants experience the workings of the main engine under different emergency situations, as well as how the crews behave under stress. Such

simulated situations range from minor defects to serious breakdown of the main engine or its particular mechanisms. Future engineers, through these simulated experiences, are able to learn appropriate responses and necessary routines to master these situations and to resolve the stressed behaviour of the crew. The diagnostic simulator of a ship's main engine allows training in the strategy for repairs to an operating engine, based upon routine measured parameters of engine motion. The chief engineer makes decisions concerning the terms of repairs or surveys of particular machines and devices, including the main engine, during the normal operation of an engine. The diagnostic simulator aims to instruct the officer to arrange the order and schedule of repairs and surveys to the best advantage of the technical state of the whole engine room. The simulator of the cargo operations of a LNG ship allows training in all typical cargo operations of a gas tanker - cooling tanks, unloading gas from a ship, loading a ship etc. With the increasing quantity of cargo carried on gas tankers of LNG and LPG types, and the unusual conditions of loading/unloading and carriage (chiefly low temperatures), it is necessary for crew of these tankers to undertake special training.

In the STCW 95 Convention, details regarding the simulators requirements and training objectives were detailed only for radar simulators. These provisions could be considered as the kick-off of the world scale training based on simulation in the maritime education and training (MET). From the beginning of the 90s, simulator manufacturers used computer technology on a large scale in order to create virtual navigation equipment and ship handling controls.
The main reason for this policy was the reduction of the price for the simulator systems and an easier way to reproduce all the parameters of the ships equipment using full dedicated software. A combination of real equipment and virtual equipment remained an option for the buyer, but the actual trend is a limitation of the real equipment to the steering console and auxiliary panels. This trend is also justified by the new generation of real ships with integrated bridge systems (IBS), where PCs, trackballs, keyboards and monitors replaced many of the traditional knob and push button panels.

As it is well-known, STCW 95 introduced a compulsory 12-month seagoing service for every candidate for certification as deck officer of watch (operational level). At least six months of this period the cadet must perform bridge watch keeping duties under the supervision of a qualified bridge watch keeping officer [IMO, 1995]. The cadet's achievements during onboard training programmes must be documented in an approved training record book.

There were two areas where maritime administrations rushed to implement the new STCW requirements: seagoing service periods and IMO compulsory courses. From the national Maritime Authorities' point of view these were the easiest tasks to be accomplished, because they do not require manpower or logistic efforts from the Authority. This one-year sea service period for cadets created several logistic problems for maritime education and training providers. The first one was a substantial reorganization of curricula, in order to allocate time for on-board training. The second main logistic problem lied in finding owners and ships, for instance in TUDEV, for almost 200-300 cadets each year. This problem is amplified by the lack of national flag ships and in many cases by the non-implication of the national Authority for providing help and support for solving this problem.

Moreover, the students lose the contact with their university/college for several months, and they have major difficulties to re-enter in the teaching programme. There are only very few large ship-owners having a coherent on-board training programme with a serious involvement of the cadets in training activities.

School ships, especially tall ships are the pride of the MET providers which own one of them. These ships are known to provide excellent training opportunity especially on the development of basic seamanship skills. Therefore school ships can be very beneficial for the first part of the sea training phase for the deck and engineering cadets as well as supporting the teaching staff with a real laboratory to reinforce learning and a means of motivating cadets to learn more effectively. Therefore, the policy of acquiring and maintaining a school ship is a good one as it offers a golden on-site opportunity to actual training and fault diagnosis on real-time basis. However, the second part of the sea training-Officer of the Watch practices- will certainly require real commercial ships to have a feel for the profession and art of seamanship under the realistic conditions. This duration may be considerably reduced with the increased amount of hours to be dedicated for simulator training. This will also help to solve the problem of limited number of training berths under the increasing number of cadets. Ziarati argues that it would be a good practice to take candidate cadet officers for a short sailing experience on board these training ships to see if the candidate has the aptitude and interest in becoming a seafarer [Ziarati, 2003]. This is he believes to be an important consideration in recruitment process and should be taken seriously as it is based on 'right first time' policy of the FoF (Factories of the Future programme (www.c4ff.co.uk) which has proven to save resources later in the process.

A reduction of sea training could provide an opportunity to include good practice courses such as Bridge Team Management, Ship Handling, etc. and also introduce the cadets to the new technology, for instance, developing their competence in the use of ECDIS and AIS.

New MET programmes must define the number of simulator hours and subjects that may replace sea training in certain terms and redefine sea training periods accordingly. Good simulator training is expected to include a good set of realistic scenarios based on previous accidents and incidents or near misses.

