Proceedings of
The 9th Annual General Assembly
International Association of Maritime Universities
San Francisco, California USA
October 19-22, 2008

Common Seas, Common Shores: The New Maritime Community



Editors:
Dr. Donna Nincic and Dr. Graham Benton
The California Maritime Academy

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The New Maritime Community

On behalf of the California Maritime Academy and the Nippon Foundation, it is a great honor and privilege to welcome you to the 9th Annual General Assembly (AGA 9) of the International Association of Maritime Universities (IAMU) in San Francisco, California.

Remembering Dr. Sasakawa's speech to AGA 7 at Dalian Maritime University where he called for a "comprehensive education about the sea," the theme of AGA 9 is ***Common Seas, Common Shores: The New Maritime Community.***

Our meeting takes place at an important time for IAMU and the global maritime community; the IAMU has received NGO status in the IMO and is in a unique position to guide the review of the STCW convention and code. Additionally, in light of Dr. Sasakawa's opening remarks at AGA 7, the world is truly becoming one, with common problems and solutions in the realm of maritime education, policy, environment, and business and law uniting all of us.

With thirty-three papers being presented at the 9th Annual General Assembly of the IAMU, we look forward to informative and innovative discussions with all our maritime colleagues, and hope that our mutual collaborations will continue to shape global maritime education and policy.

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New approach for safety and security training in simulators

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Abstract

Simulators have proved beneficial for ship handling training in real time on well equipped bridges during the last decades. Since last year a new type of simulator is available for training specific aspects of Maritime Safety and Security and can be used both as a standalone version as well as part of a full mission bridge simulator. Wismar University has been involved in the conceptual design and development of this new product made by Rheinmetall Defence Electronics (RDE) in Bremen, and which was successfully introduced into maritime education and training for both student lectures and further training for shipping manpower. In this paper the concept for the "Safety and Security Trainer" (SST) is described and the principle layout introduced. A Situation monitor displays scenario and information available to the trainee and an Action monitor displays operational and information elements from a trainee perspective. Each trainee guides a "Strategic Figure" to be moved throughout the ship's decks and compartments, using all the equipment for emergency handling and making simultaneous management decisions. Visualisation of fire, water, smoke, etc. is dramatised on screen plus specific information on the status of ship situation. A set of ship documents in paper format, such as fire plans and ISM procedure documents, complements the entire training environment.

Special features e.g., for training in fire fighting skills and water inrush manoeuvres are explained. Samples of training scenarios are used to give an overview of the benefits of the appropriate simulation-based safety & security training method. Assessment sessions after the training units have shown the simulation methods and the training exercises are highly appreciated.

As a result it can be concluded that some parts of the safety and security training can be done more efficiently and in more depth than before, particularly the management and strategic related part of emergency handling exercises.

Introduction

The situation in the shipping world with regard to emergency preparedness is affected by the following elements:

- Abilities and experiences in case of "disturbed" operation of systems are reduced or simply not existing
- Multilingual Crews cause specific problems in the event of an emergency situation
- Reduction of crew members causes lack of available personnel
- Complexity of emergency equipment is permanently increasing, but training in emergency handling is not following this development
- New management systems and regulations of the IMO (ISM/ISPS) are demanding new methods and technology for emergency training.

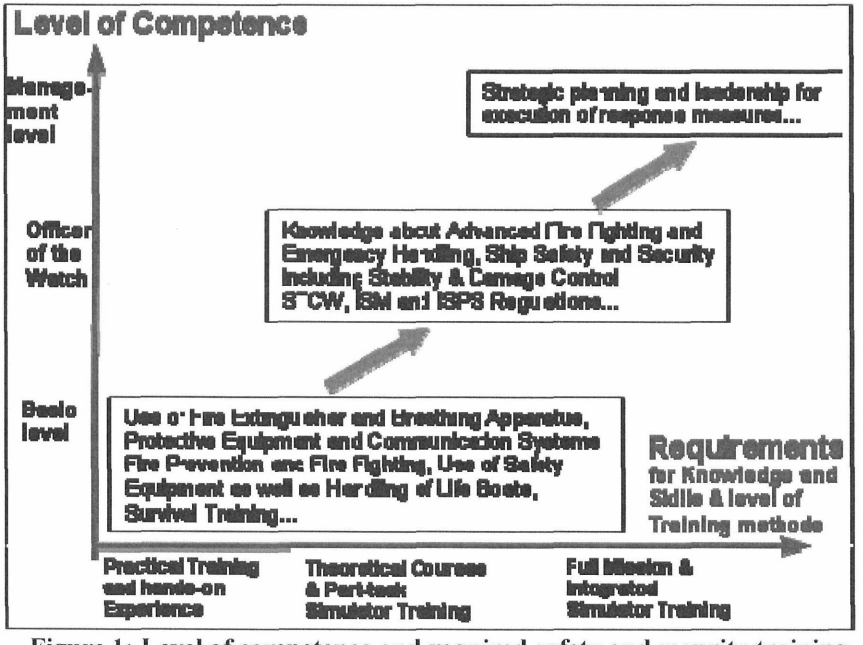

Figure 1: Level of competence and required safety and security training

According to the demand for increased level of training along with the requirements for higher competency levels, the simulator equipment at the Dept. of Maritime Studies of Hochschule Wismar was extended; adding to the existing Maritime Simulation Centre Warnemunde (http://www.sf.hs-wismar.de/mscw/) which comprises already:

- a Ship Handling Simulator SHS with for 4 Full Mission bridges and 8 Part Task Bridges,
- an Ship Engine Simulator SES with 12 Part Task station and
- a Vessel Traffic Services Simulator VTSS with 9 operator consoles

A new simulator was implemented as Safety and Security Trainer SST specifically to be used for stand alone and for integrated training with the SHS. Together with the full set up of training material, including all ships safety plans, it was introduced as the first unique comprehensive Training and Education Concept "mars^{2}" for Maritime Safety and Security including an innovative Simulation System.

In the following sections this new simulator will be described together with some elements of new developments which were designed in a student's diploma thesis at our department and implemented with the support of the manufacturer Rheinmetall Defence Electronics Bremen.

Finally some scenarios will be discussed to show samples of practical application of that simulator.

Safety and Security Trainer (SST)

2.1 Workplace Concept

Presently a new Safety and Security Trainer (SST) has been tested at the MSCW and is now available for both for student lectures and courses for shipping companies' manpower. The innovation of this most efficient simulator in the design of 2D-presentation supports specifically the management level. Additionally a 3D-version has been developed and will be implemented for training on operational level of emergency handling exercises.

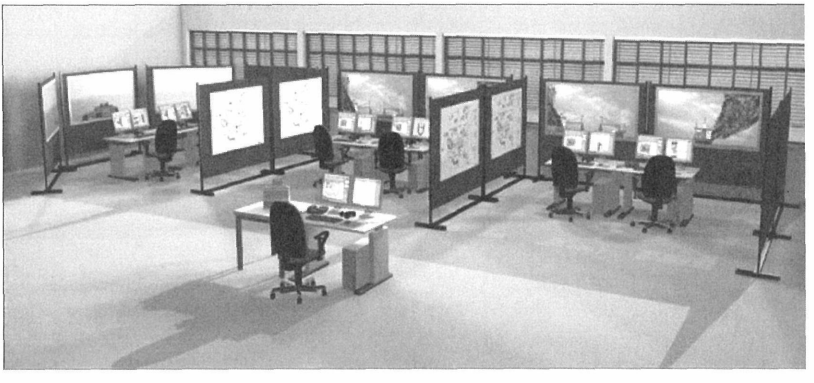

Figure 2 : 1 Instructor and 2 to 16 stations for training with the SST 7 simulator

Each station consists of two monitors. One screen is called **Situation Monitor** and the other is named **Action Monitor.** The workplace comprises the

instructor console and two to sixteen stations, providing full equipment for comprehensive safety and security training (Figure 2).

2.2 Working concept for the situation- and action monitor

A bird's eye view of one deck inside the simulated ship is mainly shown on the situation monitor. A person simulating a member of the crew can be moved through the rooms in the deck. Positioning the figure on specific IMO symbols, the related safety equipment is indicated as a generic panel on the action Monitor. All interaction done at such panels is done at the action monitor. If the "Strategic Figure" is not located on symbols representing safety equipment, the action monitor shows the ship safety plan of the appropriate deck.

In Figure 3 the main desktop displays an overview about one deck. Only rooms are shown which are viewable from the actual position of the simulated person assigned to the situation monitor. The menu bar provides access to other windows. It is possible to create new exercises and store replays. Also, malfunctions, fire, water inrush, and criteria for the incorporated assessment can be set. The actual ship status as indicated by draught, trim and list angle is shown. The name of selected person, health index and moving type (standing, kneeing, lying) is shown in the figure status display, also the kind of protective clothes worn by the figure. A single mouse click on the selected person – Captain, for example -- can be moved normally or quickly to any other position and to the IMO symbols, in which case the action monitor will show the related operable switch gear or the emergency equipment according to the Ship Safety Plan (Figure 4) provided for the trainee in a drawing beside the simulator.

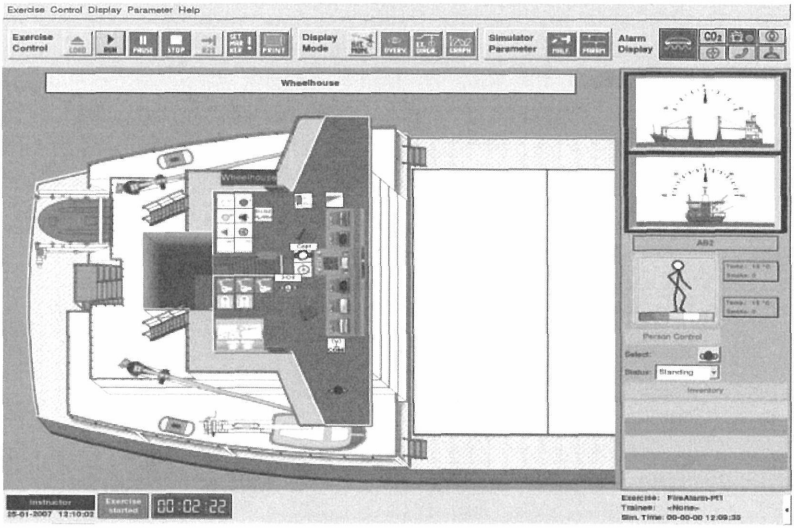

Figure 3: Situation Monitor

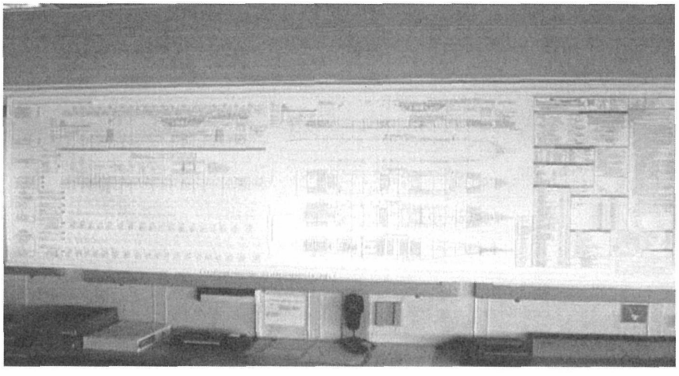

Figure 4: Ship safety plan for the complete mars system

Fire fighting system and fire fighting equipment

Most of the actions performed by the trainees with the safety equipment are performed at the action monitor. A fire model optimised visually and given noticeable effects for human beings is incorporated into the mars simulator. A modern fire alarm management system with smoke detectors and manual calling points is built into the ship. Rooms with easily flammable materials are protected by fire resistant A60 walls and doors. The fire model including smoke visualisation and the fire fighting system and equipment such as fire extinguishers, water hoses and hydrants, CO2 systems and foam, enables the

trainee to simulate a realistic fire fighting arrangement on board and interact with supporting teams and the management team on bridge and engine room. During the simulation, the strategic figure's health condition is monitored in relation to oxygen, smoke, temperature and other health influencing parameters and the measurements are monitored in diagrams. In case the figure's health is impaired his movement becomes slower. Finally the system indicates the person's exit.

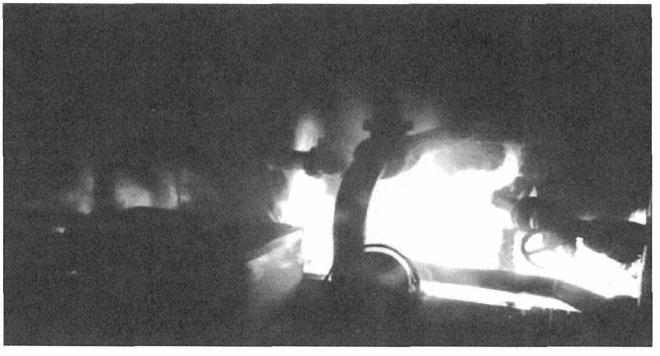

Figure 5: Fire Model on board

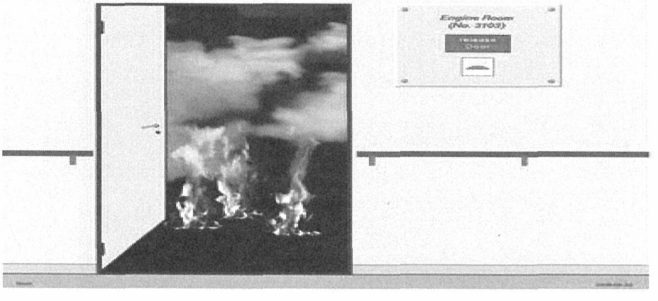

Figure 6: 2D-präsentation on the monitor

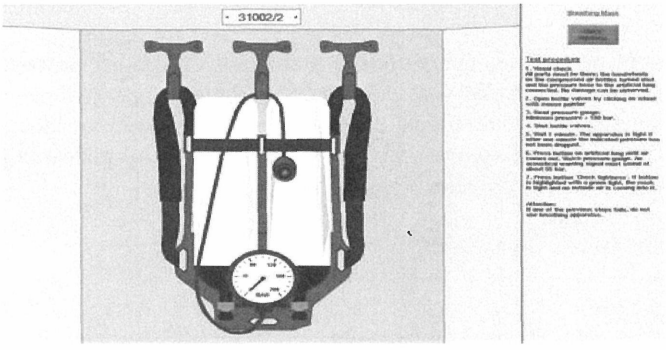

Figure 7: Breathing apparatus

Figure 5 shows a fire model on board, Figure 6 shows the presentation of fire and smoke on the monitor after opening the door of the affected area.

Also the emergency equipment is presented to the trainee on the action monitor, when the strategic figure is moved to the IMO symbol. The operation of the breathing apparatus works in the following way:
Check test instructions – visual check (no damage to be observed), open bottle valves with the mouse pointer on the wheel. The pressure should not be lower than 180 bar. Shut bottle wave, wait 1 minute. Press button of the artificial lung until air comes out. Acoustical warning signal at 55 bar. Check tightness of the mask. By activating "malfunction" the instructor can change the bottle condition, so the trainee must decide if he can use the bottle without danger. Also the instructor can refill the bottle for further use.

All emergency fire fighting equipment on board including heat protective cloth, extinguishers, fire dampers, water system and other ship safety equipment can be operated by trainees simultaneously during the simulation on the action monitor.

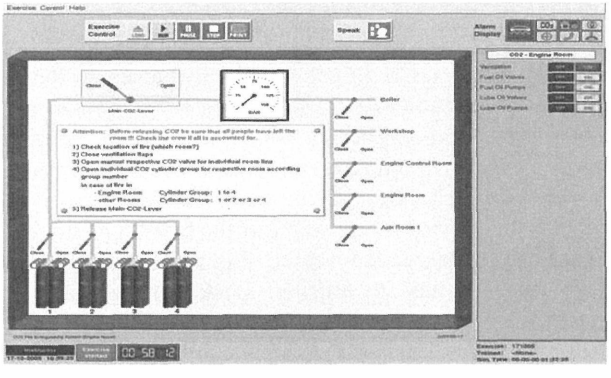

Figure 8: CO2 – operation panel for engine room

The engine room, emergency generator room and cargo holds are protected by carbon dioxide fire extinguishing system. The CO2 system is operated from a panel outside the related area. One minute after generating the alarm for leaving the area it is first time possible to open the lever of the bottles by mouse click activation. The alarm is shown graphically and acoustically.

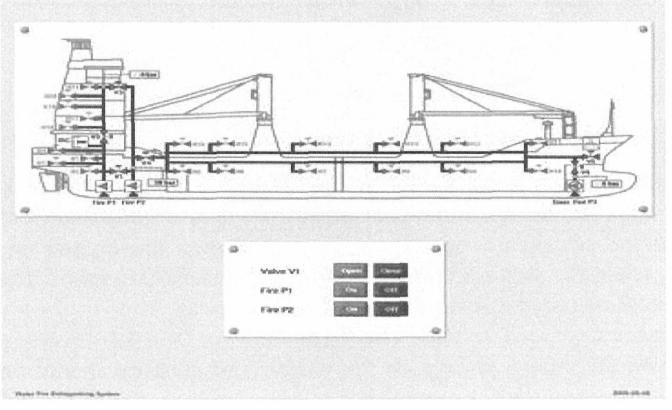

Figure 9: Overview of the water extinguishing system

A complete fire extinguishing system with water is modelled by the mars simulator. It consists of two fire pumps localised in the engine room, one emergency fire pump in the forecastle, pipes, fire hydrants, fire hoses and valves to bring the water to the area of casualty. A foam generation instrument can be added to the spray nozzle at the beginning of the hose. Water inside the ship which is not properly dealt with by the bilge pumps influences the stability of the vessel.

Water inrush system

A model calculating water inrush and its influence to the stability of the ship is part of the mars simulation. A ballast system can be used to stabilize the ship in an emergency case. The stability calculator is used to predict the consequences of a leak after collision or broken pipes. The water level in several areas can be measured. The trainee can locate the leak; determine its size and position related to the surface of the water or the bottom of the keel. Water tight doors are built into the modelled vessel. Figure 10 and Figure 11 show the ballast system and stability measuring system an enable the trainee for countermeasures.

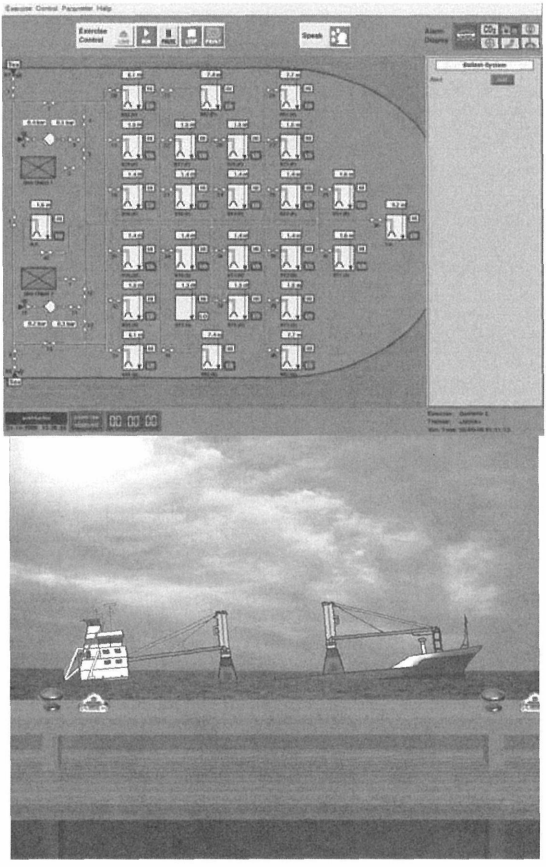

Figure 10: Ballast system for stabilization

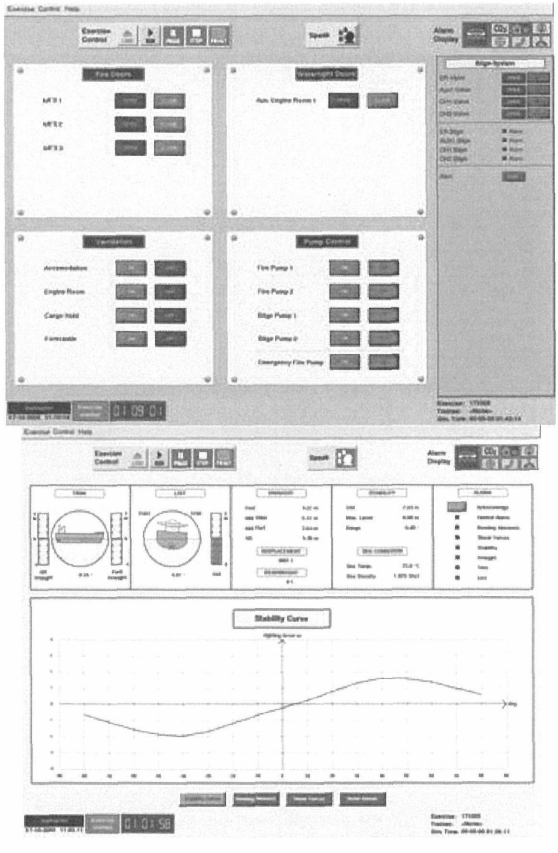

Figure 11: Fire- and bilge pump panel and stability calculator

The estimated amount of water flooding a room can be inserted into the trim and stability calculator. Taking into account the current load status of the ship and the permeability of the related room, a draught, trim and heel angle is calculated. The same is valid for the stability curve, bending moment and shear forces. The ship will have the predicted value, if the estimated mass of water floods the room for real. With information about the future development of the stability, the countermeasures can be taken into account and the bilge pumps and/or ballast system can be activated. In an emergency, the Master can give the command to abandon the ship. In this case the trainees have to follow the procedures for the life boat handling and leaving the vessel. All procedures are available for training at the mars simulator.

Innovation with the 3D-modelling at the MSCW

The most interesting innovation at the MSCW – apart from new investment in the technical upgrade of the system of the SHS, which again marks the MSCW as the chief simulation institute in Europe – was the recent innovation of a 3D- designed passenger vessel for the SST. AIDA CRUISES (one of our cooperating partners) developed the ship plans of the AIDA VITA for a spectacular 3D- visualisation of the vessel. Some decks are already available in the 3D-version, including the bridge and some passenger decks.



Figure 12: AIDA VITA

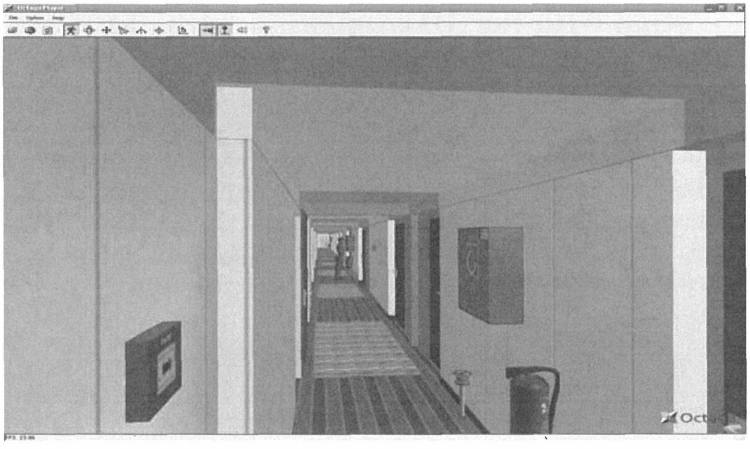

Figure 13: 3D- designed passenger deck of AIDA VITA

For a photo of the vessel and the designed passenger deck see Figure 12 and Figure 13. The inside deck illustrates the fire alarm equipment and all available equipment on the corridors and in the cabins for fire fighting. The 3D-visualisation is presently designed for to train for help with fire casualties including fire fighting (see also Figure 14) but will be supplemented to cover other danger issues, i.e. collision, water inrush, stability and ISPS alerts. Both systems, the 2D- simulation explained above in chapter 0 and the 3D-simulation, provide a complex simulation training at management level for officers and also for training at operational level inside the vessel. The crew can be trained in handling the fire fighting equipment as well as handling the collective or individual survival equipment and are thus not limited to "dry training" units as performed in weekly or monthly exercises on board the vessel. Instead they are a most sufficient way and simulating all real dangers on board and consequences involved and arising from any errors in handling.



Figure 14: 3D- visualisation of fire in a passenger cabin

Method of combined training at the MSCW with SHS – and SST – simulator

The sophistication of simulation at the MSCW has entered a new generation. Until now the training at the full mission ship handling simulator (SHS), ship engine simulator (SES) as well as the ashore based traffic simulator (VTS) embraced a network targeting ship handling and nautical and technical management on board. All systems can be combined for complex on board training and with the VTS including a ship control system from ashore. The innovation and integration of the safety and security trainer, until now considered as a useful but separate tool for training in safety and security matters, will enable the trainee to confront the entire system ship with complex scenarios and in addition to being faced with navigational and technical issues, forced to "dive inside the vessel". Now the target is to combine all simulation systems to reflect the issues which determine the reality on and around the ship. A new quality of scenarios can and has to be generated in the future for comprehensive and adequate training for ship officers. The following example will indicate the ability of training in the future.

4.1 Scenario at the SHS and SST with 2D- and 3D- designed vessel

The passenger vessel AIDA VITA, berthed at the passenger terminal Warnemünde, has embarked all passengers and is ready for sailing. Searching for stowaways completed (SST), the immigration and custom officials as well as the visitors have left the vessel, the bridge is prepared, the engines and mooring gang standby. The Master is in contact with Traffic Control (SHS) and receives

advice regarding the traffic situation. The container vessel MAERSK has entered the harbour and has to pass first. Also the frigate NIEDERSACHSEN just entering the port has to pass as second ship before AIDA can sail (see Figure 15).

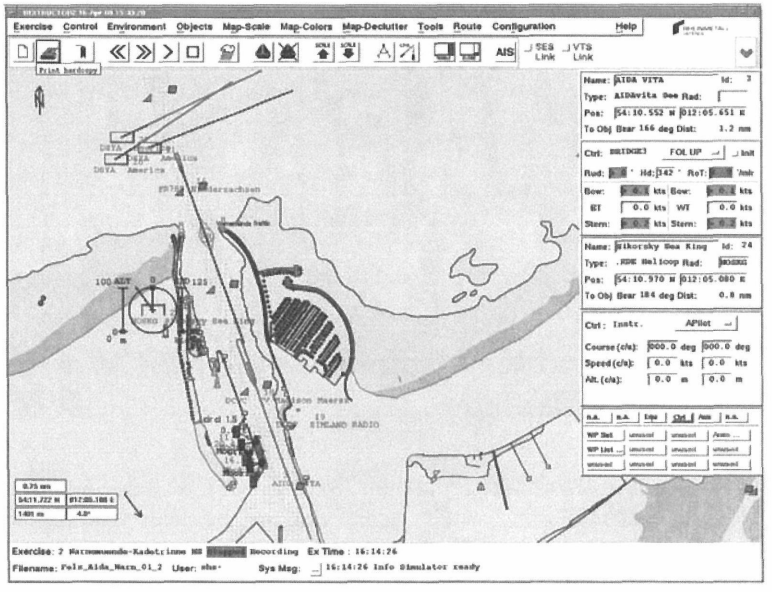

Figure 15: Traffic situation before departing Warnemünde

Four groups of trainees are working at the SHS, SES, VTS and SST simulators. The bridge management team is present on bridge (SHS), the engineers are in the engine control room (SES), the Warnemünde Traffic Control team is handling the traffic from ashore (SES), and the crew--together with the ship safety and security officer (instructor)—are handling the SST at different locations on board (instructor and for trainee stations). For example, the group at the SST has searched the vessel for stowaways.

UTC 16:35 – the two inbound vessels have safely passed the passenger terminal. VTS has granted departure to AIDA VITA. Engines are running – pitch zero. Master gives instruction for single up one and one. UTC 16:40 – vessel singled up. Master gives order to let go all lines. UTC 16:43 – all lines are on deck. Vessel departs without tugs and manoeuvring with bow thruster and two engines (pitch propeller). 16:55 AIDA VITA passed breakwater.

All groups are involved at the simulators. Four instructors and co-instructors are managing the control and observation from the instructor places.

The following scenario describes thirty minutes later, after departure (AIDA VITA is outside the port but still in the fairway channel).

UTC 17:30 – the Master has initiated the safety routine manoeuvring and called all passengers to the assembling stations. UTC 17:40 All passengers arrived at the assembling stations.

UTC 17:42 – call from engine control room. Chief Eng. reports to Master a leaking fuel pipe and gives advice to reduce speed to slow ahead. Also the SST group (2nd Eng. and Oiler) is involved in repair works in engine room – location tank top.

UTC 17:45 – fire alarm on bridge indicates fire in engine room. From now on all actions are coordinated quickly and efficiently. At the SHS alarm located, speed reduced and passengers informed by Master to wait on the assembling stations (SHS). Fire pumps activated by safety officer at the SST (2D), also the fire doors are closed simultaneously. The fire fighting team (i.e. 2nd Eng., Oiler) advised by safety officer to collect fire fighting equipment and to proceed to tank top deck with breathing apparatus and foam. Duty officer informs VTS about casualty. VTS transfer message to the traffic vessels. Only five minutes later the fire was successfully extinguished by crew (SST). The training at the SST was performed in 2D- and partly in 3D- visualisation (see Figure 14, Figure 16, Figure 17).

The effective simulation at 4 simulators completed at UTC 18:00. Debriefing with all groups and instructors includes the replay of sequences SHS, SES, VTS, SST – completed at 18:30.

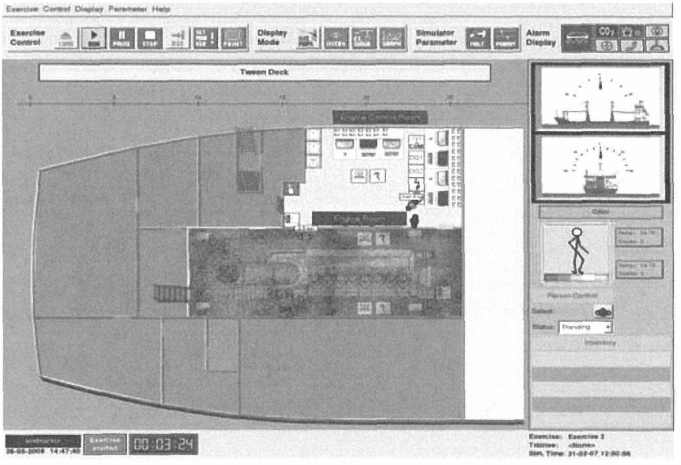

Figure 16 SST – fire in engine room

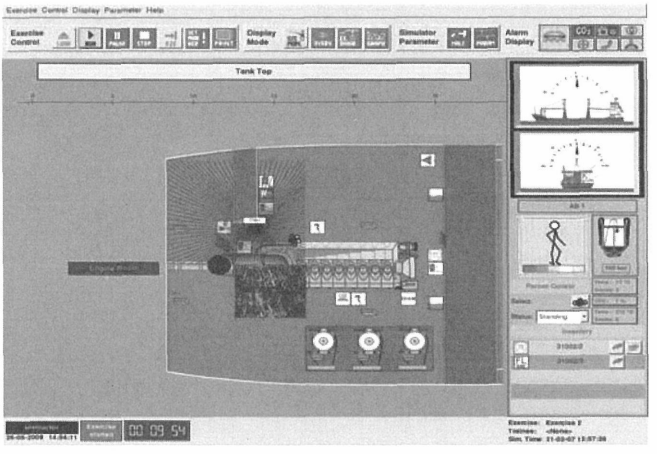

Figure 17 SST – fire fighting by crew with foam

Summary and conclusions / Acknowledgements

The Safety and Security Trainer (SST), which can be used in the same scenario optional in 2D- and 3D-version, is a new product developed by Rheinmetall Defence Electronics (RDE) Bremen in corporation with the Maritime Simulation Centre Warnemünde (MSCW) at Wismar University, Department of Maritime Studies in Rostock-Warnemünde. It can be used as a standalone version for up to sixteen training stations and would be extendable according to the product system for training of an entire ship's crew. The SST has been integrated at the MSCW for training comprehensive scenarios in combination with the SHS, SES und VTS. The complex simulation platform with four full mission simulators enables the trainees to simulate the entire system ship and challenges to officers and crew.

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The authors would like to thank Rheinmetall Defence GmbH and AIDA Cruises Ltd for their grateful assistance and cooperation in realising the training scenarios.

References

[1] Meyer, V.; Benedict, K.: Maritime safety and security environment mars - a unique way to make Ship operation safer. Paper at IMSF Conference 2007, August 20 – 24 2007 Busan / Korea

[2] Benedict, K. Integrated Operation of Bridge-, Engine Room- and VTS-Simulators in the Maritime Simulation Centre Warnemuende. Conference on Simulation CAORF / JSACC 2000, New York, 3-7 July 2000, Proceedings Vol. 1.

[3] Sauer, T.: Contribution to Improvement of Safety & Security Trainer by user friendly Modelleing of ships using Cruise Liner AIDAdiva. Diploma Thesis at Dept. of Maritime Studies of Hochschule Wismar, June 2008

Crossroads community: strengthening the Maritime Academy through library scholarship, tradition, service and access.

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Abstract

The principles of *scholarship, tradition, service* and *access* have historically dominated the forefront of academic library operations. The study "Crossroads Community: Strengthening the Maritime Academy through Library Scholarship, Tradition, Service and Access", demonstrates how the Stephen B. Luce Library of SUNY Maritime College applies these principles to cultivate successful partnerships across the maritime community. Departing from the old metaphor, "*the Library, the Heart of the University*" and by adopting a new metaphor "*Crossroads Community*" the Stephen B. Luce library study serves as a model for incorporating the operational definitions of library centrality across the maritime academic community and the maritime industry. Therefore, the four principles of library centrality: *scholarship, tradition, service* and *access*, serve as a compass for the systematic integration of partnerships with students, teaching faculty, the college governance system, the office of admissions, alumni, the maritime industry, local communities, local government and the State University of New York of which Maritime College is a part. Furthermore, the study demonstrates that successful implementation of academic library centrality strengthens the entire maritime community and in the process enhances the mission of the institution.

1 Introduction

For decades libraries stood supreme as cultural icons of the academic community with an historic mission to provide a learning space that inspired interaction with books, ideas and people. Universities endowed the libraries with the noblest buildings, centrally located in the heart of the campus. Inspired by architectural designs, the buildings fostered knowledge; added mystique to the collections and prestige to the academy. The librarians provided authoritative information and collection development lay at the heart of the library's primary purpose. Faculty and students learned to associate the library with its physical collections. Students used the library as a study hall and as venue for accessing their course materials. Occasionally, library users would ask

basic questions that sometimes led to teachable moments which gave birth to the instructional role of the academic library. The "*library was the heart of the university*"; that was the metaphor which guided the role and the traditions of academic libraries for many years.

SUNY Maritime College is one of the 64 colleges and universities of the State University of New York system. A four-year college located at historic Fort Schuyler in Throggs Neck, New York, it offers a solid academic program coupled with a structured cadet life in the regiment for both men and women. SUNY Maritime College prepares students for careers through a content-centered curricula and a hands-on, team building approach to learning. Maritime offers undergraduate and graduate degrees, 23 varsity athletic teams, summer training cruises to Europe, United States Coast Guard license and intern programs (SUNY Maritime College Website 2008).

The Stephen B. Luce Library of SUNY Maritime College is accredited by professional organizations such as the Middle State Commission on Higher Education and it adheres to the standards and guidelines of the Association of the College and Research Libraries of the American Library Association (American Library Association 2008). The Luce Library is the oldest academic maritime library serving the community of the oldest maritime academy in the United States, -SUNY Maritime College - founded in 1874. The Library's collections and resources support the research requirements of the maritime disciplines in engineering, science and the humanities.

2 Building a Framework for Academic Library Centrality

The concept of centrality is used by academic units to determine their relevance and the degree to which they contribute to the mission of their institution (Grimes 1998). In many institutions, collaborations and partnerships among different departments, not only enhances the mission of the institution but it also contributes to the success in achieving individual department goals. The concept of "centrality" was further developed by the neoclassical school of organization theory. The neoclassical school of organization theory also promoted the idea that successful organizations do not have "one best way" of achieving their goals and objectives. The constant change is a result of environmental influences which can affect organizational processes, priorities and structure (Grimes 1998). Therefore, "one best way' of achieving goals and objectives is not always the most effective way.

Although the "*the library, the heart of the university*" guided the role of the academic libraries for many decades, in reality the role of the library within the academic organization is far from what the metaphor seems to suggest. Anne Woodsworth states that "competition for funds [on university campuses] has intensified to the point that what was once a universal good (the library) is now perceived as just one more support service that must cost less and produce more ..." (Woodsworth 1989). The metaphor "*the library is the heart of the*

university" is often a misleading interpretation of the real relationships between the library and the academic community (Grimes 1998). Ironically, the old metaphor "*the library the heart of the university*" became less effective for academic library administrators who constantly negotiate and navigate the library's position within the new academic framework. Therefore, it became necessary for library administrators to move away from the sentimental stereotypes in order to redefine the library's organizational relationships within the academic community.

In order to promote a more realistic understanding of the academic library's role within the academic community, it became necessary for the Stephen B. Luce Library to make a considerable effort to abandon the old sentimental metaphor, "*the library the heart of the university*". The departure from the old metaphor and the transition required a considerable effort, of "change of thought", and "change of culture". Transitioning the library organization also required the Luce Library universally to adopt the four principles of library centrality: *scholarship, tradition, service* and *access* at all levels of the library's organizational operations. Subsequently, the four definitions, *scholarship, tradition, service* and *access* became the operational structure and the backbone of the Luce Library organization.

3 "Crossroads Community" – the premise

In October 2005, the Stephen B. Luce Library had the opportunity to present its vision and strategic direction to the SUNY Maritime College Council. The SUNY Maritime College Council is an external board of practitioners and educators from the maritime industry and education; the college council serves as an advisory board to the SUNY Maritime College's leadership. The Luce Library presented its strategic direction through a document titled "*Beyond the Library Stacks*" (2005). "*Beyond the Library Stacks*" demonstrated the role of the Stephen B. Luce librarians as educators, researchers, collection specialists, curators, technology specialists, student-advisors and members of the faculty. The report also presented numerical data regarding the library's statistics on operations, usage and instruction. More importantly, the report "*Beyond the Library Stacks*" outlined the vision and position of the library as it relates to the maritime academy and the maritime community at large.

The premise of the "*Beyond the Library Stacks*" report was to present the Stephen B. Luce Library's new organizational identity. The library's new organizational identity also introduced a new metaphor and a new concept: "*Crossroads Community*". The metaphor "*Crossroads Community*" was first used in Deborah Grimes' book "Academic Library Centrality" (Grimes 1998). The term "crossroads" is defined as the place where people congregate, discussions are conversed, activities take place and decisions are made. The term "community" implies a unity of connections, services, people, and resources. According to *Oxford English Dictionary,* community is "a body of

people organized in a municipal or social unity". This is a most appropriate definition for a dynamic organization, such as the Luce Library, which is associated with such a strong maritime community with common historical, cultural heritage and rich traditions.

3.1 "Crossroads Community" – the practice

Organizational theories are at best implemented when the members of the organization associate principles and abstract concepts with their visible and tangible surroundings. Using symbolism to represent organizational ideas often becomes a motivation and an inspiration. "Symbols embody and express an organization's culture – the interwoven pattern of beliefs, values, practices and artifacts that define for members who they are and how they are to do things. Culture is both a product and a process." (Bolman, Lee G. and Terrence E. Deal 1997 p.219).

The task of building a framework around the four principles of library centrality – *scholarship, tradition, service* and *access* – and the subsequent task of adopting and implementing the new metaphor "*crossroads community,*" raised the need for an organizational inspiration; a host that would encapsulate the essence of the above principles and the new metaphor of the "*crossroads community*".

Keeping in mind Bolman's theory of organizational symbolism, the Luce Library searched for symbols that embodied and expressed its organizational culture. The object was quickly identified as an architectural design in the center of the Stephen B. Luce Library building. This architectural element is one of a Compass Rose. It marks the center of the north side of a massive granite structure, Fort Schuyler, that houses the library wing. This beautifully designed compass rose was constructed during the Work Progress Administration (WPA) project at the time when Fort Schuyler was restored as the New York State Maritime Academy in 1934 (presently known as SUNY Maritime College). More importantly this compass rose was constructed by the grandfather of a SUNY Maritime College graduate. The compass rose and its four cardinal points North, South, East and West became the inspiration of the ideas developed and presented in the "*Beyond the Library Stacks*" report [figure 1]. The four principles of library centrality *(scholarship, tradition, service and access)* became the four cardinal points for the systematic integration of partnerships with students, faculty, college governance, the office of admissions, alumni, the maritime industry, local communities, local government, and the State University System of New York.

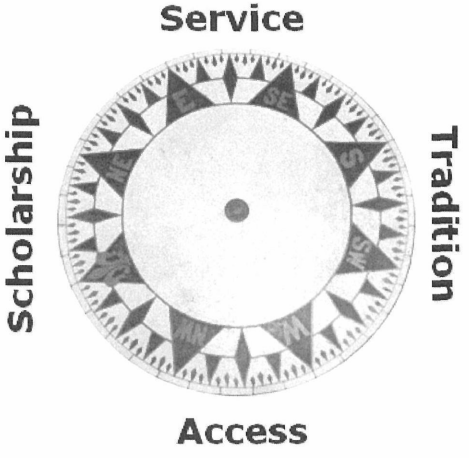

Figure 1

Reflecting on the Stephen B. Luce Library mission statement and shared institutional vision, the library was able to identify its community. Students, teaching faculty and staff, the summer sea term shipboard community (students, faculty, staff), the local district community, college governance system, the office of admissions, alumni, the maritime industry, scholars and researchers, local government and the State University of New York [figure 2] became the Library's *"crossroads community"*. Like the cardinal points of the compass rose, the Luce Library pointed its resources and services in all directions to empower the community with the four principles of library centrality (*scholarship, tradition, service* and *access).* For each member of the *"crossroads community"* the library set forth a strategic plan to promote *scholarship, tradition, service* and *access* in a way that best serves the community.

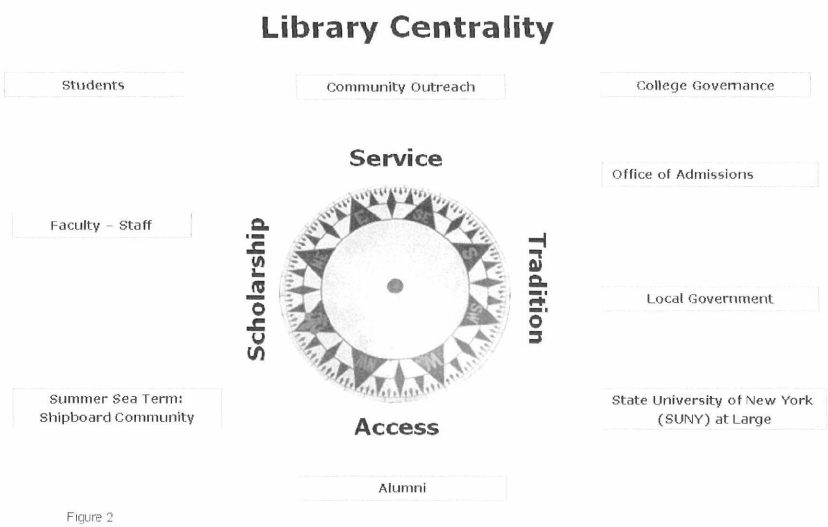

Figure 2

4 Empowering the Crossroads Community with Scholarship, Tradition, Service and Access

In the early 1990's digital technology entered the world of libraries and set forth a revolution not only in the way libraries store and transmit the recorded knowledge but also in the way people communicate and in the way they seek to gain access to information. The library space began to change to accommodate the delivery and access of digital resources, but more importantly, the librarians understood the implications of the digital learning space, and have reshaped the library to accommodate this new style of learning. The Digital Age also introduced a major shift in library instruction and pedagogy. The approach of academic library instruction has shifted from transmitting knowledge to emphasizing construction of understanding. The Digital Age, the Internet and access to scholarly resources made it impossible for library educators to transmit and teach universal knowledge. Instead, librarians developed pedagogical approaches that enabled the library community to use critical thinking and construct their own understanding of universal knowledge.

The Luce Library provides access to the maritime community from the library's physical space and virtually from any part of the world. The library's collections encompass a well-rounded maritime collection of approximately 90,000 print volumes. The collection presents special strength in marine engineering, naval architecture, marine transportation, oceanography, transportation economics and management, and meteorology.

The library subscribes to specialized print maritime magazines and journals. It also contains special collections such the vertical files known as the *Marifiles* comprised with loose-leaf information on the maritime industry, and the *Technical Reports* of approximately 4,000 recent maritime-oriented research reports in paper and microfiche format, with emphasis on research cited in Government Reports Announcements (GRA) and the NTIS Selected Research in Microfiche (SRIM). The *Maritime History* collection is a collection of classic texts on nautical education and historical treatises on marine engineering, marine transportation, maritime labor, the merchant marine and naval architecture. The Luce Library is also a *Government Depository* library, with a selective scope in maritime related documents; items received include nautical charts, sailing directions, and US Coast Guard and MARAD (Maritime Administration) publications. *The Ship's Library* is a selective collection of some 3,000 print volumes, and supports the college's Summer Sea Term academic program during the annual training cruise of the T.S. EMPIRE STATE VI. The Luce Library is known for its impressive *Archival Collections* that document Maritime History since 1700s with notable collections such as the Journals of Proceedings, Minutes of the Standing Committee, Treasurer's Account and Minutes of the Annual Meetings of the *Marine Society of the City of New York*; the journals, reports, daybooks and letters of the *Sailor's Snug Harbor* and the pilotage books, daybooks and logs of the *Sandy Hook Pilots Association.*

In addition to the print resources available to the Maritime community, the Stephen B. Luce Library subscribes to 6,470,181 full text articles indexed in a total of 1,602,860 electronic records and journal titles. Furthermore, the Luce Library has access to 21,752 electronic books (SUNY*Connect 2008).* The majority of electronic resources are available through the State University of New York library consortium, SUNY*Connect.*

The delivery of the library's digital resources and electronic services is through a digital research portal, (Stephen B. Luce Library 2008). The library team has developed a curriculum-aligned digital portal for delivering research, information, and access to online course research guides, and to other digital learning modules.

The librarians work closely with students, faculty and staff to provide access and research support for all the maritime specialized and general collections, including the historical and archival collections. The library continues to methodically digitize its archival collections in order to provide users with wider intellectual access to rare documents. Digital access to the library's rare documents not only makes the content of primary sources available for scholarly research but also enhances the students' sense of inquiry, history and maritime traditions. In addition, the library supports the curriculum with course-material placed on reserve. All maritime affiliated members may take advantage of the library's national and international partnerships and

request any resource which may be available in any library in the United States through interlibrary loan services.

Librarian outreach is at the forefront of library operations. The librarians collaborate with the teaching faculty to construct the knowledge of understanding and the critical thinking component of the maritime curriculum through the library's information literacy program. Library faculty and teaching faculty work closely to promote the use of digital databases to students and to integrate the library's resources into the maritime curriculum. The librarians provide online and in-person research consultation to all members of the crossroads community (alumni, maritime industry, local and New York State-wide communities). The Library's information literacy program is designed to develop students' skills at various levels of curriculum competencies. Starting with the Freshman, all incoming students receive their first library orientation session. Upper level students are taught discipline-specific sessions in English composition, American History and American Civilization, General Science, Marine Biology, Oceanography, Meteorology, Business and Economics and Engineering.

The work of the librarians extends to several college-wide and state-wide committees. As members of the College Governance, the Luce Librarians participate in department level curriculum planning activities meaningfully to integrate the library's resources and information literacy into the student learning experiences. They serve in college-wide assessment activities that result in improvement of resources, communication and educational approaches for students, faculty, staff, and alumni. These activities are especially relevant to the college's accreditation and program review reports.

During the two months of the summer sea term, the library transfers relevant collections onboard the Training Ship Empire State VI, and a library faculty member serves as the Ship's librarian. In support of the shipboard community (students, faculty and staff) the library provides resource and research support for the courses and curricula taught at sea.

The library also works closely with the Office of Admissions to conduct library tours for all visitors, prospective students and their families. During library tours visitors learn about the library's collection and scholarship, the history and the maritime traditions of the college, about all types of services and access offered to the students and the maritime community.

The Luce Library responds to the local and New York State government with access to its federal government documents collections. As part of the State University System of New York, the Luce Library is an active participant in the decision making regarding resource and cost sharing for collections and services among 64 SUNY colleges and universities.

The diagram, "Crossroads Community: Service-Tradition-Scholarship-Access" [figure 3] demonstrates the areas where the four principles of library centrality are systematically integrated within the "*Crossroads Community*".

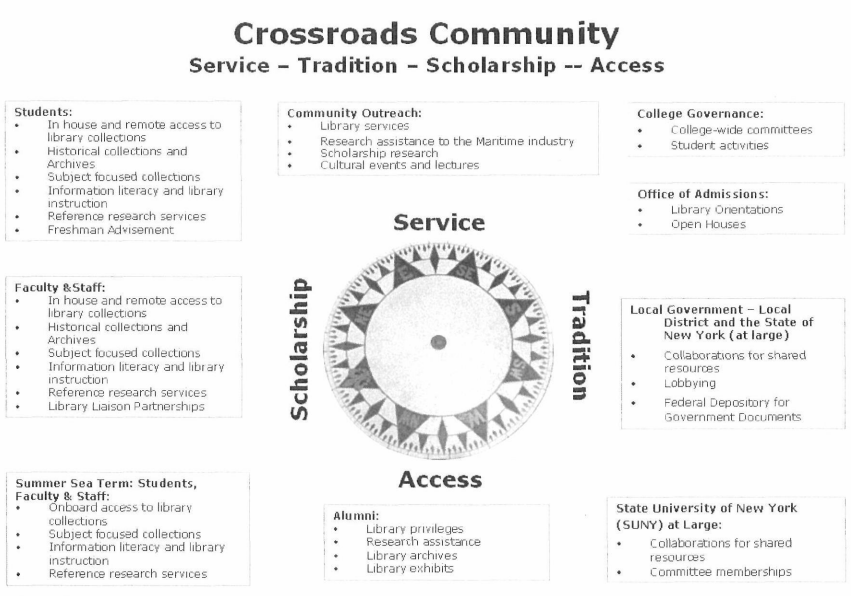

Figure 3

5 Conclusion

The Luce Library compass rose was concealed under a floor carpet for fifty years until a SUNY Maritime College alumnus and a member of the Marine Transportation Department faculty arranged to have the compass rose uncovered in 1974. Library sources tell us that it was perhaps done for the centennial celebrations of the restoration of Fort Schuyler. Centrally located in the middle of the library floor, the compass rose attracts the attention of many who pause to admire its lyrical form and the proud craftsmanship with which it was once made. The library staff eagerly tells the story of the compass rose; it is a part of their living history, interwoven in the library's organizational soul. Organizations may choose to keep symbols concealed; the Luce Library made a conscious decision to incorporate the story and the symbolism of the compass rose with its organizational objectives. So there is much to gain and so much to share when organizations choose to preserve their history by revealing their history and by reinterpreting its symbols.

The Stephen B. Luce Library has come to appreciate that library centrality is not achieved by a way of being the "heart of the university", or by being the central building on campus. Library centrality is achieved by decentralizing the core and the essence of the library organization; it is achieved by decentralizing the four principals of scholarship, maritime institutional tradition, service and access, to reach out to the maritime community. Scholarship and practice has

proven that there is no "one best way" of achieving one's organizational objectives. The maritime community is dynamic and diverse; therefore the library as an organization must be dynamic and diverse. Strengthening the maritime community requires a consistent effort of disseminating organizational access and assets to meet the needs of the community. The Stephen B. Luce Library of SUNY Maritime College Library continues to change; it morphs and evolves to become who the maritime community is and it travels to be where the maritime community is, ... at the *crossroads.*

References

[1] Association of College and Research Libraries 2008, American Library Association. Available at: http://www.ala.org/ala/acrl/acrlstandards/standardsguidelines.cfm

[2] Bolman, Lee G. and Terrence E. Deal 1997, *Reframing Organizations: Artistry, Choice, and Leadership,* 2nd edn, Jossey-Bass, A Wiley Company, San Francisco, p. 217.

[3] Constantinou, Constantia 2005, *Beyond Library Stacks,* PowerPoint presentation to SUNY Maritime College Council, October, SUNY Maritime College

[4] Grimes, Deborah J. 1998, *Academic Library Centrality: User Success through Service, Access and Tradition*, Association of College and Research Libraries, a division of the American Library Association, Chicago, p. 17.

[5] Grimes, Deborah J. 1998, *Academic Library Centrality: User Success through Service, Access and Tradition*, Association of College and Research Libraries, a division of the American Library Association, Chicago, p. 46

[6] Grimes, Deborah J. 1998, *Academic Library Centrality: User Success through Service, Access and Tradition*, Association of College and Research Libraries, a division of the American Library Association, Chicago, p. 48

[7] Stephen B. Luce Library Portal 2008, SUNY Maritime College. Available at: http://www.sunymaritime.edu/stephenblucelibrary/

[8] SUNY Maritime College website 2008, SUNY Maritime College. Available at: http://www.sunymaritime.edu/About

[9] SUNY*Connect 2008,* State University of New York. SUNY*Connect* Electronic Resources. Available at: http://www.sunyconnect.suny.edu/refres.htm

[10] *The Oxford English dictionary* 1989, ed. S.v. "Community".

[11] *The Oxford English dictionary* 1989, ed. S.v. "Crossroads".

[12] Woodsworth, Anne 1989, "Getting Off the Library Merry-Go-Round: McAnally and Downs Revisited", *Library Journal*, vol. 114, pp 35-38.

E-navigation requires new methods of training for deck officers

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Abstract

Technological developments require IMO to take actions in order to draw definitions, standards and guidelines for the emerging term of "e-Navigation". In accordance with IALA definition, e-Navigation integration and presentation of maritime information on board by electronic means must increase safety and security at sea and protect the marine environment. The key element in all this process is, again, the human factor and the level of training of the maritime officers.

In our paper we stress the new challenges that the deck officers face when they have to change the ship and became familiar with a totally different electronic equipment operation system. Only 3 to4 years ago, two or three consecutive watches were enough for the deck officer to be accustomed with the use of ARPA, GPS, bridge consoles configuration and display of the main types of nautical and maneuvering information. Today, we think that the procedures that must be applied on a sophisticated electronic ship, upon the arrival of a new deck officer, must be revised and well-balanced from the point of view of duration and briefing topics.

We underlined the "upgrades" that must be made to the maritime academic curricula in order to develop new competencies for the deck officers in order to help them less stressfully absorb the technological pressure In this context, a new course called "Integration of Nautical Information" was developed, with 75% of the time allotted to practical application on the full mission ship handling simulator in order to accommodate students with the use of integrated bridges and simultaneous reception of a great amount of nautical information.

In order to efficiently and safely use the high volume of digital and graphical information produced and displayed by these new types of bridge equipment, the OOW has to be properly trained in school and not only by on board practical means.

1 Introduction

Navigating the seas as a mean for transporting goods, livestock, and people has always been an important aspect of human civilization. Indeed, empires were forged and flourished due to commerce because there is no real substitute

to cargo transportation by water, due to its low cost and the high volume of cargo that can be shipped this way. Nowadays, in many parts of the world, we can't even imagine life without this important mean of trade that links continents and countries economically and politically.

An example for this reality are the ships themselves: in modern days, they are being assembled in a port, but their engines may come from a different country, their electronic equipment itself might originate from a country different from the previous two, and the owner may be from a different part of the world; not to mention that the crews that will be manning the ships could be internationals ones.

An interesting question that we could ask our selves is: what changes have the ships that have shaped our society as a whole, undergone (Wadsworth B., 2005)? The answer would be a very complex one. Since the Second World War, ships have begun to have an ever more important place in global economy: new concepts like Multi Modal Transport and the specialization of ships further asserted their importance. Their efficiency improved as new and powerful engines were developed and used which allowed greater speeds to be achieved, as well as new management ideas to be put into effect, such as ISM.

In the last fifteen years a fundamental change in the global economy, including the shipping industry, was dictated by the extensive use of computers. Today the computer is part of every day life for almost each of us; we find it in our homes, at our desks, and in our cars because it greatly increases our working efficiency and greatly improves the communication between two distant persons. The use of the computer is a fundamental change to our society, and it has already changed navigation, as it was perceived only 25 years ago.

This paper is about how the training of the deck maritime officer will be affected by this new concept that is emerging: "E-Navigation".

2 IMO-IALA policy for implementing E-Navigation

If we try to define E-Navigation beginning from the acronym itself, we will realize that we will not achieve an exhaustive definition, because the letter "e" stands not only for "Electronic" or "Enhanced" Navigation, it is only the name of a concept that includes those expressions written above.

In an effort to have a comprehensive definition, the International Association of Marine Aids to Navigation Lighthouse Association (IALA) proposed the following definition, in 2006:

"**E-Navigation** is the harmonized collection, integration, exchange, presentation and analysis of maritime information on board and ashore by electronic means to enhance berth to berth navigation and related services, for safety and security at sea and protection of the marine environment". In other words, this concept includes the equipment used for navigational purposes and for communication, the entire electronic equipment that is to be found on the bridge of a ship and on shore, and this includes the technology that is already

available and the future one (IALA, 2008). We must also understand that if aboard a ship only part of the equipment stated above is to be found, that ship is not "e-navigating" (IMO, 2005), simply because it is necessary that the entire range of data should be available to the officer of the watch (OOW).

IALA committee has agreed that E –Navigation should have the following notable outcomes (IALA, 2008):

a. "On board navigation systems will be developed that benefit from integration of own ship sensors, supporting information, a standard user interface, and a comprehensive system for managing guard zones and alerts. Core element of such a system will include high integrity electronic positioning, electronic navigational charts(ENC) and system functionality with analysis reducing human error, actively engaging the mariner in the process of navigation while preventing distraction and overburdening
b. The management of vessel traffic and related services from ashore will be enhanced through better provision, coordination, and exchange of comprehensive data in formats that will be more easily understood an utilized by shore-based operators in support of vessel safety and efficiency
c. E-Navigation will thus provide an infrastructure designed to enable authorized seamless information transfer on board ships, between ships, between ship and shore and between shore authorities and other parties with many attendant benefits, including a reduction of single person error."

Furthermore, IALA states that the key goals for this concept should be:

- To improve the safety of maritime navigation for all vessels and protection of the environment.
- To improve the efficiency of marine navigation and vessel traffic services.
- To provide opportunities for improving the efficiency of transport and logistics.
- To improve the monitoring of communication with sea-borne transport therefore enabling competent authorities to provide enhanced security and other allied services.
- To support SAR services and incident management.
- To provide improved tools to facilitate optimum support and to engage mariners and shore based users whilst maintaining high levels of attention without causing distraction or undue burden.

3 On board E-navigation users' interface

It has been stated that the equipment provides information to the maritime officer: what exactly is this equipment?

We can start with the electronic positioning-fixing system. This includes (but is not limited to) the GPS, DGPS, or the still working LORAN-C that are

crucial for the safety of navigation and for reducing the risk of accidents. Theis equipment is so important on board ships that most ships usually work with two or more in parallel: should one fail to perform, there will always be a spare. With regard to inshore navigation it has been observed that the GPS does not have the necessary accuracy to provide reliable information, and so the need for a position fixing system with redundancy lead to the development of systems like the European GALILEO satellite and radio navigation system and the People's Republic of China's COMPASS.

The next equipment is the ECN (Electronic Navigational Chart), or ECDIS (Electronic Chart). This equipment actually summarizes the data from all the equipment on the bridge, and from other services such as Vessel Traffic Management and Information Service (VTMIS). It gives a visual representation of the information provided by the Radar GPS, AIS, GMDSS, VTS, while providing the same data as a chart does. It also allows route planning and simplifies watch keeping. One important aspect is that information corrections on these systems are being made electronically, both on CD formats and through the Internet (Weintrit et al., 2007). Although tide tables are the responsibility of the countries that are required to ensure adequate provision of information to ensure the safety of navigation in their national waters, traditionally the UK Hydrographic Office provided a global coverage of tide table data. Nowadays, due to global warming, the tidal stream atlases are still based on rudimentary tidal chart data and more importantly the Pilot publications are increasingly outdated. Advances in ocean modeling have led to radically improved performance in ocean tide and sea level forecasting and current predictions in certain regions of the globe. The GOOS (Global Ocean Observing System), a global system for observations, modeling and analysis of marine and ocean data (Graff 2007), is slowly emerging as operational support for ocean services world wide, and it can be predicted that in the near future reliable information will be readily available for the seafarers.

ARPA is one of the most crucial pieces of equipment found on the bridge. Used to determine if there is a collision risk, the traffic situation around the ship, and her position, radar remains the most valuable tool in low visibility and by night. It usually functions in close relation with the GPS, so at any time it displays the position of the position of the ship.

The next to be discussed is the AIS (Automatic Identification System), a system that allows for easier ship-to-ship communication, because it ensures automatic and direct access to a ship's call sign and name, its IMO number, and other information necessary for safe and secure navigation, while also helping shore based systems like the VTS in their traffic management operation. It usually functions in close relation with the GPS and it communicates to the surrounding ships the main call sign of its own ship, the IMO number, the last port of call and destination port, as well as the position while receiving the same information. Furthermore, it offers the possibility of transmitting messages

between ships or from ship to shore, as well as between shore operations and authorities; thus, it can also function as a source of information.