5. REQUIREMENTS FOR INTERNATIONALLY RECOGNIZED CERTIFICATION SYSTEM AND EXAMINATION SYSTEM TO COMPLY WITH THESE REQUIREMENTS

TUDEV has recently developed a set of new programmes which are designed to improve vocational education and training standards and hence the qualifications of cadets, who are attending Officer of the Watch (OOW) vocational maritime education and training programmes (MET) at TUDEV. The aim of this project is to ensure cadets at TUDEV attain EU standards and their qualifications are recognized by all EU Countries. The project is intended to meet the increasing demand for qualified deck watch officers (OOW) which has come about due to growth of maritime sector in the EU in line with the rapid increase in the maritime trade both in EU and in Turkey. Although vocational Maritime Education and Training must be in compliance with IMO (International Maritime Organization) regulations/model courses in all countries, due to application differences, Turkish OOW licences are not recognized by EU countries. On the other hand, investigation of the maritime accidents which caused significant loss of lives and properties has shown that the main reason/causes of the maritime accidents is due to human errors, which in turn is due to lack of well-developed and well-assessed vocational MET (Safety On Sea. SOS, 2005-07). This problem has restricted the free movement of the maritime manpower due to stated standard differences. Education, training and certification of such an international profession should be at least to EU standards and recognized worldwide. TUDEV, in collaboration with her permanent partners, Centre for Factories of the Future (C4FF, England) and Glasgow College of Nautical Studies (GCNS, Scotland) has identified the differences through the former Leonardo Mobility project TRAIN4Cs and through the Leonardo Pilot Project Safety On Sea (SOS). The latter project, involving several EU and EFTA partner countries, developed a set of MET programmes which are fully compatible with those in the EU countries. This new proposal (TRAIN 4Cs II) is a follow-up of the former project and is intended to apply the findings of the TRAIN 4Cs and also those from the SOS project by developing an integrated mobility proposal. The proposal will give TUDEV cadets the opportunity to acquire qualifications which will be recognised throughout the EU and worldwide. The current partnership with GCNS and C4FF and new association with Plymouth University had led to this new proposal. The proposal will help to overcome the shortage of qualified officers in the maritime sector in Turkey and will provide the Turkish merchant navy cadet officers (OOW) with internationally recognised qualifications and through this recognition it will provide their free movement in the EU and in the world. In parallel the programmes have given the opportunity to TUDEV to verify that its programmes are accepted worldwide and that they satisfy the EU standards.

Some of the trainees from this project, as was the case with TRAIN 4Cs I, are expected to return to TUDEV and help to apply their newly founded knowledge and skills hence TUDEV MET programmes will be able to be kept up-to-date and abide by the EU standards enabling other EU countries particularly those joining or recently joined the EU to learn from TUDEV's experience through planned and expected dissemination arrangements such as SOS Final Report to EU [Ziarati, 2007] and UniMET proposal [Ziarati, 2010].

Similar practice may also become a worldwide application with the revision of the STCW which must encourage training of seafarers and especially of maritime officers in maritime education and training (MET) institutions, certified by the national maritime authorities and periodically assessed by international commissions for the worldwide recognition. Revision of the STCW must specify a minimum number of training hours (courses and practical applications) for each main category of competences, at least at operational level which requires a lot of updates taking into account the evolution of technologies in maritime transport in the recent years. After a major revision and update of the content of the existing IMO courses, they could be declared as a minimum standard of training for maritime officers. Such documents will also help the national maritime authorities in their tasks to standardize the quality of national MET system and to establish the content of the certification exams for their seafarers.

In the context of the 21st century and of the abundance of electronic navigation equipment, IMO, using the STCW regulations, must give a clear signal regarding reduction of theoretical knowledge in certain subjects such as celestial navigation. Such a message will provide guidance for national maritime authorities in establishing assessment requirements for instance, for the certificate of competency (CoC) exams.

MET institutions could not take the first step in reducing the hours allotted to the courses, because the national maritime authorities are afraid to eliminate from the certification examination the subjects involving deep theoretical knowledge. Scientific pocket calculators and even PC software must be accepted as practical means to get the results of many nautical calculations.

6. ADDITIONAL UNITS AND/OR SHORT COURSES FOR SMOOTH TRANSITION TO SPECIFIC SHORE DUTIES FOR CAREER PROGRESSION AS WELL AS FOR JOB DIVERSIFICATION

TUDEV's SOS project was designed to improve safety at sea through improved education and training. TUDEV has been running programmes of education and training for Deck Officers and Engineer Officers based on the IMO (International Maritime Organisation) syllabuses for some ten years. To improve the standard of its programmes, in 2003, the partner using the syllabuses developed by northern European countries revised its programmes and at the same time, applying cross-referencing techniques (EUROTECNET 37), also satisfied the requirements of a major international awarding body (Edexcel) for the award of a higher national diploma (HND). Graduates from these programmes can continue their education and enroll on the final year of appropriate degree programmes. This is important because many seafarers after a period at sea would like to settle down and work on shore, and the diploma would help them find good and permanent jobs. The development of the HNDs by the Contracting partner led to identification of deficiencies and ambiguities which have proven to have led to many safety lapses at sea. The comparison of the HNDs in Turkey and those in England and Scotland has clearly indicated several differences in content and method of applications. Through discussions and using cross-referencing methods an attempt has been made to bring the two sets of the HND programmes together. In doing so, with no disrespect to organisations involved with validation and accreditation of these programmes, it has been realized that there are serious differences in standards being applied, and even in the pathways chosen to satisfy the same awarding or even the same licensing body. Many examples of these differences and in some cases deficiencies have been highlighted in the body of this proposal.