The radio communication services allowing communication from ship to ship and ship to shore are playing a major role in e-Navigation. It is of vital importance for transmitting and receiving distress alerts, coordinating search and rescue efforts, and receiving signals for locating and for receiving Maritime Safety Information (MSI). Moreover, its importance is underlined by other e-services it provides, such as the service via a satellite system like INMARSAT (Internet communication and satellite-telephony). INMARSAT B was the first digital service (launched in 1993) and remains the core service for maritime industry. It provides fax, telex, and data services at rates as up to 64Kbps, as well as GMDSS – compliant distress and safety functions. This system can be used for data transfer, Internet, E-mail, fax, videoconference, remote monitoring, weather updates, telemedicine, and GMDSS. INMARSAT C is a more flexible satellite message communication system, via a low cost, light-weight terminal (Korcz 2007). While offering the same functions as INMARSAT B, it also may also provide chart and weather updates, maritime safety information, SafetyNet and FleetNet.

4 Training requirements for operating an e-Navigation ship

We must ask ourselves why we need this new concept and why we expect it to improve.

From a simple look on the bridges of two or more ships we can see that the deck officer has a multitude of information presented to him at the same time the ECDIS, the Radar, the GPS - and the most important issue of all is that each equipment has features that will distinguish itself from others that are to be found on different ships.

Even though information is readily available on almost every console (for example the position information provided by the GPS can be found at the radar display and at the ECDIS), operating this equipment at a first glance and knowing where on the display is the information that is required should a crisis situation occur and a quick decision needs to be made, the situation as a whole becomes very problematic (Patraiko 2007).

That means that each officer will need some time to find out how to operate the systems efficiently at the same time: there is the risk of accidents or misinterpretation of data due to fatigue or tiredness that is not all that uncommon in this line of activity. With E-Navigation we see an important step being made towards standardization while leaving with regard that sufficient room is left to equipment producers while leaving sufficient room for improvement. It is also under debate whether an S-Mode (Standard Mode) should be introduced for each equipment to be found on board a standard mode to which every officer and pilot should be familiarized, so to prevent any misinterpretation of data.

We must remember that e-navigating means that the OOW has a completely autonomous and fully working system on board for a safe voyage, but also has the possibility to be fed with a wide variety of information from shore-based facilities (Bibik et al., 2007). That means E-navigation requires a highly efficient data communication network that allows a constant flux of information between the ship and shore systems like VTS, ship to ship communication. This higher efficiency is needed because services like the VTS find themselves having to cope with a greater and greater number of ships and, as a result an increasing amount of time has to be spent on organizing the traffic flow and on security operations. Also the ships owners and charters will benefit because of improved communication with the ship allowing them to be up to date with her general operation.

But the e-Navigation concept is not limited to the equipment on board a ship it also includes the officer as an integral part of the system, because based on all the information available to him, he is expected to make decisions that could make the difference between safe navigation and maritime disasters. But we must realize that every equipment has its limitations and its inherent flaws, and could fail to perform. Thus, it is a very dangerous trend that in modern days an OOW should rely only on the information provided by the GPS or RADAR or the ECDIS. Indeed, many masters consider for a good reason that on board their ships the most important equipment are the eyes, ears, and the mind of the OOW, and that the most important consoles are the windows of the ships (Barsan et al., 2007b).

COLREG states under Rule 5 that "a good every vessel shall at all time maintain a proper look out by sight and hearing as well as by all available means appropriate in prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision", and under Rule number 7 it is stated: "every vessel shall use all available means appropriate to prevailing circumstances to determine if risk of collision exists" also it warns that "assumptions shall not be made on the basis of scanty information, especially scanty radar information". With this in mind we must realize that with the technological advancement in navigation equipment we expect the naval officers to exercise their profession in a safer manner. And indeed it should be so, but nowadays most of the naval accidents and naval disasters are due to human error (Hanzu-Pazara et al., 2008). However, along with the STCW convention, e-Navigation should make a great impact on safety levels and prevention of pollution.

We think that it will be compulsory that upon arrival on a new ship (which has an integrated bridge system), the OOW must have special time allocated to reading the user manuals for the IBS equipment (Barsan 2007a). After that, a discussion and practical explanation session must be arranged under the supervision of senior officers, before the ship will leave the port.

More than that, at least the first 4 to 6 watches of the new OOW must be supervised by a senior deck officer (master) by day and night, in order to teach, assist and monitor the OOW in the proper use of the IBS equipment.

Special attention must be paid to the different alarms settings, which must be explained to the OOW. Moreover, the supervisor must monitor the reactions of the OOW when such an alarm starts. In the same time, the meaning of the alarms and the triggering parameters must be explained to the new OOW.

The layout of the IBS has also a very important role in the behavior of the OOW during the sea watches. From our point of view, the layouts that incorporate two fixed rotating chairs, separated be a central console ("cockpit" design) are not at all a good solution, because they limit the mobility of the officer. Consequently, the OOW is practically forced to sit on the chair in order to have access to all the display sand commands mainly during night watches: this "immobilization" could induce boredom and sleepiness (see figure 1).

Someone may say that these factors are not related with the e-Navigation concept: we have to remember, however, that one of the most important objectives of the e-Navigation concept is to facilitate assimilation of nautical information by the bridge team using a very friendly and safe interface.

5 Preparing students for e-Navigation

At Constanta Maritime University we are educating our students with due regard to e-Navigation.

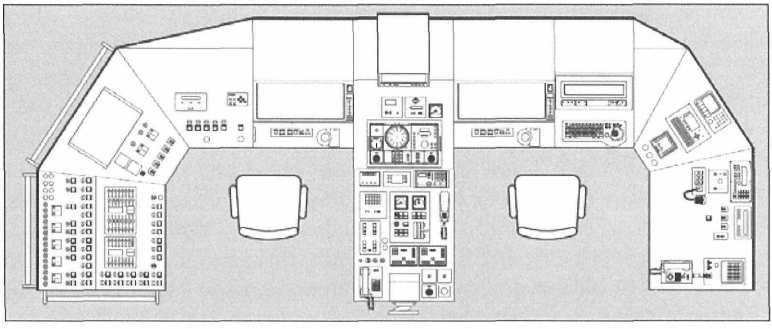
We believe that the maritime officer is a crucial part of this concept and the way they are educated is crucial to their future performances.

In their two first years they learn how to navigate a ship without the use of modern systems. Disciplines like astronomical navigation and coastal navigation emphasize the fact that a ship can be safely navigated with only a sextant, a compass, navigation charts, and a very well prepared bridge team of officers. They gain basic knowledge on theoretical and practical aspects of navigation as a whole.

In the following years their curricula includes Radar Navigation, Radar Plotting, as well as the use of ARPA. At these seminars they are introduced to at least four different radar display types. They learn how to make proper use of the ENC, the GPS, AIS, ECDIS, and the communication services on board a ship.

The most important aspect of their education regarding e-Navigation is represented by the skills they gain by working on our simulator (Raicu et al., 2007) and how to use all the knowledge they have accumulated over the years and to experience situations that they may encounter at sea. Apart from putting to practice the COLREG rules, they are accustomed to being in constant communication with VTS stations, as well as with ships in their vicinity. Separation schemes must be respected and reporting systems must be followed.

Figure 1 - IBS "cockpit design" limits the mobility of the deck officer. (Source: Raytheon Anschütz GmbH)



Moreover, they are introduced to various scenarios like Search and Rescue, or man overboard, where again they must communicate with one another, with the land stations, and with the air ships.

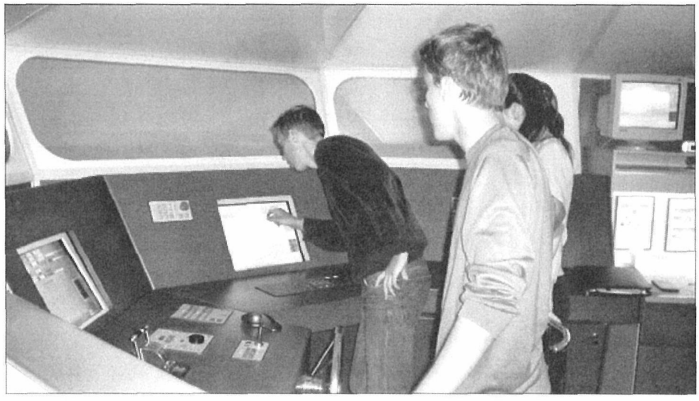
There are scenarios where the students are expected to determine their position using neither the GPS nor the Radar, but other means independent of the first two. During other simulations various system failures are being simulated (the GPS indicates a false position, or the ECDIS might not function). All this is being done to ensure that these future officers do not panic and know how to deal with the situation, or how to obtain the required information from other sources. We also emphasize that communication is the key to avoid accidents or maritime disasters.

We assume than in most maritime universities, the curricula is very much the same and the above mentioned courses are done more or less in the same manner (Barsan 2007c).

In order to better respond to the challenges raised by the modern ship bridges, during the last two years we introduced a new course for the students from the 4th year of study (the last one). This course is called "Integration of Nautical Information" and is a course that has 100% of its practical applications done on ship handling simulator (SHS).

The main aim of this course is to familiarize students with the use of an integrated bridge system (IBS) and with the best practices regarding the acquisition of nautical data in permanent relationship with ship's intended track. (figure 2).

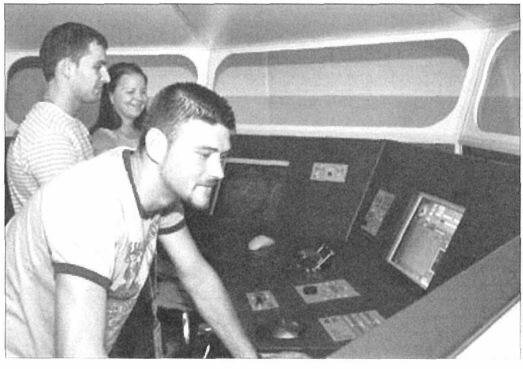
Figure 2 – Students' team during "Integration of Nautical Information" course laboratory



It is true that nowadays, due to technological advances, navigating a ship has become theoretically easier; thus, the burden on the maritime officer has been decreased, allowing him to concentrate on safe navigation, while future technologies are going to improve safety standards and ease the navigation effort even more. However, we encourage students not to rely too much on the information available from electronic sources like the ECDIS or the radar, but rather to "look out the window" and "take a look around", to use their senses, as well as making good use of what today's technology has to offer them

We also teach them what they have to do and how often they must do the required checks in order to determine if the information provided by the electronic equipment is still accurate (figure 3).

Figure 3 - "Integration of Nautical Information" course laboratory



Most of the scenarios that we play on the SHS during this course simulate a normal watch environment with medium traffic and near coast navigation. The scenarios are long (2-2.5 hours) in order to create the feeling of a routine watch, but in a specific moment there will be a triggering event that "will make the difference" and will require direct actions from the bridge team (Barsan et al, 2007b). The main purpose of the initial event is to distract attention of the OOW from the normal routine, while some of the nautical equipment will start to malfunction --, not very conspicuously, but introducing faulty data into the system.

6 Conclusion

A large-scale implementation of the e-Navigation features is inevitable in the near future.

The impact of electronics and computers on the ships' bridges is well known for at least 10 years. Despite this, there are still a lot of debates regarding the real improvement of safety based on electronics.

Because the future means e-Navigation, we have to start to prepare our students and cadets to face the challenges raised by an increasing amount of navigation information that must be absorbed, processed and analyzed in a proper way, in order to determine the right actions.

In order to achieve this goal, to traditional methods to teach navigation must be added a new kind of module able to integrate the main information from all the nautical sciences. We have to develop the student's habitude to generate his own overall image of the surrounding situation, based on as much information available as possible.

We also have to create our students' culture for a self-learning process when confronted with new types of nautical equipment and a new layout/configuration of the integrated bridge system. They have to ask for a proper on board training period, starting with enough time to learn and understand the user manuals of the navigation equipment installed in the IBS.

The setback in the training of deck officers to meet the e-Navigation challenges may also be related to the lack of mobility of IMO. On one hand, the IMO MSC is promoting the e-Navigation concept, but on the other hand the STCW provision were not updated for more than 10 years. We still have to deal with compulsory courses of radar plotting, but teaching the use of ECDIS, AIS, IBS, Bridge Team Management or Bridge Resources Management are still optional (Barsan et al., 2007b). If at least some of these courses will become compulsory for the basic training of deck officers, we assume that the bridge team will be better prepared to face the upcoming e-Navigation "tide of information".

References

[1] E. Bârsan, 2007a, New technologies for maritime safety – ISBN: 978-973-7872-64-7, Editura Nautica, Constanța

[2] Barsan E., Arsenie P., Hanzu-Pazara R., 2007b, New navigation competencies required for an updated STCW Convention, Journal of Maritime Studies, vol. 21, nr.2/2007, ISSN 13320718, pag.151-161, Croatia

[3] Barsan E., 2007c, Key roles played by shipping companies in the MET process, 8th General Assembly of International Association of Maritime Universities - Odessa, Ukraine, published in World Maritime Excellence, ISBN 978-966-8783-11-1, Ukraine

[4] Bibik L., Królikowski A., Czaplewski K., Duda D., 2007, Vision of the decision support model on board of the vessel with use of the shore based IT tools, 7th TransNav 2007 Conference – Gdynia, Polnad, published in Advances in marine navigation and safety of sea transportation, ISBN 978-83-7421-018-8

[5] Graff J., 2007, The role of operational ocean forecasting in e-navigation, 7th TransNav 2007 Conference – Gdynia, Polnad, published in Advances in marine navigation and safety of sea transportation, ISBN 978-83-7421-018-8

[6] Hanzu-Pazara R., Barsan E., Arsenie P., 2008, Reducing of maritime accidents caused by human factors using simulators in training process, Journal of Maritime Research, Volume 5, No 1, 2008, ISSN 16974840, Spanish Society of Maritime Research (SEECMAR), Santander, Spain

[7] IALA, 2008, e-Navigation Frequently Asked Questions, St Germain-en-Laye – France, http://www.iala-aism.org/

[8] IMO, 2005, IMO E-Navigation strategy, Maritime Safety Committee, MSC 81/23/10, London, UK

[9] Korcz K., 2007, GMDSS as a Data Communication Network for E-Navigation, 7th TransNav 2007 Conference – Gdynia, Polnad, published in Advances in marine navigation and safety of sea transportation, ISBN 978-83-7421-018-8

[10] Patraiko D., 2007, The development of e-navigation, 7th TransNav 2007 Conference – Gdynia, Polnad, published in Advances in marine navigation and safety of sea transportation, ISBN 978-83-7421-018-8

[11] Raicu G., Bârsan E., Arsenie P., Hanzu-Pazara R., 2007, Realistic environments for online maritime simulators, 8th EUROSIM 2007 -

Ljublijana, Slovenia, published in Proceedings of the 6th EUROSIM Congress on Modeling & Simulation, ISBN 978-3-901608-32-2, Pub. ARGE Simulation News, Vienna, Austria

[12] Wadsworth B., 2005, MARINE eNAVIGATION, Maritim Faggruppe, ITS Norwey

[13] Weintrit A., Wawruch R., Gucma L. Pietrzykowski Z., Specht C., 2007, Polish Approach to e-Navigation Concept, 7th TransNav 2007 Conference – Gdynia, Polnad, published in Advances in marine navigation and safety of sea transportation, ISBN 978-83-7421-018-8

Teaching information communication technology and its development to maritime education professionals

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Abstract

What Information Communication Technology to teach to the Maritime Education and Training community and *how* to teach it?

This paper reports on the development and implementation of a pilot course targeting these issues at World Maritime University in Malmö, Sweden. The course is based on four foundational cornerstones: a.) a problem- and project-oriented pedagogical approach where learning takes place in interaction with a concrete and familiar issue; b.) a light-weight development approach which provides enough guidance for the project group work without getting in the way of an ambition to achieve visible results; c.) a technical development platform that allows for rapid application development without requiring programming skills; d.) the recognition that useful applications require participation of the future users.

In the light of the increasing importance of technology to support both the maritime industry and maritime educational institutes, the main contribution of the course is to academically and practically improve the students relative relation to Information Communication Technologies - may it be as domain expert stakeholders, project managers, or technical developers.

Introduction

Increasingly, technology is an important component for the maritime industry and maritime educational institutes, which presents both new

opportunities and challenges. The growing realisation of the importance of Information Communication Technologies (ICT) in particular have, previously, been reported in the general assembly of IAMU by, for example, Hersham (2003) and Constantinescu (2003).

In light of recent years' rapid advances of ICT, an interest has been expressed to academically and practically explore the application of such technologies specifically by the students of the Maritime Education and Training (MET) program at World Maritime University (WMU) in Malmö, Sweden. The design of a viable course concept, to this end, can be recognised as a challenging endeavour. The course should accommodate students who: have varying but often limited technical experience; come from different organisational positions and roles; and come from different cultures that might have implications for how technical systems are developed and organisationally related. Based on the experiences gained from the implementation of this course within the MET program at WMU, this paper contributes to a discussion of *what* ICT technology to teach and *how* to teach it to the MET community.

In this paper, a concept for a one-week course unit plus homework and experiences of its implementation is presented. The course is part of the third semester specialisation courses within a 17 month MET MSc program. The learning goals of the course unit are twofold: to develop a basic understanding of web-based software products appropriate to support the MET work area, and to achieve a fundamental understanding of how to work with issues of implementation and design of ICT in an organisational context. This way the curriculum improves the students' relation to technology in their daily work, be it as a developer, user stakeholder, or project manager.

The course is based on four foundational cornerstones: a.) a problem and project oriented pedagogical approach where learning takes place in interaction with a concrete and familiar issue; b.) a light-weight development approach which provides enough guidance for the project group work without getting in the way of an ambition to achieve visible results; c.) a technical development platform that allows for rapid application development without requiring programming skills; d.) the recognition that useful applications require participation of the future users.

The outline of the paper has the following disposition: the next section presents the research methods used; section 3 details the above mentioned cornerstones; section 4 reports on the implementation of the course based on the results of the four student project groups; section 5 evaluates the course; and section 6 discusses the course outcome in form of lessons learned.

Method

The concept of the course was developed by the three authors. Bolmsten, together with a fellow colleague at the university, was in charge of implementing the course unit discussed within the premises of this paper.

During the course, an action-based research approach was applied. As an embedded researcher, Bolmsten actively engaged in the unfolding events around him in a process of participatory observation and reflection to understand and account for the targeted activities of investigation. A theoretical ground for the research approach can be found in the principles of "Co-operative Method Development" (CMD) developed by Dittrich et al. (2008). CMD provides a framework for software engineering research combining qualitative empirical research and action research. In this case, it is applied on design, implementation and observation of a course concept rather than software engineering methods.

As an additional input to the research process, the description in section 3 is based on the participating students' own feedback. The account given should not be interpreted as "unscientific storytelling" (Dittrich and Lindberg, 2004), but rather as a way to visualise the area of investigation in order to make it possible for the reader to better assess the work conducted and also argue the conclusions. The comments from the students were given in written form as an input to a focus group taking place after the course that continued to discuss and develop some of the course themes. Approval was given from the respective students when their statements were explicitly cited.

The contents of the course

The goal of the course is for the students to acquire a relevant understanding of the development of a technical tool and at the same time get insights into issues relating to the integration of software in an organisational setting. Instead of presenting a predominately pre-defined body of information in a traditional rostrum teaching setting, both academic and practical active explorations of issues in regard to the areas of inquiry are promoted. In the following, their implementation and how they support each other are explained.

3.1 Participatory design of organisational IT support

Participatory Design (PD) has been developed mainly by Scandinavian computer scientists to support the development of useful and usable software (Floyd et al, 1989). According to our interpretation, PD provides a set of tools, methods and techniques that allow domain experts and software engineers to cooperate around the development of IT support.

Due to the development and deployment of configurable half-products, e.g. contents management systems and ERP systems, the involvement of users in the design, development and maintenance of organisational IT support has changed character. Users today do not only participate in design phases of tailor-made programs, they also select, configure, and maintain configurations. In the article 'PD in the wild', Dittrich et al. (2002) discusses the appearance of a new role: local designers, domain experts that take the lead in the (participatory) design,

procurement, development and configuration of an organisations infrastructure. Those local designers provide the role model to select the learning goals for the designed course. This development is recognised by software engineering research. End-User Development and End User Software Engineering are recognised research topics. (Volker, 2006)

3.2 Project centred teaching using applications proposed by the students

Constructivist learning methods, based on project or -problem based teaching, are state of the art in software engineering (see for example Ohlsson and Johansson, 1995). The purpose is to put students in a realistic situation and support them with a coaching-like supervision to acquire and apply the necessary methods and skills and to reflect on the process and the outcome. It has been adapted to interdisciplinary projects targeting use-oriented design and development of software (Dittrich 1999). These experiences encouraged us to try a similar approach to teach maritime and MET professionals to design, configure and participate in ICT development projects.

An important feature of project based learning is that students are engaged in the projects. To assure this, the students are asked to suggest project ideas of relevance to, for example, the activities of their home organisations. Before the course starts, the suggested ideas are consolidated and an appropriate project scope is negotiated for the selected projects. Working with a project that has tangible stakes, increases the engagement and commitment to the course learning objectives.

From the start, the students are divided into project groups and assigned a project. Throughout the majority of the course the students work towards accomplishing the goals of their projects. To enable a project-based work configuration of the course, technical, methodological, and practical arrangements are put in place. The technical and methodological arrangements are described below. The challenge here was to cut down the project period to one week and still keep the goal of developing a prototype for a realistic application. This influenced the choice of both the implementation platform and the development method.

High level (4GL) technical development environment

The average student attending the course can only be expected to have limited technical background knowledge and no direct prior experience of the technical tool used during the course. This fact puts demands on the choice of the technical platform.

The course uses a fourth generation web-based platform called DotNetNuke that does not necessarily require any traditional programming experience to produce an end product outcome. A complete technical product can be produced through administration and configuration of an existing framework and existing software modules. Today, there are a wide variety of similar technical alternatives available both in the open source community and in the commercial market.

Practically, the framework acts as a host environment containing aspects such as menu and -security management. The framework also becomes the canvas on which different pieces of functionality are placed, such as document management, announcements, forums etc. The different components can both be built from scratch or pre-manufactured and ready to apply after configuration. In addition to providing a technical platform during the course, a collection of components are selected and made available to the students based on the character of their different projects.

3.4 A light-weight software development method

The course uses a light-weight software development methodology called extreme programming (XP) (Beck, 2000) which also works as a template for teaching pedagogy. XP is a project-centred approach. The focus is on empowering a local project group to design a software solution with high requirements on usefulness and usability. The development work is structured by a number of guiding development practices that both individually and in conjunction define best practices for the different dimensions of a software design process. Schematically, they can be described as follows (practices are in italics):

An *on-site customer* opens up for a PD approach during development. A project-centred style of work is upheld by *collective ownership* of the solution designed by all involved project members, and that all development is done through pair *programming*.

A project is guided by an overarching *metaphor* that is broken down into concrete requirements through a *planning game*, where individual pieces' functionality are specified from the customers own descriptions on story cards. The importance of realistic planning and expectations is emphasised by the practice of a *40-hour week*.

An evolutionary mode of development is promoted through developing functionality in *small releases* with, at any given time, the most *simple design* possible that is *continuously integrated* into an operational product. Other important practices that steer the technical development are following *coding standards* and performing continuous *testing* and *refactoring* of developed functionality.

A fundamental difference between XP and a traditional software engineering style of software development is that XP does not rigidly prescribe certain procedures or a particular implementation style. Instead, a method should only be used to the extent that it fulfils a relevant purpose within the local project.

In summary, the technical high-level development environment resembles a complex but tailored software product. Learning to handle its possibilities and constraints enable maritime professionals and MET professionals to cope with similar complex customisation and configuration tools. The XP approach to software development provides a frame that guides and encourages cooperation between domain experts and IT professionals. In this context, the PD principles put a strong focus on the capabilities of domain experts as local designers.

The implementation of the course

As a foundation for evaluation, this section describes the work process of the different projects and the resulting ICT products. An individual account is given for each project where some of the central characteristics are highlighted. In this way the reader is able to get a more multi-faced insight into the effects of the course design.

The particular instance of the course described in this paper was set during one week. For five days studies were scheduled between 09.00 and 14.00. To complete their projects the students were also expected to perform after class work.

The course was located in a purposefully arranged classroom where the furniture was re-arranged to form four personal project work areas; one for each group. Every project work area was equipped with two computer work stations (to support the pair programming practice). The classroom was open both during and after class hours.

During the two first days of the course, two theoretical sessions were provided and complemented with practical exercises to achieve a basic familiarity with the different components to be used. This also enabled the students to academically question their experiences. The three remaining days were devoted almost exclusively to project work. In the end of the course, each project group presented their final product as well as their work process to all the members of the class.

	Group 1	Group 2	Group 3	Group 4
Project	Student and staff intranet	Community portal	Staff intranet	Sea Farers Portal

	Group 1	Group 2	Group 3	Group 4
Metaphor (developed by the groups)	Keeping You Afloat	maintain links and develop the maritime professional network striving to achieve *one team one goal*	Knowledge creation and utilisation promoting dynamic system of creative routines	Waypoint To Seafarers' Welfare
No. of members	4	4	4	4

Figure 1. Overall project charter

4.1 Student and staff intranet: group 1

The majority of students came from different maritime education training institutes and an interest therefore existed to design a platform similar to the one implemented at WMU. It was decided that group 1 was going to focus primarily on student and staff communication.

4.1.1 The product

The resulting portal presented an overall proposal of how a working student and staff intranet portal might be organised based on the students own experiences from their home organisations. It included relevant pieces of functionality for this purpose including text/picture presentations of programs and subjects; general information and overall presentation of the different departments of the university as library and health care; document management to share files; and events modules to publically calendar the university's activities.

4.1.2 The group process

In the beginning of the project work, it was noticeable that members of the student and staff intranet group had little prior experience with technology. Unexpectedly to the group members themselves, it therefore turned out that *pair programming* became one of the most valuable development practices to the project (Overall, pair programming is arguably the most debated development practice. Its value is emphasised in XP, but it often departs from what professional system developers feel comfortable with.). As a student expressed:

"at first, it seemed to me as unhelpful, where we probably could waste more time than be productive, but in the end, it resulted to be highly beneficial for the project...we experienced how the mistakes were easily detected by the observer, which kept us on track". Because familiarity with technology was, in general, low in the project, substantial time was required for the group to make sense of the technical tool itself. This naturally implicated the extent to which the students worked with the other development practices. Accordingly, in addition to *pair programming* the other practice that the students mainly referred to was the *metaphor* for overall steering of the project. Another student stated regarding the metaphor: "it was the one we most often came back to...[it reminded] all those involved about how the project is supposed to satisfy the need of the customer". Arguably, the students did recognise that the practices acted as separate yet connected parts of a whole, but as a consequence of the focus on the technical issues of the project, it was stated that "it is not easy too see a crystal clear difference between them [the practices]".

4.2 Community portal: group 2

This portal took the form of a virtual seafarers lounge where current and graduated students can meet and where outside professional are also invited. Portals expanding the borders of educational activities and facilitating networking is a hot topic at WMU and at other related universities.

4.2.1 The product

The end result had a strong focus on communicational aspects such as forums and chat modules. The community portal, possibly left the widest scope of interpretation with a broad array of functionality that could be considered for inclusion. This was reflected in the metaphor chosen by the project group: "maintain links and develop the maritime professional network striving to achieve *one team one goal*". The students also considered how to work with different layers of security to diversify the access to different parts of the portal depending on which user group a user belonged

4.2.2 The group process

To cope with the constraints of the project such as the limited time available, the students actively worked with both the planning game and with the development practice of simple design to determine the scope as well as to prioritise the functionality. These practices also made the students able to understand the purpose of an evolving design, where it is possible to expand a piece of functionality in iterative cycles. One of the project members elaborated on these concepts as follows: "As we started, we thought of a perfect webpage

with beautiful design and cool functions, informative and attractive. Then we faced a lot of problems like time constraints. Conversely at least, we have launched our project on time with all necessary functions even we all know that it needs to be improved...We had to try to think like a manager that what is the minimum functional or information that need to be included in the first releases which were supposed to be launched in two weeks time...How much of a problem has to be solved in order to achieve value in production. Using story cards and simple design helped us a lot to finish out project properly".

4.3 Staff intranet: group 3

The staff intranet was a project already under consideration at one of the student's home university. Comparably, it can be argued that the staff intranet group had the most tangible project. It appeared as a project that all the project group members personally could relate to within their professional contexts.

4.3.1 The product

In terms of functionality, the project shares many similar features with the student and staff intranet but with a primary focus on staff related issues. This, for example, includes saving and sharing hand outs to be distributed to the students in class. The staff intranet became the most technically-oriented project which among others resulted in that the project members worked more than the other project groups with customisation of the implemented functionality.

4.3.2 The group process

Unlike the community portal project, an explicit customer stakeholder existed who guided the project towards a manageable set of prioritised features during the work of the course week. The student that the project idea originated from the following evaluation: "when the project started, the customer did not have a clear picture of the final product. Due to this reason, new stories were developed continuously during the whole project... The customer was sitting with the team so he could update the plan".

As a consequence of the clear project objectives provided, the project work assumed a pragmatic technical oriented development focus where the group members to a large extent concentrated on the implementation of functionality. This became reflected in the extent to which the group used the design practices. As another project member stated concerning the limited use of story cards for the planning: "we may have 6-10 such cards, with one sentence each". As the group did not perceive any purpose to work with the design practices as a whole, consequently they did not get any deeper insights in their broad application. One of the group members recognised that the practices "counterbalances and

reinforce each other" but "picking and choosing which to use and which to discard can also be tricky" and "the difficulty is not the result of technical challenges but of social challenges".

The group's technical orientation also enabled them to "challenge" the functionality to the point that "somebody initiated to do some changes that he thought it is would be useful to our page. Unfortunately the whole project was gone after that".

4.4 Seafarers portal: group 4

In the customer's own words "The project had a real business representative who desired the software and who would be the administrator." Of all the projects, the Jamaican seafarers' portal had the business stakeholder or student customer with the most outspoken aims and defined vision of the project outcome. The project related to an identified need in regard to national sea administration and primarily concerned the fact that seafarers' on different levels of a nation's ship fleet can benefit from a being able to share information.

4.4.1 The product

As the community portal, the functionality of this portal came to focus on communicational aspects such as forums. Information published can relate to multiple topics, for example incident reporting and sharing of best practices. In addition, central administrative agencies have a need to be able to distribute information which can concern new regulations or policy changes. A web-based portal would facilitate such communication as the parties are often at sea and therefore geographically separated.

4.4.2 The group process

When the project members started to work with the technical tool and the development practices, different opinions surfaced on what the project was going to entail. These were not easily reconciled. As described by a project member: "In the beginning; the planning game process for our group does not seem to run very smoothly. Even though there are positive discussions among the group members, it is still not easy to get an agreement among the members." Due to this circumstance, the project members were referred to actively explore how the development practices could help guide or mediate a satisfactory project process. After a suggestion by the lectures, it was also decided to balance the different interests in the project by assigning/enforcing the stakeholder roles of 'programmer' and 'coach' with clear mandates in addition to the already existent customer. As a result of these efforts, it was stated that: "Later on as the members begin to understand their specific role and acknowledged the role of

other group members -- especially the customer -- things start to work smoothly." The customer appeared satisfied with this process and by the time a metaphor was selected she stated that "The initial resistance waned and all team members accepted their roles because they had a part to play in developing the metaphor, so in essence they had to commit to what they invented. It became not just the customer's project, but a team effort with different roles."

Due to the reflection process regarding their course of work that the group had to undertake, they managed to get a comparably in-depth application of how the development practices individually worked but also holistically interacted. This can be exemplified by a mutual report submission from the group: "The story cards gave direction in the *planning game* and in mapping out the scope of the project for *small releases*. They gave life to the *metaphor*. Having story cards ensured a systematic and *simple approach* was taken in the development of the system allowing for continuous *testing* and sometimes immediate changes, corrections etc. The story cards kept the focus and allowed any member to continue with, according to the practice of *collective ownership*." The group was also able to critically point out unresolved issues in their experience with the design practices. Their above average understanding of the work process was also reflected in their combined grades for the course.

Evaluation

As stated in the introduction, the course unit had two learning goals: to develop a basic understanding of web-based software products appropriate to support the MET work area, and to achieve a fundamental understanding of how to work with issues of implementation and design of ICT in an organisational context. This section evaluates the teaching approach and whether the learning goals were achieved.

5.1 Project-based teaching supports integrated learning of technical and process related knowledge

The Seafarer Portal project provides a good example of how integration between technical and process-related learning works out: During the initial stages of the group work a conflict arose concerning the direction of the project. This challenged the group members to discover and reflect over how the development practices could be utilised to improve the development of their particular project. In the end, the seafarers' portal group managed to achieve a successful outcome in terms of creating a balance between understanding the technical environment and the applicability of the development practices.

In accordance with a project-based perspective on learning, it is possible to deduct from the work process of the different projects that facing problems do

not mean that one does not learn. As illustrated, problems encountered in the project work are, in fact, possibilities to learn. In this process, the teachers act as facilitators or coaches whereas the conflict remains with the students. Instead of adopting a passive and receptive role, the groups are supported in experimenting with the methods and tools provided. To this end, the learning environment should be designed to support and challenge the learner's thinking.

5.2 Basic understanding of web based software products

Though the students had various understandings of technical software support when entering the projects, all of them gained basic knowledge regarding modern ICT and how to use it to support organisational tasks. Only a few of the course participants had prior experience working with software development per se. Given these preconditions, the technical sophistication of the resulting products was apparent in the final presentations. One group, even, clearly reached the limitations of the DotNetNuke platform, when trying a configuration that resulted in a major breakdown. Such experience (for software engineers in general) allows reflection on the implementation platform as an enabling tool as well as a limitation.

All the project groups showed a good capability to translate their ideas into technical pieces of functionality. In other words, they managed to conceptualise how a certain task, for example a distribution of hand-outs for a course, could be technically supported by a particular software module, i.e., a document management module. This also includes developing an understanding of the role of supporting functionality as management of menus, and security settings.

5.3 Implementation and design of ICT in an organisational context

The course assumes from a diversified view of who is the designers of system development projects. Even though it is not a prerequisite that the students have any experience with technology, they are - confidently- put in the driving seat of the design of software. Especially, the students' visions of how their solutions could continue to evolve in order to show their ability to understand the relationship between software support and organisational activities (also see section 6).

The problems encountered during the design process mirror real-world problems: For example, the members of the seafarers group encountered differences of opinions about the direction of the project. Stakeholders who, due to their different perspectives of an application domain, have different opinions

of what constitutes a satisfactory solution can be recognised as a fundamental issue in a live development setting. The community portal group faced another common challenge regarding balancing users' exceptions on functionality with what is technically possible to implement given resource constraints such as time and knowledge. This made the participants actively work with both prioritisation and the scope of the chosen functionality.

Discussion of the course rationale and design

This was the first time that the course was given. Although the founding rationale, as described in section 3 is based on established practices of teaching software development, the course concept in a MET setting is, to the authors' knowledge, new. The course, therefore, became a pilot platform to investigate the teaching and developing approach as such and the applicability of the individual design practices.

6.1 Teaching just enough software engineering

The twelve XP practices applied during the course allowed insight into basic software engineering issues: roles are a fundamental way to assign responsibilities in software engineering; design artefacts – notations, documents, and their purpose in the development process – are central to most software engineering methods; planning and prioritisation are central tasks of project management; pair programming and nightly builds add a quality assurance dimension, and so on. To support the notion of the local designer introduced in section 3.1, the practices gave the project group members a light-weight frame for their group work, providing them with just enough structure, without introducing unnecessary overhead.

Whether the students can apply the entire framework of development practices in their home organisation remains to be seen. As one of the students noted "This subject is closely related to my work as it is heavily uses websites as a main tool... with 12 XP practices, that knowledge can be very helpful in my similar works in the future even though not all of them can be applied..." The end part of the last remark was expressed by many of the students. The complete application of the development practices promote a certain way of organising that might not be in line with the prevailing way of working in the students' home organisations.

As an improvement, it is proposed to reflect more explicitly on the XP framework as one way to address the challenge of software development and emphasise the above mentioned basic issues addressed by the specific practices. The development practices can, however, provide value individually as well as in combination. They may, for example, be applied to both improve an existing

work style one step beyond the current level of mastery or as springboard for more fundamental re-invention.

6.2 The high-level (4GL) technical development platform: enabling tool and constraint at the same time

The teaching style applied during the course would not have been possible without the technical platform chosen. If traditional programming were required to implement the students' portal projects, then the outline of the course would have to be fundamentally re-arranged.

However, even though the high-level nature of the DotNetNuke platform enabled the students to conduct the technical parts of the development, it also poses constraints. In the middle of working with the configuration of a piece of functionality, the staff intranet group solution broke down. An intervention was required by the teachers to restore a backup in order to get the portal up and running again. Though the students mastered the majority of the development themselves, the teachers actively facilitated the development process by acting as resource persons with technical expertise. Adequate support is necessary, and the role of IT professionals should not be dismissed inside or outside the classroom context.

6.3 How to complement the project work to support more equal learning

As mentioned in section 5.1, the project-based approach was a success as it engaged the MET students and thus facilitated learning results that otherwise would have been difficult to achieve. To this end, an illustration is provided of a successful application of a constructivist teaching method – a teaching style which is not only state of the art in software engineering (as described in 3.2), but in line with the objectives of the STCW95 convention of growing importance also in the MET community (Asyali et al 2003; Fedila, 2007; Horck, 2007).

By working with authentic tasks, relating to the students' own professional domains, it was possible to increase the students' motivation and enhance their confidence to engage in the work process. However, as each project developed in a specific way, the learning results also differed. Let us compare the Seafarers Portal project with the Staff Intranet project: As reported in section 4, the specific configuration of interests in the Seafarer Portal project resulted in a thorough discussion on roles and responsibilities. In the Staff Intranet project, the common experiences resulted in a much more homogeneous understanding

of the development practices. Thus the process was smoother but resulted in less learning regarding how to handle stakeholder conflicts in software engineering.

There are different ways to address this problem: One could introduce teacher-guided, class-wide meetings on a daily basis where the different projects, their challenges, and how to address them with the help of the development practices are discussed. This would give the students an opportunity to discover practices outside the immediate horizon of their projects and thus get a more holistic appreciation of the development practices. Another way could be to introduce scenarios that highlight everyday challenges of software development. These measures would work as a complement to the post reflection provided through the mutual presentations of the product outcomes and the development processes in the end of the project period.

6.4 How does culture affect the applicability of software development methods and practices?

As mentioned in section 5.3, the students of all projects managed to relate the design of technology to organisational needs. According to our evaluation, all students will be able to take part in a software design and development project as domain experts and user representatives and in that way work towards a match between the software under development and the needs of users and organisation. However, during the discussions with the students, the applicability of the PD principles and the XP development practices – that implements a very egalitarian way of organising software development – in non-western or non-Scandinavian cultures was questioned: "[T]he most difficulties of implement the XP practices are the attitude and the culture of the organisation." "The culture organisation is hierarchical with division of authority and responsibilities. The information system which flows from the top management to the low level currently do not apply any software with the use of XP practices."

To discuss these cultural issues in depth would go beyond the scope of this paper. (See e.g. Horck 2006) In the context of this course, local designers – and with this a PD perspective – (Dittrich et al. 2002) are primarily used as a role model motivating the learning goals and the XP framework as a light-weight process support for the student projects. However, the interaction between software engineering methods and cultural diversities -- respectively the need to adjust the methods and approaches to different cultural backgrounds -- was and will continue to be subject to reflection during the course as well.

Concluding remarks and future work

As a response to the increasing opportunities that comes with ICT to support MET, this paper has reported on the development and implementation of a course that gave the students both academic and hands-on appreciation of such technologies. During an intensive course week, the students of a MET program worked with projects relating to their own areas of interest to investigate the usability of a technical tool and to understand issues relating to usefulness in an organisational setting. The central lessons learned are:

- Given the students' limited pre-knowledge about technical tools, it was apparent how competent the technical product outcomes became. The importance of adequate support was, however, also evident. The role of the IT professional is not dismissed.
- The students' capabilities as designers were emphasised. The course presented an all-encompassing method for software development with high-requirements of usability and usefulness. Although due to organisational and cultural constraints it might turn out difficult to transform the entire model into practice outside the classroom, it was possible for the students to actively reflect over how they can improve their role as stakeholders in their future professional careers.
- The course also gives a positive account of the experiences of using a project-based approach to learning. It is believed that this increased the students' motivation to take ownership of their own learning process.

An interesting future topic for research is to investigate what use the students actually had of learning how to apply ICT technology. In regard to the specific projects worked with during the course, so far two of the members in the student and staff intranet group have expressed an interest to continue to individually develop their application for their home organisations. The entire community portal group will continue the development together. It has been decided that it is appropriate to host the portal as a separate entity in connection to WMU's own community portal. In the case of the staff intranet and the Seafarers portal, they are under review of the home organisations of the students that suggested them.

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References

[1] Asyali, E, Zorba, Y, Nas, S 2003, 'Adaptation of Problem–Based Learning Method to Requirements of STCW Convention', *IAMU 4th IAMU General Assembly*

[2] Beck, Kent, 2000, *Extreme Programming explained : embrace change*, Addison-Wesley, cop

[3] Constantinescu, E 2003: "TIME Model or How to Integrate New Technology on Maritime Education and Training", *IAMU 4th IAMU General Assembly*

[4] Dittrich, Y 1999, 'Shopping Web-shopping Web-shop Web-selling Selling. Teaching Software Development together with Work Practice Studies.' *Proceedings of the IRIS 22*, 7-10 August 1999 Keuruu, Finland.

[5] Dittrich, Y, Eriksén, S, & Hansson, C, 2002: 'Participatory Design in the Wild; Evolving Practices for Design in Use.' *Submitted to the PDC*, Malmö, Sweden.

[6] Dittrich, Y & Lindberg, O 2004, 'How Use Oriented Development Can Take Place', *Information and Software Technology*, vol. 46, no. 9, pp. 603-617.

[7] Dittrich, Y, Rönkkö K, Eriksson, J, Hansson, C, & Lindberg O 2008, 'Co-operative Method Development Combining qualitative empirical research with process improvement', *Empirical Software Engineering JournalI,* vol. 13, no. 3, pp. 231-260.

[8] Fedila, Mokrane , 2007, *Appropriateness of Problem Based Learning in Maritime Education and Training*, dissertation Master of Science, World Maritime University, Malmö, Sweden.

[9] Floyd, C, Mehl, W-M, Reisin, F-M, Schmidt, G, & Wolf, G 1989, 'Out of Scandinavia: Alternative Approaches to Software Design and System Development', *Human-Computer Interaction*, vol. 4, no. 4, pp. 253-350.

[10] Hesham, H 2003, 'Computer Based Training: A Global Survey of Current Developments and its Application to Maritime Education and Training', *IAMU 4th IAMU General Assembly.*

[11] Horck, Jan, 2006, *A Mixed Crew Complement. Licentiate dissertation in Education. Malmö Högskola*, Sweden

[12] Ohlsson, L & Johansson, C, 'A Practice Driven Approach to Software Engineering Education', *IEEE Transactions on Education*, vol 38, no. 5, pp. 291-295.

[13] Volker, W, Lieberman, H, & Paternó, F (eds.) 2006, *End User Development: Empowering people to flexibly employ advanced information and communication technology*, Springer.

MET and the forces of globalisation: or, the DFE versus the FOG!

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Abstract

We do not just live and work in an economy; we live and work in a society. The essence of this paper is that the forces of globalisation can be viewed as both presenting opportunities and creating challenges for maritime education and training. The relevance of the work is that it links the forces driving globalisation, education and the shipping industry with the forces driving the approach taken by the International Maritime Organisation (IMO) to maritime education and training (MET), at a time when the Standards of Training, Certification and Watchkeeping (STCW) Convention and Code is under review. Five challenges for maritime educators are posed, namely:

1. Are the corporate (invasive?) and societal (liberating?) views of globalisation truly dichotomous, or is there a balanced middle ground for education in the future?
2. Are universities and educators being subverted from their responsibilities to society by the forces of globalisation?
3. Are the forces of globalisation which are driving shipping also causing IMO to take a broader, less safety-oriented approach to issues of seafarer competence?
4. Are the forces of globalisation and STCW the dark forces of evil (DFE) or are they the forces of good (FOG)?
5. Has the time come for the International Association of Maritime Universities (IAMU), the International Association of Maritime Lecturers (IMLA) and GlobalMET to combine forces and develop a common view of maritime education for the globalised maritime community of the future?

Maritime education and training is not immune from the forces of globalisation and STCW. Because they are in no position to stop or reverse these forces, maritime universities need to determine how they position themselves in the increasingly global market. A fundamental issue which maritime universities need to address is whether or not they should collectively seek to modify the administrative, corporate and IMO forces which are driving maritime education and training, particularly for officers, away from the broader, more rounded approach to education which is fundamental to the very heart of universities.

1 Introduction

An earlier paper for the 2nd General Assembly of IAMU presented research highlighting the emerging shifts in education (Lewarn 2001). It was postulated that education was rapidly becoming globalised, massified and increasingly commodified, thus presenting both opportunities and challenges for maritime educators and their institutions.

It can be argued that the massification and commodification of education are two of the outcomes of 'corporate' globalisation; consequently this paper reports on work which seeks to better understand the forces of globalisation, their effects on maritime education and training, and how these challenges might be met by greater collaborative efforts.

2 Dichotomous views of globalisation

The term globalisation is in common use but there are quite different understandings of its precise meaning. Literature prior to the year 2000 uses the term in a variety of inconsistent ways, but some coherence was brought to the debate when Scholte (2000, p15-17) identified five broad, related and overlapping definitions of globalisation which can be summarised as:

- Globalisation as internationalisation. In this context globalisation is used to describe cross border relations between countries. It includes the growth in international exchange and interdependence with increasing flows of trade and capital investment. It encapsulates the concept of the globalised economy in which distinct national economies are subsumed by international processes and transactions.
- Globalisation as liberalisation. In this context globalisation refers to a process of removing government imposed restrictions on movements between countries in order to create an open, borderless world economy. The abolition of trade barriers and capital controls falls within this view of globalisation.
- Globalisation as universalisation. In this context globalisation is used to describe the process of spreading various objects and experiences worldwide to all corners of the earth. The spread of computing, the internet, television and even the English language, as the language of commerce and the sea, are examples which are included in this view of globalisation.
- Globalisation as modernisation/westernisation. In this context globalisation is considered to be a dynamic whereby the social structures of modernity (capitalism, rationalism, industrialism, bureaucratism etc.) are spread over the world, frequently destroying existing culture and local self determination in the process.

- Globalisation as deterritorialisation (or the spread of supraterritoriality). In this context globalisation entails the reconfiguration of geography such that social space is no longer wholly mapped in terms of territorial places, territorial distances and territorial borders. This view considers globalisation as the intensification of worldwide social relations which link distant localities in such a way that local happenings are shaped by events occurring many miles away and vice versa (Giddens 1990, p64). Academic disciplines are classic examples of this form of globalisation.

Whilst there is still debate about these five approaches to globalisation there is some agreement that the first four are essentially forms of territorialism whilst the fifth is not. This fifth approach takes a societal view and recognises that social connections have rapidly increased and that they are no longer related to territory. However, it is true to say that there is no clear agreement on whether the forces of globalisation are invasive or liberating.

What is clear is that globalisation is a multi-faceted set of processes which include not only the changes which have flowed from the new information technologies and the opening up of markets, but also new concepts which mean that shrinking space, shrinking time and disappearing borders are linking people's lives more deeply, more intensely and more immediately than ever before (UNDP 1999, p1). As Power (2000, p7) suggests, these globalisation processes will make our societies increasingly multicultural as interactions among cultural groups intensify and will also force shifts in our educational and development priorities such that the greatest global challenge facing education systems is that of learning to live together. These shifts can create both opportunities and difficulties for education and as Power (2000, p7) states: 'I believe that the opportunities created by global processes will be actualised only if we continue to insist that education is a basic human right and resist the tendency to reduce education into yet another market commodity. If we fail, I fear that our world will become increasingly unequal, competitive, polarised, conflicted and dangerous'.

Are the corporate (invasive?) and societal (liberating?) views of globalisation truly dichotomous, or is there a balanced middle ground for education in the future?

3 Effects on education

In a particularly insightful essay, Tabb (2001, p1) indicates that the university will be a very different place in another decade or two, and what it will look like depends to a large degree on what version of globalisation wins out. Governments around the developed world are requiring education providers to be more efficient by forcing them into the market model and away from the fundamental concept of education as a publicly provided social good. In short, education is becoming globalised, massified and treated as a commodity.

The nature and complexity of the forces involved in globalisation have conditioned the context in which educators operate as well as profoundly altering the educational learning experiences of students. In addition, it is observable that many makers of educational policy lean to a market driven approach to the provision of education. In summarising, Smith (2002, p2) suggests there are four significant issues regarding the practice and experience of education, namely:

- Commodification, including attempts to standardize 'products', and the corporate takeover of education.
- The threat to the autonomy of national educational systems by globalisation.
- De-localisation, changing technologies and orientations in education.
- Branding, globalisation and learning to be consumers.

These four issues apply just as well to maritime education and training: for example, IMO model courses are standard products available for sale like any other commodity; STCW is a global approach which has reshaped national maritime education and training systems; the use of flexible delivery techniques has made maritime education and training more accessible to more people where and when they want it; and maritime education and training providers have put considerable effort into branding their institution to increase its attractiveness to its potential customers.

Education today is in an era of rapid and sustained change where the old paradigms are increasingly irrelevant and are being replaced by new paradigms. These fundamental shifts in higher education are reflected by Inglis et al. (1999) and are summarised in the following Table 1.

Table 1. Old and New Paradigms in Higher Education

Old Paradigm	**New Paradigm**
Take what you can get	Courses on demand
Academic calendar	Year round operations
University as a city	University as an idea
Terminal degree	Lifelong learning
University as ivory tower	University as partner in society
Students 18-25 years old	Students all ages
Books primary medium	Information on demand
Tenure	Market value
Single product	Information reuse/exhaust
Student as necessary evil	Student as customer

Table 1. Old and New Paradigms in Higher Education

Old Paradigm	**New Paradigm**
Delivery in classroom	Delivery anywhere
Multicultural	Global
Bricks and mortar	Bits and bytes
Single discipline	Multi-discipline
Institution centric	Market centric
Government funded	Market funded
Technology as an expense	Technology as a differentiator

Some see these shifts as positive whilst others see them as negative. The supporters of globalisation take the positive view that the market place has been responsible for making education more accessible to more people, increasing the use of a wide variety of approaches to deliver education where and when it is wanted, and providing education which primarily meet the needs of the economy.

The detractors of globalisation suggest that there has been a fundamental attack on the notion of education as a public good and upon the more liberal ideas of education. Learning has increasingly been seen as a commodity or an investment rather than a way of exploring what might be good for the society as a whole. The direction of the curricula and the readiness of universities to embrace a corporate approach have combined to degrade the work of teachers/lecturers to a point where it is relevant to question whether it can be rightfully called education (Smith 2002, p7).

Having briefly illustrated some of the opposing views of the effects of globalisation on education it is pertinent to be reminded of two axioms for educators, namely:-

- Educators need to be able to do what is right rather than just what is correct.
- The right of educators to academic freedom also brings an obligation to act responsibly.

In this context it is also relevant to be reminded of just what academic freedom means. The University of Notre Dame Australia (2008) defines academic freedom as follows:-

'The University must be a liberal and unfettered place where basic values and beliefs are exposed, explained, researched, debated, freely challenged, and openly affirmed or rejected. No person within its community can or should be oppressed, vilified, demeaned or discriminated against because of their faith and values. All must be free and comfortable within the life of the University'.

Are Universities and educators being subverted from their responsibilities to society by the forces of globalisation?

4 Shipping: a Global Business

Shipping has been a global activity for centuries, but in the last fifty years there have been a number of significant shifts in the way the business of shipping is conducted. These shifts include:

- The demise of the traditional European shipowner and the rise of the Asian shipowner.
- The move to containerisation leading to the development of regional consortia and multi-national groupings.
- The rise of global shipping networks as a means of improving customer service and driving down costs.
- The shipment of ever increasing tonnages of low value, bulk commodities, particularly to the newly industrialised countries.
- The global approach to ship ownership and operation. Take, for example the relationship of shipowner and parent company: Russia - raises purchase price loan; Cayman Islands - builds the ship; Spain; establishes shelf company and registers ship – Panama; classifies ship – Norway; ship operated by management company – Hong Kong; crewed by crewing agent – India; employs Indian officers and Philippines ratings; ship chartered – Chinese importer; to transport Australian iron ore.
- The increasingly globalised attempts of IMO to improve safety of life, property and the environment.

It can be argued that most of these shifts may well have had positive effects on trade but almost certainly have had negative effects on seafaring. The international community's response to the perceived fall in the competence, quality and professionalism of seafarers was STCW 95 which attempted to change the focus away from what seafarers should know to what seafarers should be able to do.

The pressures on crews are well documented (Commonwealth of Australia 1992; International Commission on Shipping 2000) and include increasing 'compliance' workloads, shortages of qualified officers, 'hard driving' to meet schedules, as well as language and cultural issues caused by multi-national crewing. The outcomes of these pressures are many and varied, but increasing concerns about fatigue and accident rates indicate that the work done to date to alleviate these pressures is still inadequate.

In his opening address to the 39th session of the IMO Sub-Committee on Standards of Training and Watchkeeping (IMO 2008, p5), the Secretary-General expressed "concern on the anticipated shortage of seafarers of some 27,000 officers representing almost 6% of the total by the year 2015 and in light of the recent unprecedented rise in orders for new buildings, which would have to be

entrusted to competent seafarers to sail them in a safe, environmentally sound and efficient manner." The Secretary-General also "drew attention to the outcome of recent analyses of accidents which indicated that, due to inappropriate levels of manning and watchkeeping arrangements, particularly on short sea voyages, fatigue had emerged as a significant contributory factor in accidents." This view, that all is not well within the seafaring community, is frequently reinforced in the shipping press. As an example, Lloyd's List DCN (2008, p17) reported that the "Latest figures collated by the Norwegian class society establish that losses from navigational accidents continue to rise at an alarming rate, and threaten to lift insurance premiums by as much as 30% this year alone. Accidents have doubled over the past five years, due to continued growth of the world fleet and a shortage of officers with the right skills."

The current review of the STCW Convention and the STCW Code is yet another attempt to overcome a problem by taking a prescriptive, rule based approach. Taking a pragmatic view, Secretary-General Mitropoulos (2007, p4) suggests that what really matters is the attitude adopted towards compliance and that simply obeying the letter of the law is not sufficient as it is the spirit of the regulations which should be genuinely embraced. He further states "In the end, of course, it all comes down to individual people. If they do not perform their tasks properly and with meticulous care, the end result can be disaster." It can be argued that this is the basis of the case for seafarer education to be wider and more encompassing than training for technical competence alone.

Arguably, it is time for a genuinely thorough review of STCW and of maritime education and training overall – one that recognises current and foreseeable developments in the shipping industry as well as in educational methodologies and delivery techniques. This may also suggest that the time is right for STCW to concentrate on, and emphasise, safety issues rather than the multitude of broader onboard operational tasks and skills which are properly the purview of employers (Lewarn 2008, p26).

Are the forces of globalisation which are driving shipping also causing IMO to take a broader, less safety oriented approach to issues of seafarer competence?

5 Globalisation and STCW: Facing the Challenges

Cogburn (1998, p4-5) suggests that graduates of even the best of existing education systems are likely to find themselves deficient in knowledge as well as the cognitive skills necessary for the increasingly complex living and working environments they will encounter. More importantly, the complaint is often heard that graduates lack the capacity to learn new skills and assimilate new knowledge. Within the globalised framework for knowledge, education and learning it is postulated that at least ten components should be included or enhanced such that the system:

- Is an agile and flexible system

- Breaks the boundaries of space and time
- Blurs the distinction between mental and physical labour
- Encourages work in teams
- Uses virtual teams around the world
- Places a greater focus on abstract concepts
- Takes an holistic rather than a discrete approach
- Enhances the ability to manipulate abstractions
- Enhances the ability to acquire and utilise knowledge
- Produces scientifically and technically trained persons

The minimalist, task oriented approach of STCW to maritime education and training can be seen as an adaptation of the globalised market driven approach to education as it is almost entirely workplace focused. STCW does not take into account the wider societal approach to education which, of course, it is not designed to do. The wider societal approach is left to the universities which is almost certainly the best option. But with the pressures of market forces, costs, politicians, and employers who believe that all a seafarer needs is a certificate of competence, it is increasingly difficult to provide the rounded education which seafarers both need and deserve. Learning how to learn seems to be taking second place to learning how to do.

Work done by GlobalMET, a worldwide association of approximately 100 maritime education and training institutions with its membership located in 33 countries, highlights that for maritime education and training to be more effective:

- STCW must promote education and training that is in step with the human resource requirements of the shipping industry;
- STCW must emphasise clear, realistic learning outcomes rather than inputs;
- STCW must emphasise the importance of using clear, valid, reliable and consistent forms of assessment to improve competence, which are universally recognised and adopted;
- STCW must recognise the diverse range of modern flexible educational delivery methods as valid forms of learning;
- STCW must be able to be updated quickly in response to innovation and change in the shipping industry and in education and training.

It is fundamental to recognise that seafarer education and training must be outcome driven rather than the current input, process, regulation driven approach beloved of many maritime administrations (Lewarn 2008, p26). Haughton (2008, p9) supports this view when he states that "Standards are set, procedures planned, codes constructed, matrices manufactured – but these are surely only the frameworks and vehicles to get where we want. If instead we articulated our vision of where we want to get to then we might be able to leave people to design ways of getting there by themselves. IMO should be congratulated in its efforts to move more towards a goal-focussed approach to performance. Let's hope this extends to education and training." The great

danger in the prescriptive approach is that it tends to focus on the lower order skills of Bloom's taxonomy i.e. knowledge, comprehension and application, rather than the higher order skills i.e. analysis, synthesis and evaluation. In this context, the validity of IMO model courses could be questioned.

In a number of countries maritime administrations have taken the view that the courses which they approve must follow exactly the relevant IMO model course. In reality a model course is only supposed to be a guide upon which teachers can build to develop appropriate teaching and learning strategies. The highly prescriptive nature of model courses is not only at odds with the basic concepts of competency based training, upon which STCW is based, but also focuses on lower order skills (Lewarn 2002, p3). Haughton (2008, p9) further suggests this can lead to a dislocation between knowledge and meaning which, in turn, leads him to conclude that whilst things are relatively normal seafarers are relatively safe, but when things start to go wrong the higher order cognitive skills simply are not there.

Maritime education and training is not immune from the forces of globalisation and STCW. Because they are in no position to stop or reverse these forces, maritime universities need to determine how they position themselves in the increasingly global market. Perhaps a fundamental issue which maritime universities need to address is whether or not they should collectively seek to modify the administrative, corporate and IMO forces which are driving maritime education and training, particularly for officers, away from the broader, more rounded approach to education which is fundamental to the very heart of universities.

Are the forces of globalisation and STCW the dark forces of evil (DFE) or are they the forces of good (FOG)?

6 Conclusion

It must be clear that few maritime education and training institutions posses either the resources or all the skills necessary to fully grasp the opportunities and challenges presented by the rapidly changing globalised education environment. It also seems evident that to maximise the potential benefits which these opportunities present and to overcome the challenges being faced, far greater collaboration between maritime education and training providers is necessary (Lewarn 2001, p212). For example, there is a view amongst some members of GlobalMET that every maritime education and training provider that is not already part of a nationally accredited tertiary institution, such as a university, polytechnic or college of further education, should be formally linked with an accredited tertiary institution as a means of ensuring/improving consistency and quality (Lewarn 2008, p26).

Whilst this is not a formal view of GlobalMET, it is worth recalling that the establishment of this organisation arose from the desire of the original members

to support the aims and objectives of IMO for 'safer ships and cleaner oceans' and recognition of:

1. The vital importance of maritime education and training in fulfilling the needs of expanding trade and economic growth;
2. The urgent need for collective efforts in maritime education and training to promote greater safety at sea and protection of the marine environment.

The significance of high quality maritime education and training is also recognised by the 46 institutional members of IAMU (2008) where they note that:

1. The shipping industry is a service industry, in which human resources are the critical element;
2. It is only feasible to secure, and to preserve, highly qualified human resources in the maritime industries through effective education and training; and
3. Effective education and training in the maritime sector derives from:
    - scientific and academic rigor;
    - development of a clear link between practical skills and management techniques; and
    - a focus on quality

In a similar vein, IMLA, with its 542 individual members, is essentially a no-border forum: a round table for discussions on sea-related topics as well as a way to establish or maintain contact with colleagues who face the same challenges and difficulties in their work. Teachers and other parties from all over the world dedicated to transfer knowledge to future seafarers are invited to freely present their achievements, share and discuss experiences and exchange ideas. To this end, IMLA is an umbrella for the International Conference on Engine Room Simulators, the International Navigation Simulator Lecturers Conference, the International Maritime English Conference, as well as the biennial Maritime Education and Training Conference (IMLA 2008).

All three organizations clearly value education in the broadest and best sense of the word but independently work towards improving the quality of maritime education and training.

In a speech to the 7th General Assembly of IAMU, the Honorary Chair said "I believe that the development of well-balanced and highly qualified seafarers is possible only if they are taught the pride and philosophy of being a seafarer, not just the skills and knowledge necessary for safe vessel operation. In addition, to nurture and utilise seafarers who will continue to support the development of the new maritime community, we need to review and raise the standards of the conventional maritime education system. We need to develop a new systematic curriculum. One that includes comprehensive education about the sea. One that

encompasses such fields as marine environment, maritime administration and policy, international law and safety management. This new curriculum will play a key role in developing a new maritime community" (Sasakawa 2006).

This clearly fits with a societal rather than a corporate view of education. Consequently, has the time come for IAMU, IMLA and GlobalMET to combine forces and develop a common view of maritime education for the globalised maritime community of the future?

References

[1] Cogburn D L (1998): Globalization, knowledge, education and training in the global world, Conference paper for *Infoethics 98*, UNESCO, www.unesco.org/webworld/infoethics_2/eng/papers/paper_23.htm Accessed May 19, 2008.

[2] Commonwealth of Australia (1992): *Ships of Shame – Inquiry into Ship Safety*, Canberra, AGPS.

[3] Giddens A (1990): *The Consequences of Modernity*, Stanford, Stanford University Press.

[4] GlobalMET (2008): GlobalMET Members, www.ametiap.com/Website/OrgMembers.aspx Accessed May 19, 2008.

[5] Haughton C (2008): Knowledge v Learning – are we clear about the distinction? *Proceedings of the 3rd Manning and Training Conference*, Mumbai, p1-16.

[6] IAMU (2008): IAMU Introduction, www.iamu-edu.org/general/introduction.php Accessed May 19, 2008.

[7] IMO (2008): Secretary-General's Opening Address, *Report to the Maritime Safety Committee, Paper STW 39/12*, London, IMO.

[8] Inglis A, Ling P and Joosten U (1999): *Delivering Digitally – Managing the Transition to Knowledge Media*, London, Kogan Page.

[9] International Commission on Shipping (2000): *Inquiry into Ship Safety – Ships, Slaves and Competition*, Charleston NSW, International Commission on Shipping.

[10] IMLA (2008): IMLA Website Welcome, http://195.178.246.23/ Accessed May 19, 2008.

[11] Lewarn B (2001): Maritime Education and Training – the future is now!, *Proceedings of the 2nd General Assembly of IAMU*, 2-5 October 2001, Kobe, p207-212.

[12] Lewarn B (2002): Seafarer Training - does the system defeat competence?, *Proceedings of the 3rd General Assembly of IAMU*, 23-26 September 2002, Maine.

[13] Lewarn B (2008): STCW Review – Challenges for Maritime Educators and Trainers, *Seaways, February 2008*, p24-26.

[14] Lloyd's List DCN (2008): *Owners warned as casualties leap*, February 28, 2008, p17.

[15] Mitropoulos E E (2007): Compliance – just a starting point, *IMO News, 4*, p4.
[16] Power C N (2000): Globalisation and education in the twenty-first century, *Journal of Educational Research, vol 16(1)*, p7-29
[17] Sasakawa Y (2006): Speech delivered at the 7th General Assembly of the International Association of Maritime Universities, Dalian Maritime University, Dalian, PRC, October 16, 2006.
[18] Scholte J A (2000): *Globalization. A critical introduction*, London, Palgrave.
[19] Smith M K (2002): Globalization and the incorporation of education, *The Encyclopedia of Informal Education*, www.infed.org/biblio/globalization.htm. Updated: December 28, 2007.
[20] Tabb W (2001): *Globalization and Education as a Commodity*, www.psc-cuny.org/jcglobalization.htm Accessed: May 12, 2008.
[21] United Nations Development Programme (UNDP) (1999): *World Development Report*, New York, UNDP.
[22] University of Notre Dame Australia (2008): *Academic Freedom Policy Statement*, www.nd.edu.au/university/index.shtml Accessed: May 12, 2008.

Women maritime education and training: An Egyptian perspective

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Abstract

Worldwide there has been a strong emphasis on gender education as a means of empowering women to take full advantage of the positive aspects of globalization and enabling them to effectively participate in a collective action to offset its negative social and economic consequences. Gender education in Egypt as a developing country, however, shows a high statistical percentage of female illiteracy. Extremely negative consequences inevitably result from such gender inequality and women illiteracy: namely; child labour and the negative perception of women's rights.

In the context of women in the maritime profession, significant research proves that women seafarers are indeed an underutilized source of maritime talent. Enhancing maritime education through academic achievement and training should be strengthened, especially when highlighted by IMO strategies for the integration of women into the maritime sector and the implementation of the IMO women in development programme. Furthermore, the newly set regional networks for women in the maritime and port sectors are considered a real credit to women in the maritime profession. Examples of these networks are: The Pacific Women in Maritime Association, The Network for Professional Women in the Maritime and Port Sectors of the West and Central Africa and The Arab International Women's Maritime Forum for the Middle East and North Africa (MENA), which is one of the achievements of The Arab Academy For Science And Technology And Maritime Transport (AASTMT) seeking more women integration in the maritime sector. Other positive steps taken by the Academy include the admission of female students at the College of Maritime Studies and Technology; the establishment of the College of International Transport and Logistics for female and male students; holding the first Conference of The Arab International Maritime Women in MENA and Africa, July 2007, Alexandria, Egypt. Last but not least, MENA &Africa Arab International Women's Maritime Forum had been launched. The Forum means to promote more female inductions into the maritime industry in MENA and Africa and empower women decision-making change the world in full compliance with IMO objectives.

1 Gender education

Despite progress in many areas, women still face discrimination because of ingrained cultural attitudes, early marriages, pregnancies, lack of accessible schools, and inadequate gender-biased educational materials. They continue to be denied quality education in science and technology. Education at all levels is definitely the key to making any progress in moving the "platform for action" forward. The implementation of "the platform for action" and "the provision of education for all" will require political will and allocation of adequate financial and human resources.

Education will empower women to take full advantage of the positive aspects of globalization and will enable them to effectively participate in a collective action to offset its negative social and economic consequences. Access to information and communication technologies will allow women and girls to benefit from and contribute to its further development.

1.1 Women in developing countries

According to The Organization for Economic Cooperation and Development report (OECD 2007):

- On average, women in developing countries get married 6 ½ years earlier than in OECD countries.
- There are still 800 million people in the world lacking basic literacy skills. Women account for two-thirds of the total.
- Young women in sub-Sahara Africa aged 15-24 are between two and six times as likely to be HIV-positive than men of a similar age.
- About one-half of aid to basic education and basic health targeted gender-specific concerns.

In large parts of the developing world, traditions and socio-cultural norms still trap countries in poverty as they bar women from economic activities: more discrimination – less economic growth – more poverty.

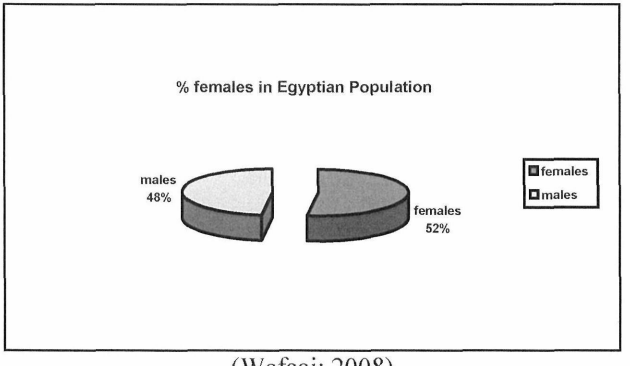
1.2 Gender education in Egypt

In Egypt women do not have the same opportunities for education as men. According to the Human Resource Development Report (2005), it has been found that education is the least area where progress has been made concerning gender equality in Egypt.

The following figures are quoted from: (Wafaai: 2008) work on gender equality in developing countries.

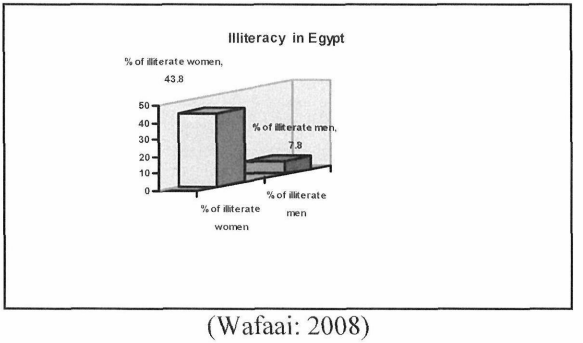
- Fig 1.3.1 the percentage of males is 48% while females is 52% in the Egyptian population.
- Fig. 13.2 the percentage of illiterate female is 44% while illiterate males is 8%
- Fig.1.3.3. the percentage of illiterate female is 44% while literate females is 56%
- Fig.1.3.4 the percentage of women not receiving secondary education is 76% and women receiving secondary education and above is 24%.
- Fig. 1.3.5 the percentage of women graduating from universities is 5% and women not having higher education are 95%
- Fig.13.6 the percentage of university graduates by gender is 31% female university graduates and 69% are male graduates.
- Fig. 1.3.7 measuring the Global Gender Gap, education is the least area where progress has been made concerning gender equality in Egypt

Percentage of Females in the Egyptian population Fig.1.3.1



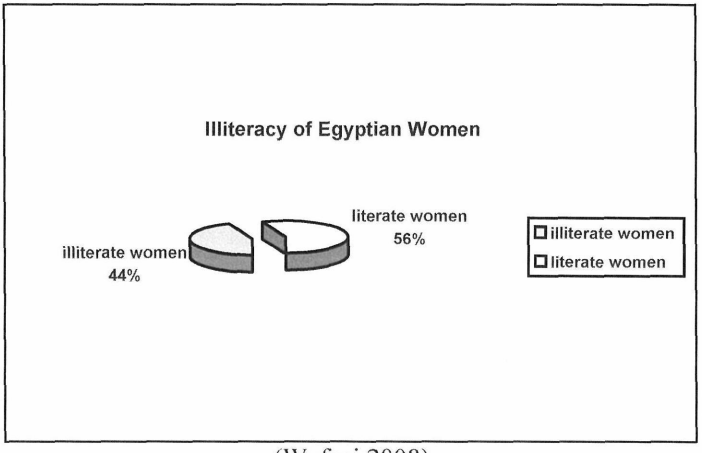
(Wafaai: 2008)

Illiteracy in Egypt Fig. 1.3.2



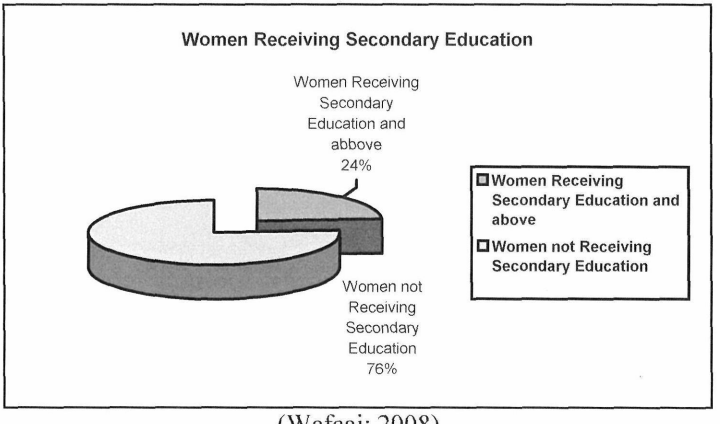
(Wafaai: 2008)

Illiteracy of Egyptian Women Fig.1.3.3



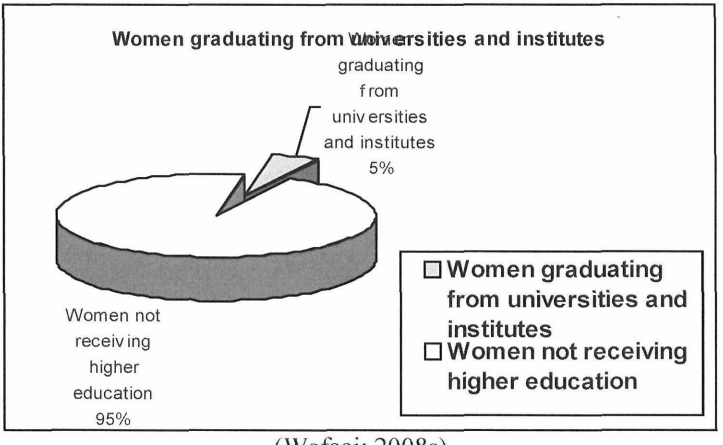
(Wafaai:2008)

Women Receiving Secondary Education Fig.1.3.4



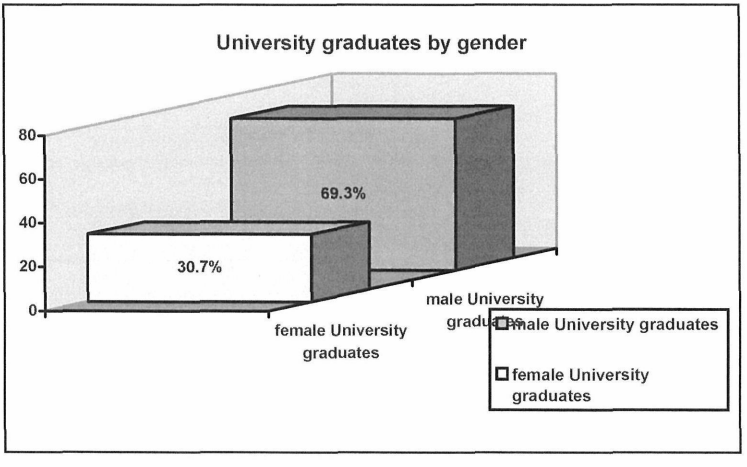
(Wafaai: 2008)

Women graduating from universities and institutes Fig. 1.3.5



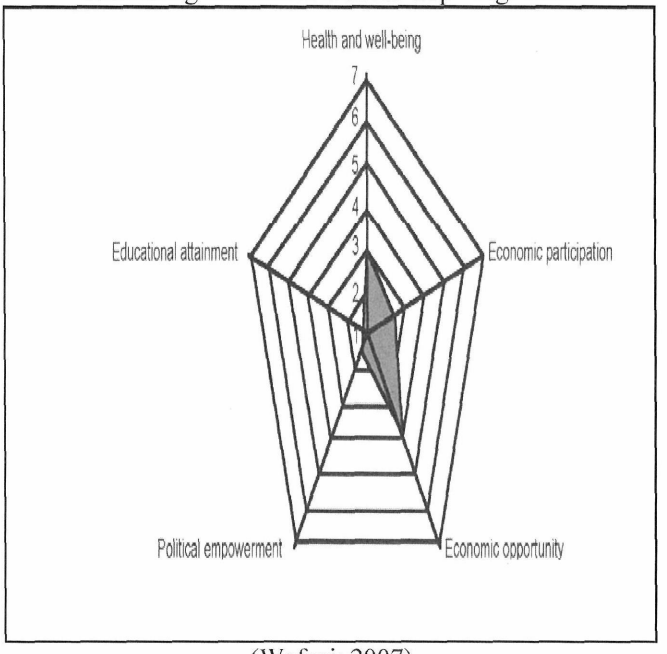
(Wafaai: 2008s)

University graduates by gender Fig.1.3.6



(Wafaai:2007)

Measuring the Global Gender Gap Fig. 1.3.7



(Wafaai: 2007)

1.3 Hazards of illiteracy

Many extremely negative consequences result from gender inequality and female illiteracy, the first being that it leads to bad upbringing of their children. Gender inequality affecting the enrolment of girls in schools in addition to economic poverty are two important issues influencing child labour. In its most extreme forms, child labour involves children being enslaved, separated from their families, exposed to serious hazards and illnesses and/or left to fend for themselves on the streets of large cities – often at a very early age. One of the most predominantly worst forms of child labour in the Arab States is child trafficking. The second relevant outcome of women's illiteracy is the negative perception of women's rights, especially in the context of domestic violence.

Some women seem unaware of the legal protections offered to them by the Egyptian law. And even if some of them are aware they consider their complaints as "culturally unsuitable."

Nevertheless, when asked how they define Human Rights, Egyptians of all walks of life—younger or older, Christian or Muslim, illiterate or college-educated—almost exclusively focus on the most basic essentials of life: food, housing, jobs, education, and health care. (Katulis: 2004).

1.4 Attempts made by Egypt for improving the status of women

The Egyptian constitution and its complementary laws provide for the principal of unconditioned equality between men and women. Many presidential decrees were issued, calling for the elimination of all types of discrimination against women and encouraging a wider participation for women in public life. The National Council for Woman (NCW) was established in 2000 as a governmental institution responsible for improving woman status and brings the differences of social gender. The National Council for Child and Motherhood and the National Council for Human Rights were established.

Egypt's First Lady, Suzanne Mubarak, is a champion for the rights of women and children. She is the technical advisor for the National Council for Motherhood and Childhood in Egypt. The Council's goals are the reinforcement of women's role in society, the study and resolution of problems confronting women, the improvement of women's performance in society, the monitoring of education of children, and the establishment of a healthy environment for children. Within the frame work of the "Reading for All" national project under the chairmanship of the first lady, several libraries have been established and equipped with electronic machines for training on information technology. Female enrolment in education reached 35%in 1991 – 2003. The illiteracy rate among women declined to 41.2% in 2005.

The NCW established an information observatory unit to monitor the content of the woman – relevant information message in the media and improve the image of women and her position in society. Egypt had a problem of early marriage and the Government endeavored to resolve it through increasing awareness and by raising the age of marriage for girls. A new decree had prohibited the practice of female circumcision. In January 2003 a presidential decree was issued whereby a female judge was appointed to the High Constitutional Court for the first time in Egypt's history. Two other women were appointed as members to the panel of High Constitutional Court Commissioners. The Supreme Judicial Council appointed 31 female judges out of 124 female candidates in March 2007.

2 Gender and the maritime profession

"Women as Seafarers" a study commissioned by the ILO following a resolution calling for a more active role to integrate women in the industry and adopted by the 29th session of the Joint maritime Commission on 2001, in Geneva, concluded that women seafarers face not only the general challenges of weather, hard work and rough seas, but also inordinate amounts of discrimination, sexual harassment and parental disapproval as well as often being relegated to low-paying jobs with limited opportunities for promotion. (Fahmy: 2007).

2. 1. Facts and figures

a. Nearly 1.2 million seafarers work in the world's shipping industry, more than a third of them are Asian. It's one of the world's most globalized industries; cruise ships crews often represent 20 nationalities or more.
b. The IMO reports that women represent 1-2% of the world 1.25 million seafarers serving on some 87000 ships. Even in the Philippines, the world's largest supplier of seafarers to the global merchant fleet, for the Philippines archipelago supplies 20 per cent of the world's seafarers, only 225 women appear on the international register of 230,000 seafarers.
c. In the cruise line sector, women represent 17-18% of the work force.
d. 94% of women are employed on passenger ships: with 68% on ferries and 26% on cruise ships and the remaining 6% are employed on cargo vessels, i.e. container ships, oil tankers, etc.
e. Only 7% of women are officers and the rest 93% are ratings. By comparison 42% of male seafarers are officers and 58% are ratings.
f. As today's ships become more specialized and automated, the required skills mix has changed. Demand for skilled deck officers and engineers continue to rise, while slimmer crews are dropping.
g. This is a solid proof that women are indeed an underutilized source of maritime talent which the industry needs to draw upon to make up this shortfall.
h. Generally, women are working as hotel staff on passenger ships; of that category 51.2% come from OECD countries, 23.6% from Eastern Europe, 9.8% from Latin America & Africa, 13.7% from the Far East and 1.7% from South Asia and the ME.
i. Women when on board often experience problems in being initially accepted and in having to "prove themselves", but over time they are usually able to integrate themselves into crews.
j. As for promotion on cargo vessels, this varies among companies; some are reluctant to promote women to senior positions in the hotel sector of passenger vessels, and promotion appears to be more related to ethnicity rather than gender.(Fahmy 2007)

3 Enhancing maritime education

It is firmly believed that the function of women in the maritime sector can be enhanced through academic achievement. Quality education and intensive training would ultimately result in better professional performances especially in terms of leadership and communication skills acquired. The integration of women into all levels of political, economic and social development has become a major objective for the United Nations system over the past 25 years. Goals such as the advancement of women and the promotion of gender equality - highlighted at the Fourth UN Conference for Women in Beijing in 1995- are considered as prerequisites for achieving political, social, economic, cultural and environmental security among all people.

3.1. IMO program objectives

IMO produced its strategy for the integration of women into the maritime sector in 1988 and began implementation of the IMO *women in development programme in 1989*, concentrating on:

a. Integrating women into mainstream maritime activities
b. Improving women's access to maritime training and technology
c. Increasing the percentage of women at the senior management level within the maritime sector
d. Promoting women's economic self-reliance, including access to employment
e. In the developing regions, the IMO Strategic principle is based on capacity-building through the transfer of technology and skills via training, fellowships, seminars, and workshops; the promotion of regional collaboration; and through capacity-building fellowship programme for women with a view to encourage equal training and employment opportunities. (Tansey 2007)
f. To encourage equity in the appointment and promotion of women to senior managerial posts
g. To make women more "visible" as resources for the maritime sector

3.2. Regional networks for women in the maritime and port sectors:

The Pacific Women in Maritime Association (PacWIMA) was the first network to be launched with support from IMO's global programme, in Fiji in February 2004, and it has generated regional cooperation and operational linkages for the women employed in the maritime sector throughout the Pacific Island region. The Network for Professional Women in the Maritime and Port Sectors of the West and Central Africa region was subsequently established in Benin, in February 2007, followed by the Arab International Women's Maritime

Forum for the Middle East and North Africa and Africa as a whole, established in Alexandria, Egypt, in July 2007-(the author of this paper is honoured to be the chair and founder of this Forum). A similar initiative has been undertaken in Mombasa, Kenya, to launch a formal association for professional women in the maritime and port sectors in the Eastern and Southern Africa region (Metropolis: 2008).

3.3. A brighter future!

A Horizon ship has an all-female deck crew. According to Kristen (Consillio, "Horizon Lines Inc. made Hawaii maritime history this week when an 800-foot container ship arrived in port with women occupying its top three bridge posts. The Horizon Navigator, carrying about 900 containers and a total of 25 crew members, arrived at Honolulu Harbor Wednesday from Los Angeles with Capt. Robin Espinosa, Chief Mate S.L. Sam Pirtle and Second Mate Julie Duchi at the helm" (The Honolulu Star Bulletin).

- More women are moving up the ranks in all areas of ship operations, signaling a new era for female merchant mariners who have gained respect in the rigorous field (WMA Spring2008 Newsletter).
- First Annual Women on the Water (WOW) conference was a big success. The WOW conference that was held last October in Traverse City, Michigan was by all accounts a great success. . It was so inspiring to see the smart and confident members of the next generation who are going to be the next leaders in our industry.
- Scholarships are available for women in the maritime industry. WMA has recently become aware of a scholarship available for women. The funds are available for women who are pursuing training at any level, including unlicensed.(Fall 2006 newsletter)
- The International Maritime Law Institute, in Malta reserves 50% of its places on its post-graduate courses for women. There is furthermore, the significant contribution which the World Maritime University has made to increase the opportunities for professional women by raising the intake of qualified women graduates to 30% from 6% in the last decade.

4 AASTMT milestones for more women integration into the maritime sector

The percentage of female students joining AASTMT colleges

a. Fig. 4.1

The percentage of females in Alexandria is 13% while males is 39%
The percentage of females in Sheraton is 9% while males is 16%
The percentage of females in Doki is 7% while males is 16%

b. Fig. 4.2
The percentage of females in Alexandria is 6% while males is 60%
The percentage of females in Sheraton is 4% while males is 30%

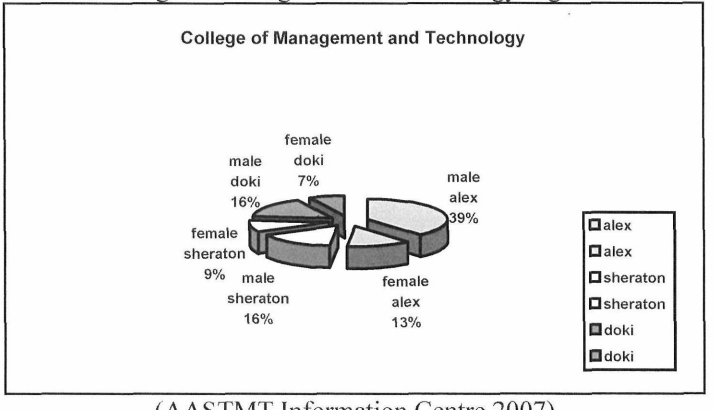
c. Fig. 4.3
The percentage of females in Alexandria is 8% while males is 24%
The percentage of females in Sheraton is 14% while males is 54%

d. Fig. 4.4
The percentage of females in Alexandria is 0% while males is 100%

e. Fig. 4.5
The percentage of females in Alexandria is 6% while males is 50%
The percentage of females in Sheraton is 9% while males is 34%
The percentage of females in Doki is 0% while males is 1%

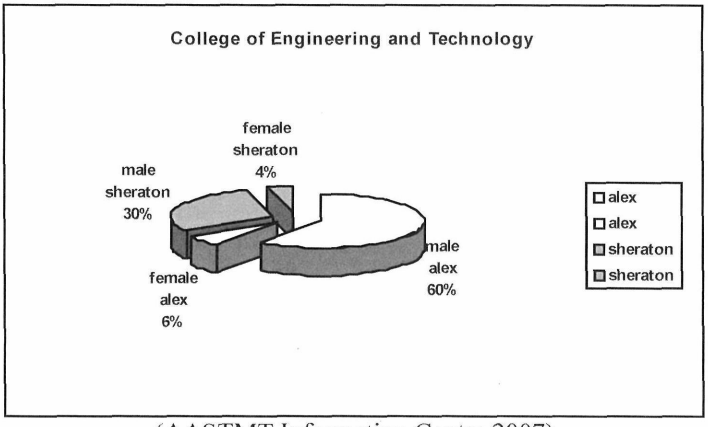
The following charts illustrate the number of female/ male students in each college. (AASTMT Information Centre 2007)

College of Management & Technology Fig. 4.1



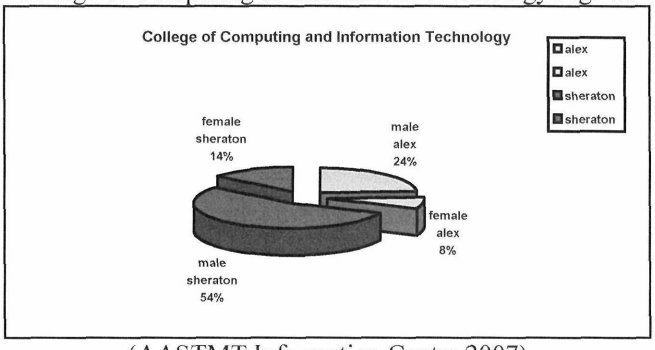
(AASTMT Information Centre 2007)

College of Engineering & Technology Fig. 4.2



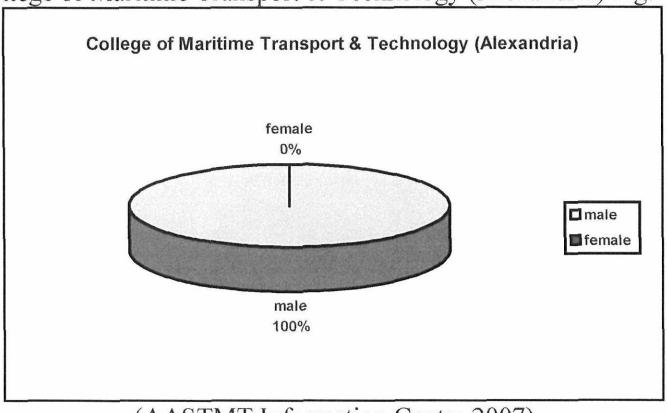
(AASTMT Information Centre 2007)

College of Computing & Information Technology Fig. 4.3



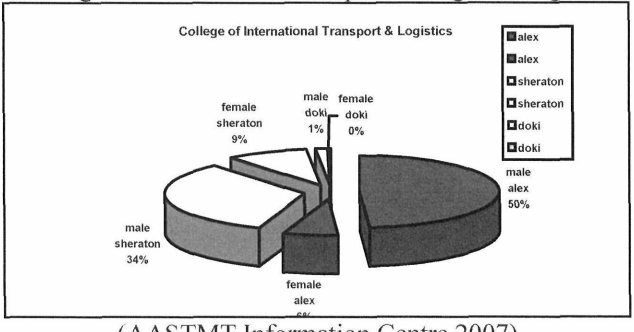
(AASTMT Information Centre 2007)

College of Maritime Transport & Technology (Alexandria) Fig. 4.4



(AASTMT Information Centre 2007)

College of International Transport & Logistics Fig. 4.5



(AASTMT Information Centre 2007)

4.1 Implications

The figures given above represent a low percentage of female students in AASTMT which might be attributed to a number of factors: first, the high tuition fees that only the middle class families can afford to pay for best education for their children; second, the open doors of national universities that competitively require minimal fees, third, and as mentioned earlier, there is a high female illiteracy rate in Egypt. Finally, and most important of all, there are many challenges confronting Egyptian working women such as a long history of male dominance, family responsibilities, short–term maternity leaves, the cultural and social stereo-types of women. Additionally, when working in the maritime sector, there is lack of sufficient relations and communication in the field due to male dominance, lack of previous experience in the maritime field, lack of necessary skills and training and lack of leadership skills and high management skills especially when reaching top management positions.

Nevertheless, AASTMT was able to set a positive example, striving forward for women's welfare in the maritime field; abiding as it were with the UN Millennium Developmental Goals (MDG) and with IMO global strategy.

September 2007 witnessed the first admission of a female student from Eretria (Djibouti) in the Navigation department .Now; we have two other students in the same Department, coming from the Kingdom of Saudi Arabia and Egypt.

AASTMT in its sincere commitment to provide the shipping industry with highly qualified personnel by integrating for the first time female students into that industry, has established the department then the College of International Transport and Logistics (ITL).

In 1996, the department of International Transport and Logistics was first established as one of three departments of the College of Maritime Transport at AASTMT (Wafaai 2008).

In 1996 there was only one female faculty member. Now female faculties constitute 60% of the members at ITL College and females reached around 20% of the graduates of the ITL College.

In 1996, The Institute of International Transport and Logistics launched a joint project between AASTMT, Norwegian Shipping Academy and NORAD (sponsor), offering a Graduate Diploma in International Transport and Logistics.

Around 25 % of total Diploma Students are Women (Arab, African and Asian women)

In 2001, The Institute has offered a Masters degree in Legal transactions and Logistics: 12% of total master graduates are women, now 31% of total master students are women.

Regional Conference on The Arab International Maritime Women in the Middle East and North Africa Annex II in the Memorandum OF Understanding (MoU) between the IMO and the Ministry of Transport of Egypt and AASTMT which endorses a 'description', an 'objective', and an 'output' for a two-day conference in Egypt for the launch of the Association of Women in the Maritime Sector (IMO MoU secretariat at AASTMT). The Regional Conference on The Arab International Maritime Women in the Middle East and North Africa (MENA)was held on 16th -17th July 2007, Alexandria – Egypt by AASTMT, in collaboration with IMO.

a) The conference aim was to discuss opportunities and challenges awaiting Arab maritime women in MENA and Africa, and to promote solutions to overcome those challenges by quoting experiences from the wider maritime sector worldwide.
b) The conference needed to explored cultural, socio-economic, legal, technological issues that might have a direct impact on the maritime profession for women in the Arab world.
c) The Conference meant to generate awareness for gender equality in some maritime professions and would pledge governments, NGO's,

trade unions, shipping companies to enhance more female induction into the maritime industry.

d) The conference was divided into 4 sessions which presented fifteen papers by speakers coming from 10 different Arab / Foreign countries, namely: Jordan, Kingdom of Saudi Arabia, Kuwait, Palestine, United Arab Emirates, Egypt, United Kingdom, Sweden, Austria, USA

On the second day of the conference, MENA &Africa Arab International Women's Maritime Forum had been launched.

Mission

We mean to promote more female induction into the marine industry in MENA & Africa and empower women decision-making change the world in full collaboration with IMO.

- The Forum is meant to function as a lobbying and advocacy body on women's concerns at the national, regional and international levels.
- The Forum is meant to build on and deepen the IMO gender mainstreaming approach, especially when addressing such challenges as the achievement of women's full participation in leadership and decision-making in the maritime sector in most of the Arab countries.

4.3 Forum Objectives

- Laying out a strategy for maritime women empowerment.
- Establishing the necessary mechanisms that are necessary for the implementation of the given strategy.
- Conducting seminars in order to upgrade the professional skills of maritime women. Capacity building is crucial and the IMO prospective training programs aim to target all levels: decision-makers, middle management and graduate students.
- Holding an annual meeting, reporting past events and suggesting future agenda.
- Advocating the immediate participation of all Arab countries during the Arab Committee Meeting – under the auspices of the Arab League of States, 9-10 September 2007.
- Networking with other similar women empowerment forums and organizations.
- Our first seminar on the training program agenda for 2008/2009 will be held on 23rd June 08.
- Our annual meeting will be held in December 2008.

Forum Committee:

- HE Dr. Gamal ElDin Ahmed Mokhtar, President
- HE Dr. Mohamed Farghaly, Director General

- Prof. Layla El Saeed, Chair
- Mrs. Pamela Tansey, IMO Observant

5 Conclusion

In conclusion it might be true that women, especially in the developing countries, still have a long way to go, but the spark has been ignited and AASTMT has taken a few modest initiatives for women's integration in the maritime sector. However, it must be proudly admitted that without IMO support and IAMU networking these attempts would not have seen the light.

References

[1] AASTMT Information Centre (Fall 2007).

[2] Arab League Publications: Woman Status in the Arab countries 1995 - 2005

[3] DAC Network on Gender Equality. (Development Assistance Committee 23-Jul-2007)

[4] Fahmy,N. (2007):The Integration of Women into the Maritime Industry, an International Organizations Perspective .

[5] IMO MoU Secretariat Office at AASTMT.

[6] katulis, B (2004): Women's Rights In Focus: Egypt findings from May—June 2004 focus groups with Egyptian citizens on women's freedom, sponsored by Freedom House's Survey Of Women's Freedom In The Middle East And North Africa, Women's Right To Education : Concerns About Short Comings In Egypt's Schools.

[7] Mitropoulos, E.(2008): Empowering Women in the Maritime World. Address by Efthimios E. Mitropoulos, Secretary-General, IMO.

[8] OECD work (The Organization for Economic Cooperation and Development) on Gender Equality in Developing Countries. www.oecd.org

[9] Perry, S. (2007): Empowering Women World Wide :(The History Of Project Five-O).

[10] Tansey, P. (2007): Presentation on IMO, Partnership For Development, AASTMT July Conference .Alexandria, Egypt.

[11] Wafaai, I. (s2007&2008): Enhancing the Role of Women in the Maritime Sector through Academic Achievement.Two presentations at AASTMT July Conference and March25th Cairo Seminar.

[12] WMA Fall 2006 Newsletter &WMA Spring (2008) Newsletter.

Some issues of safety assessment in the Ukraine

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Abstract

The safety of navigation and the marine environment is the core issue in the modern shipping industry which governs all the sides of its life, operation and development, but this issue preconditions the investigation of all sorts of dangers and threats as well as the degree of the ship's safety. The principal methodology of this process is **THE GUIDELINES FOR FORMAL SAFETY ASSESSMENT (FSA) FOR USE IN THE RULE-MAKING PROCESS** as adopted by **IMO (MSC/Circ. 1023 – MEPC/Circ. 392)** 5 April 2002 as amended by **IMO (MSC/Circ. 1180 – MEPC/Circ. 474)** 25 August 2005 and **IMO (MSC-MEPC.2/Circ.5.)** 16 October 2006. (2)

FSA is a structured and systematic methodology aimed at enhancing maritime safety including protection of life, health, the maritime environment and property by using risk and cost/benefit assessments, its principal objective being the formalization of all factors influencing the safety of the ship and the environment for their subsequent quantification.

The simplest mathematical expression of risk is the following R=PC, where R – risk, P – probability, C – consequence. Some authors give some other similar general expressions, but the most difficult and important problem in this respect is finding the independent variables -- the functions of which these expressions are -- which is of primary importance for their subsequent quantification. Some authors propose particular solutions for the identification of these independent variables and even give them quantitative values (3,8,10). In search of the solution for the above problems it is worthy to note that some authors attract the attention to the similarity of safety and the security issues (7). We also paid attention to this fact (4), especially to the identity of the mathematical expressions used for both problems.

Certainly, the independent variables of these functions will be absolutely different but the method of analysis used for the investigation of security is applicable for the investigation of the safety and vice versa.

The haphazard random element in the occurrence of accidents complicates the investigation of the causes of the disasters. Some authors (1,9) address sophisticated mathematics such as calculus of probability and game theory etc. to facilitate it.

1 Introduction

For better understanding of the analyzed papers it is necessary to review the principal terms and definitions used in them. To our mind the best definition of safety for our purpose is given by Ch. Kuo: "Safety is a perceived quality that determines to what extent the management, engineering and operation of a system is free of danger to life, property and the environment" (11).

One of the most important values requiring investigation for the provision of safety is risk. Ch. Kuo gives the following definition of risk: "It (risk) is likely outcome or probability of occurrence and the severity of consequences that are of interest"(11). One more definition is given by the other authors: "Risk was defined as a measure of the probability and severity of consequences of undesirable event". (6)

R=PC

Where R – risk; P – probability and C – consequences. Sometimes such characteristics as "frequency" and "hazard" are used in the definitions. Risk may be defined as "the combination of the frequency and the severity of the consequence" (2).

R=FC

Where F – frequency.

Or "A combination of the probability or frequency of occurrence of a defined hazard and the magnitude of the consequence of the occurrence" (ISO 8402; 1995).

Where

Consequence: The outcome of an accident.(2)

Frequency: The number of occurrences per unit time (e.g. per year).(2)

Hazard: A potential to threaten human life, health, property or the environment. (2)

In the security risk management the frequency is considered to be the product of two factors threat – (T) and vulnerability (V). (5)

F=TV

R=TVC

Where threat is defined as an event, process, or phenomenon which is able to break the stability and development. (9)

Vulnerability:

The magnitude of probability at which the existing protection measures will not be sufficient for the prevention at the undesirable event. (9)

After the Identification of hazards (step 1) the FSA manual proposes the fulfillment of risk analysis. (2)

The purpose of the risk analysis in step 2 is a detailed investigation of the causes and consequences of the more important scenarios identified in step1.

This can be achieved by the use of suitable techniques that model the risk. This allows attention to be focused upon high risk areas and to identify and evaluate the factors which influence the level of risk. (2)

Risk analysis is about developing an understanding of the risk. Risk analysis involves consideration of the sources of risk, their consequences and likelihood that those consequences may occur. That is, the risk is analyzed by combining consequences and their likelihood. The consequences and likelihood of each risk source determines the level of risk.

Risk assessment is often defined as the process of understanding what bad things can happen, how likely they are to happen, and how severe the effects may be.

2 The contribution of different authors to the specific problem of interest

Christopher Wiernicki, ABS President (3), brings into focus the predicted events for the near future which will greatly influence all the problems of shipping industry at all the levels, beginning from designing and construction of ship to their operation.

China's demand for oil and gas is now second only to that of the United States, yet its per capita consumption of energy is only a small fraction of its more developed trading partner. And India, with a population now exceeding one billion people, scarcely even registers as an energy consumer on a per capita basis. To meet the future expected demands of these two nations alone, both of which are on an accelerated pace of domestic economic growth, will provide an enormous challenge for the energy sector. Most of that exploration will take place within the marine environment. Some of those waters are relatively benign and some of them are decidedly hostile (such as the Kazakh portion of the Caspian and the northern waters of Russia).

Yet, the emerging global economic needs are relentlessly driving the next generation of Marine and Offshore Structures. These structures are growing to unprecedented size and complexity. It is likely that, before this year closes, the first order for a large compressed natural gas carrier will have been placed. In the last five years, LNG carriers have almost doubled in size from 135,000 to 250,000 cu meters for the latest orders. An entire new fleet of ice class tankers is taking shape in Asian shipyards, ready to transport the oil to market. Most of these projects are at or are pushing beyond the boundaries of existing knowledge.

The capital investments involved, the financial risks of downtime and the environmental risks of failure are now so great that safety can no longer be implied: It must be understood.

Prescriptive standards have served the industry well. Empirical knowledge will always form a bedrock upon which appropriate technical standards will be founded. But these techniques are no longer sufficient, by themselves, to offer

an acceptable level of confidence that the risks associated with a venture have been properly addressed.

The increased complexity and larger size of the ships being developed for operation in harsher and more remote environments are driving the adoption of safety equivalency standards, of unified standards and of risk-based approaches.

Current and proposed boundary pushing projects will challenge all of us to breakthrough our own technological barriers in order to protect and extend our safety frontier – the frontier where technology meets the immutable demands for the protection of life, property and the marine environment.

Perhaps, the single most important tool we have available to us as we confront this new frontier is risk assessment. Risk is defined as the product of the frequency with which an event is anticipated to occur and the consequence of the event's outcome. Risk assessment is the process of gathering data and synthesizing information to develop an understanding of the risk of a particular enterprise.

To gain an understanding of the risk of an operation, it is necessary to answer the following three questions:

- What can go wrong?
- How likely is it?
- What are the impacts?
- The risk assessment process consists of 4 basic steps:
- Hazard Identification
- Frequency Assessment
- Consequence Assessment
- Risk Evaluation

The challenge the Industry faces with these boundary pushing projects is how to properly evaluate a new design that falls outside of existing knowledge.

Risks can be quantified by risk indices that are developed from different combinations of frequencies and consequences. In general, there are four different types of risk tradeoffs based on the outcome of events and the group that is influenced by these outcomes.

These are:

- Risk Transfer
- Risk Offset
- Risk Transformation
- Risk Substitution

Depending on the frequency of occurrences, the resulting consequence and the risk tolerance of the company (or the industry or of society), these four types of risk tradeoffs form the foundation of the corporation's risk strategy.

The set of risk tradeoffs in which any increase in protection against one risk means a decrease in protection against another risk, for a given set of resources, traces out a Risk Protection Frontier.

The shape of the Risk Protection Frontier depends on the relationship between protecting against one risk and reducing protection against the other.

Any point on the Risk Protection Frontier represents a total risk distribution comprised of two components:

- Catastrophic risks (intolerable risk in FSA Manual terminology) and
- Operational risks (Tolerable risks, ALARP zone in FSA Manual terminology)

Beyond choosing among points along the Risk Protection Frontier, the question that we must continue to ask ourselves is – Can we do better and reduce overall risk?

The possibility of overall risk reduction can be achieved by moving the points to a higher Risk Protection Frontier through using "Risk Superior" moves.

Risk Superior moves are made possible by innovations in technology.

Risk Superior moves reduce overall risk rather than trading one kind of risk for another.

Risk Superior moves require a system solution that does not treat risks in isolation but acknowledges that risks cut across all boundaries.

In essence, safety must be redefined and quantified if we are to continue pushing both the physical and technical boundaries.

In considering operational safety, our efforts must be focused on how that question can be most effectively answered and to determine what information can be relayed to the operators to help them avoid previously identified operational hazards.

Technology breakthroughs such as dynamic loading analysis, probabilistic modeling, non linear structural response, composite materials, quantitative risk assessment and numerical simulations help us rationalize structure performance and safety requirements (3).

It is quite natural that those factors which influence the level of risk and the probability of an event and its consequences have a casual character. But there are such factors which may be determined and even quantified to a certain degree of approximation. For instance, factors such as region of navigation, ship design, age and the technical state of the ship certainly may influence the probability of an accident. Thus professor De Yi Gao (8), proposes as a very important criteria of risk assessment (Step 2 FSA Manual) the evaluation of two important risk components: the quality of the ship and its crew and the way of their quantification. The evaluation of the Quality Ship System may use the hierarchy analytical method of the management study by regarding the above six basic indexes as factors on the grade. Factors that can be logically estimated should not have the secondary index. As for the sixth index, a secondary index and even a tertiary one should be set in fix upon the quantified value. The index system is shown in table 1.

Table 1. The index system of the evaluation of the Quality Ship on the first grade

(Ship Safety Performance and Defect index System)

A1	Detention of the ship
A2	Violation of the safety rules
A3	Maritime accident
A4	Violation of the safety management regulation as individual
A5	The resort rate of the shipping company
A6	The accumulative integral of detects

The accumulative integral of defects (A6) can be further divided into the secondary and tertiary index according to the needs.

According the *To Rules on Safety Inspection, 1997*, 16 secondary indexes can be set. (See Table 2). Every secondary index may be followed by relevant tertiary index (C) in order to describe the meanings of the secondary index in details.

Table 2. The secondary indexes

A6	B61* W61	Ship's certificates and the relevant files end documents
	B62 * W62	Crew and equipment
	B63 * W63	Life-Saving Appliances
	B64 * W64	Fire fighting equipment
	B65 * W65	Presentations against accidents
	B66 * W66	Generic safety precautions
	B67 * W67	Alarm equipment
	B68 * W68	Stowage of goods and loading and unloading equipment
	B69 * W69	Load line
	B610 * W610	Mooring equipment
	B611 * W611	Propelling and auxiliary machinery
	B612 * W612	Navigation equipment
	B613 * W613	Radio equipment

	B614 * W614	Anti-pollution equipment
	B615 * W615	Loading and unloading equipment of liquid goods
	B616 * W616	Relevant equipment of the post and manipulation ability of the crew

Table 3. The Tertiary indexes

B61	Ship's certificate and the relevant files and documents	C611 * W611	Nationality certificate
		C612 * W612	Copy of DOC
		C613 * W613	Ship's survey certificate
		C614 * W614	Certificate of minimum manning
		C615 * W615	Documents relating to the reliability and insurance of the oil pollution
		C616 * W616	Certificate of safe operation for high speed craft
		C617 * W617	Related documents, manual, instructions and materials
		C618 * W618	Inspection book of the cargo handing facilities
		C619 * W619	Ship endorsements
		C6110*W6110	Ship Log and legal records

A conclusion can be made from the characteristics of the above indexing system. That is, the valuation system of Quality Ship is a system made by the combination of the logical estimation grade (the first grade index A) and a series of hierarchy distributions (A6). The Quality Ship may be demonstrated by the following formula:

$QS = \Sigma Ai$

The accumulative integral of the defects (A6) may be demonstrated as follows:

$A6 = B61\ W61 + B62\ W62 + \ldots\ldots + B615\ W615 + A616\ W616$

$= B61\ (\Sigma Bi\ Wi,\ \Sigma Cj\ Wj)\ W1 + B62\ (\Sigma Bi\ Wi, \Sigma Cj\ Wj)\ W61 + \ldots\ldots + B615\ (\Sigma Bi\ Wi,\ \Sigma Cj\ Wj)\ W615 + B616\ (\Sigma Bi\ Wi,\ \Sigma Cj\ Wj)\ W616$

Notes:

B61 ...B616 Stands for the secondary index of the accumulative integral of the defects.

Cj Stands for the tertiary index

Wij Stands for the secondary or tertiary or weight.

The statistics and analysis of previous and recent casualties, before and after the application of the ISM Code, reveals no improvement in the aspects of collisions and groundings problems.

"The rallying cry that most casualties were caused by human factors led to the natural corollary that about 75-96 percent of maritime casualties are caused, at least in part, by some form of human errors". (11) And the regulations and Codes are not always a proper remedy if that "part" of human errors was made at the designing level. In this respect the work of G.V. Egorov "Designing Inner Waterway ships on the basis of the Theory of Risk" is of an interest. His definition of risk is similar to those of other authors: "when considering risk it is necessary to observe its two sides: probability and damage (loss)". He tries to analyze the interconnection of theory of Risk and "Reliability theory". "In application to technical sciences risk and reliability are somewhat deferent approaches to the same side of the investigated object". "Risk may be expressed as the product of the reliability characteristic of a structure by the characteristic of the damage as a result of unreliability".

The author proposes the following expression of the risk of hull breakage used in the process of its designing

$$R = PC = \Sigma Pi (\Sigma \alpha ik\ C\ k),$$

where R – risk, P – probability, C – consequences.

i – the category of the imminent danger (threat)

(i = 1 hull breakage during cargo operations, or repair

i = 2 hull breakage when grounding etc.)

k – expenses of the hull breakage consequences recovery

Pi - probability of the accident occurrence due to i – danger (threat)

Ck – cost of I – consequence

α ik – the weight coefficient of k – consequence of i – danger.

The author states that FSA gives ground for the correction of the existing set of standards and to create a new one for the construction and operation of ships taking into consideration the economic consequences of the shipping influence on the environment and the people. But he claims that FSA is not yet sufficient for the full cycle of standards creation for the control (monitoring) of the consequences of the measures undertaken for the risk management. He proposes to add one more step – risk monitoring.

3 Conclusion

FSA Guidelines is a complex document aimed at the improvement of safety at sea. The objective of this document is very well expressed in paragraph 3 of the preface:

"Application of FSA may be particularly relevant for proposals for regulatory measure which have far reaching implication in terms of costs to the maritime industry or the administrative or legislative burdens which may result.

This is achieved by providing a clear justification for proposed regulatory measures and allowing comparison of different options of such measures to be made. This is in line with the basic philosophy of FSA in that it can be used as a tool to facilitate a transparent decision-making process. In addition, it provides a means of being proactive, enabling potential hazards to be considered before a serious accident occurs" (2).

Many researchers were applying this methodology for their research. Some of them closely followed the FSA methodology "using it as a tool" in risk analysis and consideration of "potential hazards" in their particular cases, others were searching their own ways, but in any case their actions and recommendations may be analyzed "using the instrument of the FSA".

As nowadays most of the research for the shipping industry is produced in the maritime educational establishments, we believe that IAMU is suitable to serve as a centre for summarizing and evaluating all the contributions to the critical issues of safety provision made by different researchers.

References

[1] Abchuk V.A. Theory of Risk in Shipping. "Sudostroenie", Leningrad, 1983.

[2] The GUIDELINES FOR FORMAL SAFETY ASSESSMENT (FSA) FOR USE IN THE RULE-MAKING PROCESS, IMO (MSC/Circ. 1023 – MEPS/Circ. 392) 5 April 2002. as amended IMO (MSC/Circ. 1180 – MEPC/Circ. 474) 25 August 2005 and IMO (MSC-MEPS.2/Circ.5.) 16 October 2006.

[3] Christopher J. Wernicki. The Safety is to be understood, ABS President, 24th International Conference on Offshore Mechanics and Engineering. Haikudiki, Greece, June 12-17, 2005.

[4] Marina Chesnokova, Alexander Kobylyatskiy. The Implementation of the Safety and Security Courses into the MET System of Odessa National Maritime Academy. The International Association of Maritime Universities IAMU. Proceedings of the 7th Annual General Assembly and Conference AGA-7 October 16-18, 2006.

[5] Donna J. Nincic. The Utility of Risk Assessment Tools in Maritime Security Analysis. The International Association of Maritime Universities IAMU. Proceedings of the 7th Annual General Assembly and Conference AGA-7 October 16-18 2006.

[6] Zhang Shuouih, Sun Xuejing, Zhang Shuang, Chen Xuan, Risk Analysis Methods in Oil Spill Contingency Plans. The International Association of Maritime Universities IAMU. Proceedings of the 7th Annual General Assembly and Conference AGA-7 October 16-18, 2006.

[7] Hans G Payer P.D. Link between Safe and Secure Ships. Conference paper. Germanischer Lloyd – Hamburg. The Security Conference London, February 12. 2003.
[8] De Yi Gao. On the Quality Ship System for Safety Inspection. IAMU Journal Vol. № 1 October 2005.
[9] Topalov V.P., Torskiy V.G. Risks in Shipping, "Astroprint", Odessa, 2007.
[10] Egorov G.V. Risk Theory Based Design of Restricted Area Navigation Ships Sudostroenie Sankt-Petersburg 2007.
[11] Ch. Kuo. Managing Ship Safety. LLP. – London – Hong Kong, 1998.

Methodology to define NOx emissions by ships in port

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Abstract

This paper tries to show the methodology used to establish the NO_x emissions from the ships. In addition, the operation conditions of the ships in sailing periods, during manoeuvres and in port calls must be established.

The methodology we have considered in the paper is based in estimating the NO_x emissions by means of the specific consumption applying the named emission factors per fuel mass unit consumption. The fuel consumption depends on the ship's operations, the machinery used in them and also the load of that machinery.

To get the expected results we need to define by means of models the power of propulsion and electric generation machinery per ship type. Afterwards, it is necessary to know the curves of power/specific consumption in medium and slow speed engines for the load ranges required in the operation conditions to be analysed.

The emission factors in medium and slow speed engines for different operation loads of machinery also must be found.

With all the mentioned data, the NO_x emissions can be calculated per ship type. After calculations per ship type and knowing traffic or operations of ships in the cases to be considered, the total emissions in each case can be evaluated.

The possible cases to be analysed could be areas especially sensitive because of the traffic concentration; areas considered as control areas by the Annex VI of MARPOL and ports.

1 Objective

The purpose of the present paper is to define the methodology to determine the NO_x emissions from ships during their calls in port.

It also aims to establish the operation conditions during the navigation in port, manoeuvres and berth operations.

2 NO_X generation process in heat engines

The nitrogen oxides, usually represented by NO_x, are one of the pollutants generated in the combustion process whose emission is more severely limited every day by legislation.

In the maritime industry the NO_x emissions from the ships are limited by the MARPOL Annex VI.

NO_x is a set of different nitrogen oxides: NO, NO_2, N_2O, NO_3, N_2O_3. The quantity of oxides generated decreases from the left to the right of the list; NO represents the biggest concentration and only NO, NO_2 and N_2O are considered as relevant constituents of NO_x.

There are three generation processes of NO_x: Thermic NO, NO of the fuel oil, and prompt NO.

The thermic NO is formed from a reaction of oxygen and nitrogen in the air. This reaction needs a big quantity of activation energy, then the generation of NO_x increases exponentially when the temperature increases. To reduce the generation of thermic NO, the temperatures must be reduced during the combustion process and when it is possible the concentration of oxygen must also be reduced in part of the combustion process.

The NO of the fuel oil is formed from a reaction of the oxygen of the air and the nitrogen of the fuel oil. This can be generated at lower temperature values than the NO thermic. It is important when the fuel oil has a high content of nitrogen.

The prompt NO is a process of NO generation related with radicals such as CH and C_2. It is still not well known, but it implies a quicker NO generation than the other processes. It is not very important in the case of diffusion flames of high turbulence as in the diesel engines.

Of them, the NO thermic is the most important because of its contribution to the NO_x generation.

The reactions of generation are as follows:

REACTION	SPEED CONSTANT
$O + N_2 \rightarrow NO + N$	$K_1 = 1{,}82 \cdot 10^8 \exp(-38370/T)$
$N + NO \rightarrow N_2 + O$	$K_{-1} = 3{,}93 \cdot 10^7 \exp(-450/T)$
$N + O_2 \rightarrow NO + O$	$K_2 = 3{,}80 \cdot 10^4 \cdot T^{0{,}9085} \exp(-4837/T)$
$O + NO \rightarrow O_2 + N$	$K_{-2} = 3{,}80 \cdot 10^3 \cdot T \exp(-20820/T)$
$N + OH \rightarrow NO + H$	$K_3 = 5{,}034 \cdot 10^6 \cdot T^{0{,}297} \exp(-50/T)$
$H + NO \rightarrow OH + N$	$K_{-3} = 1{,}70 \cdot 10^8 \exp(-24560/T)$

All of them can be grouped in a global reaction:

$$N_2 + O_2 \leftrightarrow 2NO$$

Since the NOx generation mainly depends on the temperature, the immediate way to reduce it is through the reduction of the temperature during the combustion process. This implies the reduction of the effectiveness of the thermodynamic cycle and the increase of fuel oil consumption. This has been the origin of the "diesel dilemma:" if the NO_x generation is reduced, the fuel oil consumption is increased, and if the fuel oil consumption is to be reduced the NO_x generation suffers an important increase.

The methods to reduce the temperature during the combustion process in diesel engines include: delay of the combustion, add water in the combustion chamber which is going to be evaporated absorbing heat, re-circulate part of the exhaust gases by introducing them in the combustion chamber.

Reducing the air during part of the combustion process cannot be done in diesel engines because the fuel oil is diffused in the cylinder full of air, but it can be done in boiler burners in which the air is reduced in high temperature combustion areas, and it is added in lower temperature areas to complete the combustion process.

An alternative to avoid the NOx generation is to eliminate them after their generation. This can be done in marine diesel engines by means of the technique SCR (selective catalytic reaction) which consists of injecting nitrogen or urea in the exhaust gases inside a catalyser where the next reactions take place:

$$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$$
$$6NO_2 + 8NH_3 \rightarrow 7N_2 + 12H_2O$$

Thus, the NO_X generation significantly depends on the fuel oil consumption, and this consumption depends on the ship's operations, the machinery used, its operation regime, and the power installed on board.

3 Conditions affecting the fuel consumption in the different operative stages of the ship: Manoeuvring, berthed (hoteling and loading/unloading) and anchored

Operations of ships related with the fuel oil consumption:

- Propulsion for navigation and for manoeuvres in port.
- Electric supply for navigation and for the systems and equipment for manoeuvres in port, loading/unloading operations, conditions in the ship.

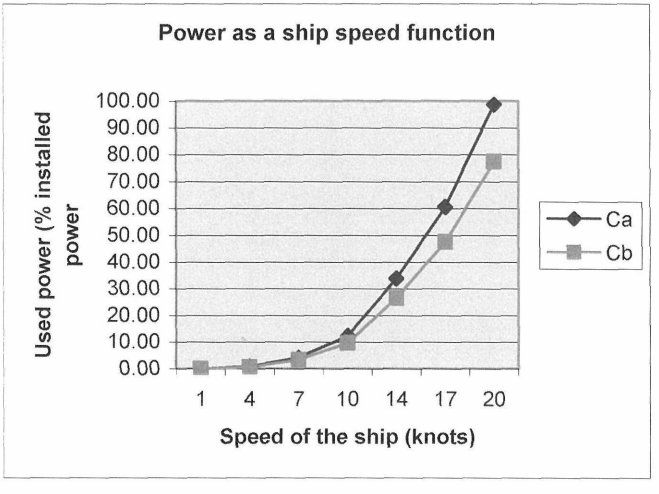
3.1 All ship types propulsion conditions during manoeuvres

Estimate of the propulsion power while sailing in port: To find it, we will consider the generally accepted mathematics model called the Admiralty Formula:

$$P = \frac{\Delta^{2/3} \cdot v^3}{C_A}$$

P = Power in IHP
Δ = Displacement of the ship in Long Tons (1 Long Ton= 1,016 t)
v = Speed of the ship in knots
C_A = Admiralty coefficient. Values between 264 – 336

As an example, it shows a containership whose displacement is 33640 t and the main engine power is 32315 IHP. The above mentioned Formula results in the graphic for the percentile of available power used as a function of the ship's speed. The graphic C_a corresponds to an Admiralty coefficient value 264 and C_b corresponds to 336.



Taking into account that the ship's speed in port is limited to 4 knots approx., we consider that speed to calculate the necessary power for propulsion during maneouvres:

$$P = \frac{33640^{2/3} \cdot 4^3}{300} = 207\ IHP$$

It can be seen that the relationship of calculated power by using the Formula and the indicated power of the ship (32315 IHP) is $6{,}4.10^{-3}$, so 0,6%. To include the transient period to get the 4 knots speed from the stopped state, the power relationship is increased to 2%.

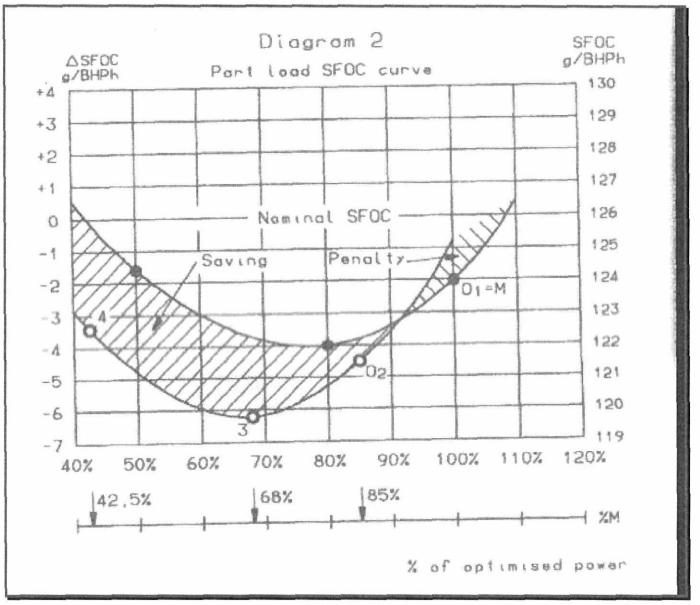
In addition, the applicability of that Formula at low speed and the exact value of the Admiralty coefficient has to be considered; for this reason to include these possible deviations, the relationship of power of the ship at manoeuvring load (4 knots) can be increased till 10%, for this case 3231,5 IHP.

Even though it has to be said that to get accurate results and because of the great influence of them in the NO_x emissions, a research job would be made.

With reference to the required time for manoeuvring from the entrance buoy to the berth, considering 4 knots speed and 2,5 h calculated as total time of the in/out manoeuvre in a model port as Barcelona, so that the time spent in this stage will be around 20% of the total time.

From the calculated power and knowing the specific F.O. consumption of the propulsion machinery (see diagram 1), the approximate F.O. consumption during the navigation in port can be found.

Diagram 1: Part load SFOC curve



Source: MAN B&W Diesel

Once the F.O. consumption has been obtained for the considered period and the corresponding emission factors have been applied (see table 1), the NO_x, quantity produced in port navigation is obtained.

Observing the graphic of the SFOC, it is inferred that at low loads its value is very high: this must be held in account to calculate the emissions.