With reference to the OECD report [OECD, 2003], those seafarer intending to come ashore to work finds that they need additional skill to adapt to the shore working environment and competency for the job requirement. The training received by seafarers in most country is still limited to the need of the marine environment and in most country training is on the seafarer own initiatives and expensive. Thus resulted they only acquired certain type of trainings that only related to the job concerned but no other soft skill such as business savvy, accounting and financial, communication and interpersonal skill (known as common Skills at TUDEV) and many skill that were not incorporated during their earlier involvement in the maritime sector. Most of those who came ashore have to learn on the job and risk losing out or some may just give-up and return to sea. This effect would later on discourage those who are intent to choose the sea as their career to shy away as there is not career alternative later in their lives.

The maritime sector is facing a lack of well trained maritime business managers. There exists significant new and rising demand for education and qualifications which enhance the innovation capacity within the sector so as to benefit from the predicted growth rates in the maritime transport sector. In future, maritime business managers need to be better prepared by possessing multidisciplinary knowledge and skills set to cope with growing maritime traffic, port development, and rising environmental challenges, all within an intermodal environment.

7. CONTINUOUS LEARNING AND E-LEARNING TO INCLUDE ON-LINE ASSESSMENT AND CERTIFICATION

The concept of continuous learning or lifelong learning has become quite prominent over the past five years. As mentioned above, core issues in maritime environment, especially on legal and environmental issues are changing rapidly. Therefore, it is difficult to find any approach to doing anything in organizations that doesn't soon become outdated. The concept of continuous learning has become important because it places priority on noticing, adapting and learning from change. On the other hand, rapidly increasing communication capabilities are alleviating use of internet almost from any point on the earth providing transfer of web based flexible learning material together with a certifiable test. This may allow cadets and officers to take some courses even when they are at sea. Outcomes of the ''Young Seafarer's Focus Group 2009'' which was submitted by INTERTANKO and ITF [IMO MSC,2009] also states importance of training as one of the main concerns of young seafarers in regards to computer-based training onboard.

TUDEV's all EU Projects were mainly focused on this issue with the aim of on-line assessment and certification. The first project-E-GMDSS was basically focused on provision of vocational education and continuing vocational training for Short Range Certificate (SRC) which is mandatory for seafarers operating vessels of up to 300 GRT

within 30 NM from coast. The target group were all mariners (there are more than 2 million of them in EU alone) that are either starting their nautical training or have to refresh their knowledge and skills at least once a year (so seafarers ranging from amateurs to professionals). The knowledge required for the SRC can be obtained through either self-training, nautical education institutions or internal training conducted at larger marine companies. To obtain the SRC award a candidate must be able to competently operate four different GMDSS communication devices (VHF DSC, Navtex, EPIRB and SART). These devices are only used for emergencies at sea which occur rarely. Therefore, the knowledge of operation of these devices tends to fade over time and should be regularly refreshed to ensure safety of crew, passengers and freight (even though this is not a legal requirement).

Future works aims to enlarge course content to the upper certificate levels such as ROC (Restricted Radio Operator), GOC (General Radio Operator) and REO (Radio Electronic Operator) and to become certified teaching and examination centre on behalf of national authorities. Since web site is available worldwide in other European Languages besides English, it will provide universal standards for maritime communications as well which is essential for the safety of all seafarers.

The other EU projects such as MarTEL, SURPASS and M'AIDER and EBDIG - are also focused on to develop web based applications for a wider dissemination. The success of the projects would lead to vocational qualifications in respective areas which are expected to be recognised Europe-wide. The standards and their associated study units will provide an opportunity for many companies' particularly smaller ones to become involved particularly taking advantage of learning materials and the intended e-learning and e-assessment facilities for self-learning and self-assessment. Impact is expected to be substantial as the projects respond to a European and international acknowledgment of the problems which these projects intend to address at source and through industrial lifelong learning.