Table 1: NO_x Emission Factors

Table VII Lloyd's Register emission factors for steady state operation

	kg/t fuel		g/kWh	
	Medium speed engines	*Slow speed engines*	*Medium speed engines*	*Slow speed engines*
NO_x	59	84	13.8	18.7
CO	8	9	1.8	2.1
HC	2.7	2.5	0.6	0.5
CO_2	3250	3165	-	-
SO_2	21*S	21*S	-	-

S=Sulphur content of oil fuel (% by wt)

Source: Lloyd´s Register of Shipping

The propulsion machinery emissions during the berthing operations will be negligible. To be considered, they could be calculated by increasing the navigation time in port at the corresponding load.

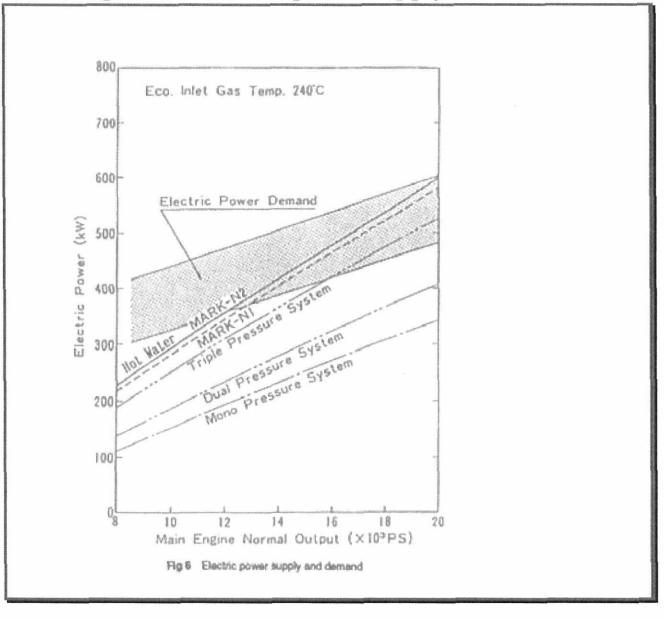
Finally, it is considered that the propulsion machinery is not running during the time the ship is berthed.

3.2 Auxiliary plant conditions during manoeuvres

Estimate of the auxiliary plant power while sailing in port and berthing operations: In general, for safety reasons during the ship's manoeuvres in port, two generators are running.

The power developed by the main generators will be considered that corresponding to navigation at sea (see diagram 2) increased between 20 and 30% due to the running of the necessary machinery required in the manoeuvres (steering gear, auxiliary blowers, bow thruster, deck machinery,...)

Diagram 2: Electric power supply and demand



Source: A. Fukugaki

Estimate of the auxiliary plant power while the ship is berthed: The auxiliary plant includes the electric power generators and the auxiliary boilers.

To establish the power, two different conditions have to be distinguished:

a) When the cargo operations require the auxiliary machinery to be manned or maintained in condition.
b) Hoteling condition.

Depending on the ship type one of the defined conditions will be analysed (see table 2).

Table 2
Average power in port operations

STEAM TURBINES PROPULSION SHIPS (% of the plant power)		
Type of ship	**% of the total power unloading**	**% of the total power in Hotel condition**
General Cargo	15	10
Bulk Carriers	10	10
Oil Tankers of less than 125000 DWT	30	15

ENGINE PROPULSION SHIPS (% of the power of the generators / boilers				
	Loading/Unloading		**Hotel**	
Tipo de buque	**Diesel Generators**	**Boilers**	**Diesel Generators**	**Boilers**
General Cargo	65	50	30	50
Bulk Carriers	30	50	30	50
Oil Tankers of less than 125000 DWT	65	85	30	85

Source: Allen G. Hansen et al.

In most of the engine propulsion merchant ships consuming F.O., a boiler is installed to heat that F.O. and for other auxiliary services. This boiler is usually running in port.

The LNG ships are mainly powered by steam turbines which take advantage of the cargo boil-off to be consumed in the boilers.

There are some cruise ships powered by steam plants.

Table 2 contains the supplied power with reference to the installed power in two conditions. One of them is during the loading and unloading operations by using the ship's means and the other one while the ship is in hotel condition,

which corresponds to the electric power supplied only for the accommodation services, galley and safety elements.

In the steam propulsion table, it can be observed that depending on the ship's type (for example oil tankers of less than 125000 DWT) as compared to an LNG, when they are unloading the power is 30% of the total power of the plant.

In the engine propulsion table it can be observed that depending on the ship's type (for example bulk carriers) during the loading/unloading operations, there is an energy consumption of 30% of the diesel generators' power and of 50% of boiler's power.

Because of the special operative conditions of cruise ships and reefers, the complexity of the propulsion and auxiliary machinery configuration and the high electric power required to maintain the ship in normal conditions (operation and accommodation) the ratios of auxiliary plant referred to the propulsion plant are higher than in other types of ships, so that they require particular research to get emission values in port.

4 Conclusion

- The NO_x marine pollution is produced by the propulsion machinery and auxiliary machinery required for the electric power supply.

- The emissions can be quantified from the F.O. consumption by using the emission factors.

- The F.O. consumption for propulsion in port is calculated by means of the required power, obtained from the Admiralty Formula. It can be estimated as 10% of the installed power.

- The auxiliary machinery power depends on the developed operation and the ship's type. For conventional ships it can be estimated according to the data indicated in the table 2. For cruise ships and reefers it is necessary to research specifically both types of ships.

To determine the used power in the manoeuvring period of time, the research must be very accurate because of the disagreement found in different studies and its importance in the final results.

We conclude by indicating that during the navigation in port, the rating of the propulsion machinery is the same in all ship's types.

References

[1] Allen G. Hansen, Gary J. Baham, Joseph D. Porricelli, "Nature of Combustion and Air Emissions from Ships". The Society of Naval Architects and Marine Engineers. New York. Spring Meeting/Star Symposium, Coronado, California, 1980.

[2] Goran Hellen. "Environmental Considerations concerning Medium-Speed Engines in Marine Applications". SNAME Transactions, Vol. 100, 1992.

[3] A. Fukugaki. "Review of shipboard energy technology- thoughts and facts behind the scene". Trans IMarE, Vol 106.

[4] J S Carlton, A A Wright, Mrs R J Coker. "Marine exhaust emissions- a regional survey of the English Channel". Trans IMarE, Vol 106.

[5] MAN B&W Diesel A/S. *Emission Control of Two-Stroke Low Speed Diesel Engines.* Copenhagen s/d.

[6] Ramon Carreras, Angel Comas, Antonio Calvo. *Cinética de formación del NO en procesos de combustión.* Universitat Politècnica de Catalunya, Terrassa, 1990.

On improper implementation of Formal Safety Assessment in practice

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Abstract

The International Maritime Organization prepared documents and recommendations for use of the Formal Safety Assessment on board the ships to improve the level of safety in everyday practice. Based on "the Guidelines for Formal Safety Assessment (FSA) for use in the IMO Rule – Making Process, MSC/ Circ. 1023, MEPC/ Circ. 392" the new companies' Risk Assessments forms have been added to the ships' files. However it is often observed that improper understanding of the use of FSA caused generating the official documents containing the serious mistakes. That caused lowered the level of safety instead of improving standards on board the ships in aspects of e.g. passage planning or deck duties. The main reason for mistakes made concerns the problem of adopting the theoretical formulas and recommendations of the IMO guidelines into the ship companies' forms to be used in practice. The examples of problems taken directly from real life, analysis of solutions have been presented in the paper.

Keywords: *FSA, risk matrix, passage planning. decision making.*

1 Introduction

The problem of safety is the most important aspect analyzed by the international maritime bodies. How to improve it in the general scale? One of the latest steps was the Formal Safety Assessment to be in use on board the ships as a new common practice. Starting from the theoretical tools and models based on probability and statistics, guidelines have been created to implement this topic in a practical way. The shipping companies were obliged to adapt the rules to take into consideration the specific kinds of maritime sector. Thus the new safety assessments forms had to be created which should have been compatible with their featured works. The point was how to transform the advanced models and recommendations into the simple form which should not be complicated to use for the seafarer in charge. Based on two variables (frequency and the severity of consequence), the risk matrix can be evaluated.

Then the use of simple numeric parameters is followed by the assessment of risk before commencing the relative process. The designated persons were to create the special sheets to make the master's or chief officer's duties onboard easier. The serious problem occurred when the guidelines for the Formal Safety Assessment for use in the IMO rule–making process were not properly followed by the shipping companies. Thus the misunderstanding of the risk matrix can often be observed in the published forms or even recommended literature [5, 6]. Examples of these occurring problems are included in this paper. The consequence of such improper attitude produces a lower level of safety. The limits between minor or catastrophic risks are shifted. Moreover, it is shifted in a dangerous direction. This means the probable area of risky acting is considerably decreased according to wrong calculations. Though the range of the matrix values influences the symmetric distribution as the basic one, the additional data can modify the final boundaries between the different types of risk (safety).

Attention ought to be paid by the persons in charge when transforming the general guidelines into their specific company ISM forms concerning FSA. This was one of the reasons to focus on the presented problem here which has been coming directly from practice since 2006.

2 IMO recommendations concerning FSA

The Maritime Safety Committee and the Marine Environment Protection Committee approved Guidelines for Formal Safety Assessment (FSA) for use in the IMO rule–making process. FSA is a rational and systematic process for assessing the risks relating to maritime safety and the protection of the marine environment and for evaluating the costs and benefits of IMO's options for reducing these risks. The use of FSA is consistent with and should provide support to the IMO decision making process. It provides a basis for making decisions in accordance with resolutions A.500 (XII) "Objectives of the Organization in the 1980's", A.777(18) "Work Methods and Organization of Work in Committees and their Bodies" and A.900(21) "Objectives of the Organization in the 2000s".

The application of the FSA may be particularly relevant for the proposals for the regulatory measures which have far reaching implications in terms of costs to the maritime industry, or the administrative or legislative burdens which may result. This is achieved by providing a clear justification for proposed regulatory measures and allowing comparison if different options of such measures are made. This is in line with the basic philosophy of FSA in that it can be used as a tool to facilitate a transparent decision–making process. It also provides a means of being proactive, enabling potential hazards to be considered before a serious accident occurs [1].

In the Guidelines for FSA by IMO, we can read that member governments and non-governmental organizations are invited to apply to FSA when it is deemed necessary, and to submit the results thereof to the organization in accordance with the standard format for reporting. The Guidelines for FSA includes the following items:

- Introduction (purpose of FSA, scope and application);
- Basic terminology;
- Methodology;
- Problem definition;
- Identification of hazards;
- Risk analysis;
- Risk control options;
- Cost benefit assessment;
- Recommendations for decision-making;
- Presentation of FSA results.

The details can be found in [1] and the references cited there.

Risk is defined as the combination of the frequency and the severity of the consequence. Consequence is understood as the outcome of an accident, and frequency as the number of occurrences per unit time. FSA should comprise the above mentioned steps from identification of hazards to recommendations for decision-making. Characterization of hazards and risks should be both qualitative and quantitative, and both descriptive and mathematical, consistent with the available data, and should be broad enough to include a comprehensive range of options to reduce risks. The availability of suitable data necessary for each step of the FSA process is important. When data are not available, the expert judgment, physical models, simulations and analytical models may be used to achieve valuable results. The human element can be incorporated by using human reliability analysis. The important item is the frequency and consequence categories used in the risk matrix have to be clearly defined. Then the combination of a frequency and a consequence category represents a risk level.

3 Improper use of FSA in practice

In the following paragraphs we try to show examples of improper implementation of the Formal Safety Assessment focusing on the risk matrices and relevant risk zones.

3.1. Directly from ships

Let us start with the example coming directly from the fleet of tankers in operation. The shipping company we'll name here simply "Company.". The persons in charge (managing director, ISM designated person) of adapting the new risk assessment forms prepared standing instructions followed by the concerned forms. On one of the pages of the new ISM Manual entitled *Company standing instructions applicable to all crews working on vessels owned, managed or chartered by the (...) Group* we can find *Risk Assessment Matrices - Guidance on Risk Assessment for use with form.* The risk assessment procedure basing on the proposed instructions and risk matrix are as follows:

Table 1. Severity levels in Company's form

SEVERITY		
1	Nil	Nil instances of medical aid / assistance, no or only very slight damage to vessel(s) or property and no oil spilt
2	Slight	Requires on site 'first-aid' only and is fit to return to work immediately. Slight damage to vessel(s)or property. No spill of oil.
3	Moderate	Requires on site 'first-aid' or a visit to hospital / doctor but fit to return to work in less than 3 days. Significant damage to vessel(s) or property, but still able to operate normally. Oil contained on vessel(s) or within shore facility.
4	High	Requires on site 'first-aid' and/or a visit to hospital / doctor, but unable to return to work in less than 3 days. Damage to vessel(s) substantial enough to take the vessel(s) out of service. Oil contaminates the marine environment but is contained within the immediate vicinity of the spill.
5	Very High	Fatal, Near Fatal Injury, Loss of Vessel(s) and/or a major uncontained oil spill.

Table 2. Likelihood levels distribution

LIKELIHOOD	
1	Unlikely
2	Likely
3	Quite Possible
4	Possible
5	Very Likely

Table 3. Risk zones with theoretic risk rating

RISK RATING No.					
Very Low Risk	01	02	03	04	05
Low Risk	06	07	08	09	10
Moderate Risk	11	12	13	14	15
High Risk	16	17	18	19	20
Very High Risk	21	22	23	24	25

Analyzing the above mentioned matrix we can easily find out that according to the company's recommended way of risk assessment it is not possible to obtain the following Risk Rating numbers: 7, 11, 13, 14, 17, 18, 19, 21, 22, 23, 24. These numbers cover 44% (!) of all matrix values (11 of 25). Taking into consideration only the numbers possible to obtain the proposed risk matrix looks as follows:

Table 4. Risk matrix composed of actual distribution of risk ratings

Risk level	**Risk rating**					**Number of possibilities**
Very low risk	**1**	**2**	**3**	**4**	**5**	10
Low risk	**6**	-	**8**	**9**	**10**	7
Moderate risk	-	**12**	-	-	**15**	4
High risk	**16**	-	-	-	**20**	3
Very high risk	-	-	-	-	**25**	1

Here are some corollaries:

a) The minimal rating $RR_{min} = 1$ and the maximal $RR_{max} = 25$ do not implicate existence of natural values RR Î [1; 25] Ç N, where RR stands for Risk Rating and N for a set of the natural numbers.
b) Very high risk level can be reached in one case only when both severity and likelihood ratings equal 5, i.e. $5 \times 5 = 25$. Not as stated (Table 3) in five cases when RRÎ {20, 21, 22, 23, 24, 25}. 25 pairs give us 14 different products.
c) Moderate and high risks can be obtained when Risk Rating equals 12 or 15 and 16 or 20, respectively. Not as far as stated in Tab. 3. Most of products cannot be achieved (3 of 5) for both risk levels. Risk Rating referring moderate risk can be obtained in 4 cases i.e. (3,4), (4,3), (3,5), (5,3) and the high risk in 3 cases i.e. (4,4), (4,5), (4,5) where the first number stands for severity and the second for likelihood.
d) According to the proposed scales for severity and likelihood ratings obtaining the risk levels looks as follows

- Very low risk: **40% (of all cases);**
- Low risk: **28%**;
- Moderate risk: **16%**;
- High risk: **12%**;
- Very high risk: **4%**.

what is presented graphically in the color coded Table 5

Table 5.Real risk zones of multiplicative risk ratings distribution

		Severity index				
		1	**2**	**3**	**4**	**5**
Likelihood index	**1**	**1**	**2**	**3**	**4**	**5**
	2	**2**	**4**	**6**	**8**	**10**
	3	**3**	**6**	**9**	**12**	**15**
	4	**4**	**8**	**12**	**16**	**20**
	5	**5**	**10**	**15**	**20**	**25**

where

- green color means very low risk;
- blue - low risk;
- yellow - moderate risk;
- orange - high risk;
- red - very high risk.

In the above mentioned case it is necessary to use a different formula for obtaining the Risk Ratings which are followed by the respective acting. One of proposed way of assessing the risk can look as follows.

The risk is obtained as stated in formula (1)

$$\underline{A} = \underline{B} * \underline{C}, \tag{1}$$

where $\underline{A}$ – risk, $\underline{B}$ – severity, $\underline{C}$ – frequency (probability) of considered situation.

To simplify the calculations we can use the logarithmic scale and define the relevant indexes: Risk Index (A), Severity Index (B) and Frequency Index (C).

Range of natural values for Severity and Frequency Index extends e.g. from 1 up to 5 only, as above suggested in Tables 1 and 2. Each value refers to a

respective situation in both cases. Then the value of risk index is calculated as a sum of values of Frequency Index and Severity Index

$$log(\underline{A}) = log(\underline{B}) + log(\underline{C}), \tag{2}$$

what can be written in the shorter way

$$A = B + C \tag{3}$$

Thus the Risk Index (A) can be a natural number from 2 (the lowest risk) to 10 (the highest risk).

To use proposed method it is necessary to define the limits of the above mentioned indexes which implicate the respective actions. Then predefined criteria depend on the nature of the considered case.

The proposed risk matrix looks then as follows

Table 6. Risk matrix basing on addition of indexes

Risk Index *A*						
		Severity Index *B*				
		1	2	3	4	5
Frequency Index *C*		very slight	Slight	moderate	high	Very high
1	unlikely	**2**	**3**	**4**	**5**	**6**
2	likely	**3**	**4**	**5**	**6**	**7**
3	quite possible	**4**	**5**	**6**	**7**	**8**
4	possible	**5**	**6**	**7**	**8**	**9**
5	Very likely	**6**	**7**	**8**	**9**	**10**

It is important to see where the boundaries between the risk levels are situated. We can use above mentioned five levels of risk and then divide them accordingly:

- Very low risk (A = 2 or A = 3) – 3 cases,
- Low risk (A = 4 or A = 5) – 7 cases,
- Moderate risk (A = 6) – 5 cases,
- High risk (A = 7 or A= 8) – 7 cases,
- Very high risk (A = 9 or A = 10) – 3 cases.

what gives 25 cases, all possible to be obtained. Then the risk levels cover the matrix values symmetrically.

Using proposed scales for severity and likelihood indexes the risk levels look as follows:

- Very low risk: 12% (of all cases);
- Low risk: 28%;
- Moderate risk: 20%;
- High risk: 28%;
- Very high risk: 12%.

This is what is looks like presented graphically in color coded Table 7

Table 7. Real risk zones of additive risk ratings distribution

		Severity index				
		1	**2**	**3**	**4**	**5**
Likelihood index	**1**	**2**	**3**	**4**	**5**	**6**
	2	**3**	**4**	**5**	**6**	**7**
	3	**4**	**5**	**6**	**7**	**8**
	4	**5**	**6**	**7**	**8**	**9**
	5	**6**	**7**	**8**	**9**	**10**

whereas:

- green color - very low risk;
- blue - low risk;
- yellow - moderate risk;
- orange - high risk;
- red - very high risk.

In another solution the point is that the numbers are used without naming the risk levels. For instance the risk index equals 5 so it is higher than 4 in another case. However both are called the same name "low risk" here. In this way we can assess the risk more precisely avoiding further approximation. And that can be useful when referring the proper precautions to be taken in each case. It is necessary to guide the master (c/o, c/e) how to act when already assessed situation may occur and the risk index equals e.g. 9 of scale from 2 to 10. Thus the respective written forms ought to be adapted properly by the shipping companies.

General example. The job to be done onboard has been assessed in advance according to the new statements in the ISM Manual including FSA. The risk index equals 8 of above mentioned scale. The person in charge (master, c/o, c/e)

should know if such a job is allowed to be done e.g. at anchor or alongside the berth only. Apart from the strict requirements and procedures there is a good seamanship, personal experience and common sense to be relied upon. However it differs depending on the person in charge, especially when an extraordinary situation happens -and this needs to be assessed as well. If the official manuals say that all actions of risk index equal or higher than 7 can be done only when alongside the quay with proper precautions taken then the decision (risk index 6 or 7) made onboard causes the serious consequences for the ship's operation. Another question occurring here is: if the risk index equals 9 or 10 (very high risk) so can a job (whatever it is) be done when at anchor or not?

We can see that there is a need for clearly defining the main actions to be taken following the risk index (especially at higher risk levels) in general by the company which can be used by the responsible person onboard. Otherwise, the risk assessment matrices as a guidance on risk assessment for use with respective form will not be pragmatic. To tell the truth it will not work at all and seem to be just the paper fulfillment of new IMO obligatory document. Let us think of not everyday situations when we are obliged to assess the risk indeed and make the decision onboard in not too long time period. We ought to know up to what risk level we are allowed to solve the problem.

It is impossible in practice to predict all situations onboard and have the manual ready in each imaginary but possible event. This article also shows how the new item works or can work, and how to optimize it following the IMO recommendations.

3.2 Literature

Formal Safety Assessment can also be used in the passage planning what is shown in Fig. 1 taken from the literature on practice and principles of passage planning [5, 6]. At the execution stage there are two important tasks to be considered:

- Risk assessment and management
- Bridge resource management

To assess the risk, five steps are used:

a) Identify the hazards;
b) Consider the potential harm;
c) Evaluate the risks. Establish if existing precautions are sufficient;
d) Record all findings and measures of control;
e) Review the assessment and if the risks are still not controlled, revise the plan until a satisfactory conclusion has been reached.

Risks have been divided into five zones, as what is presented in Table 8:

I. *Trivial Risks* – risks deemed unimportant. Action to reduce the risk is not normally required.

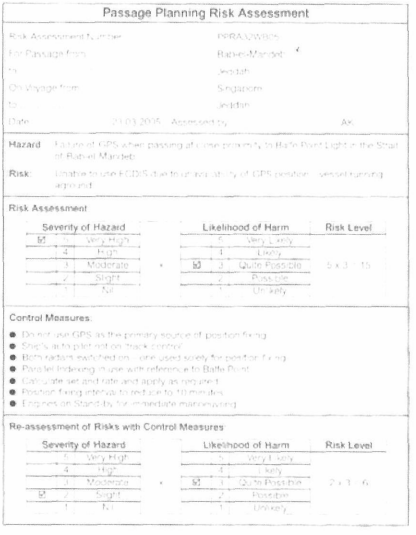
II. *Tolerable Risks* – risk that can be tolerated or accepted without any possible harm but that should be monitored to maintain control; e.g. transiting a narrow passage during the day as compared to a night transit in the same area.

III. *Moderate Risks* – additional resources are required to achieve substantial control of the potential risk, with a possibility of an increase in cost e.g. posting a helmsman.

IV. *Substantial Risks* – risks that are unacceptable and have to be reduced at any cost e.g. in restricted visibility, reduction of speed and doubling watch keepers on the bridge.

V. *Intolerable Risks* – risks that cannot be controlled or reduced due to the level of severity and the non-availability of resources. Under these conditions the passage cannot be continued e.g. when a ship meets very severe weather and has to seek shelter.

As an example, risk is given for a hazard *Failure of GPS when passing at close proximity to Balfe Point Light in the Strait of Bab-el-Mandab.* The risk has been identified as *Unable to use ECDIS due to the unavailability of GPS position, vessel running aground.* To pass through the area safely the vessel is using control measures to eliminate or reduce the risk.



Passage Planning Risk Assessment

Risk Assessment Number: PPRA32WB05
For Passage from: Bab-el-Mandeb
to: Jeddah
On Voyage from: Singapore
to: Jeddah
Date: 21.03.2005 Assessed by: AK

Hazard: Failure of GPS when passing at close proximity to Balfe Point Light in the Strait of Bab-el-Mandeb
Risk: Unable to use ECDIS due to unavailability of GPS position, vessel running aground

Risk Assessment

Severity of Hazard				Likelihood of Harm			Risk Level
☑	5	Very High			5	Very Likely	
	4	High			4	Likely	
	3	Moderate	×	☑	3	Quite Possible	5 x 3 = 15
	2	Slight			2	Possible	
	1	Nil			1	Unlikely	

Control Measures:

- Do not use GPS as the primary source of position fixing
- Ship's aid to pilot not on track control
- Both radars switched on – one used solely for position fixing
- Parallel indexing in use with reference to Balfe Point
- Calculate set and rate and apply as required
- Position fixing interval to reduce to 10 minutes
- Engines on Stand-by for immediate manoeuvring

Re-assessment of Risks with Control Measures

Severity of Hazard				Likelihood of Harm			Risk Level
	5	Very High			5	Very Likely	
	4	High			4	Likely	
	3	Moderate	×	☑	3	Quite Possible	2 x 3 = 6
☑	2	Slight			2	Possible	
	1	Nil			1	Unlikely	

Fig. 1 Example of the Formal Safety Assessment in passage planning [5, 6]

It is stated there that the risk level had been estimated with indicated control measures in place. If the control measures are not implemented, the risk assessment would not be valid and the risk level will increase. In reassessment of risk the likelihood of harm has been given a scale of 6 and it has been assumed that one radar is operational on parallel indexing throughout the passage.

It is suggested by the authors in [5,6] that a risk assessment be carried out and the resultant rating and action noted in the planning sheet and the assessment number entered in the passage plan check-list for the future references. It is also recommended to re-assess risks on a case-by-case basis and to ensure that control measures are in place.

Analyzing the risk matrix and applied algorithm we can find out that the analogous mistakes analogous as to presented in paragraph 3.1 have been made again. The essential point is that they caused very serious consequences in the context of proposed risk zones and followed actions to be taken.

Table 8. Risk zones with symmetric risk ratings distribution [5, 6]

Level	Rating	Action
1–5	Trivial	No further action required
6–10	Tolerable	Monitoring required to ensure that the controls are maintained
11–15	Moderate	Efforts to reduce risks required with attention to allocation of resources and amount of time required for reducing risk.
16–20	Substantial	Ship cannot proceed on passage until risk is reduced. Allocation of resources and time can increase to very high amount but ship may proceed on voyage once risks have been reduced.
21–25	Intolerable	Passage cannot be continued even with unlimited resources.

As we read in foreword [6] *all Bridge Officers, experienced or otherwise* are to be encouraged *to consider their own passage planning standards against these two works* (i.e. [5, 6]), *particularly with reference to the highly important section on Risk Assessment.* That is the recommendation coming from Tanker Operators Safety Forum. So the idea is worth focusing on, however it is absolutely not allowed to base the FSA in passage planning including the same arithmetic misunderstanding as in above mentioned Company form in paragraph 3.1. The details are presented in Figure 1 and Table 8. The table, including the risk zones and respective range of values, seems to be divided equally in five zones. In fact the limits of safety are shifted considerably to what allows the dangerous situations to happen according to proposed partition instead of guiding the person in charge to avoid such a case. That is especially clear in substantial and intolerable zones. This proof is analogous as before for the Table

9 as well as Table 3. The example coming from the nautical literature says to pay attention again to the proper implementation of FSA in practice following the IMO recommendations.

4 Conclusion

The problem of the implementation of Formal Safety Assessment is present in various fields of maritime research and application. The motivation to focus on the problem has come directly from the real life. The improper use of recommended tools by IMO has the opposite effect to the assumed one. The level of safety is decreased indeed when basing on the arithmetic algorithm which is not properly used. In general it is difficult to expect from the seafarers in charge to be well educated in the methods of advanced statistics and probability and to use them in FSA onboard. That is why the mathematically complicated tools were to be made easier for general use. As a guidance, the risk matrix has been evaluated, including the natural numbers as a fundamental element of risk assessment. The new form affects various events of marine operations including passage planning, security and safety matters. Interested parties having carried out an FSA application should provide the most significant results in a clear and concise manner, which can also be understood by other parties not having the same experience in the application of risk assessment from the FSA study. The methods and techniques used to carry out the assessment should be described as recommendations for decision-makers. The importance of the proper implementation of risk matrices and the relevant techniques is shown in particular as the FSA is a rational and systematic process for assessing the risks relating to maritime safety and the protection of the marine environment. To facilitate the understanding and use of the results the respective forms and reports should be based on the mathematically correct assumptions and algorithms.

The examples of practical implementation of FSA including the improper use of recommended notions and methods have been presented in the article to make a better understanding of risk assessment tools well worth exploring.

Acknowledgements

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References

[1] *Guidelines for Formal Safety Assessment (FSA) for use in the IMO Rule – Making Process*, MSC/ Circ. 1023, MEPC/ Circ. 392, London, 2002.

[2] Resolution IMO A. 500 (XII), *Objectives of the Organization in the 1980's.*

[3] Resolution IMO A. 777 (18), *Work Methods and Organization of Work in Committees and their Subsidiary Bodies.*

[4] Resolution IMO, A. 900 (21), *Objectives of the Organization in the 2000s.*

[5] Anwar N., Khalique A.(2006). *Passage Planning Practice*. Witherbys Publishing Ltd. & Seamanship International Ltd., London, Lanarkshire.

[6] Anwar N., Khalique A. (2006). *Passage Planning Principles.* Witherbys Publishing Ltd. & Seamanship International Ltd., London, Lanarkshire.

[7] Nincic D.J., Clark B. (2006). The utility of risk assessment tools in maritime security analysis. *Proceedings of Globalozation and MET, 7th Annual General Assembly and Conference. AGA – 7*, The International Association of Maritime Universities, Dalian, China.

Global leaders: Defining ethical and international studies curricula at Kings Point

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Abstract

Humanities programs at maritime-focused institutions face a variety of challenges in interpreting their missions and in connecting to the technical curriculums. At the United States Merchant Marine Academy at Kings Point, the Humanities Department is responsible for helping students develop communication skills, critical thinking skills, and for providing students an outlet to explore their own non-maritime intellectual development. On top of developing these skills, the Humanities Department has a responsibility to support larger institutional and industry goals. This raises the question: exactly what kinds of competencies, beyond technical ability, must students have? Or, in other words, what kinds of classes must a Humanities Department offer in an effort to train an effective and successful contemporary merchant marine officer?

This paper will attempt to answer these questions by examining and defining the non-technical skills required for young merchant marine officers. Using Kings Point as a case study, we will examine our humanities curriculum and explain the strengths and weaknesses of our approach. The paper will also explore how some members of the Department of Humanities have begun the process of planning for curricular reform by emphasizing the development of "Global Leadership" skills. We will examine how this might form the core of two course tracks, one in ethics and leadership and the other in international studies to serve the needs of young merchant marine officers.

Throughout this paper we will argue that excellence in maritime education requires certain knowledge and skills that can be developed in a focused humanities curriculum. This humanities curriculum plays an integral role in graduating students capable of becoming effective leaders within the industry.

1 The department

At Kings Point the terminology "Humanities Department" is somewhat misleading. Currently and historically, the department has only offered English/Literature and History on a regular basis. There are eight full-time tenured or tenure-track professors, four in History and three in English/Literature. One member of the faculty who is trained in Comparative

Literature teaches both History and Literature courses. The department expects to hire an additional Historian to replace a member of the faculty who retired in 2008. The department relies on a series of Adjunct Professors in both disciplines; some have taught at Kings Point for many years. The Director of the Ethics and Leadership program also teaches in the department. As funding permits, the department hires adjuncts to teach French and Spanish as electives.

2 The curriculum

Students at Kings Point currently must pass six courses offered by Humanities Department, each of which is three credits. Of these, two are on the English/Literature side of the department and three are on the history side. All members of the department teach the final course, Topics in History and Literature. Students have limited opportunities to take elective courses either in History, English/Literature, and Foreign Languages.

The Director of the Ethics and Leadership program, working in coordination with the Humanities department, offers a required one-credit freshman course in Ethics. Upperclassmen may also enroll in the Ethics and Leadership Program (ELP), which requires limited additional coursework and "practicum" requirements involving the fulfillment of leadership responsibilities in the Regiment of Midshipmen and the completion of leadership-related internships with the maritime industry, government, or the armed forces.

There is no choice offered to students for their required humanities courses, with the exception, sometimes, of the Topics in History and Literature course. All students must take a defined sequence, English 1, English 2, The History of Seapower, Modern World History, Modern American History, and the Topics in History and Literature course. Although the courses are technically the same and faculty teaching different sections are supposed to coordinate their goals, faculty retain the freedom to tailor some of these courses to their own interests and pedagogical strengths.

The English 1 course, Composition and Literature is a survey and review of English composition and research writing, as well as an introduction to literature, textual analysis, and interpretation. Instructors focus on helping students develop basic principles and techniques of good writing (unity, organization and coherence, development and language), and to understanding research and documentation techniques. As a literature class, students are introduced to great works of literature and aided by instructors in developing an understanding and appreciation of their intellectual power, artistry, and language. In discussions of literature, students develop critical thinking and analytic skills through textual/literary interpretation in the study of great writing, both expository and literary. Each instructor is free to interpret the term "great works of literature" in their own ways. In the past, instructors have focused on Ancient Greek epic poetry, Shakespeare, Nineteenth Century British authors, or popular and contemporary writers.

The English 2 course, Literature and Composition covers similar ground, though where English 1 is primarily a writing class with some literary analysis, this course is mostly a literature class with some work on composition. Instructors attempt to introduce students to techniques of close reading and they draw readings from a variety of literary genres (fiction, poetry, drama) and from a diversity of cultural and historical contexts. Instructors focus on writing about literature, focusing on how students respond to works of literature and how their responses change during subsequent readings. Here again instructors are free to choose material they believe best suits the goal of the class and/or that students will find appealing. Faculty here too mine often taught and generally accessible authors, but branch out into genres that students are unlikely to have previously encountered. Some faculty have also brought some film study into this class, examining differences and similarities in the concept of authorship in non-textual media.

The History of Seapower course is dedicated to introducing students to the history of the industry and tradition they have opted to join. Instructors focus on theoretical approaches to understanding mercantile and naval power and to the connections between the maritime history and the larger dynamics of U.S. history. Students learn about the role of mariners in war and how maritime technology impacted U.S. power. Students get an introduction to the central features of historical vessels and the lives of seamen in previous eras. The course is perhaps the most focused of all courses in the department because instructors do not have as much latitude in selecting material or in developing arguments. In part because the course is connected to a Department of the Navy requirement for Kings Point students, instructors do not have the latitude to extensively consider seapower on a global (or at least non-western) scale, or to focus on pre-Colonial era issues.

The Modern World History course focuses on exploring global political, economic, and intellectual interactions. Instructors are free to interpret the concept of "Modern" in their own way. Thus, some instructors begin the course as early as the Enlightenment and others start at the beginning of the twentieth century. Themes and topics considered include, but are not limited to, the age of revolution, the enlightenment, industrialization, the new imperialism, the rise of fascism, the rise of communism, the evolution of liberal democracy, the emergence of nationalism, the breakdown of colonial systems, the evolution of neocolonialism, the persistence of underdevelopment, the meanings of globalization, the causes and effects of international migration, and the repeated scourge of genocide, World War I, the international great depression, World War II, the Cold War, and the breakdown of the Soviet Union. Instructors discuss historical change and interactions between a series of regions (Western Europe, Eastern Europe, the Middle East, Sub-Saharan Africa, the Indian subcontinent, South East Asia, East Asia, and Latin America), though given the overall structure of the course, instructors usually opt to focus on the connections between only two or three of these areas.

The US since 1945 course, also referred to as Modern American History traces the evolution of society within the United States from the end of the Second World War to the present. During the semester, students examine a series of key cultural and social changes that occurred during this period and, when appropriate, they assess the political, economic, demographic, ideological, and international contexts for those changes. Themes and topics include, but are not limited to, the impact of the Cold War on society and politics, the evolution of the media and consumer culture, the struggles for racial equality and movements to promote rights for other marginalized groups (Women, Native Americans, Homosexuals, Latinos, and the Poor), urbanization and migration, and conflicts over the role of the state. Instructors may focus on the turmoil associated with the Vietnam War, Watergate, and the more recent threats of terrorism. Over the course of the semester, students assess the relative successes and failures of national leaders, both inside and outside of government, in promoting the general welfare of the American people.

Topics in History and Literature is a track encompassing courses on a variety of topics. Historically, the goal has been to offer an advanced, or perhaps mid-level, class that examines the social, economic, political structures, and religious and cultural foundations of non-Western societies. Students in the classes are supposed to gain perspectives on contemporary developments non-Western areas and the distinct historical evolution of other cultures. Because of the expertise of the faculty, the department has traditionally offered courses in Latin American and East Asian history. Recently, the department has moved away from the idea that a Topics in History and Literature class must exclusively be about non-Western cultures. In the past few years faculty have taught classes in areas of expertise, these have included Shakespeare, espionage novels, maritime archeology, and philosophy through film. These courses are taught less frequently than the Latin America and East Asia ones. Students are not guaranteed that they will have a choice in what Topics course they take, but in practice the department attempts to give students an opportunity to choose between two options on a first-come first-served basis.

All freshmen are required to take a one credit course in ethics titled Ethics Primer. This class is taught by the Director of Ethics and Character Development and by adjuncts, although currently the Humanities department head also teaches one section per semester. The course provides an introduction to individual ethical reasoning. The course may be said to form a background for Naval Science 402, Naval Leadership and Ethics, which is a two-credit class containing more of theory and application to leadership roles. As upperclassmen, midshipmen are also given the option of enrolling in the Ethics and Leadership Program (ELP). Midshipmen in this program are required to fulfill leadership positions in the Regiment of Midshipmen, to assist in the training of new midshipmen during summer indoctrination, and/or to seek out internships that have a strong leadership component. On the academic side, they must maintain a 2.5 QPA, and take approved program courses amounting to six

credits. Most midshipmen enrolled in the program take three one-credit seminars in their sophomore and junior years and an approved elective or Topics class in the senior year. The seminars offered thus far include Business Ethics, The Holocaust, Ethical Issues in Shipping, and the Profession of Arms in the Eighteenth Century. These are taken as overload courses, sometimes after the normal academic day. ELP-approved three-credit classes include Ethics and Literature, The Literature of the Sea, Public Speaking, and War and the Military Profession. Students may also arrange with individual professors and the Director of Ethics to do independent studies that fulfill some of the required credits. Thirty graduates of the class of 2008 received certificates and a note on their transcripts for completing all requirements for the ELP.

All students have the opportunity to take a number of electives. All departments offer electives in the same class period and students can choose between Humanities courses or offerings in Math and Science or the professional departments (Engineering and Maritime Transportation). Engineering students generally must take "required electives" in Engineering, meaning they may never have the opportunity to take elective classes in Humanities. Maritime Engineering students must take electives in their major department, but usually have the option to take at least two Humanities electives. Competition for Humanities is difficult because some of the Maritime Engineering courses, like Fast Boat Rescue for example, can lead to certifications that can improve job opportunities. Usually the department offers two to four electives each academic year. Recently the department has offered electives in Spanish, French, Modern Poetry, and American Government.

3 Strengths and weaknesses of the current approach

The great strength of the curriculum is that all students graduate only after being introduced to a basic series of ideas that students intending to function at a basic level in American society should know. Students have the opportunity to improve writing skills and textual analysis skills. They learn about basic contours of maritime, global, and national histories and develop their historical interpretive skills. In the Topics course, students have the opportunity to see what advanced classes are like in more traditional colleges and universities and, hopefully, have the opportunity to hone some of their intellectual skills through a deep analysis of a relatively small and new issues.

The curriculum has a series of weaknesses. These include the lack of student directed learning, lack of depth in offerings, and a limited or somewhat tenuous connection to larger institutional or professional goals.

Lack of Student Direction: One of the Kings Point mottos is that our students get to "Chart Their Own Course," yet such is not the case in the Humanities curriculum. Students get very little, or no choice in their course options. Students who might find African history interesting, or hope to learn about the role of women, ethnic groups, or certain authors have no opportunity

to pursue these interests. Instead students must take classes that they may, or may not, find engaging.

Lack of Depth: Five of the six classes might be considered introduction level surveys. The History of Seapower course, though focusing on a fairly narrow theme is taught to freshman students as a broad survey. The second English/Literature class, does build upon the first class, but is also essentially a survey as well. Only the Topics course makes any pretense to being an upper level course. However, because students often have little or no background in the subject matter the courses are often taught as surveys. Kings Point students have little opportunity to develop expertise, pursue independent intellectual questions, or to learn about central debates with academic fields. The problem here is that students do not have the opportunity to grapple with complexity. In survey courses questions have answers; in upper-level courses students usually are able to discover the multifaceted nature of societal development. They can become, in short, more sophisticated thinkers.

Lack of Connection to Institutional and Professional Goals: The department operates in a unique space as both a supporter of institutional maritime goals and as the only department where students get what might be considered their liberal arts education. No other department has a responsibility for promoting abstract and intellectual thought. At the same time, the department must recognize that our students are unique and that we are preparing them for careers in the maritime industry. As currently constructed, the curriculum is not effective in ensuring that graduates are educated in a broad senses as well as they are prepared to meet the technical demands of their professions.

4 Curricular reform

Two factors make the time ripe for curricular reform and new thinking about how to improve the Humanities curriculum. First, the Academic Dean has placed a premium on outcomes assessment processes. This process asks instructors to evaluate their courses and to determine how they are meeting their goals and what kinds of changes might help them meet goals in the future. This paper, and indeed faculty understandings of the larger curriculum suggest that a larger outcomes assessment curricular process is necessary.

Secondly, and as importantly, the institution has begun a baselining process; determining exactly what courses are necessary to fulfill Congressional, Accreditation, Coast Guard, and STCW requirements. Because of this process, professional departments will be forced to review, restructure, and re-sequence their courses. It only makes sense that the Humanities Department use this opportunity to review, restructure, and resequence its courses as well. It is worth noting that the baselining process should have little impact on the overall size of the Humanites Department. The institution's accreditation body, the Middle States Association of Colleges and Universities requires that all schools, to offer a Bachelor Degree, must have general education courses. These courses should,

to Middle States, have a connection to overall degree programs and major fields of study.

5 The ethical goal

As an antidote to some of the acknowledged weaknesses noted above, the authors of this paper suggest developing a "track" of humanities courses in ethics and leadership. One way to think about satisfying Humanities Department mandates is by understanding what graduates will be doing with their Kings Point graduation. Our students are being trained to serve as officers on merchant vessels. All must apply for a reserve commission in a branch of the United States Armed Forces, and if offered that commission accept it. Secondarily, our students can fulfill their graduation commitments through service as an active duty officer in the armed forces.

As officers, our students will have technical responsibilities, but also must be effective leaders capable of motivating individuals. Through the Regimental Program, which includes the Honor system and instruction in Academy Core Values, Kings Point rightly expends considerable efforts to ensure that graduates are at least competent leaders and that they are committed to high ethical standards in their lives and work. These efforts support the Academy mission of producing "officers and leaders of honor and integrity" to serve in the armed forces and merchant marine. The ethical and leadership challenges placed on Kings Point graduates have always been high, given the nature of the work that they do in the service of vital national strategic and economic interests.

These demands have increased over the past several years as Kings Point graduates have faced a world characterized by war and terrorism, environmental change, and a global economy that combines plenty and scarcity in a way that seems almost inevitably destabilizing. The individuals who will meet these challenges must not only be well-trained or imbued with orderly and honorable habits of behavior. They must be thoughtful people who have been prepared to handle complex and even conflicting demands and obligations. This is not just a matter of knowledge, but of imagination and empathy, which the Humanities, that are in effect a vicarious but conscientious engagement with the lives of others, can (properly taught) be able to cultivate. The ideal of the officer and leader has always been that he or she is a learned person in addition to having professional competence or expertise, and it would seem that this need is even greater in our own time.

6 The international studies goal

A second way to think serving students needs is to think about the kinds of environments they will be working in. The maritime industry is, by definition, highly globalized and Kings Point students of every major will be working with professionals of many different nations. Our students taking the military option

certainly will be entering an internationalized profession. As an antidote to some of the acknowledged weaknesses noted above, the authors of this paper also suggest a "track" of humanities courses in international studies.

Kings Point does have some internationally focused classes in the Maritime Transportation department, including International Business. In their law classes and economics classes, students are introduced to international trade concepts that are important in helping them navigate foreign commercial practice. These courses, in addition to the Modern World and Topics course come from a recognition, we hope to build upon, that the maritime industry is grounded in international commerce.

Kings Point must do a better job of making our students citizens of the world. We are fortunate that our students serve as cadets aboard merchant vessels for a full academic year and, collectively, visit every major international port as well as dozens of minor ones. These students return to campus with fantastic experiences that fuel their interest to know more about foreign cultures. Many students choose the maritime industry in large part because of their interest in seeing the world and in connecting with foreign cultures. Unfortunately, because many students have little opportunity to travel beyond port areas or beyond tourist zones, some preconceived notions are often reinforced. In addition, while many Kings Point students do come from multicultural backgrounds, we also pull a disproportionate share of our students from areas without much ethnic or racial diversity. As a result, students sometime have difficulty understanding how others understand the world. This problem must be rectified in order to best serve the students and the industry.

Secondly, the need for an International Studies track comes from a recognition that it would also help students understand and approach the major problems of the world today. Just as with the Ethical Goal, Kings Point graduates have faced a world characterized by war and terrorism, inequality and environmental degradation. To approach these problems effectively requires a grounding in their complex and transnational logic.

7 Minors vs. tracks

A track of courses, as defined here, would mean that all six of the humanities courses would focus on one of the two areas suggested above. Courses would not all need to be completely dedicated to either Ethics and Leadership or International Studies, but these issues would be addressed within them. Ideally, students would have the opportunity to choose between the two tracks early in their Academy careers.

A second option, not mutually exclusive with the track idea, is to use the tracks as a base for a minor program of study that would include additional coursework. In the Ethics and Leadership area the ELP program could serve as a nucleus for this minor. In the International Studies area the minor could build

upon the Modern World course and currently offered Topics classes in East Asian or Latin American History.

8 Conclusion

The authors believe that our proposal would go a long way towards alleviating all three of the weaknesses of lack of student direction, lack of depth, and insufficient connection to institutional goals. Students would be given greater discretion in pursuing their own education. They would have the opportunity to pursue these studies in a more scholarly and thoughtful fashion. Finally, the Humanities department would be able to demonstrate the importance of a humanities education for future officers and international mariners. Humanities instructors at Kings Point have long felt that the general educations of their students were being neglected in favor of the technical aspects of the curriculum. Others, Deck and Engineering faculty especially, have questioned the relevance of the Humanities in the training of maritime officers. Both sides have had a point. We believe that our proposal addresses both concerns, and the needs of the institution and industry, in a way that has great promise for Kings Point and the maritime profession.

Application of queuing theory to tankers and other ships that pass through the Istanbul Strait

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Abstract

For the scientific research of ship arrivals and passage through a strait, the queuing theory can be used. The length of waiting in line (queue) depends on the number of customers (the proportion of arrival), the period of service, the number of service channels serving, and the service discipline.

Istanbul Strait is one of the most crowded and potentially dangerous waterways in the world. Its narrow and winding shape, along with strong surface and counter deep water sea currents hinders navigation. In this paper, a queuing model of maritime traffic in the Istanbul Strait is presented. For this purpose the passing of tankers and other ships are used as examples for the mono service channel. For the data taken between the years 1996-2000, calculations are made according to the criteria that a tanker is not allowed to enter the strait while another one is passing through. Also by using the same method, the traffic density is analyzed for ships other than tankers.

1 Introduction

The Strait of Istanbul, connecting the Black Sea to the Aegean Sea, is one of the major trade arteries in the world with an average of 136 transits a day, second to the Straits of Malacca.

The Montreux Convention of 1936 as it relates to the regime of the Turkish Straits, establishes freedom of passage and navigation with certain formalities for merchant vessels of any flag and with any kind of cargo, by day and by night, and the Strait is kept open for shipping traffic. Hence the Istanbul Strait (Bosphorus) serves as an international seaway of economic and strategic importance.

Due to angular windings, transit shopping either way requires at least twelve major course alterations as much as 80^0, with severely limited vision around these bends.

Geographical and oceanographic conditions as well as navigational constraints are the main parameters making the navigation through difficult and risky. Additionally, since passage through the Strait entails a run by about 17 nautical

miles all the way and takes almost two hours, utmost vigilance is necessary in order to maintain safe standards of navigation and to conduct vessels (Akten, 2006).

Increased shipping traffic through the narrow Istanbul Strait (Bosphorus) has heightened fears of a major accident that could have serious environmental consequences and endanger the health of the 12 million residents of Istanbul that live on either side of the Straits. The Straits have witnessed an increase in shipping traffic since the end of the Cold War to the point that around 50,000 vessels per year (nearly one every 10 minutes) now pass through them. Around one-tenth of these are crude oil or liquefied natural gas tankers (Oguzulgen , S. 1994). This increased congestion has led to a growing number of accidents; between 1988 and 1992, there were 155 collisions in the Straits (Guler N. and Poyraz O., 1997)

In March 1994, the tanker *Nassia*,collided with the dry bulk carrier Shipbroker in the Strait of Istanbul. Burning and spilling its cargo of crude oil, the Nassia drifted perilously close to the European side before the Turkish authorities managed to tow the flaming wreck into the Black Sea .

Thirty seamen were killed in the accident, shipping through the Istanbul Strait was interrupted for seven days and over 500 vessels had to wait for passage. In May of the same year, the Turkish government issued a declaration that, beginning 1 July, Turkey would exercise certain supervisory powers over shipping in the Straits (Istanbul Strait Maritime Traffic Regulations, 1994). Turkey's case here is not that it is exercising powers it did not have previously, but merely tailoring international standards and norms to the Turkish Straits (Güclü, Y. ,2001).

Briefly, the new rules were to be as follows:

1. Ships with dangerous cargoes should inform the Turkish authorities of their intention to pass through the Straits twenty-four hours in advance, and while they were in passage, no other ship would be allowed to pass through the Straits.
2. Ships using the Straits should abide by the report systems, traffic control measures and traffic separation schemes put in place by the Turkish authorities.
3. Speed would be limited to 10 knots, overtaking would be forbidden and vessel height would be sensibly limited to 190 feet because of the two suspension bridges north of Istanbul.
4. Turkey reserved the right to close the Straits temporarily while fire fighting, sounding, sports and scientific activities, rescue operations or anti-pollution projects were going on.

2 The modeling of Istanbul Strait for a single server, single queue

The subject of queuing theory can be described as follows: consider a *service center* and a *population* of *customers*, which at some times enter the service center in order to obtain service. It is often the case that the service

center can only serve a limited number of customers. If a new customer arrives and the service is exhausted, he enters a *waiting line* and waits until the service facility becomes available (Willig, 1999).

The maximum number of tankers that can cross the Istanbul Strait (the capacity of the Bosphorus) can be found by using a First in First Out (FIFO) queuing model, with a single server, single queue and infinite a arrivals(Lee, 1966) (Gross and Harris 1974).

The maximum number of tankers that can pass should be calculated according to regulations. According to the regulations, the maximum speed of the tankers is 10.0 nm (18.5 km/h), and if a large ship with dangerous load (length is greater than 150 m) enter the Istanbul Strait, (Bosphorus) another ship with the same specifications cannot enter the Istanbul Strait. Since the data for ship length is not available and taking into consideration the heavy tanker traffic, all tankers are considered to be a large ship. Additionally, the ferry and boat traffic on the Istanbul Strait is not taken into consideration: (Şimşek, 2003)

1 day: 1440 minutes
Length of Istanbul Strait : 16 miles = 160 gomina
Speed of Ship: 10 mph = 100 gomina/hr
The time it takes for a tanker to leave the Istanbul Strait: t
t=160/100 = 1.6 hours = 96 minutes

The number of tankers that cross the Istanbul Strait are given in the tables 1 and 2.

Table 1. Number of tankers and other ships that crossed the Istanbul Strait in 1996- 1998 (source: Turkish pilots organization)

	1996			1997			1998		
	Tankers	Others	Total	Tankers	Others	Total	Tankers	Others	Total
January	336	3255	3591	337	3214	3551	397	3550	3947
February	324	2834	3158	329	3062	3391	345	3302	3647
March	380	3534	3914	357	3850	4207	378	3567	3945
April	300	3794	4094	351	3428	3779	364	3553	3917
May	377	4344	4721	381	4432	4813	440	4019	4459
June	347	3813	4160	365	4325	4690	456	3837	4293

	1996			1997			1998		
	Tankers	Others	Total	Tankers	Others	Total	Tankers	Others	Total
July	382	3933	4315	363	4375	4738	469	3969	4438
August	355	4340	4695	408	4003	4411	449	3778	4227
September	357	4007	4364	362	3910	4272	433	3736	4169
October	368	4159	4527	386	3792	4178	526	3910	4436
November	402	4046	4448	343	4381	4724	438	3453	3891
December	320	3645	3965	321	3867	4188	447	3488	3935
Total	4248	45704	49952	4303	46639	50942	5142	44162	49304
Month. Aver.	354	3808	4162	359	3886	4245	429	3680	4109
Daily Aver.	12	125	137	12	130	142	14	123	137

Table 2. Number of tankers and other ships that crossed the Istanbul Strait in 1999, 2000 (source: Turkish pilots organization)

	1999			2000		
	tankers	other	Total	tankers	other	total
January	318	3256	3574	384	2900	3284
February	299	3193	3492	345	3052	3397
March	381	3715	4096	368	3540	3908
April	360	3842	4202	425	3794	4219
May	455	4073	4528	435	3692	4127
June	401	3955	4356	460	3731	4191
July	382	3798	4180	482	3767	4249
August	374	3648	4022	448	3820	4268
September	376	3540	3916	403	3652	4055
October	407	3670	4077	383	3660	4043
November	331	3367	3698	425	3924	4349
December	368	3397	3765	379	3610	3989

	1999			2000		
	tankers	other	Total	tankers	other	total
Total	4452	43454	47906	4937	43142	48079
Monthly average	371	3621	3992	411	3596	4007
Daily average	12	121	133	14	120	134

Calculating the average number of arrivals for tankers in 1996:

$$\mu = \frac{1440}{96} = 15 \text{ tanker /day; } \lambda = 12 \text{ tanker/day}$$

The expected number of tankers in the system: L
The expected number of tanker in queue: Lq
Average time spent per tanker in the system (Istanbul Strait): W
Average time spent per tanker in queue: Wq
The probability of there being no tankers in the system (Istanbul Strait): P0

At any given moment, there can be 1 or 0 tankers in the Istanbul Strait since according to regulations when a ship carrying dangerous loads enters the Istanbul Strait there cannot be another ship of the same characteristics. Therefore there can be a maximum of 1 tanker on the Istanbul Strait . This probability can be found to be P_1 = % 80.

The expected number of tankers to cross the Istanbul Strait : Lb

Using the formulas above, calculations have been made for years 1996, 1997, 1998, 1999 and 2000 and the results can be found in Table 3. As can be seen in the table, the percent capacity used of the Istanbul Strait for tanker crossing is 80-93%, and the ratio of the Istanbul Strait being unused is 7-20%. The number of tankers in queue is between 3.2 - 13, and the time that tankers wait in queue is between 8 - 24 hours. In 1996 4248, and in 2000 4937 tankers crossed the Istanbul Strait .

The number of tankers crossing shows that the tanker traffic on the Istanbul Strait is increasing. Taking into consideration factors like the increase in number of tankers , the traffic of ferries and boats that have been ignored in this research, and also weather conditions which lead to the Istanbul Strait being closed to tanker traffic, the capacity of the Istanbul Strait should be increased.

Table 3. Calculation results for the tankers crossing the Bosporus between the years 1996-2000

	1996	1997	1998	1999	2000
λ	12	12	14	12	14
L	4	4	14	4	14
L_q	3,2	3,2	13	3,2	13
W (hour)	8	8	24	8	24
W_q(hour)	6,5	6,5	24	6,5	24
P_0	20%	20%	7%	20%	7%

3 An example application of the model for Other Ships

The maximum number of ships that can cross the Istanbul Strait (the capacity of the Bosphorus) can be found by using a First in First Out (FIFO) queuing model, with a single server, single queue and infinite arrivals.
According to the regulations, the maximum speed of the tankers is 10.0 nm (18.5 km/h),and the distance between the ships should be kept 8 gomina (1 gomina = 185 meter). The ships cannot pass each other.
The other intercity maritime traffic like boats and ships are neglected.

1 day: 1440 minutes

The length of Istanbul Strait : 16 mil = 160 gomina

Vessel speed : 10 mile /h = 100 gomina/ h

The distance between two ships : 8 gomina

The duration for a vessel to leave Istanbul Strait: (t)

t = 160/100 = 1.6 hour = 96 minutes

The number of maximum vessels that can exist in the Strait at any time: (S)

S = 160/8 = 20 vessels

The number of vessels that can pass the Strait without any restrictions: (N)

$N = (1440/96) \times 20 = 300$ vessels

If the duration of a vessel entering the Strait and leaving the Strait (96 minutes) is taken as a period, than total number of the periods in a day are: (T)

$T = 1440/96 = 15$ period

Without any restrictions 300 ships can pass the strait to the north in a day. The data given in the tables are the total number of ships that pass the strait both in north and south directions. A loaded ship that passes to the north will come back to the south after unloading its cargo. For this reason the number of ships that pass the strait in the north and south directions are agreed to be equal in number.

When the calculations are carried out for the year 1996, since 20 ships can pass every 96 minutes;

$(1440/96) \times 20 = 300$ ships /day can pass.

$\mu = 300$ ships /day

$\lambda = 63$ ships /day

Expected number of ships that exists in the system : L

$$L = \frac{\lambda}{\mu - \lambda}$$

$$L = \frac{63}{300 - 63}$$

L = 0.27 ship

Expected number of ships in the queue (L_q)

$$L_q = \frac{\lambda^2}{\mu(\mu - \lambda)}$$

$$L_q = \frac{63^2}{300(300 - 63)} = 0.06 \text{ ship}$$

Average time per ship spent in the system (In the strait): (W)

$$W = \frac{1}{\mu - \lambda} = \frac{1}{300-63} = \text{ 0.004 day = 0.1 hour = 6 minutes}$$

Average time per ship spent in the queue (W_q)

$$W_q = \frac{\lambda}{\mu(\mu-\lambda)} = \frac{63}{300(300-63)} = 0{,}001 \text{ day = 0,02 hour = 1 minute}$$

The probability that no ship exists in the system (In the strait) : P_0

$$P_0 = 1 - \frac{\lambda}{\mu} = 1 - \frac{63}{300} = 0{,}79 = \% 79$$

The expected number of ships that pass through the Strait: (L_b)

$L_b = (L - L_q)\, T = (0{,}27 - 0{,}06)\, 15 \cong 3$ ships

By using the above formulas the calculations are made for the years 1996, 1997, 1998, 1999, 2000. The results are tabulated in the table 4.

Table 4. The results of the calculations for the ships other than tankers for the years 1996-2000

	1996	1997	1998	1999	2000
λ	63	65	62	67	67
L	0,27	0,27	0,27	0,29	0,29
L_q	0,06	0,06	0,06	0,06	0,06
W(hour)	0,1	0,1	0,1	0,1	0,1
W_q(hour)	0,02	0,02	0,02	0,02	0,02
P_0	0,79	0,78	0,79	0,77	0,77

4 Conclusion

In this paper the passing of tankers and other ships through the Istanbul Strait have been used as examples for the model of single service channel.

In the light of obtained results for the years 1996-2000, it is observed that there is dense traffic in the straight and the number of tankers passing through the straight has been increasing. The calculations related with tables 1 and 2 might indicate that passage of more than one tanker might be possible.

As can be understood from the table 4, the ship passage rate is between 21-23%. The queuing time for the ships is short. The traffic to the north is not very dense.

All the calculations and results are the outcome of the data related with 1996-2000. To give a more actual interpretation, new data and other methods might be used.

References

[1] Akten , N. (2006) The Strait of Istanbul (Bosphorus) : The seaway separating the continents with its dense shipping traffic, Istanbul University, Institute of Marine Sciences and Management

[2] Gross, D. and Harris D.M. (1974) Fundamentals of Queueing Theory, Wiley ,New York

[3] Güçlü, Y. (2001) Regulation Of The Passage Through The Turkish Straits, Perceptions, Journal Of International Affairs, March - May Volume VI - Number 1

[4] Güler Nil and Poyraz Ö. (1997) Istanbul Bogazı'nda Deniz Trafigi ve Seyir Güvenligi, Turkiye'nin Kıyı Alanları 1.Ulusal Konferansı, Proceedings , p. 533-542 , Ankara

[5] Maritime Traffic Regulations for the Turkish Straits and the Marmara Region, (1994) The official announcement of the regulations was first broadcast on 23 November 1993 and then published in the Official Gazette of 11 January 1994, No. 21815. Some of the provisions of the regulations were amended the same year and these were promulgated in the Official Gazette of 21 June 1994, No. 21967

[6] Lee, Alec M. (1966), Applied Queuing Theory, Macmillan and Company Ltd. NewYork

[7] Oguzulgen, S.(1994) Turk Bogazlari Bolgesinde Deniz Trafiginin Kontrolu ve Gerekli Yaptırım Duzenlemeleri, Bogazlardan Geçiş Guvenligi ve Montreux Sozlesmesi Semineri, Istanbul University

[8] Şimşek ,H., (2003) Application of Queueing Theory to Istanbul Strait for Tankers and Ships and to the Haydarpasa Container Port Terminal , M.Sc. Thesis , Supervised by Prof.Dr. Nil Guler

[9] Turkish Pilots Organization (1996-2000), www.turkishpilot.org

[10] Willig, Andreas (1999) A Short Introduction to Queuing Theory, Technical University Berlin, Telecommunication Networks Group, www.tkn.tu-berlin.de

Fundamentals of ship maintenance and repair for future marine engineers

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Abstract

This presentation is intended to emphasize the importance of teaching the subjects related to ship engineering operations, and specifically ship maintenance and repair (M&R), to analyze the existing practices in IAMU member institutions, and to offer practical recommendations. Although the share of maintenance and repair in the cost of ship operation is substantially lower then, for instance, fuel and crew expenses, its cumulative impact is quite substantial. Besides the direct costs, this impact includes related down time, that reduces revenues, delays causing lost opportunity and more revenue loss, insufficient quality of repairs, affecting ship performance, and causing emergency repairs and down time. The fundamentals of ship maintenance and repair are examined from the standpoint of the theoretical and practical knowledge required. The STCW and other requirements are evaluated. The importance and expected outcomes of teaching the subject is discussed as a way of enhancing the knowledge and providing a needed edge in landing a better sailing job, and also a possible future job ashore, as a port engineer, or as an experienced professional in a shipyard and other repair enterprise, as well as in engineering companies. Various approaches to the problem are discussed with an accent on the limitations of the already overloaded four-year curriculum

Keywords

Marine engineering program, ship maintenance and repair (M&R), components of engineering curriculum

Introduction

Despite the efforts of the IMO and the Maritime Community, the existing curricula in many maritime schools does not totally meet the maritime industry's need for specialists with integrated knowledge of specific engineering and operational disciplines. One of the principal concerns is a relatively low readiness of the graduates to assume engineering positions ashore: at shipyards,

in engineering companies, or shipowner's engineering departments. Maintenance and repair (M&R) is the program component that varies quite substantially in its scope and content. Many licensed marine engineers, who are starting their careers with shipping companies, might soon perform port engineering functions, coordinating maintenance and repairs of assigned ships. Today's licensed marine engineering program should be designed to provide a midshipman with a solid base in mathematics and science, humanities, fundamental engineering science and specific marine engineering disciplines along with knowledge in the management of ship maintenance and repair.

Keeping in mind that the demand for competent seafarers will grow in the years to come, enhanced education and training are vital in meeting growing demands and expectations of the maritime industry. The underlying reason for the curricula development, or rather enhancement, is the need for system approach to the maritime education. The engineering sector of the maritime industry embraces not only the ships to be operated, but also the shipyards and various ship repair facilities, engineering companies and ship designers, equipment manufacturers, engineering departments of shipping companies, etc. The ideal education for the high mobility workforce should provide enough knowledge and skills for a comparatively comfortable adaptation in other areas of the maritime system.

1 Operational impact of maintenance and repair (M&R)

Mission, design type and specific features, ship's registry and flag - all these and some other issues affect the operational cost of a ship. The crew cost differs depending on the ship's complement and on the salary level. Obviously, for open registry ships the crew cost is substantially lower than for the American Flag ships. The same is true for the ships with automated engine rooms and correspondingly reduced crews. Although the annual cost of fuel and lube oil depends primarily upon the type and capacity of the propulsion plant and auxiliary machinery, its share in the total operational cost varies substantially reaching the maximum for the reduced crew ships, especially in the case of extra large tankers and cargo carriers. Using the example of an American registry large cargo carrier, the fuel cost amounts to 25-35% and it increases to 45-55% for the open registry ship.

Maintenance and repair expenses - the third major component of the operational cost - is very low, about 5-7% of the total cost, when a new ship enters the operation. However, it goes rapidly up to 15-20%, as the ship ages. After the midlife has been reached, the maintenance and repair portion of operational expenses might reach 25-30% and even more. As it has been noted earlier, although the share of M&R in the cost of ship operations is comparatively low, its cumulative impact appears to be quite significant. In the following table, an attempt is made to assemble all significant factors related to

ship maintenance and repair, and their impact on ship operations, especially when the M&R management is insufficient.

Table 1. Impact of M&R on economics of ship operations

No	M&R Factors	Impact on Economic Results of Ship Operations
1	M&R Cost	- actual cost of M&R, that causes reduction of operational profit - cost of deviation required to deliver a ship to a shipyard outside of the normal area of operation
2	M&R Duration	- down time as a result of failure or voyage repairs - non-operational time while in a shipyard - deviation time for bringing a ship to a remote shipyard
3	M&R Quality	- ship's down time due to failures and emergency repairs - reduced ship's equipment performance and associated increased operating costs and reduced revenues
4	Safety	- crew casualties and associated down time and costs - serious occupational injuries and corresponding law suites, legal costs and substantial reward payments
5	Environmental	- fines and penalties for sea and air pollution - crew productivity reduction as a result of health problems and job dissatisfaction
6	Marketing	- possible cargo damages due to ship failures and down time - late cargo delivery for the same reason and the corresponding penalties and even loss of a customer - failure down time causing lost opportunity and possibly a loss of a customer

2 Reasons for teaching ship maintenance and repair

The list of management subjects, related to ship maintenance and repair, with which the marine professionals are dealing, is practically endless. Huge resources are being spent to carry out maintenance procedures traditionally, while modern computer based maintenance system can save a lot of labor and material resources. The crew members should be taught these modern management techniques.

Even more improvement might be expected when the reliability-centered maintenance is introduced. The latter is defined as a systematic approach to develop a focused, effective, and cost efficient preventive maintenance program for such a complicated system, as a ship. It can be accomplished using a structured decision tree, which leads to a selection of the most applicable preventive maintenance tasks, and this way saves substantial resources. This approach is based on a comprehensive theoretical foundation, which includes good understanding of the reliability fundamentals coupled with the familiarity with probability and statistics applications.

Another important area which requires proper college education is the problem of spares on board. The ancient wisdom dictates to the chief engineer to

have as many spares as possible on board. On the other hand, the economic consideration calls for the minimization of inventory. Today's engineering graduates are not equipped with the modern methods of inventory management. As a result, many ships that are ready to be scrapped, carry on board millions of dollars worth of inventory; for example, one or two spare propellers, anchors, sections of the propulsion shaft, variety of valves, pipes, fittings which can hardly be sold for the face value, when the ship is retired. Therefore, when adding spares to the ship's inventory, the engineers should be guided not only by technical consideration, but also by economic reasons. For instance, the cost of having certain spare part on board should be compared with possible economic losses if it is delivered only when needed. And in many cases, this decision should be made on board by the ship's engineer.

Lack of a proper justification of maintenance and repair actions should be blamed for some negative results, when, for instance, choosing the best yard to carry ship repairs. New on the market repair facilities are appearing on the map: in China, Poland, India, Brazil, etc. More and more shipowners bring their aging ships into remote yards with a substantial deviation from the normal area of trading. A lot of mistakes have been made due to insufficient, or simply inexistent management justification. Most of the shipowners concentrate on the cost savings from the repairs leaving other variables not fully investigated: losses due to deviation, possible increased duration of repairs, problems with repair quality, etc. Lengthy delays and poor quality might add to the negative results of the endeavor. For the American flag ships an additional huge expense is added - custom dues on the cost of repairs done.

Another area where sufficient M&R background can save a lot of money is the decision regarding the scope of upcoming shipyard repairs. How much repairs to request from the yard? What is less expensive in a long run: to include a certain item in the repair specification, to carry it next time, or to do it onboard by the crew members or a riding team? All these questions represent typical decision making situations when a properly laid-out judgment is needed.

Organization and management of ship repairs in a shipyard is one more subject, where appropriate management training is needed. After the ship has been delivered to the shipyard, the primary concern of the owner's representative is the constant changes of the work scope, which require making immediate decision. First of all, the necessity of the change should be technically and economically justified by comparing losses and benefits for two options: the original work scope and the change.

Another important subject for consideration by the shipowner is the quality of repairs. The shipowner does not have much leverage over the shipyard, when it concerns the quality. However, the increased presence of the qualified owner representatives at the yard is very effective in controlling it. The fact that more monitoring is done allows to uncover the shipyard defects on time and to prevent substantial financial losses. The shipowner might affect the quality of repairs also by supplying certain materials and equipment. It is a common

practice for the shipyard to acquire most of material resources needed for repairs. And the owners are normally in agreement with this practice. One of the main reasons is that this way many possible shipyard's claims to the owner for the cost adjustment due to alleged owner-caused delay might be eliminated. However, when the economic analysis indicates that better materials, or painting schedule, or equipment will bring substantial financial benefit in operations, the shipowner might request the yard either to supply those better materials and equipment for an additional cost, or to accept the owners supply.

An important reason for an enhanced training is the growing need to make the marine engineering program more attractive for prospective cadets. Nowadays, when a young man or woman is considering a maritime profession, a couple of questions might pop up: What will happen to me if in a few years after graduation I would not be able or would not want to sail any more? Will I be prepared for a shoreside job? Additional industry oriented knowledge offered at school might amplify the career path ashore. This consideration might appear a decisive one in choosing the profession. If the question of a possible career change appears in the future, enhanced training helps to get a positive answer. These days, when the romantic attractiveness of the marine engineering profession is getting weaker, the maritime colleges have to demonstrate to the prospective cadets, that they are moving in the same directions as most of the regular engineering colleges; that is, in the direction of an increased scope of the industrial management component of the program.

Yet another important objective for improvement of the program exists: to help the graduates to land a better first job. Added skills will put the graduates ahead of the competition equipped only with traditional curriculum. The statistics of the USMMA shows that a part of our engineering graduates never sail, and a large percent of those who find sailing jobs after school, eventually go ashore and assume various engineering positions. Enhanced knowledge of current industry practices appears even more valuable for shoreside positions. Especially, after a few years, when the former cadet gains certain experience and is ready to assume a management position.

And finally, the subject of the program STCW certification: the comprehensive international certification of the maritime schools and of their graduates which has been initiated by IMO, includes certain competence in maintenance and repair to be obtained by each graduate. The following table is an excerpt from the STCW Code related to the subject.

Table 2. M&R in STCW Code

Competence Code	Knowledge, understanding and proficiency
Function 4: Maintenance and repair	
4.1	Marine systems Safety and emergency procedures Fundamentals of maintenance and repair

An enhanced M&R education is required for the lower level decision making. As an example, we might note the crew reduction efforts, which are still among the most popular ways of cutting operational cost. On one side, this is a technical problem: the ship should be prepared and capable to have the crew reduced. On the other side, this decision brings up multiple management problems and questions, and there is no guarantee that all crews are ready to operate under reduced conditions. First of all, crew reduction changes the functions and responsibilities of crew members, and the necessity to increase efficiency of every crew member becomes vital for the success of the program. But in order to achieve it, crew members should be armed with knowledge of this efficient methods.

A lot of functional changes are happening in the area of shoreside engineering support. While it is true that the number of shipboard engineers is decreasing due to automation, the total number of engineers required to operate a ship has not been dropping accordingly. Certain functions of the reduced crew should be performed now by engineers ashore, especially port engineers and repair engineers. At the same time, the overall performance of the engineering personnel at headquarters, as well as, the remaining crew members should improve. In practice, every port engineer normally handles three or four large ships with manned engine rooms; when dealing with unmanned engine rooms the number drops to two or three ships. Moreover, engine room automation leads to increased volume of shipyard repairs. In order to properly supervise these ships an extensive knowledge in management of ship maintenance and repair is required. In addition, ships are becoming more complex and more automated. Chief Engineers, First Engineers, and Port Engineers are increasingly responsible for managing a wide range of activities related to ship operation, repair and maintenance, and would benefit from additional management education. The principal tasks related to the ship's operation and at the same time dependent on the performance of the Engineering Department are reduction of the cost of fuel, and of repair and maintenance. Without giving the crew members basic knowledge, which will allow them to take proper actions in this area, it is hard to expect the most efficient decisions.

3 Additional knowledge required

Engineering programs are normally more condensed, and a common believe is that there is not enough time for anything else but the established curriculum. The average length of a program, which leads to the Third Assistant (or just Forth Engineer) license, is four years, including about a year of sailing. However, there are three- year programs, on one side, and five-plus-year programs, on the other side, like in Russia and Ukraine. The distribution of time among the components of a program and the list of academic courses vary quite substantially from country to country, and even among different schools of the same country.

The author's analysis of the M&R related subjects in the existing marine engineering programs shows the following maintenance-related component in the curricula of over 20 maritime educational institutions (see the chart below). Obviously, the longer programs allow for an increased scope of the M&R component.

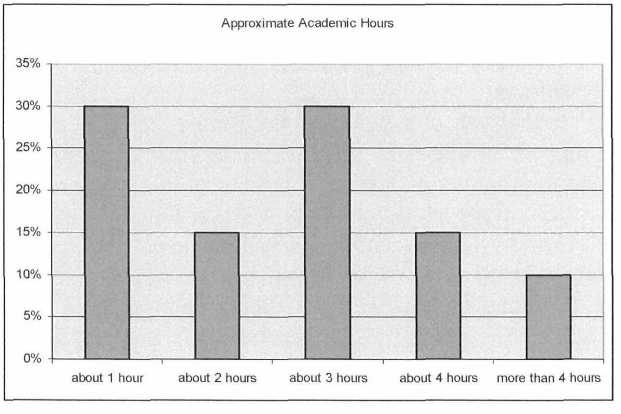

Figure 1. M&R subjects in the marine engineering programs.

What additional maintenance management knowledge is needed and what is the relative importance of certain subjects to be considered? The discussion below reflects the author's thinking and an attempt to prioritize various areas of multi-functional education relative to a marine engineering curricula.

The very first subject to be considered is a general course in marine engineering management, which might be a portion of the introductory to profession package. As to the special subjects to be introduced, the highest priority should be given to a series of courses in Ship Engineering Operations, which includes ship maintenance and repair, materials, manufacturing processes, basics of operation of shipyards and ship repair facilities. These courses

augmented with a two-month internship in a shipyard or a similar facility will provide a solid foundation for a possible shoreside industrial employment. The Table 3 outlines the principal content of the Ship Engineering Operations course.

Table 3. Components of ENGINEERING SHIP OPERATIONS Course

No	*Course Components*
1	*Management of Engineering Operations*
2	*Maintenance and Inventory Control Management*
3	*Ship Surveys and Inspections*
4	*Ship Repair and Drydocking*
5	*Basics of Ship Repair Facility Operation*
6	*Safety of Ship Engineering Operations and ISM*
7	*Shipboard Economics and Cost Control*

4 Methods of enhanced training

The most popular and, possibly, the easiest way of amending the curriculum is to develop special courses. Most schools have, at least, one mandatory operations management course. Although, it provides certain fundamentals, it does not add substantially to the practical applications of the theory in the maritime industry. It is well known that any addition to existing programs is almost impossible, unless they are offered as electives or overload.

Another way of inserting some M&R subjects into the curriculum is by developing new or modernizing existing course projects and independent studies. These projects should be prepared by the cadets either during their sea service and apprenticeship period, or during the regular academic year. It might be a design project which includes justification of the chosen alternative, or development of the project management plan, or analysis of existing systems and equipment and evaluation of possible changes, etc. At some schools, where the in-class period exceeds three years (in Russia, Ukraine, China, for example), a special diploma project or thesis is being prepared during almost the entire semester. It appears to be a very useful tool of management training, and is somewhat analogous to the senior thesis required at many of the best colleges in the US.

A comprehensive capstone design project is developed by the seniors of the specialized Marine Engineering Management Program at the US Merchant Marine Academy. One of the principal projects, which a team of four midshipmen is working on during the entire senior year, is entitled SHIP OVERHAUL PROJECT. The team uses a repair specification obtained during the internship or provided by the Faculty Advisor. The principal modules of the

project are shown in the Table 4. After completing the project a graduate feels very comfortable, when offered a job as an assistant port engineer, or as a project engineer at a shipyard.

Table 4. Typical content of a senior capstone design project

No	Capstone Project Modules and Tasks
1	***Development of a bidding package*** 1.1. Preparing a draft repair specification 1.2. Estimating cost and setting a budget 1.3. Finalizing repair specification 1.4. Approximating repair duration 1.5. Developing request for proposal
2	***Economic evaluation and justification*** 2.1. Economic justification of overhaul vs. scrapping 2.2. Economic evaluation of selection of a shipyard 2.3. Economic justification of overhaul
3	***Project management strategy*** 3.1. Selecting schedule activities 3.2. Estimating schedule activity durations 3.3. Developing a draft schedule 3.5. Optimizing schedule 3.6. Balancing workforce 3.7. Developing final schedule
4	***Modernization proposals*** 4.1. Selecting proposals 4.2. Preliminary design 4.3. Economic evaluation of proposals 4.5. Design calculations and sketches 4.6. Final drawings and diagrams
5	**Design of production processes** 5.1. Breaking down into operations 5.2. Production procedures 5.3. Calculating operation characteristics 5.4. Identifying time rate
6	**Shipyard capacity analysis** 6.1. Shipyard master production plan 6.2. Workforce requirements 6.3. Capacity of principal facilities 6.4. Shipyard modernization proposals

An internship at a shipyard or a similar facility should be considered a vital component of a multi-functional program. All midshipmen enrolled into the Marine Engineering Management Major at the US Merchant Marine Academy

are required to work two months in a real production environment. Most of them either assist Project Manager at the shipyard, or work with a Port Engineer, who is supervising an overhaul of his ship. The following is a short list of the subjects the interns are required to learn or at least become familiar with:

- Shipyard preparations to performing the contract job
- Engineering support services
- Planning and scheduling of a contract
- Management of construction and repair program and of individual projects
- Organization and production methods in ship repair and overhaul
- Work outsourcing in repair and construction projects
- Principal capacities of the shipyard
- Material management:
- Modern ship repair and construction methods and procedures
- Quality control, testing and trials

An important component of the maritime educational system in some countries is post-graduation training: after a certain period of sea service, the officer returns to school for additional instructions in order to raise the certification level. In our opinion, this is a very efficient way of improving the qualification of officers by introducing them to all the latest changes and developments in maritime practice. However, obvious financial and organizational barriers do not allow this training to become a mandatory system, which it definitely deserves to be. The experience of France, Belgium, Indonesia, Israel, Russia and other countries supports this conclusion. A special decision of an international body is long awaited in order to set unified requirements for promotion of marine officers.

Until these unified requirements have been set, many schools are offering various advanced courses to former graduates, not necessarily of their own school. These are either refresher and retraining programs, for instance, from steam to diesel, or special training based on new regulations and changed work conditions. There are also various courses related to new equipment and technology. That is when a special attention should be given to the M&R management training. Moreover, some courses might be geared to a relatively narrow area, like management of shipyard repairs, methods of reliability-centered maintenance, etc. Incidentally, many companies are sending their engineers to regular universities for management training on the continuing education basis.

5 Conclusion

A variety of tasks being performed by the engineering graduates of the maritime academies, who are either sailing or working ashore, require multi-functional education related not only to ship operations, but in a great degree also to shoreside jobs. Therefore, the basic knowledge of shipyards and other manufacturing enterprises, as well as ability to manage ship maintenance and repair, should be included into the curriculum of the maritime schools on a substantially higher level and scope, than it is done now. However, providing that the engineering license remains the first priority of any program, this task puts a strenuous time limitations.

Therefore, the endless list of industrial management subjects and topics, which are useful for the cadets, should be prioritized. And the highest priority should be given to the subjects of ship engineering management and operations, optimization of ship maintenance and repair, repair project management, etc. Development and introduction of special courses in accordance with the priority list is the simplest and most widely used method of M&R training. However, due to time constraints in the program, these are mainly elective courses.

Industrial management training after graduation is quite popular in some countries, and should be further developed. It would be very helpful if a Maritime International Body develops uniform requirements to the engineering programs and also to the promotion of the engineering officers.

References

[1] Boris Butman, Management and Economics in Marine Engineering Curriculum, Proceedings of the 1997 Transportation Operations, Management and Economics Symposium, SNAME, New York, USA, 1997

[2] Capt. William T. Mc Mullen, The Attitudes of American Merchant Marine Officers Toward Some Aspects of Reduced Crewing Schemes on American Vessels, Doctoral Thesis, University of Wales, 1993

[3] Everett C. Hunt and Boris S. Butman, Marine Engineering Economics and Cost Analysis, Cornell Maritime Press, Centreville, 1995

[4] Boris Butman, Economic Impact of Repairs on Ship Operations, Proceedings of the Conference of the International Association of Maritime Economists, Izmir, Turkey, 2004

The development of maritime programs for delivery to overseas students in the UK

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Abstract

The current and predicable future experience of recruitment to UK Maritime Universities and Nautical Colleges is towards a greater proportion of non-EU students. This has heralded a situation where there are programmes specifically for non-EU students and clients as well as those specifically for UK and EU students plus programmes accepting both sets of students.

The UK as an established Maritime nation is seen by many developing countries as a prestigious place to undergo Maritime Education and Training (MET). Of recent years the delivery of this MET in the UK has focused on a few centres consisting of Universities with associated training establishments and some training colleges independent of the University sector. Other University departments, not previously noted for maritime education but with particular specialities have developed courses in individual maritime disciplines, notably maritime law. All these centres have attracted overseas students. This education and training has spanned levels from STCW OOW, which is broadly at level 1 degree, to Post graduate and PhD study.

Training, particularly at the STCW OOW level is moving towards a "Foundation Degree," which is the first two academic years of the full BSc (Hons) degree for UK students and EU students meeting the admissions requirements generally associated with the UK Tonnage Tax. Training at this level for Non-EU students generally requires a greater amount of seatime before the student is eligible to sit the national oral examination and achieve the Certificate of Competency (CoC). The seatime element for students on the Foundation Degree is often included as "Work Based Learning" in the structure of the course, whereas non-EU students studying for CoCs require the seatime to be achieved prior to starting the course.

There is an ongoing demand on UK Maritime Universities and Colleges from non-EU students requiring training courses often, but not always, linked to degree study. UK nautical educational establishments have developed ways of providing for this demand at the pre-degree, degree and post graduate levels. Pre-degree is normally for CoC courses. Degree level may include elements of CoC but often includes management education, whilst post- graduate study is for

management education and also specific job functions such as Maritime Lecturing.

1 Introduction

The UK has long been a provider of education to overseas students and the maritime area is no exception to this. Students feel that certificates, diplomas and degrees obtained in the UK have a currency worldwide. This currency comes from the standards maintained as well as the confidence held in those standards.

Over recent years courses have been developed in UK Nautical Colleges, UK Universities traditionally specialising in maritime disciplines and other UK Universities to cater for and attract students from India, Pakistan and South East Asia. These courses have covered traditional maritime subjects such as Certificates of Competency but have also expanded into the graduate and postgraduate areas.

The aim of this paper is to examine the development of maritime programmes for overseas students in the UK using LJMU as an example of the type of development experienced elsewhere in UK Universities offering maritime programmes.

2 Experience of teaching foreign students in the UK

The flow of overseas students to the UK has increased over the years from 28,000 in 1955 to 273,000 in 2003 (Bousmann & Miller 2008) with 175,000 of these coming from outside the EU. These figures are growing (Misra 2005) and a proportion of this vast number enter Nautical College and University maritime courses. Students from overseas face a problem of "lingua franca," whereas in English speaking countries such as the USA and UK foreign languages are screened out by the indigenous population (Brown 1996). This may be a reason why some students actively choose the UK for education and certainly the members of Middle Eastern students in LJMU has chosen to study English for six months prior to starting their technical course. This language enrichment facility has been passed to private companies in some Universities (Newman 2007).

3 Development of professional qualification courses for non UK students

As the demand for UK seafarers diminished, UK Nautical Colleges developed their range of courses by offering programs to overseas students. The UK ship owners in the 1970s consolidated their activities in container consortia and shipping pools. After the 1990 OPA90 was introduced, oil majors reduced

their fleets and independent oil companies took up the mantle of moving the world's oil supplies. All this change was part of the resulting world-wide downturn in the UK fleet to just 2 million DWT in 2000 (Chamber of Shipping 2008). Several UK colleges closed down: Edward VII Nautical College and John Cass in London, and Trinity House in Hull. Others moved their emphasis away from training to education. Liverpool & Plymouth Polytechnics, amongst others started degree courses in 1968 and by 1990 had largely moved away from professional teaching, although LJMU previously Liverpool Polytechnic, retained Master's Orals teaching to 1998 and Chief Mates (Class 2.1) until 2005.

Four Nautical Colleges concentrated on professional courses Warsash (Southampton); Fleetwood Nautical Campus (Blackpool); South Shields (Newcastle) and Glasgow Nautical College. Professional teaching was still retained at Lowestoft, North Kent College (Gravesend) and Banff and Buchan with Plymouth Maritime Training starting in the South West.

The reduced requirement for professional training within the UK during the 1980s meant that for the Nautical Colleges to remain solvent they would need to obtain a supply of students from overseas and this need was met in particular from India where there were insufficient college places to satisfy the demand for training. As India (and to a lesser extent Pakistan) began to develop, shipping was seen as a prestigious industry in which to be come involved. Clearly companies from these countries would not want to employ highly paid European officers except in the most responsible positions, and then only if suitable nationals were not available. Thus Indian seafarers began to find a demand for their services as junior and middle ranking officers with some of the more experienced becoming Master and Chief Engineer.

India and Pakistan looked to the gold standard of the UK certificate system, and sought training and places in both the UK and Australia. There was pressure on UK colleges to franchise courses to colleges in India, a pressure that still exists. However the UK Marine and Coastguard Agency (MCA) and its forerunners refused to sanction the granting of UK Certificates of Competency to students undertaking courses outside the UK. The system, which still exists today, requires all but a few of the short courses to be studied in the UK. The MCA defends this position by explaining that it is unable to adequately audit courses in colleges outside the UK and as all but the Scottish Qualifications Authority (SQA) and oral examinations are assessed in house by the Nautical Colleges, this audit amounts to a large portion of student learning and assessment.

Many students are happy to obtain CoCs from India, Pakistan and the Philippines and there is every indication that in the best colleges in these countries the teaching and education is on a par with that in the UK. Nevertheless there is growing demand for places on certificate courses in the UK resulting in special courses being set up to satisfy that demand. Limited entry courses exist at LJMU and Lowestoft (broadly restricted to students from India & Sri Lanka) as well as courses at Glasgow, South Shields, Warsash and

FNC that have a majority of students from the Indian subcontinent. The teaching of these students brings particular problems. At LJMU courses of a purely academic nature designed to meet the needs or develop the study skills of students pre-date the development of the professional courses now being taught in Liverpool.

3 Examples of programs developed for overseas students

Table 1 lists some of the programmes developed specifically for overseas student cohorts. They are split between those developed specifically for seagoers and those of a purely academic nature. The table is not definitive in that it deals with just a few programmes known to the author at LJMU and the Warsash Nautical College (part of Southampton (Solent) University). Many, indeed perhaps all, Universities and Colleges will develop programmes for overseas students both within and outside the maritime area. This section merely serves to highlight some of the variety in that programme development.

Programmes developed for professional purposes and thus requiring approval by a body outside the University clearly are more restrictive to a course development team than those of a purely academic nature. At LJMU the development of the professional courses numbered 1 & 2 in table 1 are recent additions to the course profile. They were developed to satisfy the need for seagoers from the Indian subcontinent to attain Certificates of Competency as OOW or Chief Mate and run alongside the FD programme that is essentially for UK seafarers entering the industry.

Table 1 Examples of Programs specifically designed for Overseas Students

No	Programme Name	Group Catered for	University	Start Date	Remarks
1	Cert HE Nautical Science	Indian Sub Continent Seafarers	LJMU	Sept 07	MCA approved. STCW
2	Dip HE Nautical Science	Indian Sub Continent Seafarers	LJMU	Jan 09	MCA approved STCW
3	BSc (Hons) Marine Science	Middle Eastern Ports Authority	LJMU	Sept 09	Academic
4	CPD Marine Insurance, Maritime Project & International Trade	Scandinavian University	LJMU	Jan 04	Academic
5	CPD Maritime	Scandinavian	LJMU	Sept	Academic

	Business	University		03	
6	PG Cert Marine Lecturing	Philippine Nautical College	SSU	Sept 07	Academic
7	MSc Maritime Operations & MSc Maritime Technical Operations	Greece & Iran	LJMU	Sept 1999	Academic

Programmes 4 to 6 were developed for purely academic purposes and satisfy a need identified by the parent institutions of the individual cohort groups to extend the experience and knowledge of the participants. Those in programme 6 are experienced maritime lecturers, some with superior qualifications to that studied, but it is provided due to recognition by the employing college for which this specific learning experience would be a positive benefit (Barrett 2008). Students in 7 are employed in the maritime sector and enter the programme individually or as part of staff development from the company concerned.

3.1 Course length

The Cert HE is a two semester, 24 week course, whilst the Dip HE is closer to 12 months, lasting from January to December but having a one month or six week break in the summer. The BSc Marine Science is a three years academic study but may lengthen to four years if a year of industrial training is inserted somewhere within the length of the course. The two CPDs are only one semester long thus three months in length whilst the PG Cert is a distance learning programme with periods of block teaching in the Philippines and the UK. It is likely to last around two years. The MScs distance taught in Greece and Iran can last up to five years, depending on how long it takes for the student to complete the dissertation.

4 Experience of courses for professional students from the Indian subcontinent

Students generally enter the programme with a reasonable level of English; however their experience is from a rating level rather than cadet officer. This means that often they need English tuition. Math is not generally a problem however because Math tuition is normally provided. Courses are set up for OOW and Chief Mates and become exclusive for these students as UK officers are taught on HND and increasingly the Foundation Degree routes, which are not offered to overseas students. The course recently set up at LJMU is a Certificate of Higher Education (Cert HE; 1 in Table 1) making it Level One of

a degree course and theoretically those who pass could move to Level Two of a degree. A proposed Chief Mates course will be a Diploma in Higher Education (DipHE; 2 in Table 1) and Level Two of a degree.

The range of students on the Cert HE Nautical Science is wide, with some being excellent and others of a low standard. Students generally are not used to academic life, being older than the usual cadets (mid 20s) and having been out of formal education for many years. They all have enthusiasm and in general attend well compared to degree students who sometimes find that their necessity to undertake paid employment may conflict with their academic studies.

The entry requirement to the CertHE Nautical Science is "three years six months sea time" with at least six months of that on Bridge Watch Keeping duties. Students have priorities when they arrive and study. They know from their peers that they must pass their SQA exams before they can enter for the oral examination and they must hold a valid "Notice of Eligibility" (NOE). This is obtained from the MCA individually by students and is given on the correct production of valid seas service. This obtaining of an NOE is an immediate hurdle for the students as without it they will be unable to sit the SQA examinations and their orals, therefore not gaining their CoCs.

The SQA exams at OOW level are 1) Navigation and 2) Stability and Operations with 3) Navigation and 4) Stability and Structure being the exams at Chief Mates' level. There is varied initial evidence from the OOW exams with some students achieving high marks and others failing. From the student's viewpoint success is critical as the SQA exams are only available 3 times per year, thus failure in one set means the student waits up to four months before being able to resit.

In-house college exams (audited by the MCA) occur during each teaching session, three times per year if three cohorts. If two cohorts or less are taught special exams will be set, although if only one cohort per year is taught then a main exam and resit attempt will be required.

5 Teaching to students other than professional students

Increasingly there are cohorts of students requiring tututoring that is not linked to professional qualifications (3-7 in Table 1). These cohorts range from short CPD courses to long 3-year degree courses. Where possible these courses, unlike the professional Cert HE/ Dip HE courses, are merged within the existing teaching. This makes the use of resources, both staff and room allocation generally more efficient. Problems occur with large module cohorts (over 30) where the number of rooms of sufficient capacity may be limited. The CPD student experience. however, is better than that of the professional students who only meet with their peers whereas CPD students meet and study with various student cohorts, making the educational experience superior and tutorials varied.

The teaching of English to students of a confined cohort may be difficult if their experience outside the classroom is within their own cohort. Individually

students not forced to speak English revert to their own language and the English development is delayed.

6 Development problems

The introduction of overseas students provides maritime teams with development problems, some of which are listed in Table 2.

Table 2 Course Development Problems

No	Problem
1	Class Size
2	English Standard
3	Study Skills
4	Cultural Issues
5	Integration with existing teaching
6	Examination and Flexibility
7	Contractual / payment

6.1 Class size

The introduction of a new student body is generally welcome, although it presents challenges with allocation of teaching space.. All educational establishments will have a variety of teaching accommodation both in type (Flat desk, bench seat, lecture theatre) and size (20 to 200+). As any particular establishment gets closer to capacity then pressure on class size becomes more intense. Some subjects can be taught in many different class types; i.e., a lecture to 20 students can be given in a flat desk, 30-seat room or a 200-seat lecture theatre, whereas other subjects require more specialist facilities, i.e. chartwork needs large flat desks and 30 of these require a large space. This variety of equipment can pose difficult obstacles to those involved in timetabling. At LJMU the maritime team has adapted computer rooms for use as substitute chart rooms, the flat computer screens being moved out of the way.

6.2 English standard

Generally, students entering UK courses will be asked to attain an IELTS or TOFEL English standard. IELTS 6.0, TOFEL 560 paper based; 220 computer; 72 – 74 Internet is used with some postgraduate programmes asking for 6.5 or even 7.0. If students arrive with an English standard less than this then they will face communication problems in the classroom. English classes are provided, however if the initial English standard is poor the final level achieved tends to be low.

Presently an English course is being taught at LJMU for Saudi Arabian students over 24 weeks with the first 12 weeks having 21 hours contact split into two parts: Part one is Classroom study (4 hours between 0900 & 1300) and part two is Guided study (2 hours between 1400 and 1600). The second 12 weeks has 17 hours contact and includes more maritime based tuition. Table 3 outlines a broad syllabus for this English course

A 95% attendance record is required for this course in order to achieve the broad outcome of raising a student's English level one whole IELTS grade from say 4.5 to 5.5 (Hill pers comm 2007) at which stage they would be admitted to a BSc (Hons) Marine Science programme. This level is less then generally required as outlined above but is considered adequate as the technical level of entry will be high.

6.3 Study skills

All students, whether overseas or home, face the problem of integrating into higher education and the exigencies and requirements of work at this level. Study skill classes are provided as part of the curriculum in an effort to redress this balance. Overseas students sometimes find these classes anomalous, as they may not be related to the technical curriculum but just to the method or structure of learning. Three separate modules are provided for study skills in the programmes offered at LJMU Maritime. Table 4 shows the learning outcomes of those modules. Two modules, those offered to seafarers, include numerical skills. The one offered to more general business students (MR1001 Integrated Activities) does not include mathematics as this is covered in a numerical skills module elsewhere on their programme. MR1001 Integrated Activities is also used to develop maritime knowledge using study skill techniques as a teaching base. The study skills offered to seafarers does not need this as those students obtain that information through their other studies.

Table 3 Broad Syllabus for Maritime English Course

Course Element	Time Allowed
Stage 1 General English	
Classroom Study	
Grammar Focus	5 hours
Writing Skills	4 hours
Speaking Skills Groups of 12 max	2 hours
Vocabulary development	1 hour
Weekly test	1 hour
Guided Study	
Project Work (British Culture)	2 hours
Information Technology	2 hours
Learning Resource Centre	2 hours

Course Element	Time Allowed
Test Preparation	2 hours
Stage 2 English for Specific Purposes	
Classroom Study	
Cultural Awareness	2 hours
Information Technology	2 hours
Learning Resource Centre	2 hours
Assignment Preparation	2 hours
Classroom Study	
English for Maritime Purposes	6 hours
English for Academic Purposes	6 hours
Integrated Skills	3 hours

6.4 Cultural issues

These are not necessarily a problem as travel and learning in different environments and cultures develop in the modern world. Nevertheless, course planners need to take care in planning to ensure that they do not exacerbate possible areas of tension. The English programme itemized in Table 3 includes time spent discussing cultural issues in the UK.

6.5 Integration with existing teaching

The proper use of resources, particularly teaching accommodation and staff, means that where possible new programmes should be integrated with existing teaching. The problems here revolve around subject matter, applicability to the course, class size, learning ability and timetabling. These elements may be considered individually or in combination. Thus even where the subject matter may be the same, the difference in overall group learning ability may mean that integration between individual groups is impractical because of the variety of learning rates. This then starts to put pressure on staff and room resources. The experience at LJMU is that large overseas groups have been independently taught whereas small groups have been integrated. The development of these smaller groups can be achieved through separate tutorial sessions allowing the general subject matter to be presented to a large group and individually developed within a smaller group.

Table 4 Learning outcomes of study skills modules delivered at LJMU Maritime

Module	Learning Outcomes	Course Involved
MR1001 Integrating Activities	Research, write and reference a report properly	BSc (Hons) Maritime Studies; BSc (Hons) Maritime Business and Management
	Give a presentation on a maritime topic	
	Work as part of a team to produce a presentation	
	Develop key skills including problem solving skills related to the maritime industries	
LM1007 Personal Development Skills also LM1015 Numerate & Personal Development Skills	Manage their own learning and study effectively	BSc (Hons) / FD Nautical Science Cert HE Nautical Science
	Collect information from appropriate sources both within and outside the University	
	Use basic IT skills	
	Present and analyse data in an appropriate fashion	
	Communicate effectively in writing for various purposes	
	Demonstrate correct usage of algebraic notation, mathematical operations and geometry	
	Work effectively as part of a team to produce and present a poster	

6.6 Examination flexibility

LJMU has one main examination session at the end of the normal academic year. The University works on a two-semester system starting annually in September, completing semester 1 in December. Semester 2 starts in January and completes at the end of April followed by a 3-week assessment period completing in mid May. Subject modules can be taught over a single semester (either 1 or 2) or "year-long" covering the two semesters. Subjects taught in semester 1 only may be examined in December or the first week in January; however, the timing of these exams is controlled by the individual programme teams or schools. The main examination period in May is organised by the central University and may take place outside the university campus at large examination venues. The local Aintree racecourse has been used for several years as it has large rooms ideal for examination purposes.

The problem for some of the maritime programmes is that their layout and scheduling does not fit in with this examination regime, thus novel ways of providing the examinations is needed. The use of "time constrained" course works has been used successfully for the new OOW and Foundation Degree programmes where their examinations occur totally outside the university examination timetable framework.

Table 5 shows the timings of the examinations, time constrained courseworks and possible referrals for the three different maritime cohorts running at LJMU. The OOW Cert HE students enter the programmes 3 times per year in September, January and May. The BSc /FD Nautical Science students enter once per year in September as do the Maritime Business students. The Cert HE students have to sit the externally set and assessed SQA examinations. The University has a week of referral examinations in August every year. The Cert HE students are given a referral attempt at the third sitting of their exams irrespective of whether the exam failure was at their first or the second exam sitting. The BSc/ FD Nautical Science students are given a referral attempt in September of each year. The general University referral time of August is too early for these students as they are generally still at sea and hence their referral will be in September as shown in table 5.

Table 5 Timing of professional examinations and university examinations 2008/2009 LJMU academic year

Programmes	Cert HE Nautical Science					BSc (Hons) FD Nautical Science	Main University Examinations		
	Jan 08	May 08	Sept 08	Jan 09	May 09				
							Xmas	May	August
Summer Referral						September 08	Dec 08 8th to 12th and Jan 09 5th to 9th	April 09 27th to May 09 15th	August 08 11th to 15th & August 09 12th to 16th
Summer Exam	July 08	July 08							
Semester 1 (Autumn) Exam		Nov 08	Nov 08						
Referral	July 08								
SQA		Dec 08							
Semester 2 (Spring) Exam			Feb 09	Mar 09		March 09			

	Cert HE Nautical Science								
SQA			Mar 09						
Referral		Feb 09							
SQA				July 09					
Summer Semester Exam					July 09				
Referral				Nov 09		September 09			

6.7 Contractual/payment

All study attracts a payment that finances the university activities. At LJMU there are three distinct payment regimes; standard university fees, collaborative agreements, and enterprise agreements. Standard university fees and those coming from collaborative agreements are "top sliced" to finance central university activities such as infrastructure provision, libraries and general computer facilities, office of the Vice chancellor etc. The income from students studying under enterprise agreements goes directly to the school and is thus extra income from the main stream income which is considered to be the standard university fee. Clearly the university as a whole needs to keep the division of fees and revenue input in balance, but if in general the standard fee allows the central university responsibilities to be discharged then there is incentive for schools to develop their "third stream" income via enterprise activities.

Research income is a further revenue stream, however this is split between the university, school, research group and the researcher in question. Knowledge transfer (KTP) income also comes within this area.

Programmes either set up for or attracting overseas students in Maritime training have recently occurred in the enterprise area allowing groups to be attracted from developing countries at a reduced fee, where payment of the standard fee would render the programme inaccessible. The enterprise model also allows the payment by an individual organisation for a "closed client" student group.

Table 6 compares the fees from a variety of courses. Recently the collaborative route has not been used and tends only to be used where programmes are taught overseas. Those taught in the UK use either the University standard fee or a collective fee negotiated through the enterprise facility.

Table 6. LJMU Maritime programmes with payment method

Programme	Student Cohort	Payment Method
BSc (Hons)/ FD Nautical Science	UK EU students seafarers	University standard fee
Cert HE Nautical science	Indian Subcontinent	Enterprise Fee
English for Maritime Students	Saudi Arabian	Enterprise Fee
BSc (Hons) Maritime Studies	All students	University Standard Fee

7 UK tonnage tax and the foundation degree (FD)

The demise of the UK fleet mirrored in experience by maritime regimes in other European maritime countries led the UK government to set up a "Tonnage Tax" system around the year 2000. At that time the UK fleet had reduced to around 2 million DWT (Chamber of Shipping 2008), and to avoid losing the maritime skill base entirely a system of attracting ship owners to place their ships under the UK flag was devised. There are several Tonnage Tax models but the one chosen by the UK government was to allow ship owners exemption from or a reduced corporation tax liability if they place their tonnage under the UK flag. In return the ship owner had to agree to train one UK cadet per annum for every 15 seagoing officers employed in their UK fleet. In 2007 this has led to around 640 deck and engine room cadets being trained (Chamber of Shipping 2008) with the hopes that in 2008 there will be above 800.

Simultaneously with the development of the Tonnage Tax regime the UK Chamber of Shipping altered their preferred route into Merchant Navy officer status. The traditional route was from high school with required success in national examinations at 16 (General Certificate in Education) ordinary level (GCE O Level) and Certificate in Secondary School Education (CSE)). In the 1960s around 10% of UK school leavers would take these examinations with only 5% taking the harder exams (GCE Advanced level or A Levels) at 18 and then moving to University. Developments in UK secondary school examination culture plus a realignment in the examination structure at 16 meant that the majority of secondary school pupils now sit national examinations at 16 (GCSE). The financing of secondary schools by "local school management" (where revenue flows in from a growing number of students remaining in secondary education until 18) now means that the incentive is for these schools to retain as many students as possible at 6th Form level.

Thus the number of students leaving school at 16 has been considerably reduced with the inevitable reduction of the pool of students available for cadetship at 16. This reduction has been in quality as well as in quantity. Simultaneously, the complexity of operations in navigation, engine room

activities and legislation and regulations has meant that officers now need to be far more aware of technological developments and the need to remain within regulatory boundaries than was historically the case. Thus students with a higher educational ability are needed rather than those of a lower educational standard.

This scenario is the background to the UK Chamber of Shipping, which embraced the UK educational development from 2000 onwards for the new Foundation Degree (FD). This degree is the first two years of a University Honours degree and has now replaced the Higher National Diploma (HND). From the 1960s a certificate/ diploma system was developed in Further Education. Initially Ordinary National Certificate (ONC) and Ordinary National Diploma (OND) were developed and these led to Higher National Certificate (HNC) and Higher National Diploma (HND) qualifications. The maritime area aligned itself to the ONC & OND for cadets from the 1960s and in the 1980s the Certificate of Competency system of Second Mate, Chief Mate and Master Foreign Going gave way respectively to Class 3, 2 & 1. This class system also aligned itself to the HND regime where eventually Chief Mate became equivalent to an HND Nautical Science. Master's or Class 1 was an extra qualification above HND but not aligned to any wider academic qualification.

8 UK MCA; STCW & certificate of competency requirements

The professional programmes require approval from the UK MCA and need to be aligned to STCW. Thus students need to satisfy the University requirements and also the UK MCA requirements although those students on recognised cadet routes are exempt from the national professional SQA examinations. Within their course of study students required to sit SQAs must rise to that standard. This always presents problems, as the exact needs are not always recognised within the college. Oral tuition and revision classes raise the level of understanding and student confidence allowing them to approach the SQA national examinations with the opportunity of success. This need to succeed in the external examinations supersedes the educational development of the students on these programmes and turns the educational experience in to pure training. The use of rote learning is necessary, a technique despised by educationalists but almost required by trainers. Table 7 compares the percentage pass required by the various organisations associated with the professional student assessments. It shows the higher pass level required by the MCA and SQA than the equivalent for the University.

Table 7 Percentage Pass on Assessed Work for Module Pass (Wall pers comm 2008)

Programme	Univ'y	MCA	SQA	Remark
BSc (Hons) Maritime Business	40%	N/A	N/A	
BSc (Hons) / FD Nautical Science	40%	Navigation & Chartwork 65%; Stability 60%; others 50%	Not required	
CertHE	40%	Criteria Referenced	Navigation Part A 70%/ Part B 60% & 65% overall. Stability 60%	CR means the student must show competence in all learning outcomes

9 Conclusion

A variety of models of overseas programmes is available serving both seagoing and maritime business education exclusively for overseas students to the UK. These programmes are available across the UK and satisfy a need from the Indian Subcontinent, the Middle East and Scandinavia. Problems do occur for students studying these courses, however solutions are available. Generic study skills are placed in all courses and allow similar material to be tailored to coherent required outcomes.

References

[1] Barrett M (2008) Discussion with author Feb.

[2] Bolsmann C & Miller H (2008) International student recruitment to universities in England: discourse, rationales and globalisation. Globalisation, Societies and education, Vol 6, Issue 1 pg 75-88

[3] Brown M (1996) One Person's Opinion. The English Journal. Vol 85, No 8. Dec. pp13-14.

[4] Chamber of Shipping (2008) Statistics. Chamber of Shipping. Found at http://www.british-shipping.org/British%20Shipping/Statistics/#g accessed on 22nd May.

[5] Hill S (2007) Discussion with author Nov.

[6] Misra M (2005) Is vision blurred by global view? Times Higher Education Supplement; 8/19 Issue 1705 p42.

[7] Newman M. (2007) Private firms tighten grip. Times Higher Education Supplement; 20/4. Issue 1970 p2.

[8] Wall A. (2008) Discussion with author.

Maritime education and its role in improving safety on the sea

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Abstract

Within the past few years there has been an increasing number of ship accidents. This fact must be seen as a dangerous dissapointment for safety regulatorson the sea, with great impact on maritime industry and, at the same time, on the environment. Safety on the sea is difficult to be clearly defined. To realize what "safety"means, itis necessary to create a "culture of safety". This term is easily understood if it is explained and applied starting from the first year of maritime school. For this reason is important to increase the role of maritime schools in this issue. It is generally accepted that the actual regulation regarding safety on the sea is not very accessible for younger seamen. For the moment, there are many rules, regulations and codes, international and national requirements regarding safety on the sea, but all of this are stated in difficult terms hardly comprehended by a person who doesn't have knowledge in the field.

In this paper we will try to develop a method to introduce the future deck officers in the so called "culture of safety." We will present alternative ways of understanding the actual regulations, instead of classical style of read and learn. These procedures will include discussions about code themes, case studies and interactive analyses about the cases and safety measures and will use simulation techniques to create a virtual situation of safety alteration. Studying student's reactions in these simulated cases will bring data about the ability of acquiring the concepts of safety culture during their learning period and their future applicability expressed in the reduction of ship accidents or number of events.

1 Introduction

Essential things are often learned from examples. It's written in human nature: we keep in mind other people's mistakes in order not to make the same. Agreeing with this general opinion and reflecting it in the maritime field, a way to learn from other's mistakes is to study maritime accidents. Studying and discussing these accidents with students creates concrete explanations of what "safety" means and shows the results of unsafe actions.

The starting point of many accidents has been represented by a wrong decision or action. These mistakes were made through breaking the existing rules regarding safety and resulted, in many cases, in a disaster. To avoid these situations it is necessary to know and respect all international, national or local rules and regulations, such as company rules or onboard rules.

Today's students are the future seagoing officers. During their study cycles, especially at the university level, they learn about present regulations applied in the maritime domain regarding safety and security onboard the ships. As an example related to the safety sector, they take knowledge about COLREG Regulation, the ISM Code, Bridge Team Management and other regulations and codes created for crew members, ships and environment's protection.

It is difficult to evaluate their knowledge in this field using only classical examination forms, simple questions based on the regulation text. It is important to know if students understand the rules and are ready to apply them properly. This can be made in fact only through evaluating of one real situation onboard the ship or simulating this situation in an exercise. Discussing and analyzing their reaction will allow a correct evaluation of their knowledge in the field.

In this context, the evaluation using simulation techniques helps students to gain practical skills by using electronic devices, which they will work with in reality onboard the ships. Generally, safety elements used in navigation activities are bounded with data received from electronic devices. Understanding the data and making decisions based on them can be critical for a safety environment.

2 The "Safety Culture"

The term "safety culture" has been used to describe an organizational environment that promotes self-regulation by ensuring that each individual within the organization takes responsibility for actions to improve safety and performance. (Moore & Roberts, 1995)

According to this concept, the main element involved is the person. Onboard the ship this person can be any crew member, responsibilities being divided with respect of his position.

As a future officer, a student has to know the responsibilities for the safety of life, of ship and environment. These responsibilities should come from actual regulations and also as a natural behavior. First they are learned during training, and secondly, they are characteristic for each person.

The most important thing is to be able to understand and define the term "safety" by its personal meaning. If one can realize the correct meaning of the concept, than it's able to create a safety environment for the others. This depends also on the level of knowledge and the performance on duty.

Maritime education can be seen as an organization, and has a role in building its"safety culture." Maritime universities and academies are very important as a first step in the training of future officers and have to take the

position of initial creator of behaviors related safety conscience and safety acts performed onboard ships.
At this moment, the revised STCW Convention added new requirements, but still kept these at a minimum level of knowledge for future officers. When we talk about safety it is impossible to maintain only the minimum standards; is necessary to try to reach a higher level of understanding in the training process and in the end to have a normal level of application.

Once developed and instilled in future officers, the safety culture has to be maintained.
Therefore, to be able to offer a safety environment as a duty officer on a ship, present students must understand the concept and the way to apply it. After that, they have to prove that they are able to implement and develop their own culture of safety. It is a duty for maritime education to inspire them to make this effort in order to have safe seas in the future.

3 Actual requirements for training

At this moment the training process in the maritime field is made under the recommendations of International Maritime Organization, in accordance with the STCW Convention and IMO Model Courses for operational and managerial levels.

The STCW Convention provides the requirements necessary for a trained person involved in operations on sea and the IMO Model Courses explain how these requirements can be satisfied and what has to be covered during the training process at the higher educational level for an operational or managerial officer. The duty of maritime universities is to acknowledege in their curricula the indications given by these documents and to do the training accordingly.

Regarding the requirements of IMO Model Course accepted as a standard level of training, we have some remarks near complete training, especially with the use of electronic navigational devices. We do not consider this absence as an intended one, due to the fact that the Course Model is edited in 1999 and the techniques continued to grow up after. Our idea is a revision of courses with the adding of these elements as mandatory in academic curricula.

Bearing in mind that the revision of STCW Convention and Code was made long after its birth, a moment when basic concepts were considered outdated by the actual requests onboard the ships, we appreciate that the reappraisal of IMO Model Course in order to cover the present especially about the use of modern technologies in maritime activities.

There is an option to study electronic navigation separately, but it would be much more useful to combine with other navigational procedures, such as coastal and celestial navigation in complex applications.

Also, requirements about the use of computerized techniques and specialized software for applications in the coastal and celestial navigation are necessary to be introduced in the mentioned courses model.

This conclusion comes from the actual situation on board ships, where the higher techniques are already present. The role of the maritime university is to provide education to the world fleet officers that are more trained and capable to work with latest equipment. It is irrational, in a century of technical innovation, to teach about procedures in a field as navigation, but not to mention about the latest technology found onboard, made just to be used for a more safely navigation activity.

In order to the improve competences and skills of the future officers, it is important to make changes on the present training requirements and bring them to the actual development of the maritime field so as to ensure all are covered.

Some steps are made by the local authorities through their own requirements related to the use of electronic devices in navigation, especially for electronic charts and automatic identification system. These come to complete the general requirements expressed by IMO.

Another concept of training not clearly implemented concerns the use of case studies in the training process. This concept can be very useful in the theoretical modules as collision regulation and watch-keeping duties.

4 Training techniques for understanding of safety concept

As we stated before, it is necessary to develop techniques to help and provide to the students the possibilities to understand and work with the actual international regulation. One way will be to explain the regulation text through real life cases and in this way maintain the essence of these rules. For this method the materials can be found on the internet in the web page of the maritime accidents investigation commitiies and organizations, such as The United States Coast Guard, the Maritime Accidents Investigation Branch of the UK and from other national or international authorities with competence in this field.

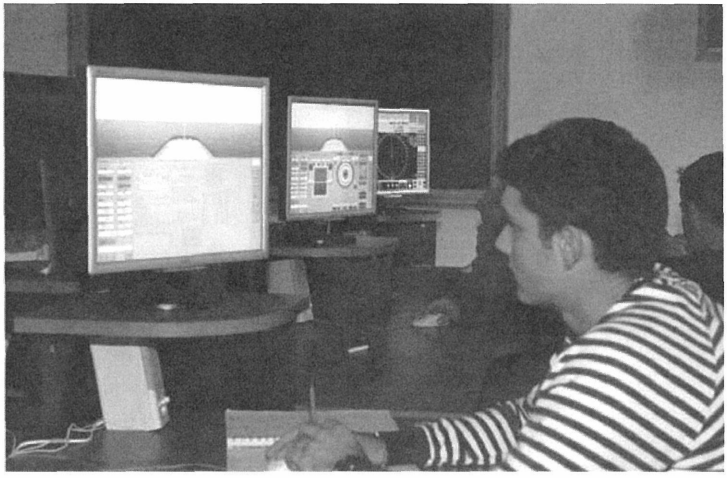
The cases to discuss must be chosen in order to have the desired impact on the student's memory. Many times the presented cases are those in which in the end were produced only material damage and no person was affected.

Currently, these types of cases are used in the process of Collision Regulation learning, where accidents are produced because of breaking rules for lights and signals, mainly in restricted visibility conditions or when navigation is made during night inside of a separation scheme, in heavy traffic conditions.

We agree with the idea that COLREG should be learned as it is and that there are no omissions allowed, but is a fact that the student is more perceptive when together with a rule is presented a real situation.

At the first contact with the COLREG, many students have never seen a ship before, and do not know what is a navigation light, a beacon or a fog signal. Using ships machetes and draws for imaging, together with learning movies are a good solution for a starting point in the knowledge achieving process.

After that, during simulated exercises they can use lights and signals according to situation and become able to realize the importance of these elements in the safety of navigation.
Case discussion is also a good method with good results when presenting the ISM Code and The Bridge Team Management and Procedures.



Students during training on navigation simulator

Many accidents produced are the result of a lack in the safety management system or in the arrangements on the bridge level. Problems like misunderstanding based on difficult communication inside the team or in relation with the outside authorities are very well explained using the students during different applications, which suggest the use of Standard Maritime Vocabulary -- in this way, they can find by themselves the problems in communication.

Poor communication between members of the bridge team can be an opportunity for a dangerous situation to arise. Using the complex navigation simulator helps create a situation on the bridge which requires good communication, such a port entrance maneuver, passing of a strait or navigation in a heavy traffic area. During these applications, students are grouped as a team of two – a maximum of three persons -- each of them having their own tasks and covering a duty on bridge. In these conditions they must to communicate to one another and take the best decision in order to provide safe navigation with the respect of regulations. At the end of the exercise, students participate in a debriefing session where they can see what went wrong and how they have passed a difficult situation.

Also in these applications, students must take very seriously their duties and this means that they are forced to give orders to their colleagues; this is a

moment when the friendly relationship is replaced with a subordinate one. For doing this student is necessary to be convinced about his decision and be able to apply it. This action requires knowledge on how to acquire information, how to analyze it and implement it according to a good seaman practice and as per regulations.

If the student is in a position to execute an order, he must know what it means and how it can be done. It is necessary to understand the orders and to have skills regarding ship characteristics and maneuvering details.

Another unsafe situation that can arise on board the ship is represented by possible bad relations between members of a team with duties related to safety. This situation can show a misunderstanding of the Bridge Team procedures and could appear if students do not realize the importance of these regulations.

If it is difficult to have a good team relationship in a simulated situation during classes, when the members know each other, the situation could be worse when the team is formed by people meeting for the first time, from different nations and cultures.

As an officer on the watch it is necessary to know to conduct the ship and to complete the ship's mission. These duties require complete knowledge about navigation and voyage planning. The ship route planning must be done according with the good practice and in respect of safety procedures, connoting use of all equipment present on the bridge and necessary for these tasks.

A good navigation officer has to be a good user of all navigation equipments and should be able to apply the navigation principles through classical procedures as well as modern ones.

In this spirit, in simulating application, student's have to plan the voyage as on a real navigation bridge, starting from the paper chart and continue with the GPS devices, and route planning, the electronic charts display for route planning and in this way to cover all requirements for a watch officer with navigation duties.

Also, in these voyage planning activities, they have attributions regarding the consultation of nautical publication, chart correction and the acquirement of all needed data for the actual voyage.

Working as a team, students should check themselves about completing the planning task and correct what they think is unsafe and risky for their mission so they can observe mistakes from the beginning, without lecturer's intervention during application in order to correct it. This stimulates them to pay more attention to such important activity.

Another regulation with importance in the safety maritime process is the ISM Code. The ISM Code represents at this moment the actual regulation regarding the management of safety on board the ships and at the companies.

Mandatory regulations are made in juridical terms, which are difficult to be understood by the younger students who may read such a document for the first time.. This Code is made not only for reading, it is made to establish a safety environment on board and for the companies offices.

As we said before, to be able to generate a safety environment means to understand the principles of safety. The ISM Code contains many elements with direct impact on the level of safety for crew, ship and environment. Do not forget that the ISM Code was created after a concrete situation of breaking the safety rules with the cost of many lives. Understanding it can reduce the chance to have other similar cases.

This Code is mainly necessary for the managerial level, but could also be usefully to be known at the operational level, due to the fact that many actions with risk are made by the persons under the managerial stage.

For this, it is recommended to discuss with the students each chapter, to try to make them understand the idea, to give them examples from daily life, which can be correlated with the activities onboard; also the use of case studies are very efficient.

When students reach the necessary level of knowledge about all Regulations and Codes learned during the classes, the applications, including computerized and simulated exercises can be made containing elements from all of them. In this way is created a complex system of evaluation with a minimum level of understanding requested for passing of 70%.

Application forms contain data about the ship characteristics, ship mission, route imposed to be executed and requests.

Evaluation forms are based on different criteria according with exercise tasks. The principal elements of all evaluation forms are presented as a table with columns as:

- team number;
- team members name and surname;
- team members level of training or year of study;
- skills level in using of technology present in application;
- using of Maritime Standard Vocabulary (beginners in native language, advanced in English);
- using of electronic navigational devices;
- organization at the bridge team level;
- respect of principles of safety navigation;
- applying the COLREG Rules;
- different requests according with the application tasks.

For each evaluated task students receive points from 1 to 10. To pass the exam it is necessary to have a minimum 5 points for each task, but in the end not less than 70%, with an average of minimum 7 points.

We consider that a student able to cover 70% of a complex application has sufficient knowledge about safety regulation and procedures and is capable of offering safety environment for the other crew members.

In the evaluations based only on COLREG Rules, the minimum level for passing is 90% correct answer, for this uses a computerized program which at the application end offers student the possibility to find out his score and also to see at what point he has given a wrong answer.

As concrete results, during one application made with the 3 rd year students, based on ISM Code watch safety requirements and Bridge Team Management procedures, we collected the following data.

Exercises description and condition:

- students present for evaluation: 200;
- competences evaluated: safety requirements for navigation on bridge level included COLREG Rules;
- exercise time: 4 hours (according with a watch period);
- area for navigation: Southern part of England;
- type of the ship used: crude carrier of 55,000 dwt;
- number of bridge team members: 3 (one in role of the Master, one as watch officer and one helmsman);
- day time application: 18.00 to 22.00 hours;
- language use for communication: English;
- technology used for application: complex navigation simulator.

Evaluation results in percents:

- 70 % of the students ended application with tasks completed; entire category respected the rules and regulations in a percent of 60% to 80%;
- 20% of the students ended application with tasks completed; a percent of 40% to 60% respect of requirements (they bring vessel few times in dangerous situations or near miss conditions, some COLREG Rules were broken, especially related navigation light and navigation inside a vessel traffic scheme);
- 10% of the students could not end application; they grounded or collided with other vessel.

These results lead us to believe that we reached our objective of creating a safety conscience to our students, to help them to understand and apply correctly the regulations regarding practice of a safe navigation.

All of these techniques based on mandatory regulations used for training students can be used to acquire a level of safety efficiency; the results can be measured afterwards, in the reduction of accidents, or even in decreasing of their impact in economical and social life.

5 Use of high technology in the training process

According with the revised STCW Convention, the simulators must be used more effectively in the training process of the future seamen and officers. The high technology has to be used in order to increase the level of training and to reach higher standards of knowledge and skills. The use of simulators and technology, especially electronic devices in the training process offer the

possibility to create models close to reality. Moreover, students are more involved in the events and also more receptive to the training objectives.

In the first stage we have to familiarize students with all of these equipments and make them understand their function and role in the navigation, with implications in the safety of maritime activities.

Today, many ships are armed with the latest technologies for navigation, as GPS devices, Anti-Collision Radar and Electronic Charts Display, Automatic Identification System devices. Their role onboard the ship is to reduce the human work level and, at the same time, to increase the quality of navigational processes at a safe and secure level. These are very useful if the operators know how to work with them, to get the necessary information, to analyze it and to take the right action accordingly.

The training process for the use of these devices is a long one, starting in school and continuing onboard. During school training, future operators receive data about technical details, configuration, operational procedures, models of data analyze and correct decisions. During the applications made with simulators, students have the possibility to develop their skills by using these devices, they can work with them interconnected, analyze all data or compare data received from two different devices or from other sources. They will learn to use information in the navigation activities and in the end to realize a safe and correct travel for their virtual ship.

Onboard, they will apply knowledge according with to a particular situation and will complete their skills by using real electronic navigational devices.