8. CONCLUSIONS

The International standards for merchant navy education and training (MET) currently in place were introduced in 1995 [IMO STCW-95]. Since 1995, there has been rapid revolution in design of ships and the equipment used in the navigation and propulsion systems on board these ships. One very important development has been the introduction of automation in operating a ship. The modern ships particularly container and fuel carrying vessels are becoming increasingly automated. The automation has brought with it two problems, one concerning the inadequacy of existing seafarers' education and training viz., that if any aspects of automation fails the crew often are not trained to use alternative systems and hence respond to it effectively [IMO MSC 82, 2006; Ziarati, 2007]. The second problem has arisen from the review of the arguments from recent IMO Maritime Safety Committee (reports MSC 82/15/2 and MSC 82/15/3, 2006) namely that the human operators rarely understand all the characteristics of automatic systems and these systems' weaknesses and limitations which have now been found to be the main causes of accidents. These reports concluded that there is a need to improve the content of all maritime training and that the knowledge, skills and understanding of automation should be included in the basic training of all Chapters of the STCW Code of practice and hence address this very serious issue at source. Furthermore, to address the second problem, it is considered feasible to gather the knowledge for inclusion in the existing seafarer's education and training in a short course format that can be easily introduced for existing seafarers and hence enabling the seamen currently working at sea and in ports to develop the competence to handle and respond to automation failures.

In the context of onboard and simulation based familiarisation and skill enhancement to improve the performance of seagoing crew, short course programmes built over a well balanced MET Curricula seem to be the most effective model to update knowledge and skills of the seafarers. Skill enhancement programs must focus around training that combines the best practices from education, psychology, social environment, career counselling and technological training. Situational awareness, which is one of the main aspects of the onboard problems, can easily be achieved through cognitive and behaviour problem solving approaches.

SURPASS Project [Ziarati, 2009] concludes there has been a shift from component based training to system-based training and the focus is on team operation viz., bringing the bridge team to work effectively as a team and in turn making sure that the Engine personnel and Deck crew work in harmony particularly in emergency situations [M'AIDER, 2009-11]. The latter consideration is as important today and it has been in the past. Organizational skills such as problem solving, assertiveness, time management, relaxation responses, and stress management are essential for better functioning of any organization and situational awareness. This should be taken into consideration in classroom and/or simulator based training programs. Besides simulator based training, the e-learning and e-assessment tools and internet software interfaces developed by TUDEV and its partners [MarTEL, 2007-09 and EGMDSS 2006-08] already available should be adapted for application in delivery of the intended

course/modules and as a self-learning/assessment tool for a wider usage.

Designed courses should be also available to industry to ensure companies in the sector, particularly ship operators and ship builders are aware of the recent developments in the maritime environment. It will enhance the governance and attractiveness of VET systems through increased cooperation with social partners and all relevant stakeholders by facilitating the participation of companies and SMEs. It is in this respect, the courses should also address to improve the quality and to increase the volume of co-operation between institutions, enterprises, social partners and other relevant bodies. This aim is to make the companies more competitive and reduce loss of life and personal injuries as well as substantially reduce the cost of accidents and incidents due to lack of knowledge and skills in the relevant areas. The courses can also be used by ship crews who are already serving on board vessels for some time and pilots at ports, as an up-dating programme of personnel or self development. Furthermore, many employees and individuals will be able to enhance their skills and competence and hence become more employable and participate in the labour market. The skills and competence again could help individuals to become more mobile and seek better paid jobs or work in other flag states.

Education and training of seafarers is still a very complex issue when compared to other disciplines, which requires various considerations to be taken into account for a well balanced MET programme. Therefore, practical training onboard and in the simulators cannot be thought alone for skill enhancement when compared to human performance enhancement in extreme environments such as aviation. Although simulators and sea training onboard a ship plays a very key role for practicality-oriented navigational education, a well developed MET programme must include theoretical and practical education and training in a well-balanced curriculum and must ensure there are well-designed and internationally recognized programmes of education and training leading to higher qualifications and certifications for career progression as well as for job diversification. There is therefore a need for clear education and training pathways recognized internationally with clear progression routes onto degree and higher qualifications in the related subjects.

TUDEV has achieved a great deal in receiving recognition for its Merchant Navy Education and Training programmes for both deck and marine engineering officer and senior officers by balancing these requirements through the Leonardo Safety on Sea (SOS) and Maritime Test of English Language (MarTEL) Projects. TUDEV programmes were jointly developed with the Institution of Marine Engineering, Science and Technology (IMarEST) with support from the MCA (Maritime Coastguard Agency). The SOS project also helped TUDEV to become involved with other National and European projects. There are now over 30 major centres working with TUDEV supporting various European Projects.

The vision of TUDEV is not only to support the maritime industry in Europe but also look into the future and make an attempt to identify the trends and prepare the industry. TUDEV's training and education philosophy is primarily based on skills and competence preparing the young people not for the past but for the future through self studies, student centred activities, group and individual assignments and a series of other skills essential for a well rounded and confident person.

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