6 Conclusion

For achieving a satisfactory level of safety at sea it is necessary to start creating a safety conscience from the first level of specialized training during the academic stage. For this reason is probably needed to change or to bring out the present international context regarding maritime training.

It is the duty of maritime universities to request to the International Maritime Organization to review the policy regarding training, especially to Officer On the Watch and Master and Chief Officer level, to introduce as mandatory the use of latest techniques in the training process, and to increase the role of the modern navigation technology.

These requirements are not meant to increase the difficulty of the training level; they are coming from maritime companies, the beneficiary of the future officers. If these officers will be better trained, they will be able to provide a more safe and secure navigation and ship operations, thus resulting in a reduction of accidents.

We tried to show a way, or an idea about few alternative possibilities to explain to a beginner in this domain what it means to do a safe activity, what is the sense of the word "safety" and how they can create their own safety environment and conscience.

Starting with the regulations lecture, continuing with the case studies and discussions, bringing the reality through simulated applications, it can be an efficient method of understanding and correct applying the present regulation and thus, a real improvement of safety at sea.

References

[1] A guide for the Shipping industry – The Revised STCW Convention, 1995, ISF, London.

[2] Directive 2003/103/EC of the European Parliament and of the Council on the minimum level of training of seafarers, 2003.

[3] International Convention on Standard of training Certification and Watchkeeping for Seafarers, STCW – 78/95.

[4] Moore, W.H. & Roberts, K.H., 1995 – Safety Management for the Maritime Industry: The International Safety Management Code, Proceedings of the 1995 International Oil Spill Conference, Washington D.C., American Petroleum Institute.

[5] www.imo.org

What new challenges is MET facing today?

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Abstract

The paper focuses on the crucial issues, which have far-reaching, and unforeseeable consequences, addressed in the Section 2.5 of the EU Green Paper on the future maritime policy of the European Union, entitled "Developing Europe's Maritime Skills and expanding Sustainable Maritime Employment." In this section the Green Paper deplores the quite rapidly declining number of Europeans engaged in and attracted to a maritime career, particularly in seafaring. The occurring shortages of qualified European maritime professionals, especially in seafaring as well as in onshore maritime activities are an increasingly serious impediment to maritime development in Europe. I have tried to answer and analyse WHY is there an insufficient and declining number of young European men and women who are attracted to a maritime career, particularly in seafaring. Further consideredaton is given to the question of what, if anything, can be done to reverse the evident downward trend and make the choice of a maritime career more attractive and exciting for young European men and women. Discussion is provoked, and also some suggestions for change are made, such as the rising of the general standards of maritime education and training (MET) and providing seafarers with knowledge and skills, that would enhance their chance to be employed outside seafaring in shore-based maritime industry or other industrial sectors. A question is raised whether today's existing system of MET -- indeed our existing approach to MET -- is capable of reversing this negative trend, and whether in MET alone can be found sufficient energy to make seafaring again an exciting, adventurous career choice for young Europeans. Basic primary factors, which influence a person's choice or attraction to a specific employment and career in the field are given. Analysing what is to be done to reverse the downward trend in the number of Europeans entering and staying in certain maritime professions, especially seafaring recognised are certain basic facts. A decreasing number of young Europeans consider today seafaring as a guarantee to achieve a long-term professional career, providing only limited choices and opportunities for mid career transition to professional onshore employment in maritime industry outside. To challenge this conviction and attract young Europeans again to seafaring in general, efforts are proposed to secure life--long professional careers in maritime transportation. An attached graph in the paper outlines the

main features of a possible system of integrated professional education and career progression combining at sea and onshore maritime employment. The proposition put forward here is simply to try an approach, which both raises the educational standards of maritime employment and integrates seafaring and onshore employment.

1 Introduction

About 95% of goods are transported worldwide by ships. The most important people to make the ships move and operate are the seafarers. But the seafarer shortage is a crisis of our times. These alarming news are reported by a number of professionals in the maritime field and maritime press.

Professor (Lane 2003) Director of Seafarers' International Research Centre (SIRC) in Cardiff, sees a manpower crisis in European shipping, a crisis that will decimate global standards unless radical action is taken. European seafarers may be a thing of the past as soon as 2010 according to a new study by SIRC. Fears are that if the industry loses European professionals, shipping will lose its European training infrastructure; an infrastructure which was setting the benchmark in standards for the rest of the world. Although today in 2008 our benchmark should differ from the pattern of standards in the past years. Today we have a crunch issue: a shortage of crews with proper standards.

This view is also supported by Grey (2008) who writes that shortage of seafarers is a perfect case of the market beginning to react, and a realization that supply has been overtaken by demand. Good, experienced, responsible and prudent seafarers are today becoming a scarce species.

Some shipowners are complacent and not doing enough training because they can buy labour from other countries where they do not have to pay any labour costs. But this may be a bitter disappointment. This was some years ago. Today all those fine Indian and Filipino officers who supposedly would fill the breach after the old chaps faded fast away to leave a serious gap behind them, are not hanging around for a full sea career, as did their predecessors, but leave the sea the instant they have accumulated enough savings sufficient to make the break. Which as pay has risen on the international fleet, is much faster than up to now. Quite a number of them do not wish to be promoted to senior officers' ranks, as they are aware of the price of these responsibilities, thinking it is not worth paying, for health reasons among other factors.

A building spree threatens crew shortages writes Grinter (2006). Crew shortages and the consequent shortfall in the quality of many who decide to sail seems to be a chronic problem with little in the way of solutions. Paradoxically, as the shipping industry enjoys its most recent building boom period it at the same time leads to its own misfortune.

There are around 5,000 tankers, bulk carriers and containerships filling the order books of the world's shipyards. All will be delivered between 2007 and the end of 2009. Half will replace ships due for scrapping. The rest will add 50%

more tonnage to the world fleet. To man the expanded global fleet effectively 10,000 qualified officers will have to be found and employed. In turn they will need to be supported by a further 60,000 ratings. So we can conclude that more vessels mean new problems.

The Baltic and International Maritime Council (BIMCO) has been warning about the global manpower situation for many years, urging members to maintain and step up their training commitments.

The ISF/BIMCO 2000 report estimated that in 2000 there were 404,000 officers and 823,000 ratings readily available in the market and the demand was estimated as 420,000 officers and 599,000 ratings, thus indicating a small deficit in the number of officers. This small deficit of officers may already be posing a threat to the safety of life at sea since it has been seen over the past few years that there was an increase on board ships of the number of people with false certificates of competence who are probably filling that gap. Some 12,535 cases of forgery in certificates were revealed by a study in 2000 (IMO 2001).

The realistic "benchmark" scenario see Fig. 1 considers the observed historical growth rate of the number of ships in the world fleet in the past decade at 1%; today it may have reached even 2 to 3% and assumes that recruitment and wastage levels are the same experienced over the last five years. Although the forecast is quite sensitive to a number of factors, the clear message is that the present shortfall of officers will worsen unless action is taken.

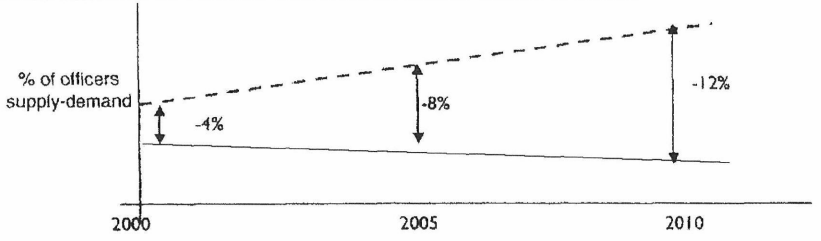

Fig. 1. Predicted supply-demand gap for officers (ISF/BIMCO)

To overcome the predicted manpower shortages Bucknall and Freire (2003) propose unmanned cargo ships as a vision in 2020. In their paper the results of a technical and economic appraisal of a fully automated unmanned cargo ship are presented within the context of expected world developments in the next decades.

With all respect to the elaborate technical level of this paper, the realization of the proposed unmanned ship concept described in it is not for a professional and experienced marine engineer a viable one, no matter what level of technology we reach in year 2020. Thus we have to find still another solution, remembering that the most important people in any shipping company are the seafarers; they are taking care of the assets, they are there to solve the problems, they are where the problems are, they meet the customers, they must be on the ship.

2 EU Green Paper on the future maritime policy of the European Union

In section 2.5 of the Green Paper entitled "Developing Europe's Maritime Skills and Expanding Sustainable Maritime Employment," the Green Paper bemoans the declining number of Europeans engaged and attracted to a maritime career, particularly in seafaring. The paper indicates that the resulting shortages, both in seafaring and in onshore maritime activities, are an increasingly serious impediment to maritime development in Europe as well as worldwide.

Why do we have an insufficient and declining number of young Europeans who are attracted to a maritime career, particularly in seafaring? What, if anything, can be done to reverse the evident downward trend and make the choice of maritime career more attractive for qualified young Europeans and others worldwide?

The EU Green Paper, whose basic purpose is to raise issues and provoke discussion, also makes some suggestions for change -- such as the raising of the general standards of maritime education and training (MET) and of providing present and future seafarers with additional knowledge and skills that would enhance their employability outside seafaring; that is, in shore-based maritime employment or other industrial sectors.

This raises the question of whether the existing system of MET – indeed, our existing approach to MET – is capable of achieving this, and whether changes in MET alone are sufficient to make seafaring again an attractive "career choice" for young Europeans as well as for others.

There is a need to revamp some universities and colleges existing methods of lectures and exercises. The students should be activated and lecturers should put a lot of effort in order to pass a maximum of useful knowledge and skills without repeating of what can be read in the textbooks. The study courses in the maritime universities and colleges should therefore be conducted by using an active teaching method, corresponding with the most effective known in the world solutions in the domain of education. The largest advantage of this method is a simultaneous passing on the students of knowledge and practical skills, thanks to this they hold an advantage compared with students from other universities. One of the most important elements of the education process are case studies concerning operational problems of ships like various casualties, breakdowns of machinery, careless navigation etc. All mentioned case studies are now enumerated in reports by various organisations like UK Marine Accident Investigation Branch (MAIB), Classification Societies banks of serious damages Lloyd's Register, BIMCO, Alert Bulletin and others. These case studies collected by various organisations mentioned are an invaluable source of ships' operational experience and problems are second to none with any textbooks. Completed by proper usage of available today's latest generation of simulators, we shall have a mature and well prepared ship's duty officer.

Therefore conducting traditional lectures should be given up except may be during first years where some theoretical aspects of various subjects should be highlighted. The lectures in the next study years should have a seminar and workshop character. In this way, it is possible to utilize the experience of all participants. The students can work in small groups of few students. The condition of effective participation in the classes is a good earlier preparation for the classes.

The prestige of idea and not the idea of achieving prestige is possible if in the university a partnership between the lecturer and the student exists. The lecturers perform roles of advisors and not of the arbiters. They are the guides encouraging us to independent thinking by creating a creative atmosphere. Thanks to it, the students are not afraid to ask, seek out, demand; they can also consult each other lecturer specializing in a specific problem and not only the person conducting the classes.

3 Basic considerations about the recruitment problem

This is the crunch issue. As already mentioned in the introduction, some seafarers, especially engineers, do not want to commit themselves to a long term career in the main stream maritime industry because they see better opportunities ashore and in the offshore sector. For the development of crew shortages we can partly blame the shipowners themselves. The shipowners used to regard their crews with the same feelings as they did luboil, fuel or paint – as a necessary evil which they sadly could not do without – suddenly recognising that seafarers were actually human being. Ship managers, companies should have a vested interest in proper training, because for them the crew is the basis from which they start to do the business. Training is an investment that the owners have to participate in, and should be aware of it. Thus the universities and colleges should seek close relations with shipowners, especially in large shipping companies, for which they will do the recruitment, will do the selection, will do the training and competence building, but as already said the owners need to participate and invest in this by for example offering already the first year students a scholarship.

The universities in turn should start an even aggressive and powerful students recruitment promotion for particular shipping companies so a candidate for a study course in the university should know in advance his future environment and work place. Thus closer cooperation between the universities and big well-known shipping companies should be established. Errors which are done during the recruitment process are mainly the delayed actions in enlisting. If we visit the schools and try to recruit the last class high school students a few months before they complete high school, it usually will be too late because they have already made up their mind what they would like to study, so we should rather address the younger classes giving them some food for thought about their future.

The primary factor which influence one's choice of or attraction to a particular job and career in any field are a mixture of the following:

- wages and salaries,
- quality of working conditions and experience,
- professional status and career prospects,
- availability or lack of alternative employment opportunities,
- intangible factors unique to a certain type of work or profession (for example such as "the call of the sea") which traditionally attracted twenty or thirty years back young men in Europe and elsewhere to seafaring.

These days these factors do not favour a seafaring career by young people. These consequences are clear and well documented, Fig. 2:

- an ageing corps of EU officers (about a third are over 50 years of age),
- wastage of officer trainees (over 10% drop out before completion of training and accelerated attrition of EU officer corps because of early exit from the industry or retirement. This obviously represents a significant waste of investment in maritime education and training.

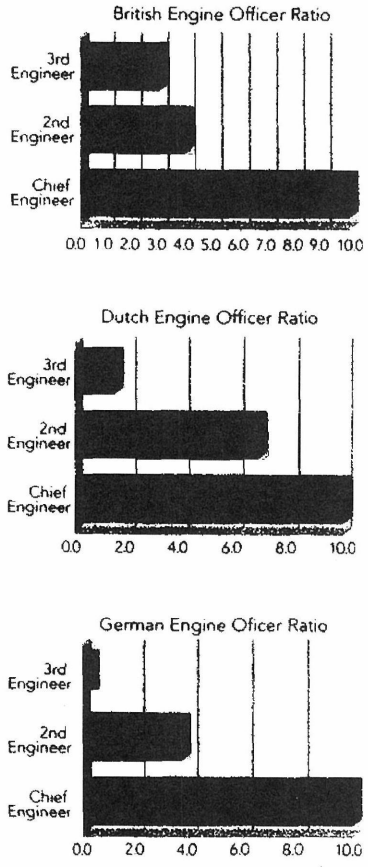

Fig. 2. Engine officer ratios in Britain, Germany and Holland point to a worrying lack of junior ranks coming through (Lane, 2003)

As a result of this there is not only a growing shortage of officers – nautical and engineering officers to man the ships -- but also a greatly reduced flow of professional seafarers required for onshore employment in maritime administration, industry and service sectors.

Considering what is to be done to reverse the downward trend in the number of Europeans entering and staying in certain maritime professions, especially seafaring it is useful to recognize certain basic facts:

There is no systematic process for employment mobility between seafaring and onshore employment; only an ad hoc process of officers moving to onshore positions in the maritime sector exists.

4 Professional career progression in maritime transportation

A professional career in any field of human activity has two basic features: first, competency based on advanced education and special training; and second, the expectation and possibility of life-long work and progressive advancement in one's chosen field of activity.

Today a decreasing number of young people consider and pursue seafaring as a long-term professional career. And the experience from seafaring, no matter how good and extensive, provides only limited choices and opportunities for mid career transition to professional onshore employment in the maritime industry or outside it.

If you leave the sea and go ashore you generally have to start all over again building a new career for yourself and your family. Being at see for rather a short time, say 5-10 years, may change your situation for a better case.

In order to attract young people, especially Europeans, again to seafaring and to a life-long career in the maritime sector in general, I think our efforts should be directed towards what shipping delivers and how shipping works. And this is rather sad, in that people in the shipping industry know that they are part of an amazing, essential and international industry.

Just over five years ago BIMCO decided to use the facility of the World Web to try and address the widespread ignorance of our industry. BIMCO Seascapes was devised, quite simply, to become a useful general source of information on contemporary shipping, maritime topics and current maritime industry issues. It would be hopefully useful for perhaps schools and colleges, for teachers or others seeking rather sparse teaching materials about the shipping industry. It would be pitched at the level of an intelligent 15 years-old and upward, with the emphasis in interest and accessibility (Grey 2007). This could be the beginning of a recruitment process of a young man making him familiar what seafaring is all about.

Thus our efforts should be directed towards following matters:

- creating a pattern of professional education integrating a university first degree, professional training, work experience, professional registration and the option of higher degrees, along the same lines as other professions such as medicine, civil engineering, architecture, law and so on;
- create a pattern of professional career progression integrating seafaring and onshore employment into a life-long progressive path that offers age appropriate career choices, post experience higher university degrees and senior management positions.

The attached graph, Fig. 3 (Laubstein pers. comm. 2007) outlines the main features of a possible system of integrated professional education and career progression combining at – sea and onshore maritime employment. The essential requirements of such a system would be:

- upgrading of MET instruction and qualifications to full university status at the (B.A or B.Sc.) level: raising of academic standards; broadening of

curriculum to include non MET subjects (e.g. law, economics, finance, human resource management, logistics of marine transport etc.); recognition and acceptance of such a degree for admission to postgraduate studies (i.e., portability of the degree in the higher education milieu, consistent with the Bologna process in European higher education);

- accessibility to, and financial assistance for mid – career postgraduate studies in different specializations of maritime affairs or other maritime – related subject at the Master level (M.Sc. or MBA);
- employer sponsorship of transition from seafaring to onshore employment in professional positions in maritime administration, industry, MET institutions and various maritime services (classification societies, P&I clubs, Seamen Unions, etc.).

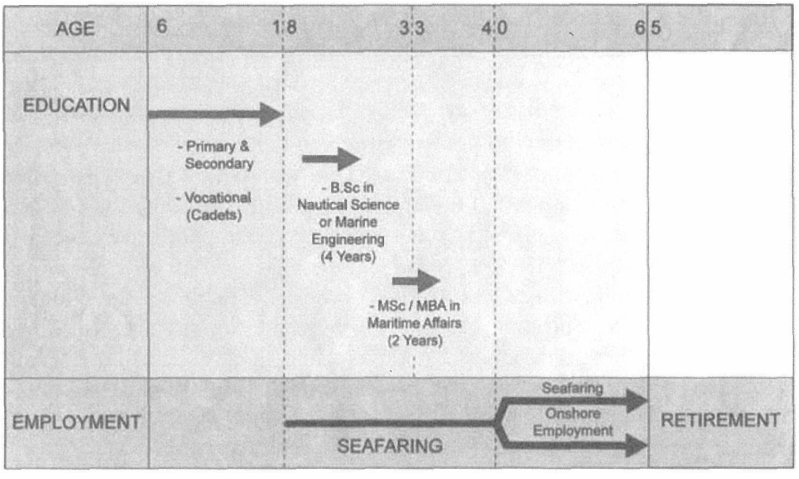

Fig. 3. The maritime professional: education and career progression (Laubstein pers. comm. 2007)

This all amounts to a move towards increased professionalization of the maritime transportation sector based on university-level education standards and qualifications in line with standards and developments in other major industrial sectors. This would raise the status and career prospects of maritime professionals working both at sea and ashore, enhancing the employability and mobility both within and outside the maritime sector.

The transition from seafaring to onshore employment requires obviously forward planning by employers to integrate officers with postgraduate qualifications into appropriate senior management or technical position in their organizations. Ideally, there should be some kind of contractual arrangement between officers and their employers which covers both the postgraduate studies and the move into onshore professional positions. Most probably this would include certain binding commitments by both the employer and the employee.

5 Conclusion

Fewer and fewer young Europeans seem to be attracted to a career in the maritime sector and in seafaring.

Quite obviously, nowadays seafaring is not an attractive choice of a professional career compared to the opportunities open to ambitious young people in other fields. One of the reasons could be the long time period before the young man can reach the senior posts i.e. a master or chief engineer. The solution in this case could be a fastrack scheme in Europe (Lane 2003) to promote appropriate candidates to senior positions in their mid twenties. Experts in European countries should advise what is necessary in their view as far as an additional training between 20-25 years is concerned. The training should take the form of short courses and distance learning, such as a demonstration project having a European Community subsidy already under way. Some may think that a lack of experience may well be the major stumbling block for any plans to fastrack individuals, no matter how talented, into senior roles. Of a different opinion is Professor Lane who points out that in the Second World War 40% of German submarine commanders appointed between 1937-45 were aged between 20-25, and 70% were appointed under the age of 30. And this was not purely a wartime phenomenon. There were plenty of very young people as senior officers among American merchant ships as well.

I served myself with a twenty-five year-old captain on the Singaporean Neptune Orient Line Shipping Company's "Neptune Saphire". In this company, promoting young Singaporeans to top ranks was a general rule. There is a belief between people that to be in a senior position such as a chief engineer or captain one has to be old and wise, but you can also be old and foolish. I believe that in creating a young man's perspective that at 25 and a holder of a M.Sc. degree he can command a ship worth of billion dollars should be very exciting and stimulating as it would be very difficult for him to reach such a highly responsible position onshore. He may further speculate that after 5 years of sea service he will be still 30 and would not have any problems getting an onshore job in other branch of the maritime industry, starting as well a decent family life.

Thus we have to explore ways and means to make the "maritime career" a more attractive choice for young Europeans and other nations. A 25 year-old captain or chief engineer are a good and tempting example.

The proposition put forward here is simply to try an approach, which both raises the MET educational standards of maritime employment and integrates seafaring and onshore employment.

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References

[1] Bucknall, R. & Freire, P. 2003- "Unmanned cargo ships: a 2020 vision", Journal of Marine Design and Operations No. B5 2003, pp. 57-68.

[2] Ginter, M. 2006- "Why more vessels mean new problems", Lloyd's List, September 12, 2006, pp. 10.

[3] Grey, M. 2007- "Seascapes – a widow on our maritime world", BIMCO Bulletin, Volume 102, No. 4, 2007, pp. 30-31.

[4] Grey, M. 2008- "Who will shoulder the burden?", Lloyd's List, March 31, 2008, pp. 8-9.

[5] IMO News, Issue 1, International Maritime Organization, 2001.

[6] ISF/BIMCO, 2000 Manpower Update – "The Worldwide demand for and Supply of Seafarers", International Shipping Federation, April 2000.

[7] Lane, T. 2003- "Count down to extinction", Marine Engineering Review, July/August 2003, pp. 34-35.

Why do we need a global organization to promote excellent MET?

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Abstract

Shipping is a global industry and will always respond to radical changes in political, economic, technological, as well as educational changes. So, a global organization such as the International Association of Maritime Universities (IAMU), should guide Maritime Education and Training (MET), which can impact the MET system worldwide. Obviously, if each nation develops its own process of MET individually, the result would be a maze of differing, if not conflicting, national MET systems.

The IAMU has clear objectives for establishing a worldwide MET network among the maritime universities of excellence. So, a comprehensive strategy for promoting MET could be developed globally, depending on the combined participation of maritime academies, institutes and universities members of IAMU.

The IAMU, due to its position as a non-governmental organization (NGO) in the International Maritime Organization (IMO) and can lead and guide the process and criteria of MET, which would lead to global standardization of excellent MET.

The paper focuses on methods of harmonizing what maritime academies, institutes and university members of the IAMU can do together in order to help the Association develop a global MET standard, and how the Association can activate it.

Keywords: *Shipping industry, Global Organization, MET, IAMU, Activation*

1 Introduction

The main objective of IAMU Working Group III is to promote global maritime excellence. Working Group III aims to establish the global standardization of Maritime Education and Training (MET). To achieve this objective, the academic access and consideration should be carried out regarding the development of existing systems in MET Universities members in the IAMU. To initiate a newly developed global system we should analyze and assess the MET systems offered by existing MET Universities.

In other words, the Association should play an important role in globalizing maritime education and training and activate this role in order to apply globalization in all maritime institutes and universities in the same manner in which IMO activates international conventions, treaties and protocols.

2 Globalization

Globalization can be described as a process by which the people of the world are conjoined into a single society and function together.

Sometimes the terms internationalization and globalization are used interchangeably but there is a slight formal difference. The term "internationalization" refers to the importance of international trade, relations, treaties, etc. such as International Maritime Organization (IMO). "International" means among nations. "Globalization" means abolition of national boundaries for economic purposes and national trade.

Globalization has various aspects that affect the world in several ways, e.g., industrial, financial, economic, political, informational, cultural, ecological, social, transportation, international cultural exchange, technical, legal and ethical.

Technology has been the other principal driver of globalization. Advances in information technology, in particular, have dramatically transformed economic life.

The accelerating changes in all the walks of life are the typifying feature of the modern age; they have resulted in eliminating the borders of countries and in the globalization of organization of educational systems. These accelerating changes have had a profound impact on competition within the quest for knowledge in this age of technology and communications. These changes have necessitated reviewing all educational systems. The maritime educational system is of course no exception. Educational systems of all types should be reviewed and modified to cope with the explosion of knowledge and the tremendous developments in technology. The old concepts of traditional educational systems are no longer capable of accommodating these new developments.

Obviously, there is an urgent need to adopt new instruction and assessment techniques according to global standards with a view to achieving lifetime success and self- learning. The world is characterized by continuous activity. It has been observed that in the past three decades international shipping industries sustained momentous changes. The global era started in the last decade. Commonly, it is expected that the winds of change towards globalization will change the existing systems of international shipping industries arena; therefore passing on maritime skills and knowledge to the following generations needs to be achieved on global scale.

Globalization has been attended by the vast internationalization and multi-nationalization of maritime activities and problems;, in order to solve the

emerging related issues we need to ensure not only a high and standard level of education, but also unified globalization of MET.

3 The shipping industry

The shipping industry is one that economists prefer to think of as "capital intensive" due to the tremendous costs of the developed equipment used.
Since antiquity, the spirit of man could not be confined to a country's borders. It has been noticed that the shipping industry has continually served humanity in trading and in exporting civilization along with goods. A ship is not confined to the borders of its flag country, nor is it confined to the borders of the shipowner's country of origin, which has always complicated things.

The economy is seen by MET mainly from an institutional consideration, whereas the effect of the globalization of the shipping industry is given some regard because it is beyond the effect of MET universities.

The provision of skilled and experienced personnel for the maritime industry to cope with the growing requirements of this global industry has been the most difficult and imposing matter that owners encounter in every shipping center.

It has been observed in the field of the shipping industry that technical innovation develops very quickly. The principle of the shipping industry is to develop the quality of seafarers in order to face the future demands of the shipping industry.

In fact, the progress of the shipping industry and related issues has been affected by the improvement of MET; maritime officers have been trying to accommodate the developments in industry demands.

The maritime industry is included among the most multifarious and global industries in the world; it is truly a global market. All shipping companies employ people coming from many countries with different backgrounds in MET and various cultures. This is why efforts must be exerted to formulate global MET.

4 Maritime Education and Training: "MET"

MET is the process which provides maritime education and training for seafarers at both the operational and management levels for the shipping industries and wherein candidates become acquainted with knowledge, attitudes and skills necessary to perform various duties on board ship and to enable them to work in varied fields of maritime industries. It is the wider aggregation of education and training systems in general.

As the 21st century started, we expected to witness radical changes in the proficiency required by seafarers. The crew (officers and ratings) remain most energetic element to the safe and efficient operation of any vessel. The influence

of the human element is very high. The human element is a very important factor in the process of carrying out the various functions of shipping companies. The human element plays the most crucial role in almost all operations at sea and ashore.

It should be noticed that there has been an increasing need for personnel working in the field of the shipping industry to do more than just actual practical tasks. People working in the field should be more professional in their attitude, thinking about their jobs and how they can operate in a professional manner and have enhanced inquiring intellects. Education and professional training, as well as development of performance, should be given due consideration, as well as -- and it is a very significant point -- the needs of expedient crew training for tasks which are very specialized and complicated. The important role of those providing this training should be highlighted because we must ensure that they are highly qualified, well-motivated and provided with a work environment that helps improve their skills and encourages them in carrying out their professional responsibilities. Consequently, developing the educational process of the university members of the IAMU is an important task to be entrusted to the IAMU.

The constant development of the shipping industry led to developing MET which has faced many new requirements, such as the requirement for further fostering of seafarers' practical skills and proficiency. The process of meeting these requirements can be seen as a new promotion of MET. Diverse difficulties and problems are encountered in such process.

In the future, the development of MET should keep pace with the development of the shipping industry, which includes both development of technology and of maritime management science.

Promoting MET for seafarers means that they are better educated and trained and have the ability to exercise greater functional adaptability.

The continuous promotion of MET should depend on: the ability to implement the criteria, a global MET system which should be proposed and organized by the IAMU, and on the capacity to overcome cultural differences and different types of education and training.

The proper implementation of IAMU criteria should go towards achieving IAMU objectives. The important role of those providing MET should be highlighted because we must ensure that they are highly qualified and can provide the appropriate educational environment.

MET universities, which are responsible for tutorage, are necessary to interface between the tutorage procedure and the shipping industry in order ultimately to obtain the expedient process to avoid problems resulting from new technologies, international conventions or new trends in international transport. The MET of merchant marine officers is affected by changes in technology, industry and society.

The question now is: what are the necessary requirements to achieve a sound process of MET in MET universities so as to meet the continuously increasing requirements of technology and globalization?

MET universities obviously have a vital role in shaping the attitudes of seafarers, and their approach to becoming professional and acting in an effective manner. A wider globalization education approach is needed.

MET universities have the ability to deliver quality courses that meet the individual's and the shipping industry's demands. But the IAMU should ensure that this is achieved within a global system, and here the role of a global organization becomes crucial. The IAMU should be prepared to undertake this task if we are to ensure success and not failure in promoting MET standards worldwide.

5 MET universities

The role of MET universities is very important in delivering higher education and playing an energetic and crucial role in diversifying and shaping the attitude of seafarers, i.e., developing their ability to become professional and to perform in an effective manner. Nowadays, the goal of MET universities is to develop a new MET program with effective teaching and learning tools to cope with the demands of the shipping industry and global standards, and to provide practicing personnel with career improvement programs which provide professional mobility founded on high technology. Global promotion for this MET approach is needed.

It is not easy to judge the excellence of any maritime university. Some characteristics which distinguish excellent universities from others are: MET courses, staff, facilities and equipment, operating standards, external audit/accreditation, and the quality of the graduates.

It is clear that not every MET university can be the best, but every MET university can strive to achieve quality MET. IAMU criteria should be seen as a call for MET universities to enhance their performance. Some MET universities providing four years of education with boarding facilities and disciplinal systems have been constituted with the apparent desire to provide well-educated seafaring officers for the national and international shipping industry.

Some maritime universities have responded to the social, cultural, economic and political forces of globalization. Such organizations as the IMO and the IAMU work to spread ideas within a global arena. Some MET universities have started to include theories, subjects and practices of globalization into various courses, such as visiting foreign ports, which helps to enhance multicultural aspects.

Seafarers play an important role in enhancing and developing careers at sea. So, empowering seafarers starts with developing MET universities within a higher integrated education and improving on multiple skills. This improves their careers at sea and makes working at sea more attractive by offering

multiple career choices. Attracting students to sea careers and equipping them with high standard MET are very important to safe and effective operation in shipping industry.

Higher standards of MET will also help acquire flexible operational skills, proficiency and competency needed in shipboard operations today. The role of MET universities, and consequently the role of the IAMU, is very essential and vital in empowering seafarers.

MET universities, the World Maritime University (WMU) and the IAMU play a crucial role in the development of the criteria needed to achieve excellence and globalization of MET. Cooperation among them will not only improve the quality of maritime education but will also make seafaring a truly global profession. Thus, the development of a network of learning and facilitation that centers across the maritime university members of the IAMU is required. I think that the majority of MET universities members of the IAMU can be networked. The IAMU can organize this. MET collaboration should exist and the role of the IAMU should be activated to facilitate such a process and provide a common platform.

6 MET and the shipping industry

It is unquestionable that good MET in the shipping industry is essential for the success of this industry. The maritime industry should educate and train candidates up to approved international levels.

Because of the nature of the maritime industry, global compatibility of MET standards constitutes a real challenge. It is operated by people from different nationalities and different cultural backgrounds. Nevertheless, they are required to work together in excellent teamwork with efficient cooperation. Indeed, it is universally recognized that real competency could only be achieved by globalizing MET practices.

7 IAMU

It is therefore proposed that the IAMU's goals of promoting a global system of MET of excellence concerning maritime safety management at sea by providing high standards of MET could be achieved by unification of MET universities and of course maritime businesses. This unification could be recognized as shaping the Association to utmost cooperative interests. It is obvious that global academic collaboration can have significant potential for MET and it could also be beneficial in innovating an advanced MET system.

7.1 The IAMU and its role in the globalization of MET

The IAMU has MET experts from all over the world who can fill academic managerial positions in MET universities. The Annual General Assemblies and conferences provide an ideal way to exchange experiences, ideas and motifs in order to put the criteria and the system of globalization of MET in effect and also to activate it.

It is also convenient to perceive the future role of IAMU as a global organization - not international - in promoting MET to determine what efforts and measures are considered necessary to adapt globalization of MET to its changing environment of economy, regulations, society and technology.

The IAMU not only provides the chance for communication between staffs of MET universities worldwide, but also provides the channels for the development of cooperative efforts.

The "common objective," of which all MET experts approve, is seen as serving the shipping industry and the individual, improving safety and security, protecting the environment and efficiently operating the shipping industry on the one hand and, on the other hand, developing employment opportunities for MET graduates.

The IAMU can make it clear that the "common objective" is farther away for some than for others. It can also make it clear that the service of MET for the industry has to be extended more than it is now to a service of MET for the individual's professional mobility. The IAMU should give a high priority to the development of MET and the development of the human element and resources by promoting the highest quality of MET of all levels. One of the subjects given a high priority has been the establishment of a global MET system.

7.2 IAMU stars

IAMU stars are the mechanism by which universities which have implemented the new criteria are required to submit to the IAMU adequate documentary evidence to testify or demonstrate that action has been taken to implement the new criteria requirements. Every university report must then be subjected to evaluation by IAMU experts before being approved by IAMU's committee.

7.3 Star/Stars

The IAMU stars is seen as being at the center of the package of controls designed to help ensure compliance with IAMU criteria, and it is assumed that it will become the key tools used to assess universities.

MET universities members of IAMU can be classified as *, **, *** stars. Etc.

1- * University offers the essentials, i.e., its syllabi meet the minimum requirements of STCW 95 + extensions to B.Sc.
2- ** + Master of Science (Post Graduate Courses) at Master degree or higher level.
3- *** 1 and 2 above + Ph.D.

Many renowned universities from developed countries and some from developing countries such as AAST-MT have their own postgraduate programs which are recognized by shipping industries. However, some academies in developing countries have problems in progressing and handling postgraduate studies. This is a future area for enhancing collaboration between IAMU member universities. In order to resolve these troubles and problems, the IAMU should create a working group or committee to supervise and accept the MET programs of those universities.

Conclusion

For so many years, since the establishment of the Association, we have been talking about globalization of maritime education and training, which is one of the objectives of the Association. Many papers have been delivered about globalization. It is time we raised the questions: "Have we actually achieved this objective? Have globalization criteria been set? It is time we started thinking seriously about how to activate this objective. I think that if we start with the universities which are members of the Association, other universities will soon follow the same path.

References

[1] Batrinca, G. (2006), "How Maritime Education should Change in Order to Help the Industry Reduce the Gap between Demand and Supply of Qualified Officers?", Proceedings of AGA-7 Globalization and MET, (16-18 October 2006, Dalian, China): Dalian Maritime University Press, pp 91-96.

[2] Bennett, S. (2000), "Implementation of STCW 95 from the perspective of the International Shipping", Eleventh IMLA, (21-25 August 2000, Malmo, Sweden): WMU, pp 42-45.

[3] Benton, G. (2007), "Globalization, Maritime Education, and Student Exchange Programs", Proceedings of AGA-8 World Maritime Excellence, (17-19 September 2007, Odessa, Ukraine): Odessa National Maritime Academy, pp 185-186.

[4] El Ashmawy, M. (2006), " Applying Unified Criteria in MET: The Way to Globalization", Proceedings of AGA-7 Globalization and MET, (16-18 October 2006, Dalian China): Dalian Maritime University Press, pp 121-129.
[5] El Wakil, A. & El Ashmawy, M. (2000), "Maritime Safety. The Maritime Education and Training (MET) Perspective: Focus on Human Element", Eleventh IMLA, (21-25 August 2000, Malmo, Sweden): WMU, pp 214-216.
[6] Graveson, A. (2000), "The Human Element- Success or Failure", Eleventh IMLA, (21-25 August 2000, Malmo, Sweden): WMU, pp 46- 50.
[7] Manuel, M. (2005), "Beyond Rules, Knowledge and Skill", Proceedings of AGA-6 Maritime Security and MET, (24-26 October 2005, Malmo, Sweden): WIT press, pp 257-258.
[8] Pagonis, T. (1996), "Who's Afraid of the New Era in Shipping?" BIMCO Review 1996, Stroudgate plc, for BIMCO London, pp 283 – 284.
[9] Petersen. S. (2000), "Maritime education & Training –The BIMCO/ISF Manpower 2000 update", Eleventh IMLA, (21-25 August 2000, Malmo, Sweden): WMU, p 25.
[10] Pritcard, B. & Zec, D. (2000), "MET Academic Approach VS. STCW 95", Eleventh IMLA, (21-25 August 2000, Malmo, Sweden): WMU, pp 51-56.
[11] Ruan, W. (2001), "Meeting the Requirement and Development of Maritime Education and Training", Proceedings of AGA-2, (2-5 October 2001, Kobe, Japan): Kobe university of Mercantile Marine, p1.
[12] Shah, S. (2006), "Forging Academic and Maritime Business Alliances", Proceedings of AGA-7 Globalization and MET, (16-18 October 2006, Dalian, China): Dalian Maritime University Press, p 101.
[13] Solanki, I. & Nakazawa, T. (2007), "Empowering Seafarers- Role of Maritime Universities", Proceedings of AGA-8 World Maritime Excellence, (17-19 September 2007, Odessa, Ukraine): Odessa National Maritime Academy, pp 388-398.
[14] Youn, M. (2001), " MET Program in Mokbo Maritime University", Proceedings of AGA-2, (2-5 October 2001, Kobe, Japan): Kobe university of Mercantile Marine, p9.
[15] Weintrit, A. (2001), "Do We Need the Official Ranking of Maritime Universities/Faculties Associated in IAMU", Proceedings of AGA-2, (2-5 October 2001, Kobe, Japan): Kobe university of Mercantile Marine, p 77.
[16] Zade, G. (2000), "FORWARD", Eleventh IMLA, (21-25 August 2000, Malmo, Sweden): WMU, pp 22-24.
[17] www.imf.org/external/np/exr/ib/2000/041200.htm. IMF Staff, Globalization: Threat or opportunity.
[18] 18. http://en.wikipedia.org/wiki/globalization, From Wikipedia, The free encyclopedia.

Analysis of drifted drums of dangerous goods in Osaka Bay during the great Hanshin-Awaji earthquake

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Abstract

On January 17, 1995 the Great Hanshi-Awaji earthquake struck. 164 drums of dangerous goods stored in Karumo-island, to the west of central Kobe, were lost into the sea. A search was immediately executed. The purpose of this research is to examine why the drums drifted so far and to different coasts outside of the Karumo-island area, and much more quickly than predicted

The drums were not stored directly facing Osaka Bay. They had drifted out from the island into Osaka Bay, but not according to the current investigation by the tide table. There was a big low tide with 151cm difference on the night of the earthquake. Most of the floating drums had drifted out to Osaka-Bay during this time. 110 drums were recovered by 29th January. On the other hand, one drum was found at Izumiotsu port in Osaka Prefecture on January 27th and two drums were found on the coast of Wakayama Prefecture on the 31ST. Therefore, further search efforts focused on the further coasts, such as Wakayama Prefecture; these were executed from 2nd February. In total, 145 drums were recovered; search efforts came to a halt on 17th February with 19 drums notrecovered. The total recovery costs came to about US $140,000.

The factors affecting drift objects at sea are: Tidal currents (particularly the current at each sea) wind-driven currents, and leeway. As the length of each drum was from the surface of the seawater to the top cover was about 10cm, it was considered that leeway did not have a big effect on the drift route of the drum. By using the Oil-spill Prediction Model, it is possible to make the distribution chart of an oil slick when we consider factors such as place, tidal current and tide-induced residual current, etc. We predicted the drift routes of the drums by comparing the oil slick distribution chart made by this model with the places where the drums were found in reality. Moreover, we calculated without considering properties of the oil, such as surface tension, evaporation and so on. This, because a drift object in this research is a drum. According to the calculating results, wind-driven currents had the most effect on an object drifting on the surface of Osaka-Bay. Tidal currents and tide-induced residual

currents had a big effect on the drums which were found on the western coast of Awaji island.

1 Introduction

The recovery efforts of drift objects were executed under high risk. Those put into the sea by damage from the earthquake, flood or accidents at sea, are generally expected to be dealt with at an early stage to help prevent disasters from marine hazards. It is, therefore, necessary to establish a risk management strategy to reduce the initial damage and risk caused by such accidents.

On January 17, 1995 the great Hanshin-Awaji earthquake hit Kobe Port in Japan. 164 drums of dangerous goods stored in the Karumo-Warehouse in Kobe fell into the sea at the Karumo-Seawater area. It was expected that recovery efforts would retrieve them quickly. The contents of the drums were Alkyl methacrylate, Methyl methacrylate and Butyl methacrylate. These are considered dangerous as they would cause seawater pollution. Moreover, there was concern that the drifting drums might interfere with the safe passage of ships navigating in Osaka Bay. This was also a danger. Apart from Karumo-Seawater area, it was reported that drums had been found further along the coastline of Osaka-Prefecture. Partial recovery was from a wider range than had been expected. This took several days, despite recovery efforts being executed immediately after the earthquake.

The purpose of this research is to inspect the risk management system at that time, and to study why the drums drifted to different coasts outside of the Karumo-Seawater area so much more quickly than our prediction. We will propose a drift forecast and searching method for a drift object; such as a drum or lost object from a passing vessel, loss of a container along the sea route, etc. We will also analyze the drift behavior.

2 The drifting drums of Osaka Bay from the Karumo-Seawater area

2.1 Site of damage area



Fig.2.1 Damage situation of Karumo-Bridge drums[1, 2)]



Fig.2.2 Damage situation of the

Karumo-Shima was built on reclaimed land in 1931 [1)] Fig.2.1 and Fig.2.2 show the damage situation to the Karumo-Warehouse in pictures taken immediately after the earthquake.

There were two routes for the drums to drift out and towards Osaka Bay. One is the right-hand route, about 750 m from Karumo-Warehouse to Osaka Bay. The other is the left-hand route, under the bridge, about 1,300 m from Karumo-Warehouse to Osaka Bay.

2.2 Current investigation of Karumo-Shima by tide table

It turned out that the almost all floating drums in the Karumo-Seawater area had drifted out to Osaka Bay before the recovery efforts of the 17th. The tide tables of Karumo-Shima for the two days before the earthquake occurred were retrieved from the tide record table of the Japanese Coast Guard [3)]. From this we ascertained the time when the drums began drifting toward Osaka Bay by the ebb current. Karumo-Shima is not registered as a standard port in the tide record table. Tides and tidal heights of there are calculated by using the described correcting method in the table.

2.3 Tidal record at Karumo area

Tides and tidal heights (except high and low tide from 17th to 18th January 1996) were also required and Fig.2.3shows the results.

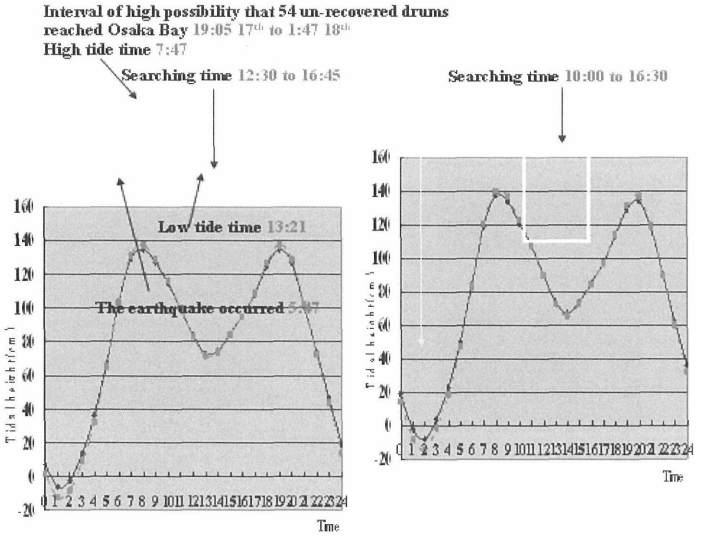

Fig.2.3 Tide records of Karumo-Shima from 17th to 18th January[3)]

According to Fig.2.3, the high tide of the 17th was at 7:47 am, about 2 hours after the earthquake. Therefore, the possibility that the drums began drifting toward Osaka Bay during this high tide period is low. After 7:47 am, it is estimated that the drums began drifting out on the low tide at 13:21 am. 164 drums were eventually lost into Osaka bay. 30 drums were recovered drums by the 17th between12:30 pm and 16:45 pm. It is considered that these recovery efforts were not so successful, because during the day of the earthquake the workers might have thought that it would be no great problem to leave the drums because the current speed of the seawater area was so slow. However, there was a big low tide from 19:05 pm on the 17th to 1:47 am of the18th, as shown in Fig.2.3. The tide difference at this low tide time was 151 cm and was over the prediction. On the other hand, the unrecovered drums had already drifted out to Osaka Bay before the beginning time of the recovery efforts on the 18th. Therefore, it was considered that most floating drums had drifted out to Osaka Bay during the low tide time.

3 Details of the drums drifting to each sea area

3.1 Detail of found drums in each coast

Fig.3.1 shows the found places of the drums on map From January 27th to February 17th

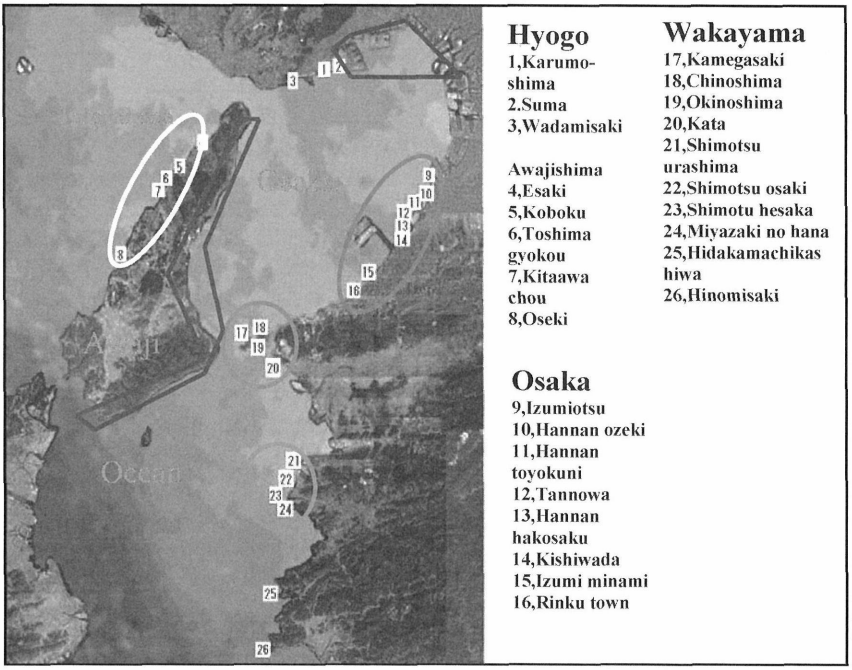

Fig.3.1 Places where drums were found

In Fig.3.1, it can be seen that the drums had drifted much beyond Karumo-Shima. The furthest was to Hinomisaki as shown by the number 26 in Fig.3.1. All of the drums located outside of the Karumo-Seawater area were found to have drifted ashore on the coasts, and were not drifting in the sea. In addition the drums which had drifted ashore were found almost in the same areas as shown at the frames red, yellow, pink and orange in Fig.3.1. On the other hand, there were areas (shown at the blue frame in Fig.3.1) where no drums were found at all, even as recovery efforts were enacted.

According to these results, it may be considered that the places where the drums drifted, or not, depends on, and is connected to, the currents of Osaka Bay. However, the total number of drums found was 35. Recovery efforts were discontinued on 17th February. A total of 19 drums were never seen again. It was

thought that the unrecovered drums had sunk somewhere beneath the surface of Osaka Bay.

3.2 Prediction of the drift routes of the drums to the coastal parts around Osaka Bay

The factors influencing drift objects at sea are mainly ocean currents and tidal currents. Additionally, the shape of a drift object influences the drift route [5]. For instance, even if the place of a departure point and the weather are the same, driftwood which has sunk almost under the sea and a sailor of the same weight as the driftwood will have greatly different drift paths. This is because the influence of the wind on each is different. It is almost possible to guess drift routes if the factors mentioned above are grasped with accuracy. When guessing a drift route of some drift object in the ocean, such as the Pacific or Atlantic Ocean, then the main factors which makes drift objects flow "away" are the ocean currents, and not the tidal currents. But in this research, the seawater area into which the drums had been flowing was Osaka Bay, which can be considered an "Enclosed Coastal Sea" from the Pacific Ocean by the Kii Channel and from the neighboring western part of the Inland Sea by the Akashi Strait. In an enclosed coastal sea like Osaka Bay, there are no ocean currents, such as the Tsushima current which flows in the Japan Sea. Instead the influence of the tidal currents is large.

By using the Oil-spill Prediction Model developed by the Petroleum Association of Japan, it is indeed possible to make a distribution chart of an oil slick with consideration given to: the point of departure, tidal currents, tide-induced residual currents, river-water driven flow, the influence of sea wind, the kind of oil, and the outflow form of oil moment within Osaka Bay. The drift process of the drums is then analyzed by using the Prediction Model. [5]

3.3 Influence of leeway on the drums

As mentioned above, the sea wind is the prime factor which influences drift objects. The influences of the sea wind are leeway, when the sea wind sweeps drifting objects away directly, and the wind-driven current, which occurs when wind blows over the sea. In this section, we consider the influences of leeway on the drums. The ratio of volume of the floating drum on the sea surface is calculated by considering the different demystification of the packing situation on the drum and seawater.

3.3.1 Detail of the drum

The drifting drum has a capacity of 200 L and is called "H class". Fig.3.1 shows the side and upper view of the drum and with the name of each part listed.

Numerical values of the drum

D (Diameter):	567 mm
D1 (Diameter of Rolling Hoop and Chime):	584 mm
H (Height):	890 mm
h (Height of chime)	7 mm
a (Height of Rolling hoop)	7 mm
W_d (Weight of the drum)	27.5 kg

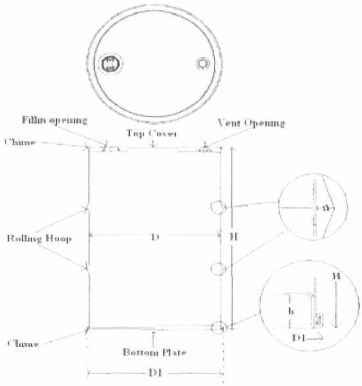

Fig.3.2 Detail of the drum

3.3.2 Calculation result

The drum is not the exact shape of a column due to the two rolling hoops 7mm high. It is considered to be small. Therefore, the volume of the drum is calculated without considering the volumes of the two rolling hoops. The ratio of the volume of the floating drum on the sea surface is calculated by considering the different density of seawater and the packing state of the drum containing Alkyl methacrylate.

Volume of the drum (V_d)

$$V_d = \frac{D}{2} \times \frac{D}{2} \times \pi \times H \quad (3.1)$$

$$= \frac{567}{2}\ \text{mm}^3 \times \frac{567}{2}\ \text{mm}^3 \times \pi \times 890\ \text{mm}^3 \quad 224722214.4\ \text{mm}^3 \quad 0.2247\ \text{m}^3$$

Weight of the packing drum (W_p)

Weight of Alkyl methacrylate (W_m)

W_m = Density of Alkyl methacrylate (D_a) × Volume of Alkyl methacrylate (V_a) (3.2)

$D_a \times V_a$

= 0.87 Kg/l × 200 ℓ = 174 Kg

$W_p = W_m + W_d$ = 174 Kg + 27.5 Kg = 201.5 Kg

Density of the packing drum (D_p)

$$D_p = \frac{W_p}{V_d}_p = \frac{201.5Kg}{0.2247m^3} \quad 896.7512\ Kg/m^3 \quad 0.8967\ g/cm^3$$

(3.3)

According to these results, the ratio of volume of the floating drum is calculated by using the formula below.

$$\frac{\text{Density of the packing drum}}{\text{Density of the seawater}} = \frac{D_p}{D_s} = \frac{0.8967g/cm^3}{1.025g/cm^3} \times 100 \quad 87\%$$

(3.4)

Therefore, ratio of volume of the floating drum on the surface of the sea is 13 %.

3.3.3 Discussion on forces moving the drums

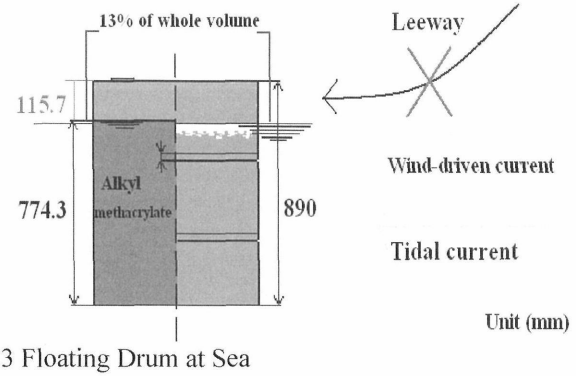

Figure 3.3 Floating Drum at Sea

Since it turned out that the ratio of the floating drum on the sea surface is 13 % according to the calculation result, the length of the drum from the surface to the top cover is about 115 mm, as shown in Fig.3.3

Moreover, the other contents were Methyl methacrylate and Butyl methacrylate. The calculation result of Methyl methacrylate was only 7 % and that of Butyl methacrylate was 11%. The weight of packing state of the drum is about 200 Kg each and it is too heavy. The side of the drum is spherical in shape which can be influenced by sea wind and is quite different from the shape of a sailboat, which is of course easiest to be influenced by sea wind. Therefore, it is considered that sea wind influencing the floating drums are low in potential.

Therefore the factors most influencing the drums are tidal currents and wind-driven currents.

3.4 Distribution chart of the oil made by using the Oil-spill Prediction Model

The Oil-Spill Prediction Model developed by the Petroleum Association of Japan enables us to investigate the oil slick distribution chart when considering point of departure, tidal currents, tide-induced residual currents, river-water driven flow, the influence of sea wind, the kind of oil, and the outflow form of oil (discrete or continuous) in Osaka Bay. Based on these calculated conditions, the drifting tracks and the distribution chart of the drifted drums can be predicted by adapting the real conditions while they were drifting in Osaka Bay. According to the discussion in section 3.3, the factors influencing drifting objects at sea were tidal currents, tide-induced residual currents, and wind driven currents. However, there are also compounded currents: such as tidal current and tide-induced residual current, tidal current and wind driven current, which compound the factors at sea. Therefore, the combinations of the factors influencing drifting objects at sea are shown in the following.

① Tidal current □ Wind driven current

② Wind driven current □ Tide-induced residual current

③ Tidal current □ Tide-induced residual current □ Wind driven current

The drifting tracks and distribution chart of the drifting drums are predicted by comparing where the drums actually drifted ashore and the results of the drifting tracks and distribution chart of oil, calculated by adjusting each of the calculating conditions above, along with the combinations of the factors influencing drifting objects at sea.

3.5 Calculated results and discussion

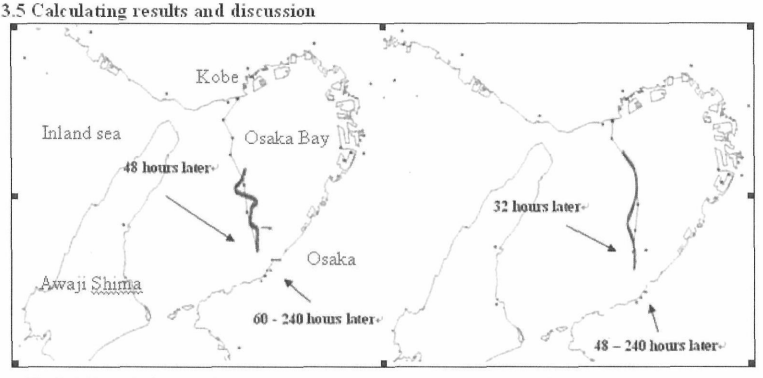

Fig.3.4 Calculating result of Tidal current+ Wind driven current

Fig.3.5 Calculating result of Tide-induced residual current + Wind driven current

The oil track in Fig.3.4 shows the top of the oil slick. Here, all of the oil slick shown as being below are on top of the oil slick. As shown in Fig.3.5, the top of oil slick drifts toward the coastal parts of Osaka Prefecture; though near the center of Osaka Bay. The top of the oil slick got into the coastal part of Osaka Prefecture 60 hours from the start time of the calculation. The rest of the oil slick got into the coastal parts of Osaka Prefecture, as shown in Fig.3.4 one after another. Moreover, the oil slicks that drifted ashore in the coastal parts of Osaka Prefecture never moved until 24 hours later. As shown in Fig.3.5, the calculated result was similar to the calculating result of Fig.3.4: The top of the oil slick got into the coastal parts of Osaka Prefecture 48 hours later. Moreover the rest of the oil slicks never moved until 24 hours later, after reaching the coastal part of Osaka Prefecture. This is shown as the calculated result of Fig.3.4. According to Fig. 3.4 these results, by exchanging the calculating condition, such as tidal current or tide-induced residual current, the difference of speed of oil slick can be seen, while the different landing place of the oil slick could not be seen. Therefore, it turned out that the influence of wind driven current on the drifting route of the oil slick was bigger than the influence of the tidal current or the tide-induced residual current.

3.6 Tidal current + Tide-induced residual current + Wind driven current

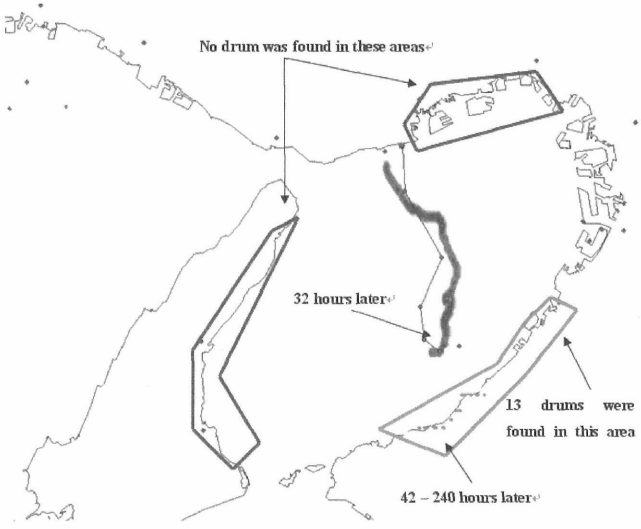

Fig.3.6 Calculated result of tidal current
+ tide-induced residual current + wind driven current

The top of oil slick arrived at the coastline of Osaka Prefecture 42 hours after the earthquake first struck. This was the fastest of all the results. The oil slicks didn't move until 240 hours later, after they had drifted ashore into the coastal parts of Osaka Prefecture. According to the result, it also turned out that the influence of wind driven current on the oil slick was the biggest even when the compounded current of tidal current and tide-induced residual current were considered in the calculation.

3.7 Discussion on the current

The places where the oil slick drifted ashore in the calculating results were almost identical. Moreover, it is almost the same when compared with the pink frame shown in Fig.3.6, where the most drums were found in reality. As these results demonstrate, what most influenced the routes of the oil slick was the wind driven current. However, the data of wind used in this calculating was not that of real time. Moreover, only the drift behavior of Fig.3.6 was different. However, five drums were found in the coastal parts of West Awajishima. It was considered that the influence of the tidal current and tide-induced residual current was greater on the drums toward Akashi Strait. It was reported by the Kobe Maritime Safety Agency that one drum was found along the coast of Osaka Prefecture on 27th January, ten days after the earthquake. On the other hand, the calculated result of Fig.3.6 shows that the top of the oil slick arrived at

the coastline of Osaka Prefecture 60 hours later. This was the slowest. The volume of the oil slick or the drum under the surface of sea is completely different. This means that the ratio of the influence on drifting objects under surface of sea is different. Given this consideration, it is hard to consider that the drift behavior of the oil slick and the drum is quite same, even if the weights are the same in the calculation. And the drum arrived at the coastline of Osaka Prefecture faster than did the oil slick. Therefore, it is predicted that the drum got there between 42 to 240 hours. The problem with this drift calculation is that no oil slick drifted toward the coast of Wakayama Prefecture. It is considered that the reason for the difference between the drift behavior of the oil slick and the drum is because the wind data was the average data, not real data. There might be a problem in the accuracy after five days from some accident happening though this drift calculation is probably effective within five days.

4 Conclusion

The drums were stored along the coastline, even though they were well known as dangerous goods. This meant that they would fall into the sea if stored in that manner. The recovery efforts commenced within seven hours of the great Hanshin-Awaji earthquake. But there was some ineptitude in the execution of the recovery efforts. Moreover, it was believed the drums would not drift into Osaka Bay, even if not immediately recovered. However, an extremely low tide had occurred that day, until nightfall.. This caused the majority of the floating drums to float away into Osaka Bay. It was hard for the risk management system, according to these facts, to consider other countermeasures to prepare for such an occurrence. The recovery efforts were executed in the coastal parts of Osaka Prefecture, Wakayama Prefecture and West Awajishima. They were continued for one month after the earthquake. They discontinued on 17th February, even though 19 drums still had not been found. It was estimated that the unrecovered drums had sunk underneath the surface of Osaka Bay or may have drifted to areas outside the recovery area. The recovery efforts costs exceeding some 10 million yen or $100,000 US as the search area was expanded. By comparing the calculated results with those drums found in reality, it turned out that there was a similarity of drift behavior with that of the drift objects. That is without the influence of leeway and oil, though each shape is different. However, it also turned out that the drift route changed greatly because of the influence of factors on the drifting objects in the sea, such as in Osaka Bay in which the tide-induced residual current had a major effect.

According to the research results, we conclude that the drums would not drift out from the Karumo Seawater area to Osaka Bay, and the search ranges of the drums in Osaka Bay were different from the area where the drums had actually drifted. Dangerous goods should not be stored along the coastline, even if the storage system of the dangerous goods is well maintained. Sometimes a large-scale disaster causes damage greater than our expectation. Therefore, it is

necessary to establish countermeasures, such as drift prediction. It is proven that if the drift prediction was accurately done before, then that would lead to the reduction of the damage caused by drifting objects once they began to move. Finally, this thesis concludes that effective method of drift prediction is accurately to know the properties of likely drift objects, the conditions at the starting point, the currents of the sea, and real time data of wind in each area throughout the year.

References

[1] Private contact to Chikko Co.,Ltd.

[2] Onohama shipyard of Kobe, History of Kobe Port, Web site of Onohama shipyard of Kobe http://209.85.175.104/search?q=cache:t6WMPlNyS2kJ:homepage3.nifty.com/rekick/rcent/portofkobe/portofkobe.htm+%E5%92%8C%E7%94%B0%E5%B2%AC%E3%80%80%E9%95%B7%E7%94%B0%E6%B8%AF&hl=ja&ct=clnk&cd=1&gl=jp.

[3] Hashimura, M., et al. Drifted drums of Dangerous Goods in Osaka Bay at the Great Hanshin-Awaji Earthquake in 21st The Institute of Social Safety Science, (Nov. 2007).

[4] Petroleum Association of Japan, Users manual of the Oil-spill Prediction Mode, Petroleum Association of Japan, (Jun. 2003).

[5] Hashimura, M., Research on drifted drums of Dangerous Goods in Osaka Bay at the Great Hanshin-Awaji Earthquake, Master Thesis, (Jan.2008).

On risk assessment and decision-making while controlling the ship in adverse weather conditions

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Abstract

As worldwide statistics show [Gale, Patraiko 2007], the increase of ships' size and their technical equipment haven't significantly changed the environmental influences upon them. . .

Ships continue to be lost at sea and suffer heavy damages, such as shifting and loss of cargo, damage or full destruction of deck arrangements and mechanisms, and experiencing cracks and bends in their construction. Additionally, heavy seas decrease ship speed, worsen the comfort of the crew and passengers, and make it difficult to maintain the terms of cargo delivery. Handling of the ship in the seaway either from practical or from theoretical point of view is one of the most complicated and hard-to-research navigational problems. Mostly, it is connected with the incompleteness and uncertainty of the initial information and environmental conditions, and the multivariate nature of the decision-making problem.

Keywords: *ship, adverse weather conditions, decision-making, intelligence system, neural fuzzy network.*

1 Introduction

A ship passing through storm areas is subject to a series of negative influences and phenomena that may be met in different combinations such as:

- Heavy pitching and heaving accompanied with green water & slamming effects.
- Pitch induced rolling, parametric resonance.
- Synchronous rolling (resonance).
- Reduction of transverse stability.
- Loss of steering, broaching.

All these phenomena can lead to:

- Risk of hull damage due to stresses and vibrations (especially in head waves).
- Risk of losing the deck cargo due to significant accelerations on deck, and green water effect.
- Risk of capsizing (in case of significant reduction of transverse stability, or broaching).
- Crew and passengers fatigue.
- Speed reduction as a result of added resistance & propeller emersion.

Generally the problem of the optimal control of the ship in adverse weather conditions can be solved in two stages:

- Preliminary planning based on the weather forecasts; choosing the optimal safe route;
- Real-time decision-making, adjusting the control mode of the ship (velocity and heading) based on the ship's actual conditions and weather conditions in the stormy area.

The approximate prediction of the ship's behavior on route planning can be roughly estimated using general simplified formulas as presented in Kozyr and Aksutin [2006]. A more accurate prognosis can be achieved using strip theory [Jornee, Massie 2001] or other specific calculations. Usually the main uncertainties in such calculations are in the stochastic nature of the environmental disturbance and highly non-linearity of the ship's behavior.

The onboard assessment of the ship's actual condition on the basis of conventional measuring devices present on most ships (clinometer, gyro compass, log) is not always sufficient. Also, any predictions using conventional diagrams [IMO MSC 1228, 2007] may be inaccurate due to their initial generality and probability of having two or more irregular wave systems in the area.

Thus more accurate calculations using specific software -- together with the support of specific sensors to access the real condition of the ship and the weather -- are needed to assist the navigator in solving this complicated problem.

The increase in computer efficiency, together with the use of probability theory, mathematical statistics and soft computing conceptions nowadays, makes possible the development of an intelligent system for monitoring and providing decision-making support of the navigator handling the ship in the seaway (ISS – Intelligent Seakeeping System).
Generally such a system should have following properties [Nechayev, 2001]:

- The capability to work with incomplete, inaccurate and out-dated information;
- Self-organization and learning capability (self-tuning);
- Robustness;
- The possibility of adaptive reaction due to unplanned events;
- A focus on information from technical devises;

- The capability of analysis and prognosis of plant dynamics;
- A guaranteed time of response;
- Integration of on-board software;
- Separation of operator and ISS functions.

ISS can be divided by following subsystems (fig. 1):

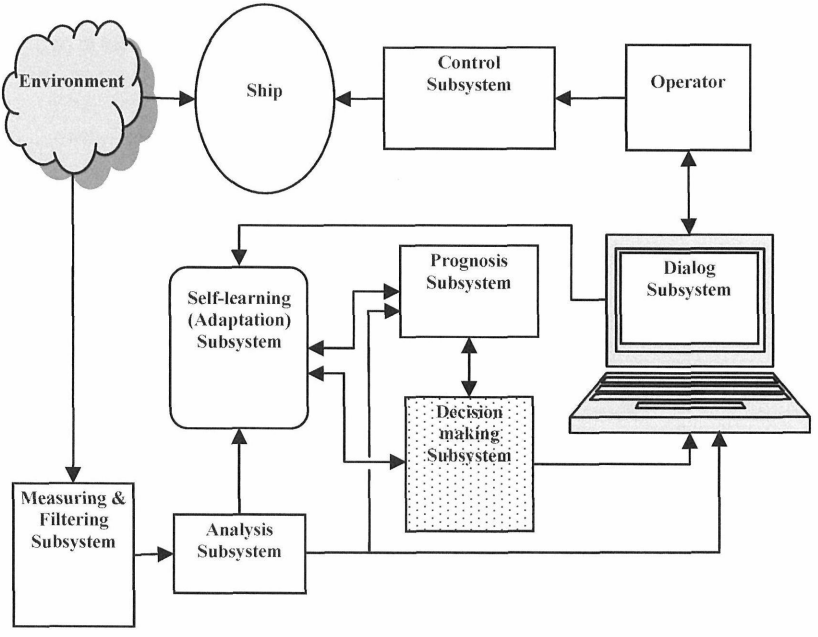

Fig. 1.Intelligence seakeeping system structure.

ISS can be divided by the following subsystems (Fig. 1):
- Measuring and data processing subsystem;
- Analyzing subsystem;
- Prognosis subsystem;
- Decision making subsystem;
- Dialog (output) subsystem;
- Self-organization subsystem;
- Operator.

Obviously, the target section of such ISS is the *decision-making subsystem*, which, depending on the properties of controlled plant and prevalent conditions, generates recommendations for the operator, for instance on the display screen, or sends the signals directly to the control loop.

As mentioned above, in conditions of incomplete initial information and uncertainty of environmental disturbances it is quite difficult to calculate accurately the control mode needed for the ship (course, speed, ballast displacement, autopilot parameters). However, a sufficiently close solution to the problem can be obtained using self-tuning fuzzy-neural networks, which are widely described in the literature, for instance *Borisov et al* [2007].

2 Linguistic approach

The use of fuzzy logic allows us to divide each input and output parameter on fuzzy sets, that can initially be defined in terms of linguistic variables ("*significant rolling amplitude*", "*frequent slamming*" etc.), consisting of intersecting membership functions. That means that each value of the set belongs to one or other linguistic term with defined probability. For instance, rolling amplitude $\theta_{max} = 1°$, belongs to the term "*significant rolling amplitude*" with the probability $P \rightarrow 0$, and to the term "*minimal rolling amplitude*" with the probability $P \rightarrow 1$. In such a way the data coming to the network is input and then processed by a series of mathematical transformations well known from the fuzzy logic theory. On the output, depending on the properties of the net, we obtain fuzzy or discrete values, describing one or other recommendation. In linguistic terms the logical chain of recommendation processing can be given as follows:

INPUT

sea condition:	7 force wave
wave relative direction:	port bow
wave length:	medium
slamming occurrence:	frequent slamming
pitching occurrence:	significant pitch amplitudes
ship's speed:	full ahead
risk:	bending forces applied to the hull exceed safe limits

OUTPUT

fuzzy solution:
reduce the speed significantly;

fuzzy limited solution:
reduce the speed by 4-5 knots;

deterministic solution:
reduce the speed by 4.5 knots.

It should be noted that such a format can be used for the implementation of the interface as a method of dialog of ISS with the operator, however the

calculation by itself is based on a strict and complicated mathematical origin, working with discrete, fuzzy and stochastic values.

3 Neural-fuzzy network operation principles and adaptation method.

Generally the operation principle of neural-fuzzy network for decision-making can be described as shown below.

Measuring, analysis and prognosis subsystems send to the network input *m* of antecedents. Let's denote X (M x N) $\in \Re$ as set of all possible antecedents, Y (I x J) $\in \Re$ - set of all possible conclusions (recommendations). M – quantity of input parameters, N – size of the vector of all possible values of an input parameter, I – quantity of output parameters, J - size of the vector of all possible values of an output parameter. Initially in prescribed subsystem any m antecedents can cause I x J conclusions. That means that the calculated probability of efficiency of each solution with current antecedent P(X) = 1.

It's obvious that the network training process consists of finding the values of weight coefficients that determines the relevance of the connections between antecedents and conclusions.

It should be noted that such neural networks contain the competitive type neurons; i.e. on the output of the net not the weighted sum of all neurons is obtained, but the defined quantity of neurons having the highest weights (initially this principle was used in the problems of classification) [Haykin, 2006].

As the main goal of the system is to advise the operator on the optimal control mode for the ship, satisfying the objective function for optimization in this case means the minimization of the general influence of the negative factors impacting the ship in bad weather, for instance: significant ship's oscillations in all directions, additional wave resistance, slamming and green water effects, propeller immersion, reduction of transverse stability, significant probability of broaching, capsizing etc.

The decision making subsystem tuning (training) process can be divided into the next four stages.

Stage 1. By means of an expert appraisal on the operator's level, obviously wrong connections between inputs and outputs (P(X) = 0) are discarded.

Stage 2. The mathematical model of interaction between plant and environment is used. Calculating these data by use of the mathematical model we obtain the set of optimal solutions as a first approximation.

Stage 3. Further adjustment can be performed by the trial tests in the towing tanks that allows significant reduction of wrong solutions made by the systems installed on the real ship.
After preliminary fine-tuning, the ISS unit can be installed on the ship. Generally this unit can appear as a software application integrated into the integrated bridge system, having access to all needed sensors or a fully independent computational block directly connected to the measuring system.
During the operation of the ship, dependending on the measuring system installed on board, part of data necessary for the assessment of ship seakeeping conditions is obtained from sensors (e.g. list, trim and yaw angles), part to be input by the navigator (e.g. if tensor sensors are absent on the ship, the quantity of slamming occurrence during the prescribed period to be input manually).

Step 4. During the ship operation described above, depending on the sea and ship conditions, the system generates the variety of possible ship handling modes in descending order (solutions with the highest probability of effectiveness on top), and the results of ship motion prognosis after performing the maneuver, calculated using the mathematical model. The operator in turn chooses one of the solutions or makes his own, inputting new prescribed motion parameters into the system. After carrying out the maneuver, the system analyses the ship's condition during the prescribed period and "makes conclusion" about efficiency of the decision made. After the weight of this solution with preceding antecedents to be increased or decreased by prescribed rule, that provides the self-learning and adaptive properties of the ISS.

4 Conclusion

Thus, such a conception allows the minimization, on the one hand, of errors in decision-making arising from the inadequacy of basic mathematical models and, on the other hand the incorrectness of expert or operator solutions. However generated solutions should be based not only on strict mathematical calculations, but also on statistical analyses of information, coming from the ship's sensors and on "good seamanship".

References

[1] Borisov V.V., Kruglov V. V., Fedulov A. S. Fuzzy models and networks. – M.:Hot Line – Telecom, 2007. p. 284

[2] Gale H., Patraiko D. Improving Navigational Safety. Seaways: The International Journal of the NI., July 2007. p. 4-8.

[3] Intelligence systems in marine research and technology / Nechayev U. I. et al. SPB: SPB STMU, 2001. p. 395 p.

[4] Journée J.M.J., Massie W.W. Offshore Hydromechanics/ Delft University of Technology – 2001. p. 570

[5] Kozir L. A., Aksutin L. R. Ship handling in storm. – 3-rd edition. – Odessa: Phoenix, 2006 p. 218

[6] S. Haykin Neural Networks: A Comprehensive Foundation. 2nd Edition. Prentice Hall, 2006. p. 1104

Coastal records of rapid changes in the eastern Baltic area

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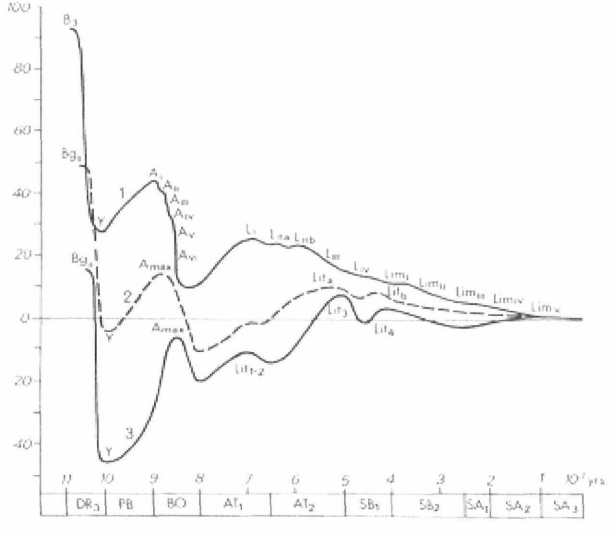
Abstract

Rapid changes taking place in coastal areas are of fundamental importance for better understanding the natural and man-induced processes which should be recognized and managed. Technological developments and the ensuing progress in marine transport have been accompanied by a dramatic increase in human activity of which the Baltic Sea has experienced more than any other sea in the world. In recent years, intense traffic of high-speed passanger ships, especially in Tallinn Bay, has caused damage to objects located in the coastal area, has brought serious problems to the traffic of small ships and has endangered holidaymakers on the beach. The sea-level in the eastern Baltic region has been controlled by the unequal land uplift that has affected different areas in different ways. The present average rise of the world ocean level does not remarkably affect the evolution of the beaches in the northern part of the study area: in that area, due to crustal uplift (2-3 mm per year), the coast is rising more rapidly than the level of the world ocean (about 1.5 mm annually). However, the sinking southern part of the study area would be endangered, especially due to accelerated sea-level rise, which is the result of natural processes and the "greenhouse effect". Extensive erosion and alteration of depositional sandy shores appears to be largely due to the increased storm activity. Severe shore damage is usually caused by the combination of heavy storms, high sea-level, and absence of ice cover. The exceptional storm named Erwin/Gudrun of January 2005 motivated studies of the wave measurements and coastal protection. Substantial changes in coastal morphology have often been caused by the action of ice, when ridges of pressure ice up to 15 m high are generated by persistent undirectional winds, and are pushed forward against the shore with an enormous force, shaping the shore, breaking trees and damaging buildings.

1 Introduction

Research into topography and shoreline displacement of the Baltic Sea goes back well over a century. However, in spite of a great number of publications and serious improvement in investigation methods, many topical problems of the history of the Baltic Sea have still remained unsolved. It is well-known that the North, Central and South Baltic developed under sharply different tectonic conditions and their shorelines mirror this (Fig. 1). The connection between the lowering of shorelines and their seaward retreat, and the process of land uplift was obvious to scientists back to the nineteenth century; however, the present land uplift around the Baltic Sea, in which isobases denote the extent of uplift in relation to sea level, is still under discussion. It is clear that the land uplift in Fennoscandia is mainly glacio-isostatic in nature, but to calculate another inclusion in total uplift seems to be more than speculation. It is quite possible that in the basement and sedimentary cover there are neotectonically active lifting and sinking blocks, which influence the sedimentation and erosional processes in different ways.

Figure 1



Structurally the study area, comprising Estonia, Latvia and Lithuania, and the St. Petersburg and Kaliningrad Districts of Russia, belongs to the north-western part of the East-European Platform. The boundary between the Fennoscandian Shield and the Platform is defined by the northern limit of sedimentary rocks and runs through the Gulf of Finland. Depending on tectonical pecularities, the bedrock of different ages crops out in the form of sublatitudinal belts, starting from Vendian and Cambrian rocks in the north (North Estonia) and ending with Mesozoic and Neogene rocks in the south (Lithuania). As a part of the vast East-European Plain, the study area is characterized by a flat surface topography with small absolute and relative heights. The sea-level history in the eastern Baltic region has been controlled by the unequal land uplift which has affected different areas in different ways. In the northern regions of the study area, the ancient coastal formations are located tens of metres above the water level; in the southern part of the area, correlative coastal formations lie at the depth of up to 60 metres below the sea level (Fig. 2). Several sinking and lifting blocks with anomalous heights are also encountered (Miidel 1994).

Figure 2



2 Rapid changes in the past.

The Baltic Sea was formed about 12,000 years ago after the readvance of the ice margin from the northern slope of the Pandivere Upland in northern Estonia (Kvasov & Raukas 1970). Consequently, the isolated big ice-dammed basins west and east of the elevation joined up. Basically, the Holocene and Late-glacial stages are intervals of either open or closed connection with the ocean, with consequent changes in the mode of sedimentation, shore displacement and salinity in the Baltic basin, which are, in turn, reflected in the biology of the basin. The Late-glacial drop of the Baltic Ice Lake (the first stage in the history of the Baltic Sea) to ocean (Yoldia) level, the rapid transgression of the following Ancylus Lake about 9500 yr BP (Haila & Raukas 1992) and its regression in late Ancylus time were rather catastrophic and are clearly traceable on the shore displacement curves. In Estonia the lowering of the Baltic Ice Lake level was estimated at about 25-30 m.

The Ancylus transgression culminated in the different regions of the Baltic Sea at different times. In the area of the Gulf of Finland it reached its maximum somewhere between 9200-9000 years BP. If the water level in the Ancylus Lake rose 15-20 m above the ocean level over 300 years, then its annual rate of rise must have been 5-6 cm (Eronen & Ristaniemi, 1992). The velocity and amplitude of the rapid Ancylus regression are well established on the Island of Hiiumaa in Estonia. On the Kõpu Peninsula, the Ancylus transgression level has been fixed at the height of 42-45 m, and the lowest Ancylus regression level at Partsi at the height of 8.7 m. This yields some 30-35 m for the regression amplitude and 3.0-3.5 cm for the annual regression rate between 9000 and 8000 yearrs BP (Raukas et al. 1996).

Such rapid events were important both from the geological and social point of view, because the inhabitants had to adapt themselves to the rapidly changing shoreline. For example, a Stone Age human settlement at Pulli (SW Estonia) was highly controlled by the evolution of the Baltic Sea and related changes in the local hydrology (Raukas et al. 1995). In the first half of the Pre-Boreral, during the low standing of the Yoldia Sea, when the regression of the Baltic basin was most pronounced in the entire history of the Baltic, Mesolithic hunters and fishers settled here about 9600 years ago, but were soon forced to abandon the settlement of Pulli due to the rise of Ancylus Lake water level. During the Ancylus regression, the shoreline again retreated a long distance towards its present-day position and the early inhabitants had to adapt themselves again to the changing shoreline and the new drainage system. A new water level rise took place during the following Litorina Stage.

3 Contemporary shore changes and influencing factors.

In general, the epicontinental character of the Baltic Sea is reflected in all processes that have influenced the coastal morphology and sedimentation. Isolation, modest size and small depth are the factors limiting the development of significant currents. Tidal changes of the water level are small. The principal coastal agent is the wave action induced by heavy storms with wind velocity 40-45 m/s. In the autumn-winter period, when the water level is relatively high, great water masses are piled up. Under such high-water conditions, the surge can reach several metres and cause severe damage to the coast (Fig. 3). Wave observations in the Baltic sea area extend back more than 200 years. These data, however, represent only wave properties in the near-shore regions and often reflect open-sea wave fields inadequately. Contemporary wave measurements in the northern Baltic Sea were launched about three decades ago when semi-autonomous measurement devices were deployed in different parts of the sea. Unfortunately, hardly any by wave data measured instruments are available from the coastal areas of Estonia, Latvia and Lithuania, except for visual observations from the coast and for sporadic measurements made with pressure-based sensors (Soomere 2005). During exceptional storm named Erwin/Gudrun of January 2005, extreme wave conditions existed and according to Soomere in the late evening of 13th January the largest wave height reached 7.82 m in the open sea. But on 25 th December 1996 an extremely high single wave 12.79 m high was measured. Although devastating tsunamis in Eastern Baltic are virtually impossible, the occurrence of such high waves should be taken into account in strategic planning, as the appearance and the results of these hazards are fairly similar.

Figure 3



Ice-push (Fig. 4) is at its greatest on sandy beaches; where under the compressing and ploughing influence of the ice, deep furrows are often formed on the beach and coastal slope. On till shores big erratics are moved by expanding ice. Occasionally, tens-of-metres-long stone walls are encountered in

front of scarps which they defend from further erosion. Cornics, wave-cut notches and vertical tectonic joints in the bedrock contribute to the downfall of huge blocks on the shore, modifying the erscarpments, but on the other hand, they protect the cliff from erosion (Fig. 5) and affect longshore drift of sediments over decades.

Figure 4

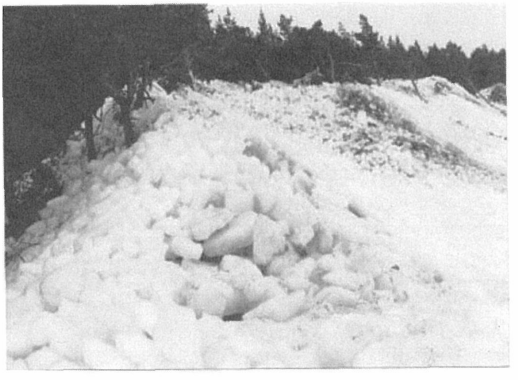
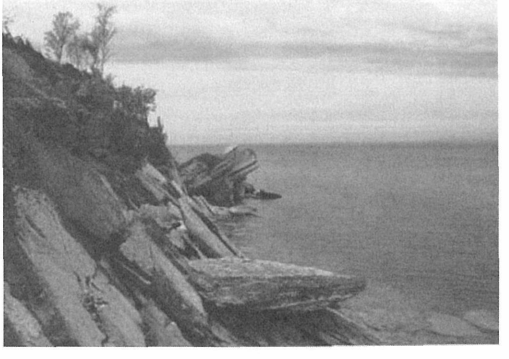


Figure 5



Earthquakes have also played a certain role in the shaping of shorelines, causing slides and remarkable changes in coastal escarpments up to 56 meters high, cut into Ordovician and Silurian limestones. The 4.7 magnitude Osmussaare earthquake on 25 th October 1976 affected an area of 191,000 sq km. Its epicentre was suposedly related to a fault zone running from the central Baltic via the Island of Hiiumaa to the coast of Finland. Because of this earthquake, particularly large masses of limestone blocks fell in front of the steep escarpments on the Island of Osmussaar.

Our recent investigations of mass movements at the North Estonian klint (Miidel & Raukas 2005) demonstrated the importance of joints and lithology in gravity erosion. The following types of mass movements were distinguished: rock falls, rock slides (or block glides), rotational slips and talus creeps. Rock falls are mentioned in the areas where the klint is exposed immediately at the sea or only a little away from the waterfront. Rock falls are the main factors related to the formation of the broad and thick talus in front of the escarpment. The material ranges from angular debris of variable size up to huge blocks. The size of the material depends on the spatial distribution of tectonic joints. The length of the blocks that have fallen down due to the sea erosion and earthquakes may reach 50-70 m (Fig. 5). As an example, in December 2003 during a heavy storm, an arch-like block, 9.4 m wide and 27 m long, and weighing about 1,500 – 2,000 tonnes, was involved in a rock fall in Pakri Cliff. Recent rock falls in the same place occurred in March 2008.

Rock slides are confined to the places where steep vertical walls consist of carbonate rocks and form the upper part of the escarpment. The slip surface is commonly formed by joint planes and is mostly associated with the terrigenous rocks in the lower part of the escarpment. In the case of rock slides, the rock block remains relatively monolithic and is not crushed. Often the downsliding beds face the sea. Rotational slips are related to the specific talus from Cambrian "blue clays". Such landslides may be triggered by heavy storms or rainfalls when the toe of the talus slope is eroded away. A great landslide took place at Toila in May 2001. The landslide was about 180 m long and formed a transverse ridge. In this process, sea erosion during the high-water stand plays a significant role, changing the equilibrium of the talus. The equilibrium can be disturbed also by the root systems of large trees. When the trees move back and forth in strong wind, their crowns act as wind-catching sails. Talus creeps occur in Cambrian clay areas, serving as a drainage pathway of groundwater percolating through the bedrock and discharging at the foot of the escarpment. As a result of talus creep, large blocks of Ordovician carbonate and Cambrian and Ordovician terrigenous rocks are found at the shore, 50-100 m away from the escarpment. Differences in mass movement depend on the geological structure. Talus is lacking in the western part of the klint and therefore rock falls prevail. Here in the eastern part of the klint, where the talus zone overlies Cambrian clays, rotational slips and talus creeps occur. In some places, due to slope processes, the edge of the escarpment reaches the old Tallinn – St. Petersburg highway and several houses, built on the klint edge, are in danger of falling down.

4 Influence of ship wave action

In recent years the staff of the Estonian Maritime Academy has intensively studyied the influence of stern waves in Tallinn Bay (Levald & Valdmann 2007 a. o.) Ships plying the Bay of Tallinn can be divided into two groups. One group comprises classical ferry boats and hydrofoil ships, the other group

consists of high speed catamarans and SuperSeaCat IVs. Intense traffic of high-speed passenger ships causes damage to objects located in the coastal area, creates problems in small ship traffic, and could be dangerous to holidaymakers on the beach. Hydrofoil ships and classical ferry boats do not cause dangerous waves to a large extent due to the fact that their stern waves do not exceed the reach of wind waves and they practically do not influence the coastal processes. Yet, the altitude of the stern waves of high-speed ships exceeds the altitude of wind waves highly many times a day (Käärd & Valdmann 2007, Soomere, 2005).

5 Conclusion

Some environmental changes in the Baltic Sea reflect global trends, the others reflect local and regional trends only. Nevetrtheless, it is important to compare them with global scale processes. In this paper potential marine, natural and anthropogenic hazards affecting the coasts in the Eastern Baltic area, were reviewed. In the long run the most important hazard for coastal communities is the rise in sea level. This problem is actual for the slowly sinking areas in the southern Baltic Sea (Poland and Germany), and also includes Lithuania and Kaliningrad District, where three potential adaption strategies (retreat, limited protection and full protection, Zeidler 1997) can be used. In the northern Baltic Sea the neotectonic uplift of the Earth`s Crust is faster than the rise of the sea level and this problem is not actual. Another major long-term hazard accompanied by the gradual increase of the water level, is the increased flood risk, which is already high even in several low-lying areas of south-west Estonia, where they may reduce the quality of coastal forests and damage low-lying buildings. Coastal hazards related to large wind waves (up to 4 m) and associated management issues are usually regarded to high water stand in autumn period. Rapid erosion and accretion can be the result of both short-lived storms and longer (sub-decadal) water-level changes. The results of both numerical studies and the analyses of historical wave data confirm that waves in the Gulf of Finland are relatively small and this is the reason why waves from the fast ferries form an appreciable portion of the total wave activity in Tallinn Bay. The daily highest ship waves belong to the highest 5% of wind waves in the area (Soomere 2005). Hummocky ice may also cause extensive damage to the coast. At the same time sea ice can reduce the wave loads during the ice season and protect the coasts.

Acknowledgements

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References

[1] Eronen, M. & Ristaniemi, O. 1992. Late Quaternary crustal deformation and coastal changes in Finland. – Quaternary International 11/12, 175-184.

[2] Haila, H. & Raukas, A. 1992. Ancylus Lake. - In: Raukas, A., Hyvärinen, H. (Eds.). Geology of the Gulf of Finland (in Russian, with English summary). Estonian Academy of Sciences, Tallinn, 283-296.

[3] Kvasov, D. & Raukas, A. 1970. On the late-glacial history of the Gulf of Finland (in Russian). – Izvestiya Vsesoyuznogo Geographitseskogo Obshchestva 102, 432-438.

[4] Käärd, A. & Valdmann, A. 2007. Laevalainete mõjust Tallinna lahes. (Influence of wave action in the Tallinn Bay). - Proceedings of Estonian Maritime Academy, 5. Tallinn, 23-35.

[5] Levald, H. & Valdmann, A. 2007. Aegna sadama arendamine (Development of Aegna port). - Proceedings of Estonian Maritime Academy, 5, 36-44.

[6] Miidel, A. 1994. Geological background of the present regional uplift anomaly in Estonia. – Proceedings of the Estonian Academy of Sciences. Geology, 43, 69-80.

[7] Miidel, A. & Raukas, A. 2005. Slope processes at the Northestonian klint. – Proceedings of the Estonian Academy of Sciences. Geology, 54, 209-224.

[8] Raukas, A., Moora, T. & Karukäpp, R. 1995. About the history of the Baltic Sea and early inhabitants in the Pärnu area. - In: Meidla, T., Jõeleht, A., Kalm, V., Kirs, J. (Eds.). Geology of Livonia (in Estonian with English summary). University of Tartu, Estonian Geological Society, Tartu, 119-124.

[9] Raukas, A., Tavast, E. & Molodkov, A. 1996. Partsi – a new promising area for the investigation of Late Boreal and Early Atlantic water level changes of the Baltic Sea. – Proceedings of the Estonian Academy of Sciences. Geology, 45, 92-101.

[10] Soomere, T. 2005. Fast ferry traffic as a qualitatively new forcing factor of environmental processes in non-tidal sea areas: a case study in Tallinn Bay. - Environmental Fluid Mechanics, 5, 293-323.

[12] Zeidler, R. B. 1997. Climate change vulnerability and response strategies for the coastal zone of Poland. – Climatic Change 36 (1-2), 151-173.

Text to figures

Figure 1. Water level changes at Kõpu, Island of Hiiumaa, Estonia (1), in western Latvia (2) and western Lithuania (3) with clear regressions of the Baltic Ice Lake and the Ancylus Lake.

Figure 2. Ancylus Lake shoreline about 9200 yr BP and main localities, mentioned in the text.

Figure 3. Under high-water conditions heavy storms cause severe damage on the coast. Island of Ruhnu, October 2001. Photo by K. Orviku.

Figure 4. Every year in some places ridges of pressure ice shape the shore. Photo by K. Orviku.

Figure 5. Rock fall on the Island of Väike-Pakri in May 2004. Big limestone blocks will defend the shore from further erosion. Photo by G. Baranov.

Instructor criteria for the "New Maritime Community"

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Abstract

Quality assurance in Maritime Education and Training (MET) may be said to rest on three principal elements: 1) the curriculum to be delivered, 2) the methodologies of delivery/assessment and 3) the resources required to achieve desired educational and training objectives. Of paramount interest in the third element is the human resource – in this context, the MET instructor.

The global emphasis on quality in MET has increased significantly in recent times. However, global uniformity regarding desired generic qualifications of the MET Instructor (as an index of quality) is not that obvious. Section A-I/6 of STCW95 requires each party to the convention to "ensure that instructors, supervisors and assessors are appropriately qualified for the particular types and levels of training or assessment of competence". The notion of "appropriateness" with respect to the technical training required by STCW 95 is arguably easy to arrive at. However "appropriateness", with respect to the delivery of curricula beyond STCW 95 (a real trend in the maritime community), is much more elusive. In pursuit of what Mr. Yohei Sasakawa calls "the new maritime community", it is pertinent to raise the issue as to what kind of MET instructor qualifications are "appropriate".

This paper discusses one tool for institutional self-evaluation, benchmarking and strategic decision-making regarding aggregate MET instructor qualifications and institutional orientation, vision and aims. It further reports findings of an exploratory study (at the World Maritime University) about how a lack of standards of MET instructor criteria detracts from or supports notions of quality in MET.

Introduction

Requirements for mandatory quality standards systems in MET in the STCW 95 Convention and Code (International Maritime Organization [IMO] 2001) have led to a perceptible permeation of a quality culture into maritime education and training institutions globally. This trend is shown quite clearly by the increased institutional subscription to quality assurance/management

systems such as ISO 9001:2000, although this may not have been exactly what was intended by the STCW 95 (IMO 2005). Quality is increasingly acknowledged to be an essential mindset for organizational success in today's world of globalisation and not just an extension of a legislative requirement.

Despite this state of affairs in MET, there are still many appeals for increased quality and the development of systems, procedures, cultures etc. that will create officers for a "new maritime community" (Ho 2004; Sasakawa 2006).

Quality in MET encompasses the concepts of excellence in output, resources, sustainability of product/service and industrial competitiveness, as well as (increasing and important) social and environmental responsibility. According to the ISO 9000:2000 series, quality is "the degree to which a set of inherent characteristics fulfils requirements" (Peach 2003). In this paper we define quality in global MET (limited to the IMO goals of cleaner oceans, safer and secure seas) as the consistent and continual improvement of global standards in all aspects of education and training that equip seafarers in cognitive, behavioural and affective domains to achieve/exceed global requirements/goals regarding safety and security of shipping, protection of the environment and long-term sustainability of efficient maritime transport. This is a step further than the requirements of the STCW 95 requirement for quality standards systems, which it defines as systems that are "able to manage and control all necessary activities and information through a set of documented procedures"(IMO 2005).

In consonance with the given definition, there is a clear need to clarify what global MET seeks to achieve in cognitive, skill and affective terms and in three essential domains:-

The curriculum to be delivered

Methodologies of delivery and assessment, and

The resources (including most importantly, the human resource) required for achieving desired educational and training objectives.

1.1 The prima facie purpose of MET

On the face of it, MET is supposed to produce competent people to operate ships at sea.

Reflecting on the three domains mentioned above, it is noteworthy that there has been significant work done (especially in the context of the IMO) to enable Maritime Education and Training institutions (METI) to meet this goal of producing competent people to operate ships. STCW 95, for example, defines the requirements of competence for being a qualified license holder, which should be clearly reflected in the teaching objectives of related curricula. Further to this, IMO Model Courses provide managers, instructors, assessors and students of maritime education and training institutions with valuable guidelines for course frameworks, teaching syllabi, and teaching/assessment

methodologies. It can be said, therefore, that there have been attempts to significantly address the first two elements, at least at the technical competence level.

However, such attempts are not so evident regarding the third element and particularly the human resource for delivering the curriculum. Though it is acknowledged that there is a clear statement in STCW sections A-I/6 and A-I/8 requiring parties to ensure that "instructors, supervisors and assessors are appropriately qualified", it is evident that the term "appropriately qualified" is context and time dependent and detracts from gaining a universal standard regarding quality. In contrast to the progress in the development and organisation of technical curricula and the establishment of assessment procedures, issues relating to the qualifications of instructors and assessors at METI (as a global index of quality) seem to have been left behind.

1.2 A more latent purpose of MET

Quality in higher education has been defined, among many other definitions, as "fitness for purpose" (Council for Higher Education Accreditation [CHEA] 2001; Harvey 1995; Harvey and Green 1993). The purpose and quality of MET may be said to go beyond the direct meeting of industry need related to the provision of technically competent ship crew. In light of current trends, one significant purpose of MET should be the holistic development of the human resource employed on ships to facilitate the emergence of clear career paths and options for the trained ship's officer. Ironically, this shift of focus to the needs of the seafarer rather than the primary competency needs of the shipping industry will in the long term better serve the interest of the industry. Among other benefits, the institutionalization of this shift of focus from purely technical matters will make the industry more attractive to younger people (who will recognise that the education and training they receive gives them options later in life and that they will not necessarily have to be consigned to a life at sea by virtue of a restricted technical education (see e.g. the suggestion of the European Commission 2006)).

There appears to be a real and probably unstoppable trend toward METI offering more than fundamental STCW-based curricula. However it also appears that these "extra-IMO curricula" have been left largely to individual MET institutions. These seem to have no real structured way (as per a globally accepted benchmark) to make the determination as to what is required by global stakeholders as a whole. As a result there are significant variations in what each MET institution considers "appropriate" with such variations evident even among faculty of individual institutions.

When looking at the technical training required by STCW 95, what is "appropriate" regarding instructor/assessor qualifications is arguably easy to arrive at. On the other hand, when other curricula intended to create more rounded maritime officers for a new maritime community are considered,

"appropriateness" becomes a much more elusive concept. This elusiveness is further exacerbated by the fact that the static/reactionary nature of regulation (in this case STCW 95) juxtaposed against the dynamism of context with time (changes of socio-technical, legal, industry practice and curricula needs), creates a tension that is not easily resolved – at least on a global level and that seems to require institutional dynamism not presently in place.

As a result of all this, we consider it appropriate to raise the issue of MET instructor qualifications while maintaining an acknowledgement of the greater importance of developing curricula that comprehensively addresses the needs of a new maritime community.

2 Qualifications and experience of instructors in MET institutions

2.1 Academic and professional careers as experience of instructors

Conceivably, the content/delivery of a subject provided by various instructors will not be exactly the same even if they have the same syllabus, textbooks and teaching facilities. This is because the style of teaching depends not only on the subject area, but importantly also on the processes that the instructor has undergone when obtaining his/her knowledge and skills. Taking, for example, the subject area of diesel engines, one instructor who has mainly gained theoretical knowledge of diesel engines from a designers' point of view will usually emphasize fundamental performance and the structure of diesel engines in his/her classroom, whereas another who has a long career as a marine engineer may attach greater importance to the know-how of the operation of the marine diesel engine. While it is debatable which of the above backgrounds and styles would be more "appropriate", it is evident that the instructor, together with his/her background and delivery, does significantly influence the delivery of the formal curriculum as well as the hidden curriculum and by extension the quality of the end product of MET. The hidden curriculum (Jackson 1968), which "includes all of the unrecognized and sometimes unintended knowledge, values, and beliefs that are part of the learning process in schools and classrooms" (Horn 2003) and is influenced by the instructor's background, may well be fundamentally more important for generating "professionalism" in the mariner than the explicit curriculum.

In general, the complete educational/training package delivered at a maritime institution consists of diverse curricula items provided by instructors with different qualifications. Some curricula items are knowledge-based and others are skill-based. In other words, institutional MET is supported by a team of many specialist instructors with sometimes significantly varying expertise and backgrounds. The number of such specialist instructors can be very high, especially where the education is supposed to lead additionally to the award of an academic degree. The students are consequently exposed to and gain various

forms of knowledge, skills, attitudes and motivation from each of the faculty members with diverse backgrounds. It is reasonable to hypothesize that – allowing for individual personalities and other extraneous factors - the graduating student is a product of the whole course curriculum and its delivery as influenced by the total "summary/aggregate" of the backgrounds of the teaching staff involved in the delivery of the curriculum. This "output" can furthermore be said to be characteristic of the general output and potential of the maritime institution.

2.2 Instructor qualifications/experiences and quality standards and management

As indicated in STCW 95 (e.g. in paragraph 2 of section A-I/8 and paragraph 4 of section B-I/8 of the Code), the qualifications and experience of instructors and assessors are relevant to the attainment of globally accepted quality standards. Various quality assurance systems e.g. ISO 9001:2000 - though not specifically named or required by STCW 95 (IMO 2005) – are in agreement with the STCW 95, with quality-focused human resource management being regarded as an essential requirement (see for example International Organization for Standardization [ISO] 2007). Quality assurance - whether intended to help meet the requirements of STCW 95 or to serve as an inherent institutional value system to meet customer demands - require that all activities be verifiably planned and implemented based on their place vis-à-vis the attainment of stated aims and objectives in a continuous cycle of improvement (Deming 2000). Effective decision-making appropriately based on the implementation of the "plan-do-check/study-act" cycle inherent in all quality management systems requires drawing on valid conclusions derived from real and measurable data and not guess work.

3 Preliminary study

In an earlier paper, an evaluation model/tool aimed at acquiring measurable human-resource related data for evaluation and decision-making was proposed (Nakazawa 2002). In the development of the tool, academic education (AE) and practical training (PT) were selected as two main domains/categories based on a synthesis of the requirements of education and training. These two broad scopes were also chosen because of current trends towards an academic emphasis in course delivery in some institutions; while others retain a practical certificate of competency orientation exclusive to all else. With reference to academic education, academic degree and teaching experience were used as measurable variables. Similarly, certificate of competency and seafaring experience are used for the practical training domain. In all, the variables for evaluation in the tool were:

Academic Degree (AD)

Teaching Experience in MET (TE)
Certificate of Competency (CC)
Seagoing Experience (SE).
Using a self-developed quantitative ranking system and formulae derived from calculations for the centre of gravity of plane areas, the tool could be used to evaluate an institution from diagrams such as shown in figure 1.

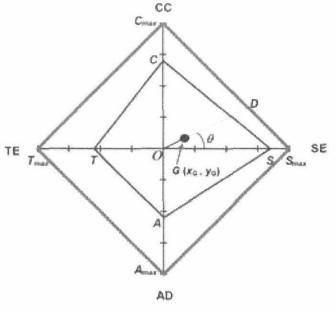

Figure 18: Geometric analysis for institution orientation/disposition

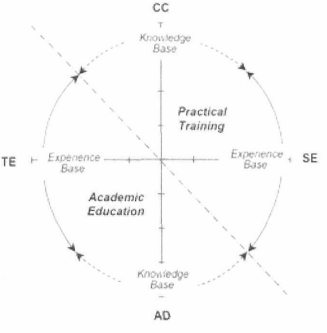

Figure 19: Institutional

Relevant indices, positions and lengths are obtained from figure 1:
Index P - defined as the ratio of the area enclosed by the blue lines (A), to that enclosed by the red lines (A_{max}) – gives an indication of an institution's overall potential compared to a theoretical maximum in both academic and practical domains.
The location of the centre of gravity, G (x_G, y_G), of the quadrilateral $CSAT$ is the balance point of the aggregate of instructor qualifications. The coordinates at G are x_G and y_G.
The length between the origin O and the centre of gravity G indicates the deviation from the even point where the four variables are completely balanced.
Index D is the ratio of the length between the centre of gravity and the origin, OG, to the maximum length, OD, at the angle θ,
Finding these details for any institution gives an assessment of institutional orientation based on figure 2 (see Nakazawa 2002 for complete details of the use of this tool).

4 Follow-up study: Global benchmarking

In a follow up to the primary study (and as an exploratory study) we use the principles on which the model is based to suggest a way of finding out the global aggregation of **opinions** regarding the importance of the different variables at any specific time in the maritime industry.

4.1 Methodology

A brief survey was conducted with a limited sample of instructors and management personnel of MET institutions around the world to generate representative results as a reflection of what opinions might exist in a global context. The sample was limited because of the exploratory nature of this study. Invitations were sent out to individuals in various institutions to answer a web-based questionnaire. The institutions were chosen from the IAMU membership as well as from a comprehensive list of Maritime Education and Training Institutions reporting to the IMO and who offer STCW-compliant certificate of competency courses.

In all 68 responses (9 female and 59 male) were received from 37 institutions in 28 countries.

The survey obtained data regarding type of institution the respondent works in, perceived stakeholders, institutional dependence on external policy/legislation/funding and demographics of respondent. Among other questions, the survey asked respondents to rank the variables academic degree (AD), certificate of competency (CC), teaching experience in MET (TE), and seafaring experience (SE) on a scale of 1 to 10 (10 being the most important criteria an instructor should have in meeting the needs of the respondent's institution). Based on the respondents' ranking, quantitative measures were given to the variables.

4.2 Findings

Descriptive statistics for this particular question in the survey are as indicated in table 1.

Table 1: Descriptive statistics for 4 variables

	N	Minimum	Maximum	Mean	Std. Deviation
CC	68	3	10	8.43	1.887
SE	68	1	10	8.22	2.058
AD	68	1	10	8.03	2.233
TE	68	1	10	6.38	2.052
Valid N (listwise)	68				

Respondents to the survey belonged to 4 main types of METI:
Training institution/college/academy (only for Cert. of Competency)
University/college/academy (degree awarding to Bachelor's and Cert. of Competency)
University/college/academy (degree awarding to Master's and Cert. of Competency)
University/college/academy (degree awarding to PhD and Cert. of Competency)

Of primary interest was the determination of whether the respondents' ranking of the stated variables (treated as a continuous variable) was influenced by the kind of institution to which they belong (treated as a categorical variable). To assess this, a non-parametric statistical test was performed, since the assumptions of normality for the data were not met. The Kruskal-Wallis Test (using SPSS version 16) showed a statistically non-significant difference in all the measured variables across these types of MET institutions (see table 2).

Table 2: Kruskal-Wallis Test results

Test Statistics [a, b]				
	AD	**CC**	**TE**	**SE**
Chi-Square	2.265	3.809	0.957	0.019
Df	3	3	3	3
Asymptotic Sig.	0.519	0.283	0.812	0.999

[a] *Kruskal Wallis Test*

[b] *Grouping Variable: METI type*

This implies that the ranking of importance given to the four different variables by respondents in this sample was not related to the type of METI they belonged to; suggesting that there is currently significant ambiguity across METI types in what is felt to be the most important variable for MET.

To generate calculations based on the tool in the earlier study (Nakazawa 2002), the means in table 1 were multiplied by a factor of 0.4 thus obtaining mean values for the variables from this sample as follows:

CC = 3.4, **SE** = 3.3, **AD** = 3.2 and **TE** = 2.6

These mean values generate a radar diagram as shown in figure 3 which can then be analysed using the formula introduced in the evaluation tool from the preliminary study.

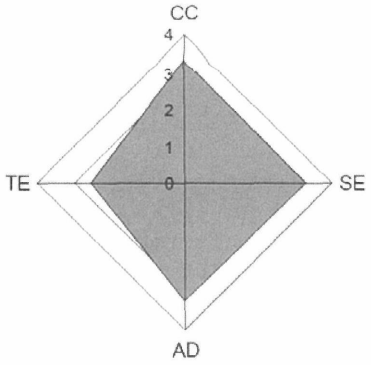

Figure 20: Ranking for variables

We obtain the following results:
P = 0.608 (i.e. 60.8 %), $x_G = 0.25$, $y_G = 0.05$, $\theta = 11.0^0$, and D = 0.074 (i.e. 7.4%). The conclusion drawn is that despite the perceived increase in academic orientation in METI, with regards to qualifications of instructors, the global MET community (as represented by this sample) retains a greater orientation (in opinion) towards practical training than it does towards academic education with about 7% deviation from a perfect balance between the two.

5 Discussion and conclusion

5.1 Purpose and use of the model

Though many international conventions, guidelines and quality standards systems support activities related to quality maritime education and training, the teaching staff, as the most directly involved human resource, exert the most influence on the real quality of a MET institution. The tool introduced here is aimed at better assessing institutional position with respect to this important resource.

It is not the intent of the authors to suggest a tool for ranking maritime institutions. The tool/model is put forward as a suitable means of verifiable self-evaluation regarding the aggregate potential of specific institutions based on the qualifications and experience of the teaching staff. This is beneficial for management, stakeholders and customers alike. The principles on which the model is based also bring the global community one step closer to global benchmarking regarding suitable MET instructor qualifications.

It should be noted that the introduction of the model/tool in the primary study is not intended to be a wholesale endorsement of Quality Management Systems as they are applied today. The merits of the way in which such systems

are applied and their overall effectiveness are debatable (see for example Seddon 2000) and such debate is not the focus of this paper. We only recognize that irrespective of what model of quality management is subscribed to by an institution, decision-making and self-evaluation based on real, measurable data are critical to the progress of an institution. It is to these ends that the tool is introduced.

As mentioned earlier, the index P shows the aggregate potential for MET based on instructor qualifications. Ideally this would be 100%, but achieving this would appear to be utopian. The index number D shows the deviation from the potential even point (perfectly balanced point) of a maritime institution. It is optimum when this is close to zero. However deviations into the first quadrant could be an institutional goal, for example where there is great demand for marine officers and students who do not mind a restricted field of career options (as pertains in some developing countries). Even where there are deviations from the centre, it would seem preferable, optimally, that the angle θ is close to 45 degrees to indicate a perfect balance between a knowledge-based education and an experience-based one.

With respect to human resource management, this model gives indicators for assessing the status quo as well as for strategic recruitment planning to meet needs at all levels (institutional, departmental or even at training course level). If, for a specific institution, department or course, it is intended to emphasize one domain over the other, recruitment policies can be rationally made and defended based on the current location of G. Take the case for example, of an institution which intends to offer more practically oriented training. If the status quo has G located in the third quadrant, the tool will allow for a determination of this and subsequently policy decisions can be made to move G into the first quadrant by attracting and recruiting new instructors with COC, hopefully at the management level, and with significant seafaring experience.

While it is possible for assessments, decision-making and subsequent action to be based on intuition/gut feeling, this evaluation method is considered a better alternative because it comprehensively meets the key elements of a quick, systematic and verifiable approach to strategic planning in human resource management. To quote Deming (1982):

> *One of the main aims of improvement in quality is to reduce variation of product. The only safe guide to the cause of variation, to detect the existence of a special cause, is use of statistical signals. The naked eye looking at figures is not a safe guide: it is a hazard.*

5.2 Bridging international gaps in standards

Arguably no industry is more international in the scope of application of what is learned on the global stage than the maritime industry. What has been referred to as the internationalisation of higher education; "the process of

systematic integration of an international dimension into the teaching, research and public service function of a higher education institution" (Wächter 1999 as cited by Van Damme 2001) is even more pertinent to the maritime industry than to most. In our opinion, significant effort should begin to be placed on the merging of different criteria to determine what it is MET is trying to produce at an international level and the kind of instructor who will facilitate this. In the words of Paine-Clemes (2005): "we must agree on what we are trying to achieve: technical proficiency, cognitive growth, character development, intellectual breadth and depth, or a particular combination thereof". The WMU exploratory research indicates significant differences in respondent's opinions about instructor criteria (irrespective of gender, institution, institutional rank, seafaring experience or academic qualifications). We acknowledge that no matter what is agreed to internationally, there is substantial institutional diversity to warrant individual institutions fine -tuning any global parameters. Unequal training does exist in an unequal world (Sampson 2003). The prioritisation of stakeholder needs varies depending on factors such as national policy, the economic state of a country, degree of maritime dependence of the state etc. It can be appreciated that in such a variety of contexts, it is no small task to find a consensus for the criteria of the qualifications and experience required for instructors and assessors at maritime institutions. However it is essential that more detailed global parameters exist beyond the level articulated by such terms as "appropriately qualified" with respect to instructor qualifications.

This is a goal that the global maritime community must attempt to reach considering the global nature of the delivery of shipping services and the key role human resources play in quality achievement in MET. The following quote from Van Damme (2001) is insightful:

> *From the wandering scholars of late-medieval times...to the emergence of a mass higher education system and the making of a global virtual culture, universities have been related to social and cultural movements which have the ambition in common not to confine themselves to particular spatial boundaries....However...universities are also a product of the modern nation-state".*

This duplicity in the role of and influences on tertiary educational institutions is particularly onerous where maritime education and training is concerned. MET institutions aim at preparing individuals for a very international industry with the highest requirements of multinational and multicultural cooperation at a personal level and further to equip these individuals with the skills, knowledge and behavioural education required for diverse careers beyond a life at sea. The need for better internationalisation is best articulated by Sasakawa (2006): "... in order to solve emerging issues

related to the sea, we need to reform the traditional system of the maritime community, in which each government basically acts as an individual".

Is this an achievable goal? With respect to global MET instructor criteria, it does seem so. It should be possible to develop at least generic standards that MET institutions can meet with respect to their instructors as a whole and not infer an evaluation of individual instructor competence.

6 Limitations of this study

A pertinent consideration is that evaluating an institution's human resource is both difficult and sensitive. However, an objective evaluation of any educational institution cannot be achieved without a consideration of academic curricula and teaching staff. In trying to maintain objectivity, the authors recognize that other data should be considered when looking at performance of teaching staff as a whole. We have been careful to indicate that this study is limited to the variables that are deemed relevant to academic and practical training qualifications/experience. We acknowledge other variables that influence performance such as motivation, remuneration, availability of other resources/infrastructure, institutional ability to attract and retain instructors etc. This study does not include these variables.

Similarly the study uses teaching experience and seafaring experience as (*ceteris paribus*) being indicators of proficiency in performance, while acknowledging that teaching experience in years may not be directly proportional to capability in teaching, nor number of years at sea directly proportional to relevant sea experience.

It is also worth noting that the relationship between academic degree and teaching experience is not as strong as that between the possession of a certificate of competency and seagoing experience.

Regarding the exploratory study, even though the sample size of 68 was statistically adequate taken as a whole, the number of responses per institution/country could not be said to be representative enough of the institutions/countries. Accordingly we refrained from drawing conclusions with respect to specific institutions or countries.

7 Further research

The follow-up study was by no means exhaustive being in nature a preliminary, exploratory study to determine the need for a further exhaustive (in scope and depth) study into instructor criteria and quality in MET. It is envisaged that the next stage of this work would consider a much wider sample - covering as much of global MET as possible – and rely on official data retrieved from specific institutions instead of the use of questionnaires directed at individuals, thus shifting the focus from opinions to actual instructor

qualifications. This shift will also remove the element of marked subjectivity evident from ambiguity even among individuals from the same institution when opinions are considered.

The main aim of any such research would be to check for the presence/absence of any relationships between institutional focus of MET and instructor criteria, controlling for factors such as economic positioning and maritime dependence of an institution's host country as well as perceived stakeholders in the institution and their needs. We further anticipate that the substantive study when completed in the future will contribute to the acquisition of an empirical basis for non-legislative global benchmarking with respect to MET instructor qualifications for a new maritime community.

Lastly we note that the grading numbers used for different academic and practical qualifications in the original tool were subjectively generated to achieve an ordinal ranking. Further research will be needed to generate an objective ranking based on empirical data.

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References

[1] Council for Higher Education Accreditation [CHEA]. 2001. "Glossary of key terms in quality assurance and accreditation."

[2] Deming, W. Edwards. 1982. Quality, productivity, and competitive position. Cambridge, MA: Massachusetts Institute of Technology.

[3] Deming, W. Edwards. 2000. Out of the crisis. 1st MIT Press Edition. Cambridge, Mass.: MIT Press.

[4] European Commission. 2006. "Green paper: Towards a future Maritime Policy for the Union: A European vision for the oceans and seas." Brussels.

[5] Harvey, L. 1995. "Editorial: The quality agenda." Quality in higher education 1(1):5-12.

[6] Harvey, L and D Green. 1993. "Defining quality." Assessment and Evaluation in Higher Education 18(1):19-34.

[7] Ho, D. M. 2004. "IT...all begins with people." Digital Ship Plus 23:14-16.

[8] Horn, Raymond A. . 2003. "Developing a critical awareness of the hidden curriculum through media literacy." The Clearing House 76(6):298-300.

[9] International Maritime Organization [IMO]. 2001. International convention on standards of training, certification and watchkeeping for seafarers 1978, as amended in 1995 and 1997 (STCW Convention). London: Author.

[10] International Maritime Organization [IMO]. 2005. "STCW Convention: Background to quality - IMO quality standards system document number LN-01-QSS-R05." London: IMO.
[11] International Organization for Standardization [ISO]. 2007. Quality management systems: Guidelines for the application of ISO 9001:2000 in education. Geneva: Author.
[12] Jackson, P. W. 1968. Life in classrooms. New York: Holt, Rinehart & Winston
[13] Nakazawa, T. 2002. "Evaluation of maritime universities/faculties based on the qualifications of the academic staff." In Third General Assembly of the International Association of Maritime Universities: Enhancing global maritime excellence. Maine, USA.
[14] Paine-Clemes, Bunny. 2005. "What is quality in maritime education?" In Proceedings of the International Association of Maritime Universities (IAMU), 6th Annual General Meeting and Conference on Maritime Security and MET, World Maritime University, Malmö, Sweden, ed. Detlef Nielsen. Southampton: Witpress.
[15] Peach, R. W. 2003. "Overview of the ISO 9000 series standards." In The ISO 9000 handbook, ed. R. W. Peach. 4 Edition. New York: McGraw-Hill.
[16] Sampson, Helen. 2003. "Equal training in an unequal world? An examination of global MET standards." In Seafarers International Research Centre's 3rd Symposium - 2003. Cardiff University, Cardiff, UK.
[17] Sasakawa, Yohei. 2006. "Development for a New World Maritime community." In 7th General Assembly of the International Association of Maritime Universities (IAMU). Dalian Maritime University, Dalian, China.
[18] Seddon, John. 2000. The case against ISO 9000. Dublin: Oak Tree Press.
[19] Van Damme, Dirk. 2001. "Quality issues in the internationalisation of higher education." Higher education 41(4):415-441.

A ship's waste reception facility for the marine environment

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Abstract

Hydrocarbon spills cause marine pollution and those spills occur due to tanker accidents, ballasting, flushing of refinery plants, offshore drilling and pumping, shipping activities, petroleum transporting, polluted rivers, industrial and domestic effluent. Various marine organisms such as plankton, algae and fish may be affected by marine pollution.

As a signatory to the International Convention for the Prevention of Pollution from Ships, (MARPOL 73/78), and as a member state of the International Maritime Organization (IMO); Turkey is obligated to establish port reception facilities for ship-generated waste. As an initial step, Turkey is considering the establishment of such facilities in all Turkish ports. At present, even in some European countries that are parties to the MARPOL 73/78 Convention lack port waste facilities, leaving the countries vulnerable to pollution from solid and oily wastes that may be disposed at sea. These wastes are transported by wind and currents to shores often in locations distant from the original source, causing serious pollution. In this paper authors discuss the establishment of a port reception facility in the Republic of Turkey. The authors collaborated to develop a waste reception facility for the Port of Izmir and its immediate environs.

Keywords: *Ship's waste, port reception facilities, marine pollution, MARPOL convention, port operation, waste treatment.*

1 Introduction

Since the maritime industry is achieving its goals by developing itself, marine pollution has been increased steadily due to heavy maritime operations. The first step to prevent marine pollution was the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), accepted by International Maritime Organization (IMO) in 1973, modified later in 1978. The MARPOL 73/78 Convention has a purpose of reducing marine pollution caused by ships. According to the new regulations, the International Maritime Organization (IMO) requires all member states to build port reception facilities or renew the present one(s), in order to reduce marine pollution. MARPOL 73/78 obviously requires member states to take serious precautions to eliminate marine pollution.

Since import/export involvements have been increased dramatically, marine transportation has been required to enlarge its routes in order to respond the transportation demand. The Maritime industry develops itself by enlarging its fleet and involving joint ventures with multinational shipping carriers. On the other hand, major ports are being renovated in order to handle increased number of tonnage/container and increasing ship traffic. Due to the mentioned reasons, ports are being kept busy with handling cargo. A large volume of shipments forces port authorities to outsource their business. In addition to this, port authorities do not prefer to deal with secondary tasks. Port managements outsource the business into segments in order to focus on their core business which is how to improve their cargo flow. As a result, this paper will focus on the selection of a suitable site for a treatment facility for ship generated waste collected at waste reception facilities at the Port of Izmir.

2 Marine Pollution and Port Reception Facilities

It is common knowledge that "pollution" is the environmental damage caused by wastes discharged into the sea; the occurrence of wastes at sea and the wastes themselves. But marine pollution is defined by GESAM as: "Marine pollution is introduction by man, directly or indirectly, of substances or energy to the marine environment resulting in deleterious effects such as: hazards to human health, hindrance of marine activities, including fishing, impairment of the quality for the use of seawater and reduction of amenities (IMO, 1999). Tanker accidents are the major reason for the oil pollution. Besides tanker accidents, oil pollution may be generated by noxious liquid substances in bulk, pollution by harmful substances carried by sea in packaged form, sewage from ships, garbage from ships and air pollution from ships. Pollution from ships is one of the inputs of marine pollution, all inputs of the marine pollution (IMO, 1999).

Port reception facilities will significantly contribute to the protection of the country's marine resources and the preservation of its ecosystem and the general marine environment. It will also separate hazardous from non-hazardous waste in general and reduce pollution levels of the harbor and its environs. On the other hand, port reception facilities will be contributing to GDP in an economical way by marketing the recycled oil to the market. Facilities will contribute to the creation of long-term economic benefits through income generation and employment opportunities. Oily mixtures from feeder or oceangoing ships will generate a final disposal for market use.

The IMO has been working on MARPOL for more than 25 years in order to make it more efficient for member states. MARPOL Annex I, II and V were accepted by the Republic of Turkey on June 24, 1990. Regulations are now being enforced by the Turkish government after several modifications. For several years different models for reception facilities were developed by IMO. Member states are now to apply one of those models for reception facilities.

In Turkey most of the ports have their own reception facilities but most of the facilities lack efficient handling, technology and support services. For many years the government couldn't invest enough to improve the quality of port reception facilities. In Turkey a significant number of ports belong to the government or its agencies. Due to the new requirements of MARPOL, port authorities are now willing to privatize the recycling process to privately held companies. That is because the port aims for effectiveness in its core business rather than dealing with recycling process; and of course port authorities are to supervise the ongoing recycling activities in its boundaries. That means port reception facilities will be handled by entrepreneurs. MARPOL 73/78 does not only require ports to have reception facilities but also requires any facility that has activities with oil and its products, such as ship breaking facilities and factories produce chemical products or leather etc.

There are 295 port facilities including tanker terminals, bulk terminals, fishing and yacht ports in Turkey. Twenty of them are the major ports in Turkey. Most of the ports are managed by government service Turkish National Railway Systems (TCDD). Lack of investments in port reception facilities have generated a significant shortage for the regulations, but generated an important investment opportunity for entrepreneurs.

A reception facility must have proper equipments and should be able to get involved with recycling procedures according to the international regulations. There are different types of facilities that follow different recycling techniques. Those different types are: oily treatment equipment facility, noxious liquid substances treatment equipment facility, sewage treatment equipment facility, garbage treatment facility, laboratory and other equipment. In Turkey, according to regulation 8 and 11 of the Environmental Act, every organization must establish and operate collecting and treatment facilities. In December 2004 the Regulations of Collecting Waste from Ships came into force in Turkey. These regulations arrange collecting waste from ships, and establishing and managing

reception facilities in Turkish Ports. According to the new regulations, existing reception facilities will be upgraded and new reception facilities will also be established within a year.

3 Port of Izmir

Port of Izmir is operated by General Directorate of Turkish State Railways and located in 38° 25' 00" N, 27° 09' 30" E. Izmir is situated at the east end of Izmir Bay. To reach the main facilities of the port of Izmir, a ship must enter Izmir Bay (inlet) from the Aegean Sea on a southeasterly course for about 20 nautical mile, then turn eastward through Izmir Bay for about 10 nautical mile. The port of Izmir is Turkey's third largest port and has the best natural harbor. Traffic at the harbor is not congested; the ships transit the channel each day. Plenty ships can load/unload simultaneously (TCDD, 2006).

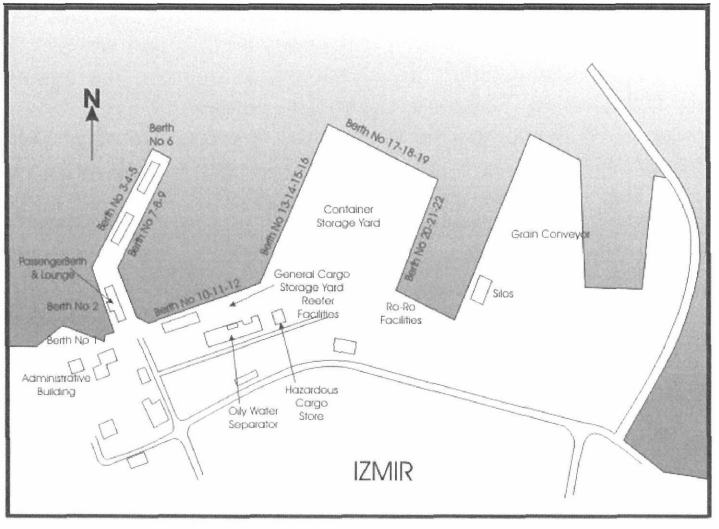

Figure 1: Plan of Izmir Port

The current recycling plant in Izmir was established with the fund supplied by World Bank foundation in 1986. The present facility has currently no recycling activities due to the outdated technology and old equipmens. The only current activity is the storage of inflow oil waste. There is an international company that collects ship-generated wastes from the port of Izmir. This company uses a wet bulk carrier to load the wastes and carry it to the plants. Since there has been no competitor against this international firm, the port of Izmir was exposed to accept any offer that had been made by this company. A

new establishing company will increase the amount payable to the port such as lease payment which is significantly valuable for any port/terminal. Paying lease to the port authority will lead the new establishing company to do the marketing job very well in order to expand its total revenue from its total costs. This process will lead both firms to get involved in a perfect competition.

4 Treatment of Oil Waste

The goal of this section is to define the existing treatment technologies that are used for recycling, destroying, and recovering energy from oil waste. Oil waste treatment is performed extensively. Currently in Turkey, thousands of tons of used oil are generated. Most of the waste doesn't go through the treatment process; however significant number of oil wastes is used as fuel oil. Some of the other categories that oil wastes are used for such as; asphalt, lube oil and other products.

Specifically, the discussions will summarize:

- Technological concepts
- Applicability to oil waste steams
- Extent of use
- Advantages and disadvantages
- Product streams.

4.1. Final Product

Ships generate a serious portion of oil wastes. Oil wastes consist of water or the other materials to be separated during the recycle process. This greatly increases the volume of oily waste for treatment and disposal. Ideally collected oil should be reprocessed through an oil refinery or recycling plant. Unfortunately this is not often possible as the oil may have weathered or been contaminated with debris and seawater. As far as possible the different types of oily waste should be collected and stored separately as each type of waste may demand the use of different disposal options. Various methods of disposal are available including direct disposal to controlled landfill sites; use in land reclamation, road building, factory use or similar activities; and destruction by incineration or biological processes.

The waste oil re-refining operation in the Port of Izmir has fortunately no activity. Besides ship-generated oil wastes, used oil is also generated through various activities including auto repair, metal working, machine lubrication, hydraulic equipment repair, and ship operations. Ship operations is our first goal to achieve and as a long term goal the company should be willing to spread the idea of recycling any kind of oil waste that can be collected from manufacturing plants that are located all over the city of Izmir. Oil can be recycled to make new lubricants or industrial fuels. If properly recycled, used oil can no more be

considered as a hazardous waste. Companies that are dealing with waste management have to be familiar with different types of wastes given below.

Ship generated wastes:

- Used lubrication oil,
- Fuel residues,
- Sludge,
- Oily water,
- Dirty ballast water,
- Oily tank washing.

Ship generated wastes do not wear out, they just get dirty. hey can be used over and over again. 14% of used oil that is reclaimed is re-refined to its original virgin state. Re-refining base oil is the end product of a long process. The oil is first cleaned of its contaminants, such as dirt, water, fuel and additives. This is done through a process of vacuum distillation. The re-refined oil is blended with a fresh additive package to make the finished lubricant. 75% of used oil which is reclaimed is reconditioned and marketed to:

- Asphalt Plants
- Industrial Boilers
- Power Plant Boilers
- Steel Mills
- Cement/Lime Kilns
- Marine Boilers (Bunker Fuel)
- Pulp & Paper Mills
- Other

5 Business Structure

Recycling facilities will be handled by a privately held firm(s) located in the Port of Izmir. The new company may be seeking to be at the top of oil recycling industry in Izmir. Since there is no oil waste recycling company in Izmir, it is a logical opportunity to establish a facility that recycles collected oil wastes from ships and sells it to potential customers. The new company will be working in teams, including; administration, accounting engineering, marketing, and port operations.

The engineering division will handle the recycling process and production process, the marketing division will handle communication with ship owners and potential customers who are willing to buy the outflow oil waste. The accounting department will deal with financial analysis for use of the

administration and the public. Port operations will deal with daily port operations including the process of collecting oil wastes from ships and transporting them to the facility. Administration will be the top management that makes sure all activities fit their purposes.

As we mentioned before, used oil has a significant value for the companies that are willing to cut heating oil costs. The first target is to find out all the potential customers and build long a term relationship with them. The plant has to be extensively equipped and its machinery for recycling oil waste should match the requirements. Recycling process, assembly, and testing all technical activities should take place in the plant. Systems and procedures must be in place and geared towards high standards of quality control and willing to meet the acceptance criteria of oil waste processing.

6 Establishing the Facility

In a port reception facility, for the start up process, there must be one vertical reactor (mixer), one reactor, two heated oil boilers, two condensers, vacuum-pump units, raw materials and product storage tanks, and generator and purification units. In the facility electricity is ideal used for production process. According to port statistics, the estimated electricity consumption will be 100 KW per day. Twelve personnel are ideal for the planning process of the facility and 18 personnel is ideal for the operation process in the Port of Izmir.

In this facility, there should be at least two 150 ton capacity storage tanks (inflow) for oil wastes and three 100 ton capacity product storage tanks (outflow) for the final disposal. All types of tanks must be made of special steel that has a proof of quality from the Turkish Standards Institute (T.S.E). The facility must be working 24 hour/day and 365 days/year in the Port of Izmir. Total capacity estimated of inflow is 200 ton/day (200 ton*365 days= 73000 ton/year). Raw materials are the oil wastes that are collected from ships.

Since the facility will be located in the port of Izmir, transportation has to be handled either by licensed trucks, pipelines or barges from ship to facility. As we mentioned before, the transportation system may vary according to the company's financial aspect. If a company focuses on short term benefits, then transportation must be handled by licensed trucks. Transportation of the inflow depends on the location of the facility. The most suitable system for transporting the wastes from ships to the facility is pipelines.

As an initial step of the recycle process, two reactors are used to separate the raw materials. Oil waste is be heated to 300-350°C by using a distillation method in order to separate the raw materials. Some parts of the oil wastes cannot be evaporated. Those parts are called deep product which are raw materials for asphalt production. Deep products are pumped into product tanks. Right after that, products stay in the distillation column which is a part of reactor, in order to be cooled down. The cooling down process is handled by

condensers. A vacuum pump is the equipment to vacuum the condensed material and transfer it to the tanks.

Separated products should be taken to the product tanks and will be stored there until the analysis results prove the quality of the products. Analysis is a very important step for the recycling business. Analysis reports identify the type of product and its quality level. After the analysis process, the product is to be filtered by a one micron size gland. This step is needed to collect very small compounds or particles from the oil waste in progress. This is one of the important procedures of the recycling process because factories that use oil wastes as heating oil may encounter problems with the production cycle due to the small particles. Those particles have to be cleared out from the refined oil waste. Those tiny particles may even cause serious damage to the factory's machinery and may cause a production stoppage. After the filtering process, products will be available for market use. Filters are to be placed in pouring exit of the tankers in order to collect little particles. Three glands will be used for this process and glands are to be changed every six months or every year depending on the capacity of the facility.

7 Business Strategy

The new company will be established on a strategy that consists of continuous improvement that seeks improved efficiency and lower cost through better discharge operation, recycle process, products and services. The goal is the perfection in the core business of collecting oil wastes from ships, recycling them and selling the final product to the market as well as maintaining the operations while preventing the blue from pollution.

The new establishing company should have a vision that makes the flow process more efficient and beneficial in terms of achieving the organization's goal. In order to establish an efficient flow process, the company's marketing department should seek to stabilize the inflow and outflow in terms of building long-term business relations with the ship owners as well as with the buyers of outflow. The company's marketing department should follow the given given principals in order to stabilize the flow process.

- Marketing research must have straight information in order to design, collection, analysis, and reporting of data to the recycling business.
- The company should decide what customers to serve.
- Prices should be in accordance with the competing ports in order to gain more inflow oil waste.
- Advertisements should be spread out through the company's website or media mass.
- Customers are to be satisfied by supplying qualified products because customer equity is the main element that leads businesses grow.

8 Conclusion

In this paper we discussed the concept of a port reception facility in the Republic of Turkey. With the International Convention of MARPOL 73/78, port reception facilities have become an important function of a port. Due to the new regulations of MARPOL 73/78, a new business sector is now available for entrepreneurs.

The final oil waste has always been a specific need in developing countries. Comparing to the refinery fuel oil, recycled wastes have always been much cheaper. Before MARPOL 73/74, ship-generated wastes had been used without reutilization process which caused serious damages to machinery of the factories and the production units. From now on oil wastes cannot be sold without a proper refinery process and all facilities that process oil waste have to meet the requirements of MARPOL 73/78.

Recycling oil waste throughout a proper recycling environment had never been performed in Turkey until 2000. Before 2000, obviously entrepreneurs never tried to enter this business because of the economic environment in Turkey. That effect has imposed entrepreneurs to invest in sectors that have lower risks. Buying a ship is always a common business area in terms of having more experience, high volume demand, and low risk. However, investing a significant amount of capital in a reception facility has always been a risk since there had been no enforcement for the proper processing of oil waste. Financial and technical support from International Maritime Organization is another driving force for the entrepreneurs. They should rethink how profitable the recycling business may potentially be. This sector may be much more complicated than other industries because of the new established regulations and new technology; however, by the help of those facilities our coasts and harbors will be saved while investing a new developing business.

References

[1] IMO, 1999, Comprehensive Manual on Port Reception Facilities, Second edition, IMO Publication, London.

[2] IMO, 2002, International Convention for the Prevention of Pollution from Ships.

[3] www.tcdd.gov.tr/liman, Turkish National Railway Systems (TCDD).

[4] www.cevreorman.gov.tr, Republic of Turkey Environment Ministry.

[5] Republic of Turkey Ministry 0f Maritime Affairs, Port of Izmir Information

[6] www.vsep.com, New Logic Research Inc.

[7] www.epa.qld.gov.au, Environmental Protection Agency.

[8] www.offshore-environment.com, Global Conventions Protection of Marine Environment.

[9] www.g-forcebv.com, G-Force Consulting Engineers BV

[10] www.portofmelbourne.com, Shipping Lines and Carriers

[11] www.iaphworldports.org, Guidelines for Ensuring the Adequacy of Port Reception Facilities

Integration of technology into bridge resource management: human factor perceptions

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Abstract

People make mistakes! No matter how well intentioned or conscientious a person may be, the simple fact is that eventually everyone will make a mistake. In the maritime transportation field, a mistake on the bridge of a ship can lead to catastrophic consequences. The primary methods used to prevent mistakes are the introduction of technology or people management and training.

Modern ships have a vast array of technology available on the bridge to assist watchstanders in making decisions concerning the safe navigation of the ship. One recent technological innovation is the Electronic Chart Display and Information System (ECDIS). ECDIS is a digitized display of a navigational chart that can be integrated with satellite positioning to indicate the vessel's position in real time. This system allows the navigator to do route planning, voyage monitoring, and other navigational tasks that have been traditionally done by paper and pencil.

Although the California Maritime Academy (CMA) requires that deck cadets take an ECDIS course in their third year at the academy, the cadets have traditionally not been allowed access to this technology during the bridge simulation course taken in the fourth year. The justification for this has been the belief that if students are allowed to use ECDIS they will abandon the more traditional navigation methods and those skills will not be developed or assessed.

The literature on learning suggests that students who perceive the benefit and real-world application of a subject have an increased motivation to learn. The purpose of this pilot study was to investigate student perceptions of the benefits of using ECDIS in the bridge simulation course. A better understanding of student perception will inform instructional pedagogy of both ECDIS and bridge simulation courses in order to enhance student learning. The study was carried out in the full mission bridge simulator at CMA using volunteer participants during October and November of 2007. Twelve sections of four participants each participated in two different scenarios. Approximately half of the simulations were conducted with the participants using ECDIS and the other half without. Quantitative and qualitative techniques were used and SPSS 13.0 was used for analysis.

The findings from this study are not generalizable. The qualitative data suggest that participants believed the use of ECDIS increased situational awareness, enabled them to reduce navigational cross-track error, and improved the over-all performance of their bridge team. In some cases these perceptions differed from quantitative measurements of those same variables.

1 Introduction

Ships are dangerous places. Every year hundreds of vessels collide, run aground or strike fixed objects. These accidents often result in fatalities and injuries (U.S. Department of Transportation 2007). In recent decades, maritime accidents, such as the *Exxon Valdez* (National Transportation Safety Board (NTSB) 1990) and *Cosco Busan* (NTSB 2008) incidents, have resulted in catastrophic environmental pollution and millions of dollars in clean-up costs. Perrow (1999) noted that an accident involving a liquid natural gas tank vessel could result in the destruction of part of a city.

In order to prevent marine accidents, legislative bodies have enacted regulations like the Oil Pollution Act of 1990 (OPA 90) and Safety of Life at Sea (SOLAS) regulations. In addition, Cunningham (2007) noted that the primary methods used to prevent mistakes are through the introduction of technology to assist watchstanders in their decision making or through personnel management and training.

Technology has radically altered the way ships are navigated. The past century has seen the advent of the gyrocompass, radar, and electronic and satellite positioning systems (Donderi, Mercer, Hong & Skinner 2004). Technology has had a positive effect on maritime safety. United States Coast Guard (USCG) statistics show that vessel accidents such as collisions and groundings significantly decreased during a recent five year period (USCG 2004). This has been attributed to enhanced navigation technology (Hetherington, Flin & Mearns 2006). In recent years, ECDIS has been introduced and is further transforming the practice of navigation (Donderi et al. 2004). ECDIS use on vessels is predicted to steadily increase in the coming years (Sauer, Wastell, Hockey, Crawshaw, Ishak & Downing 2002).

ECDIS is intended to contribute to navigation safety and enhance situational awareness (International Maritime Organization (IMO) 2004). Situational awareness has been defined as knowing what is going on around you (Endsley & Garland 2000). Or, in more detail, "Situational Awareness is the ability of an individual to possess a mental model of what is going on at any one time and also to make projections as to how the situation will develop" (Hetherington et al. 2006, p. 405). Loss of situational awareness can lead to maritime disaster. In a survey of maritime accident reports, Grech (2002) determined that 71% of human errors were attributed to situational awareness problems.

Salmon, Stanton, Walker and Green (2005) noted several methods in use to measure situational awareness in aviation. These methods include freeze probe techniques, real-time probe techniques, observer rating techniques, performance measures, process indices and self-rating techniques. Although self-rating techniques -- conducted post-trial -- have been criticized as potentially unreliable due to reliance on participant recall and sensitivity issues, they have the advantages of ease of application and non-obtrusiveness. This pilot study uses self-rating techniques to investigate student perception as other studies have (Rassuli & Manzer 2005).

Several studies have investigated the use of ECDIS on vessels. Smith, Akerstrom-Hoffman, Pizzariello, Siegel, Schreiber and Gonin (1995) used ECDIS in full-mission bridge simulations with experienced professional mariners. Their data suggest that ECDIS has the potential to improve safety by reducing the time spent navigating, which increases the time available for collision avoidance. ECDIS also improves situational awareness and reduces cross-track error, the offset of a vessel's position from its intended path of travel. In their study, participants self-evaluated their situational awareness at several points along the track. The perceived situational awareness level was significantly higher for mariners using ECDIS.

Gonin, Dowd and Alexander (1996) summarized four at-sea trials and one simulator experiment on ECDIS. The key findings of the studies were that ECDIS provides equivalent or greater navigational safety than paper charts and a reduction in the navigation workload. Cross-track error was the primary measure of navigational accuracy. This study reported that the mean cross-track error for mariners navigating using ECDIS was approximately one third of that for mariners without ECDIS. The use of ECDIS provided equivalent or greater safety than the use of paper charts and more traditional navigation methods. Exit interviews in the study revealed that mariners felt that ECDIS contributes to safe navigation.

Donderi et al. (2004) conducted a study that entailed two simulated navigation exercises on the approaches to Halifax, Nova Scotia. The effectiveness of the use of paper charts and of ECDIS was investigated. Cross-track error, contact closest point of approach (CPA) and number of helm orders were recorded. The NASA Task Load Index (TLX) was used to evaluate workload. The authors concluded that the use of ECDIS reduced cross-track error and navigation workload and optimized CPA.

Although technology has the potential to reduce maritime accidents, others have noted that technology alone does not prevent accidents and in some instances actually contributes to them. Human error, misinterpretation of data and poor decision making are still factors despite the presence of reliable technology (Hetherington et al. 2006). Often equipment is added to vessels with little effort to train bridge officers in its use. When this happens, the equipment is frequently underutilized or ignored completely (Olsson & Jansson 2006). On many vessels the reduced workload that the technology enables has resulted in

reduced manning and an increase in the number and scope of tasks for which a bridge watchstander is responsible (Sauer et al. 2002).

The use of bridge simulations to evaluate human factors in the marine environment is an established practice (O'Hara & Brown 1985; Smith 1993; Smith & Mandler 1992). Simulation is also an accepted teaching technique with many advantages. Simulation provides many benefits over real-world environments such as: the ability to concentrate on events of interest, the capacity to control the external environment, the replication of events and circumstances with multiple groups, and the ability to safely evaluate high risk events while students learn from mistakes without experiencing serious negative consequences (Smith, et al. 1995; Hertel & Millis 2002). According to Hertel and Millis (2002), simulation can be an effective pedagogical method to (a) transfer knowledge, (b) develop skills and (c) apply both knowledge and skills. Students acquire discipline-specific knowledge that they are able to later apply in professional settings.

Researchers have determined that students are motivated to learn technical material, such as mathematics and sciences, when they see the real-world application of the subject (Turner, Cox, CiCintio, Meyer, Logan & Thomas 1998). Davis (1992) states that students feel that course material is boring when "severed from the real world (p. 730)." Student perception of the benefits of course material results in motivation to learn and an increase in student motivation can lead to an increase in ability in the subject area (Portal & Sampson 2001).

The purpose of this pilot study is to investigate student perceptions of the benefits of using ECDIS in a bridge simulation course. Multiple teams of cadets participated in two simulation exercises. Approximately half of the teams had use of ECDIS and half did not. The literature suggests that ECDIS will help the bridge team do their work more efficiently and accurately and will result in better situational awareness. Because all of the participants had previously been trained in the use of ECDIS, it is expected that those participants who had access to ECDIS would have the perception that their performance benefited from that access and those who did not would have the perception that they were disadvantaged. Specifically, it is expected that the participants with access to ECDIS would have the perception that they had better situational awareness, task prioritization, more confidence, improved vessel handling and better overall team performance than those teams without access to the technology. It is also expected that the participants without access to ECDIS would have the perception that had they had access to ECDIS their performance in those areas would have improved.

This pilot study will provide a better understanding of student perception of the use of technology in bridge watchstanding decision making and will inform instructional pedagogy of both ECDIS and bridge simulation courses in order to enhance student learning.

2 Methodology

This pilot study was carried out in the full mission bridge simulator at the California Maritime Academy, a campus of the California State University system. Students in the simulation course during October and November of 2007 volunteered to participate. This bridge simulation course is designed to have a maximum of four students per section. The four students in each section are the bridge team for that section during the course. Students may register for any section that fits their needs. Once enrolled in a section, however, the student remains in that same section for the nine scenarios making up the course. Because the enrollment at CMA is relatively small, the population for this experiment is a census of all enrolled cadets at CMA who are taking the bridge simulation course during the fall semester of 2007 (N = 47). The participants met all prerequisites for the course and had previously taken a 35-hour ECDIS course.

In total, twelve sections participated in two different scenarios. This pilot study utilized the last two scenarios of the nine-scenario course. The first scenario used was Scenario #8 in which the student team is required to navigate a containership from the San Francisco Main Ship Channel to a specified anchorage position in San Francisco Anchorage #8. The second scenario used was Scenario #9 in which the student team is required to navigate a tanker from the Bligh Reef light through the Valdez Narrows in Alaska. Each scenario takes approximately 90 minutes to complete and, once started, is run without interruption. Each team was given the same standing orders and had one week to develop a detailed voyage plan for each transit.

Approximately half of the teams were randomly selected to have access to ECDIS for Scenario #8. The remainder of the teams did not have access to ECDIS during the scenario. Then, for Scenario #9, those teams that did not have access to ECDIS during Scenario #8 were given access and those teams that did have access during Scenario #8 were denied access.

During the scenarios, the course instructor used a data sheet to record measurements at predetermined points during the exercise. These measurements provided the source for the quantitative data which have been reported elsewhere (Buckley & Pecota 2008). After each exercise (during the debriefing period) participants were given a survey that elicited responses about the performance of his/her group as well as his/her opinions as to the effects of having, or not having, use of ECDIS during the simulation. The survey instrument consisted of a series of five-point Likert-type perception statements about which the participants were asked to indicate the level to which they agreed or disagreed with that statement (1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly Agree).

Data gathering took place during regularly scheduled class periods. Due to the nature of the data gathered, both quantitative and qualitative methods are used. From the survey questionnaire, nonparametric tests are used to test the

hypotheses. Although nonparametric tests statistically are not as powerful as parametric tests for analysis because their underlying assumptions are less stringent (Cooper & Schindler 2003), nonetheless they do permit acceptable levels of analysis for categorical variables. The hypotheses testing were accomplished using the Statistical Package for Social Sciences (SPSS) software version 13.0. For a 95% confidence level, an alpha level of significance (2-tailed) of $\alpha = 0.05$ was set *a priori* for all tests.

The primary research hypothesis (null hypothesis) to be tested for all questions is that there is no difference between the perceptions of participants having access to ECDIS and those without access to ECDIS.

3 Results

For each of the perception variables, an independent sample *t*-test was used to test the hypothesis that there is no difference in the means of the participants that had access to ECDIS and those that did not have access to ECDIS. A Levene's test was used to determine homoscedasticity of the populations, which is an important assumption when using a *t*-test.

3.1 Scenario #8 Results

Scenario #8 required the participants to navigate a containership from the San Francisco Main Ship Channel, under the Golden Gate Bridge, along the San Francisco waterfront, through the Alpha-Bravo span of the Oakland-Bay Bridge, and finally to anchor the vessel in a specified anchorage position in San Francisco Anchorage #8. Twelve teams participated in this exercise and each had previous experience navigating in San Francisco and maneuvering this particular ship model.

The results of the perceptual data for this exercise are shown in Table 3.1. The null hypothesis for these tests is that there is no difference in means between the two groups. As can be seen from the table, based on the observed significance level, and using a level of significance of $\alpha = 0.05$, there are no statistically significant differences between those participants using ECDIS and those not using ECDIS in their perceived agreement that their team's task prioritization was very good, that their team was confident throughout the scenario, that they maneuvered their vessel efficiently, that their performance was good, and that ECDIS would have/did improve situational awareness, task prioritization, turn accuracy, and overall performance. Therefore the null hypothesis cannot be rejected for those questions.

However, based on the observed significance level of .039, and using a level of significance of $\alpha = 0.05$, the null hypothesis that there are no differences in perception between those groups using ECDIS and those groups not using ECDIS with regards to their perception that using ECDIS would have/did improved(d) the team's ability to maintain the track can be rejected. In this

case, although both of the populations agree with the statement, their means appear to be unequal, with the groups not using ECDIS having a much stronger feeling that ECDIS would have improved their ability to maintain the track than the groups that had access to ECDIS felt that it actually did improve their ability to maintain the track. The quantitative data in cross-track error suggests that there were no actual differences in the teams' ability to maintain the track (Buckley & Pecota 2008) but there is a statistically significant perception difference between the groups. Both groups were neutral about whether piloting without ECDIS would be unsafe.

Table 3.1
Survey Sheet (#8) Independent Sample T-Test Result (Yes n=27, No n=18)

Survey Question	ECDIS	Mean	Std. Dev.	*t*-test for Equality of Means ($\alpha = 0.05$) *T*	df	Sig. (2-tailed)	Ho
1. I feel the bridge team's situational awareness was very high.	Yes	4.33	.620	3.212	43	.002	Reject
	No	3.67	.767				
2. I feel the bridge team's task prioritization was very good.	Yes	4.04	.649	.194	43	.847	Not Reject
	No	4.00	.594				
3. I feel that the team was confident throughout this scenario.	Yes	4.07	.616	1.550	43	.128	Not Reject
	No	3.78	.647				
4. I feel the vessel was maneuvered in an efficient manner.	Yes	3.89	.698	.840	43	.405	Not Reject
	No	3.72	.575				
5. I feel the team's overall performance in this scenario was very good.	Yes	4.07	.675	.092	43	.927	Not Reject
	No	4.06	.639				
6. I feel that using ECDIS would have/did improve(d) the team's situational awareness.	Yes	4.30	.775	-.392	43	.697	Not Reject
	No	4.39	.778				
7. I feel that using ECDIS would have/did improve(d) the team's task prioritization.	Yes	4.07	.874	.417	43	.678	Not Reject
	No	3.94	1.211				
8. I feel that using ECDIS would have/did improve(d) the team's ability to maintain the track.	Yes	4.30	.869	-1.904	43	.039	Reject
	No	4.72	.461				
9. I feel that using ECDIS would have/did improve(d) the team's turn accuracy.	Yes	4.00	.961	-1.736	43	.090	Not Reject
	No	4.44	.616				
10. I feel that using ECDIS would have/did improve(d) the team's overall performance.	Yes	4.19	.622	-0.625	43	.571	Not Reject
	No	4.33	.970				
11. I feel that piloting without ECDIS is	Yes	2.89	1.086				

				t-test for Equality of Means ($\alpha = 0.05$)			
not safe.				-.482	43	.633	Not Reject
	No	3.06	1.211				
12. I feel that using ECDIS would not have enhanced the team's situational awareness.	Yes	2.44	1.251	.530	43	.599	Not Reject
	No	2.22	1.555				

3.2 Scenario #9 Results

Scenario #9 required the participants to navigate a tanker in Alaska's Prince William Sound from the Bligh Reef light through the proper inbound traffic lane to Tongue Point and from there through the Valdez Narrows. The participants did not have previous experience navigating in Prince William Sound but they did have experience maneuvering this particular ship model.

The results of the qualitative data for this exercise are shown in Table 3.2. As before, the null hypothesis for these tests is that there is no difference in means between the two groups; those with access to ECDIS and those without access to ECDIS. As can be seen from the table, based on the observed significance level, and using a level of significance of $\alpha = 0.05$, the null hypothesis that there are no differences between those groups using ECDIS and those groups not using ECDIS in their perception that the team's situational awareness was high, that their task prioritization was very good, that the team was confident throughout the scenario, that the vessel was maneuvered in an efficient manner, that the team's performance was very good, and that they felt that ECDIS would have/did improve(d) the team's task prioritization, ability to maintain the track, and turn accuracy cannot be rejected.

Table 3.2
Survey Sheet (#9) Independent Sample T-Test Result (Yes n=19, No n=28)

Survey Question	ECDIS	Mean	Std. Dev.	*t*-test for Equality of Means ($\alpha = 0.05$)			Ho
				T	df	Sig. (2-tailed)	
1. I feel the bridge team's situational awareness was very high.	Yes	4.42	.607	.452	45	.653	Not Reject
	No	4.32	.819				
2. I feel the bridge team's task prioritization was very good.	Yes	4.32	.749	-.767	45	.447	Not Reject
	No	4.46	.576				
3. I feel that the team was confident throughout this scenario.	Yes	4.37	.831	-.120	45	.905	Not Reject
	No	4.39	.567				
4. I feel the vessel was maneuvered in an efficient manner.	Yes	4.32	.820	-.509	45	.613	Not

				t-test for Equality of Means ($\alpha = 0.05$)			
							Reject
	No	4.43	.690				
5. I feel the team's overall performance in this scenario was very good.	Yes	4.42	.692	-.233	45	.817	Not Reject
	No	4.46	.576				
6. I feel that using ECDIS would have/did improve(d) the team's situational awareness.	Yes	4.68	.671	2.945	45	.005	Reject
	No	3.93	1.086				
7. I feel that using ECDIS would have/did improve(d) the team's task prioritization.	Yes	3.89	1.100	1.364	45	.179	Not Reject
	No	3.46	1.036				
8. I feel that using ECDIS would have/did improve(d) the team's ability to maintain the track.	Yes	4.32	.946	1.236	45	.223	Not Reject
	No	3.93	1.120				
9. I feel that using ECDIS would have/did improve(d) the team's turn accuracy.	Yes	4.00	1.247	.411	45	.638	Not Reject
	No	3.86	1.113				
10. I feel that using ECDIS would have/did improve(d) the team's overall performance.	Yes	4.21	.976	2.195	45	.033	Reject
	No	3.54	1.071				
11. I feel that piloting without ECDIS is not safe.	Yes	3.11	1.100	1.444	45	.156	Not Reject
	No	2.64	1.062				
12. I feel that using ECDIS would not have enhanced the team's situational awareness.	Yes	2.26	1.098	-1.211	45	.232	Not Reject
	No	2.64	1.026				

Based on the observed significance level of .005, and using a level of significance of $\alpha = 0.05$, the null hypothesis that there are no differences between those participants using ECDIS and those not using ECDIS about their feeling that using ECDIS would have/did improve(d) the team's situational awareness can be rejected. Although both groups of participants agree with the statement, those with ECDIS have a statistically stronger feeling that using ECDIS did improve their team's situational awareness. With an observed significance level of .033, the null hypothesis that there are no differences between participants about their feeling that using ECDIS would have/did improve(d) their team's overall performance can be rejected. Although the participants agreed with the statement, those with ECDIS have a statistically stronger feeling. Both groups were neutral about whether piloting without ECDIS would be unsafe.

3.3 Comparing Scenario #8 and Scenario #9 Result

As noted earlier in this paper, although both scenarios required the participants to navigate a ship with which they were filiar, there was a significant difference in their familiarization with the area in which they were navigating and the environmental conditions during the run. The geographic construct for Scenario #8 was very familiar to the participants and the exercise started during daylight hours and transitioned to darkness. By contrast, the geographic construct for Scenario #9 was not familiar to the participants and the exercise began in darkness and transitioned to daylight.

The results of the qualitative data for these two exercises for the participants without access to ECDIS are shown in Table 3.3. The null hypothesis for these tests is that there is no difference in means between the two scenarios for those participants without access to ECDIS. As can be seen from the table, based on the observed significance level, and using a level of significance of $\alpha = 0.05$, the null hypothesis that there are no differences between the participants in the two scenarios that did not have access to ECDIS in their feeling that using ECDIS would have improved the team's situational awareness and task prioritization cannot be rejected.

Although the participants in both scenarios generally agreed with the questionnaire statements, based on the observed significance level of .010, the null hypothesis that there are no differences between the participants in the two scenarios about their feeling that their team's situation awareness was very high can be rejected. For this question, the participants in Scenario #9 had a significantly stronger feeling. Based on the observed significance level of .012, the null hypothesis that there are no differences between the participants in the two scenarios about their feeling that their team's task prioritization was very good can be rejected. For this question, the participants in Scenario #9 had a significantly stronger feeling. Based on the observed significance level of .001, the null hypothesis that there are no differences between the participants in the two scenarios about their feeling that their team was confident throughout the scenario can be rejected. For this question, the participants in Scenario #9 had a significantly stronger feeling. Based on the observed significance level of .001, the null hypothesis that there are no differences between the participants in the two scenarios about their feeling that their vessel was maneuvered in an efficient manner can be rejected. For this question, the participants in Scenario #9 had a significantly stronger feeling. Finally, based on the observed significance level of .030, the null hypothesis that there are no differences between the participants in the two scenarios about their feeling that their team's overall performance was very good can be rejected. For this question, the participants in Scenario #9 had a significantly stronger feeling.

Based on the observed significance level of .002, the null hypothesis that there are no differences between the participants in the two scenarios about their feeling that using ECDIS would have improved the team's ability to maintain

the track can be rejected. For this question, the participants in Scenario #8 had a significantly stronger feeling. Based on the observed significance level of .036, the null hypothesis that there are no differences between the participants in the two scenarios about their feeling that using ECDIS would have improved the team's turn accuracy can be rejected. For this question, the participants in Scenario #8 had a significantly stronger feeling. Based on the observed significance level of .014, the null hypothesis that there are no differences between the participants in the two scenarios about their feeling that using ECDIS would have improved the team's overall performance can be rejected. For this question, the participants in Scenario #8 had a significantly stronger feeling. The participants from both scenarios were neutral about whether piloting without ECDIS would be unsafe.

Table 3.3

Scenario #8 and #9 Combined (No ECDIS) Independent Sample T-Test Result (Scenario #8 n=18, Scenario #9 n=28)

Survey Question	Scenario	Mean	Std. Dev.	*t*-test for Equality of Means ($\alpha = 0.05$)			Ho
				t	df	Sig. (2-tailed)	
1. I feel the bridge team's situational awareness was very high.	8	3.67	.767	-2.712	44	.010	Reject
	9	4.32	.819				
2. I feel the bridge team's task prioritization was very good.	8	4.00	.594	-2.635	44	.012	Reject
	9	4.46	.576				
3. I feel that the team was confident throughout this scenario.	8	3.78	.647	-3.399	44	.001	Reject
	9	4.39	.567				
4. I feel the vessel was maneuvered in an efficient manner.	8	3.72	.575	-3.609	44	.001	Reject
	9	4.43	.690				
5. I feel the team's overall performance in this scenario was very good.	8	4.06	.639	-2.250	44	.030	Reject
	9	4.46	.576				
6. I feel that using ECDIS would have improved the team's situational awareness.	8	4.39	.778	1.557	44	.127	Not Reject
	9	3.93	1.086				
7. I feel that using ECDIS would have improved the team's task prioritization.	8	3.94	1.211	1.436	44	.158	Not Reject
	9	3.46	1.036				
8. I feel that using ECDIS would have improved the team's ability to maintain the track.	8	4.72	.461	3.336	44	.002	Reject
	9	3.93	1.120				
9. I feel that using ECDIS would	8	4.44	.616				

				t-test for Equality of Means ($\alpha = 0.05$)			
have improved the team's turn accuracy.	9	3.86	1.113	2.229	44	.036	Reject
10. I feel that using ECDIS would have improved the team's overall performance.	8	4.33	.970	2.555	44	.014	Reject
	9	3.54	1.071				
11. I feel that piloting without ECDIS is not safe.	8	3.06	1.211	1.218	44	.230	Not Reject
	9	2.64	1.062				
12. I feel that using ECDIS would not have enhanced the team's situational awareness.	8	2.22	1.555	-1.014	44	.320	Not Reject
	9	2.64	1.026				

Comparing the response means to each of the questions for the two different scenarios for the participants who had access to ECDIS showed there were no statistical differences in their responses to any of the questions.

4. Conclusions and discussion

This experiment is an important step in understanding the complexities of integrating ECDIS into bridge team management. Prior to conducting this pilot study, we expected that the participants with access to ECDIS would have the perception that they had better situational awareness, task prioritization, more confidence, improved vessel handling and better overall team performance than those teams without access to the technology. It was also expected that the participants without access to ECDIS would have the perception that had they had access to ECDIS their performance in those areas would have improved. In general, the data affirmed those expectations with several being statistically significant. These findings were consistent with Donderi et al. (2004), Smith et al. (1995) and Gonin et al. (1996).

When we compared those participants who used ECDIS in the simulated exercise in San Francisco Bay (SFB) in Scenario #8 with those who used ECDIS in the Prince William Sound (PWS) exercise in Scenario #9, there were no significant differences and they affirmed the previously discussed expectations. However, when comparing the two scenarios for those participants who did not have access to ECDIS, the results were surprising. Because CMA cadets are very familiar with operating actual and simulated vessels in SFB and have little or no experience in PWS, we expected that participants would be more comfortable navigating without ECDIS in familiar waters during daylight (Scenario #8) than in unfamiliar waters in the dark (Scenario #9). The results for each of the survey questions were contrary to what was expected and in most cases at a level that was statistically significant. Participant comments gathered during scenario debriefing provide possible explanation to these findings. They

reported that in the absence of ECDIS, in Scenario #8 they relied extensively on single parallel index lines, a traditional navigation technique using radar, while during Scenario #9 they made extensive use of double parallel index lines to maintain track and felt more confident in the use of this technique and its reliability. Another possible explanation might be that because participants had had more simulation experience prior to Scenario #9 than they had prior to Scenario #8, that added experience might have resulted in greater confidence in their own abilities. Perhaps because the participants were not familiar with PWS and knew it would be dark during the exercise they more thoroughly prepared for Scenario #9 than they did for Scenario #8.

Although this pilot study has some interesting results, we do recognize and acknowledge the following limitations: small sample size, the difficulties in interpreting perception surveys, the limitations of a 5-point Likert scale, the inherent weakness of post-trial self-rating techniques and the fact that we compared two scenarios with different geographic locations and environmental conditions.

Students who perceive the real-world application of instructional material have increased motivation to learn (Turner et al. 1998). The results of this study indicate that students who are exposed to ECDIS in bridge simulation courses readily perceive its benefits to watchkeeping. Although current practice in simulation courses is to not allow access to ECDIS (Pecota pers comm. 2007), maritime training centers should consider incorporating advanced navigation techniques, including the use of ECDIS, as early in their programs as practicable in order to increase student motivation to learn those subjects.

While this pilot study answered some basic questions, many more questions were revealed. Will these results be replicable with more common scenarios? What would be the effect of running Scenario #9 earlier than Scenario #8? Instead of comparing a scenario involving a familiar geographic area with an unfamiliar area, what would result when two unfamiliar areas are compared? Would relocating the ECDIS display on bridge yield different results? Would the results be different with a one person watch than they were with a four person watch team? What would be the effect on student performance in an ECDIS training course of exposing students to ECDIS earlier in the training cycle?

References

[1] Buckley, J. & Pecota, S. (2008). Integration of ECDIS into simulation courses: Are there performance or perception differences? *Proceedings* of the International Navigation and Simulator Instructor Conference (INSLC) 15.

[2] Cooper, D., & Schindler, P. (2003). *Business research methods* (8th ed.). Boston: McGraw-Hill Irwin.

[3] Cunningham, J. (2007). Break the monotony. *Professional Engineering*, 20 (20), 33.

[4] Davis, R. (1992). Reflections on where mathematics education now stands and on where it may be going. In D. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 724-734). New York: Macmillan.

[5] Donderi, D., Mercer, R., Hong, M., & Skinner, D. (2004). Simulated navigation performance with marine Electronic Chart and Information Display Systems (ECDIS). *Journal of Navigation*, 57, 189-202.

[6] Endsley, M. & Garland D. (2000). *Situation Awareness Analysis and Measurement*. Mahwah, NJ: Lawrence Erlbaum Associates.

[7] Gonin, I., Dowd, M. & Alexander L. (1996). *Electronic Chart Display and Information System (ECDIS) Test and Evaluation, Summary Report. Report No. CG-D-20-97.* U.S. Coast Guard Research and Development Center, Groton, CT.

[8] Grech, M. (2002). *Human error in maritime operations: Analyses of accident reports using the Leximancer tool.* Key Centre of Human Factors and Applied Cognitive Psychology, University of Queensland, Brisbane, Qld.

[9] Hertel, J. & Millis, B. (2002) *Using Simulations to Promote Learning in Higher Education.* Stylus Publishing: Sterling, VA.

[10] Hetherington, C., Flin, R. & Mearns, K. (2006). Safety in shipping: The human element. *Journal of Safety Research*, 37, 401-411.

[11] International Maritime Organization (2004). *Performance Standards for Electronic Chart Display and Information Systems (ECDIS).* MSC/circ.637.

[12] National Transportation Safety Board (1990). *Marine Accident Report: Grounding of the U.S. Tankship Exxon Valdez on Bligh Reef, Prince William Sound Near Valdez, Alaska March 24, 1989.* NTSB/MAR-90/04, National Transportation Safety Board, Washington, DC.

[13] National Transportation Safety Board (2008). Allision of the container ship M/V *Cosco Busan* with the San Francisco Oakland Bay Bridge November 7, 2007. Retrieved June 05, 2008 from http://ntsb.gov/events/2008/San-Francisco-Bay-CA/default.htm.

[14] O'Hara, J., & Brown, W. (1985). An investigation of the relative safety of alternative navigation system designs for the New Sunshine Skyway Bridge: A CAORF simulation. *CAORF Technical Report Number 26-8232-04*. National Maritime Research Center, Kings Point,NY.

[15] Olsson, E., & Jansson, A. (2006). Work on the bridge – studies of officers on high-speed ferries. *Behaviour & Information Technology*, 25 (1), 37-64.

[16] Perrow, C. (1999). *Marine accidents. Normal accidents: Living with high risk technologies.* Princeton, New Jersey: Princeton University Press.

[17] Portal, J., & Sampson, L. (2001). Improving high school students' mathematics achievement through the use of motivational strategies. Unpublished thesis, St. Xavier University, Chicago.

[18] Rassuli, A. & Manzer, J. (2005). Teach us to learn: multivariate analysis of perception of success in team learning. *Journal of Education for Business*, September/October, 21-27.

[19] Salmon, P., Stanton, N., Walker, G. & Green, D. (2006). Situation awareness measurement: A review of applicability for C4i environments. *Applied Ergonomics*, 37 (2), 225-238.

[20] Sauer, J., Wastell, D., Hockey, R., Crawshaw, C., Ishak, M. & Downing, J. (2002). Effects of display design on performance in a simulated ship navigation environment. *Ergonomics*, 45 (5), 329-347.

[21] Smith, M. (1993). *Precision electronic navigation in restricted waterways: a simulator investigation.* United States Coast Guard Research and Development Center, Groton, CT.

[22] Smith, M., Akerstrom-Hoffman, R., Pizzariello, C. Siegel, S., Schreiber, T. & Gonin, I. (1995). *Human factors evaluation of Electronic Chart Display and Information Systems (ECDIS).* United States Coast Guard Research and Development Center, Groton, CT.

[23] Smith, M. & Mandler, M. (1992). Human factors evaluations of electronic navigation systems. *Proceedings of the First Annual Conference and Exposition for Electronic Chart Display and Information Systems*, Baltimore, MD. February 28-29.

[24] Turner, J., Cox, K., CiCintio, M., Meyer, D., Logan, C., Thomas, C. (1998). Creating contexts for involvement in mathematics. *Journal of Educational Psychology, 90*, 730-745.

[25] United States Coast Guard (2004). *Fiscal year 2004 report.* Retrieved February 15, 2005 from www.uscg.mil/news/reportsandbudget/2004_report.pdf.

[26] U.S. Department of Transportation (2007). *National Transportation Statistics*. Research and Innovative Technology Administation, Bureau of Transportation Statistics. Retrieved April 12, 2007 from http://www.bts.gov/publications/national_transportation_statistics/.

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Organizational Collective Intelligence with its antecedents and consequences for a maritime community

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Abstract

"Community" can be defined as a group of people or organizations that purposely share material wealth and property in some degree of common ownership and control . It can be said that to be an effective community, the members of community should develop the organizational collective intelligence which involves the capability of using the key components of community to collaborate in order to achieve goals in a complex environment. In this study, we aim to understand the importance of achieving an organizational intelligence-based maritime community.

1 Introduction

"Community" can be defined as a group of people or organizations that purposely share material wealth and property in some degree of common ownership and control. Another definition of community refers to a group of people with diverse characteristics who are linked by social ties, share common perspectives, and engage in joint action in geographical locations or settings. Consequently, organizing for a community generally involves being together for a purposeful collective effort for the enhancement of social conditions. These collective efforts constitute both learning to take each member's viewpoints, and integrating the reactions of others into their own activities. Joint actions, common perspectives and collectivism form an organizational archtitecture to allow people to create intellectual property and become the basic, but key, component of community.

To be an effective community, the members of the community should develop an organizational collective intelligence which involves the capability of using key components of community to collaborate in order to achieve goals in a complex environment. Accordingly, developing a new maritime community requires the integration of organizational collective intelligence.

Developing an effective maritime community depends on the ability to acquire several types of information and viewpoints, and to process and respond to them. Thus the maritime community should be evaluated from the perspective of three antecedents of organizational collective intelligence, which include the actions of acquiring, sharing and processing information, beliefs and viewpoints. These three antecedents are: The theory of the organization, the language of the organization, and the composition of the organization. Being a community is a process, therefore the output of the process for a maritime community – such as enhancing innovation and creativity in maritime community, and assuring maritime sustainability – involves the impacts of the antecedents of collective organizational intelligence.

In this study, we aim to understand the importance of achieving an organizational intelligence-based maritime community. We begin with a literature review for the general community, and organizational collective intelligence theories. Then a model is constructed for the maritime community. In the model, the antecedents of organizational collective intelligence is modified to a maritime organization. As a consequence of the model, we view the impact of the antecedents on the outputs of an effective maritime community such as innovation, creativity and sustainability in a maritime community.

2 Organizational Intelligence

Intelligence is an indispensable concept for the areas of psychology, organizational behavior, management and engineering (Dayan, 2003). Although there are a lot of definitions for intelligence, all of the theories agree that

intelligence is based on biology and is an improvable capability or potential. Studies about individual intelligence compose the bases of organizational intelligence (OI) literature. Research about organizational intelligence generally have been done through the definitions and perceptions of individual intelligence literature. When the organizational intelligence literature which is shown in Table 1.1 is evaluated, it is obvious that OI is also undertaken through both cognitive and physocometric perspectives.

Table 1.1. Organizational Intelligence Literature (Dayan, 2003)

AUTHORS	DEFINITIONS OF INTELLIGENCE
Greene (1966)	Processed information of interest to management about the present and future environment in which the business is operating.
Wilensky (1967)	The problem of gathering, processing, interpreting, and communicating the technical and political information needed in the decision-making process.
Gordon (1989)	The process of obtaining and analyzing publicly available data to develop the information necessary to serve as input to competitive strategy development.
Nevis et al. (1990)	Understanding organizations as learning systems and creative systems.
Halal et al. (1995)	A function of five cognitive subsystems: organizational structure, culture, stakeholder relationships, knowledge management, and strategic processes.
McMaster (1996)	The capacity for computation, which can be, applied to information that is externally gained or internally generated to meet survival challenges.
Glynn (1996)	The capabilities to process, interpret, encode, manipulate, and access information in a purposeful, goal-directed manner, so it can increase its adaptive potential in the environment in which it operates.
Liebowitz (2000)	The collective assemblage of all intelligence that contribute towards building a shared vision, renewal process, and direction for the entity.
Fleisher & Blenkhorn (2001)	The process by which organizations gather actionable information about competitors and the competitive environment and ideally apply it to their decision-making and planning processes in order to improve their performance.

From the cognitive perspective, intelligence is the capability of a system to transfer and acquire information from its internal and external environment.

Information is used for maintaining the stability, adaptation and enhancement of the system (Stalinski, 2004).

Furthermore intelligence refers to the computation capability that can be applied to the information. Computation capability is a system that involves the integration of the capabilities of receiving inputs from the external environment for capturing information, interpreting the information and converting the resulting interpretations to action (McMaster, 1996). Consequently, Organizational Intelligence should involve

- The capability to take signals from the external environment
- The capability to interpret the signals through various aims and internal structures
- The capability to create discrepancies from the inputs
- The capability to process and integrate the internal signals as the external signals.
- The capability to generate outputs and responding.

Information acquisition includes scanning information and reevaluating the signals from the primary and secondary information resources in the external environment (Dayan, 2003). Information distribution is sharing the information amongst the organization and transmitting the information to the related entities (Kohli & Jaworski, 1990; Beyer & Trice, 1982). Implementing the information is also another important issue in development of innovative processes, technology transferring and problem solving (Moorman, 1995; Lynn, 1998).

Nevertheless organizational intelligence is taken from the point of psychometric view. Gardner's multiple intelligence theory for individuals is integrated to organizations. Various resources of organizations provide various capabilities among organizations. These different capabilities have evolved as the kinds of intelligence. Halal (1998) specified that organizational intelligence could also be measured like individual intelligence, and matched the components of individual intelligence to organizational intelligence.

Albrecht (2003) defined organizational intelligence as the summation of all of the brain power in the organization. He emphasized that organizations could succeed in overcoming their weak points through improving their knowledge, capability and cultures. Osborn (1999) claimed that organizations should integrate their individual and collective intelligence to be healthy and functional entities. He suggested that organizational intelligence can be evaluated from the perspective of collective intelligence. In this context, the concept of collective intelligence emerges.

Collective intelligence (CI) is not a new concept. It is seen among evaluated groups in nature (Thorndike, 1911). As CI emerges in groups that have common aims or in groups that are coordinated around an object, it can be assessed from the aspects of the organizations that consist of the individuals who come together for a purpose. The broad definition of CI is the intelligence of

community. Community refers the systems that consist of more than one individual. Furthermore CI can be seen as *Holon*. In Greek, *Holon* means to be a whole while being a part of a whole. Thus CI is a *holon* because indvidiual intelligence is both a whole and a part of a collective system. Smith (1994) specified the CI as the capability of a group of individuals to complete a task as an organism that has a mind. He also emphasized that CI is essential for developing effective communities and collaborations.

Naturally many dependent variables of communities are necessary for the emergence of CI. Understanding these variables allows us to obtain the community system that will perform effectively with collaboration (Atlee, 2003).

3 Modeling Collective Organizational Intelligence for a maritime community

Organizational Intelligence literature evaluates information acquisition, sharing and distribution through the concept of intelligence (Dayan, 2003). In the studies of organizational intelligence, the structure (Delspande and Zaltman, 1982) and culture of the organization (Moorman, 1995) are introduced as the antecedents of OI, while organizational performance and the innovation process of the organization are presented as the consequents of OI.

By combining the literature about organizational collective intelligence, a model (shown in Figure 3.1) can be designed for organizational collective intelligence for the maritime community. In the model presented in this study, the theory of the maritime community, the composition of the desired community, and the communication of the community, are taken as the antecedents of the organizational collective intelligence of the maritime community. The consequents that will arise because of effective organizational intelligence are introduced as the innovation and creativity among maritime organizations, and enhancing sustainability by establishing maritime security and environmental protection more effectively.

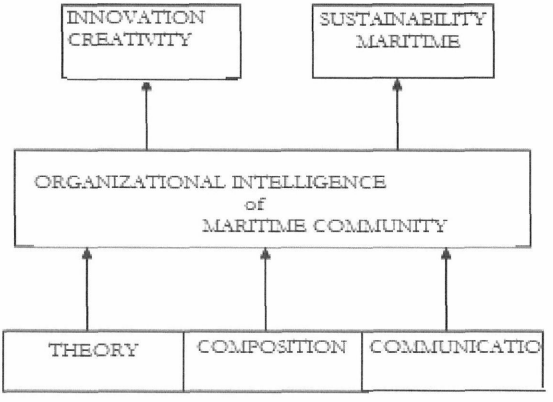

Figure 3.1. Model of Organizational Intelligence Antecedents and Consequents for the maritime community.

3.1 Theory of the maritime community

From the perspective of OCI, theory is the complementary statement that informs our perceptions, descriptions and judgments for our behaviors and activities (Mc Master, 1996). Namely, theory refers to developing cognitive models for our internal and external worlds.

Cognitive models are the mechanisms which provide explanations for the aim of systems, the functionality of the systems, and observed system conditions, while making forecasts (Rouse and Morris, 1986). Cognitive models are ordered knowledge structures that are used for communication with the environment. Furthermore, they are used for developing linkages between perceptions by creating expectations. They are also necessary to understand the basis of the performance of complex systems.

Gentler and Stevens (1983), and Rummelhart and Ortany (1977) analyzed cognitive models among the relationship of team members. Using this context, we can integrate the literature to the maritime community. Thus the maritime community should be shaped out of the cognitive models of the individuals of the commune. The structure of knowledge structure of the cognitive models can be specified by three models (Rouse et al., 1992; Canon-Bowers et al., 1993);

1- Instrumental Knowledge is related to the functionality, limitations, and operation procedures of resources and assets.
2- Task Knowledge is related to procedures of task knowledge, strategies and scenarios.

3- Group Knowledge is related to the role and responsibilities of teams, information resources, communication, interactions and the relationship between the members of the group. The capabilities of the members in the groups also should be known.

The Maritime community should be treated as teams. As cognitive models are related to the ordering and organization of the information of the maritime community, it is important to know who knows what in this community.

Klimoske and Mohammed (1994) noted that multi-cognitive models can be generated within team members. These multi-cognitive models involve common aims, common tasks, common operations and interactions. It is seen that teams that develop shared aims, tasks and operations are more successful than other teams (Klimoske and Mohammed, 1994). This means that shared cognitive models expose real expectations towards the members of the community and the external environment.

Since cognitive models involve describing and configuring the environment, they are important for the organizational collective intelligence of the community. High cognitive capability in an individual does not help us to see and understand all of the aspects of the environment (Wilson & Rutherford, 1989). Individual cognitive models give a person the required information. If this phenomenon spreads through the community members, each member can understand similar events and create similarities between the perceptions of other community members. Eventually explaining cognitive models will form the intelligence of the maritime community. As a result it can be said that:

The cognitive models will constitute the intelligence of the maritime community

The cognitive models will increase the effectiveness of the maritime community

3.2 Composition of the maritime community

Gardner (1983, 1999) explains the reason for the different capabilities of individuals with his multi-intelligence model. Integrating the multi-intelligence concept with the team work of a community exposes various operation styles, different core capabilities, and strategies in the community. Hoffman and Maier (1961) emphasized that heterogeneous task groups showed more successful results than homogenous groups. Furthermore it is also noted that when overcoming the challenges of the complex environments, diversifications should be obtained in the communities, so also in the maritime community. All in all,

Diversification in the community will constitute the organizational intelligence of the maritime community.

Diversification in the maritime community will positively affect the performance of the maritime community.

However, diversification should be taken with the identification of the aims. Fixing the aims of the community is important because ambiguity of tasks would yield a lot of different outputs. As a result, the determination of the performance assessment cannot be done effectively. Uncertainty in the tasks would also result in weak standards for operational procedures. Unfortunately, understanding the aims of groups are more difficult than the individual's aims. Weiryart and Weldon (1991) state that members of a group can develop different purposes while their group is focusing on their purposes. As a result the members of the maritime community can generate effective strategies (Hunter, 1996). Furthermore the feedback that is gained from the members of the community will improve adaptation, which is a key component of intelligence. Determination of the purposes of the community and getting the feedback from the strategies to achieve these aims provides for easy adaptation to different tasks.

3.3 Communication of the maritime community

In organizations, interaction and communication are necessary to provide linkages between members. The main purpose of communication is establishing coordination. Coordination is making decisions of the questions who-when-what, and to guarantee the achievement of the desired aims in a chaotic environment (Nevana, 1996). From the perspectives of communities, coordination can be developed with two concepts. These are synchronization and information flow.

Synchronization is required for the maritime community for continual and common tasks. The members of the community should do their tasks simultaneously. Accordingly, a common mind with a team spirit can be obtained through the community. As a result, the organizational intelligence of the community can be formed (Paolus, 2000) and

- Synchronization can develop organizational collective intelligence through the maritime community.

Communication of the community is also dependent on information flow. Information flow enhances the intelligence of the community by enhancing organizational learning (Glynn, 1996). Information flow is directly related to the usage of information and communication technologies. As one of the definitions of intelligence involves information processing, organizational intelligence in the maritime community will be more effective with the effective usage of information technologies.

4 The consequences of Collective Organizational Intelligence in the maritime community

4.1 Innovation and creativity

Thinking or ideas need intelligence (Gardner, 1983; Sternberg, 1985, Quinn, 1989). Gardner (1983) stated that creativity is a result of a combination of various intelligences. Consequently, based on individual intelligence, organizational intelligence has been evaluated with creativity. Creativity can be assessed through different perspectives. But the key point for the maritime community is probably the effect of creativity on innovation. As creativity can be defined as generating applicable new ideas, innovation can be taken as applications of creativity (Amobile, 1996; Kasof, 1995; West, 1990). Accordingly, organizational intelligence that will be created in the new maritime community will also trigger innovation and creativity in the maritime sector.

4.2. Sustainability

Sustainability can be defined as "the ability to meet today's global economic, environmental and social needs without compromising the opportunity of future generations to meet theirs" (Hamzah, 2006). For sustainability in the maritime sector, the following issues should be incorporated:

- strategic regional visions for connected regional marine systems;
- understanding the interdependence of various regional values and functions;
- formulation of long-term economic and ecological objectives, with concrete indicators;
- planning and investing directed at sustainable economic and ecological development;
- monitoring, evaluation and feedback according to established indicators.

Furthermore an integral system should be constructed by establishing integrated maritime programs and developing steering instruments. Hamzah (2007) also emphasized that for sustainable development in the maritime community, and in maritime activities, environmental and safety considerations should be taken such as:

- Management of estuaries
- All forms of pollution at ports
- Managing ecology and habitat
- Management of chemicals in or near water environments

- Oil discharge prevention and response
- Dredging and sediment removal including its disposal
- Management of ports and marinas and vessels
- Management of waste from vessels
- Loading and unloading of ships
- Ballast water and hull fouling and cleaning.
- Safety of ships and the people living around harbours
- Security of goods. Since 9/11, US Customs has insisted on security clearance and inspection of goods and vessels destined for US ports. The IMO has introduced security measures known as the International Ship and Port Facility Security (ISPS) Code for all ports, oil and gas terminals and merchant ships that engage in international trade.

When the above activities are analysed, it is obvious that the management of the organization of the maritime community is the main and common point for achieving sustainability. However, in some cases progress has been hampered because of difficulties in communication and coordination between parties. So the organizational intelligence that has been created among the maritime community can enhance sustainability by learning, creating, and providing coordination and communication effectively.

5 Conclusion

Organizational intelligence is greater than the sum of the knowledge of each individual in that organization. Organizational intelligence includes historical knowledge inherent in the organization and generative intelligence that results from collaboration between organizational members. To establish an effecitive maritime community, we should know that the sum of the all of the efforts are greater than the part which is the result of emergence of organizational collective intelligence through the community. In this way, the maritime community can behave with a team spirit. Accordingly, the maritime community should improve its intelligence to achieve its main purposes such as sustainability, which includes security, safety and environmental protection of the sea. By the context, Safety of Life at Sea (SOLAS) would shift to more common codes like Happiness of Life at Sea (HOLAS).

References

[1] Albrecht, Karl. The Power of Minds at Work: Organizational Intelligence in Action. New York: AMACOM, 2003.
[2] Amabile, T.M (1996). Creativity in context. Boulder , CO
[3] Atlee, T. (2003). The Tao of democracy using co-intelligence to create a world that works for all.

[4] Beyer, J. M., Trice, H. M. (1982). The utilizaiton process: a conceptual framework and sythesis of emprical findings., Administrative Science Quarterly, December, 591-622.
[5] Cannon-Bowers, J., and Salas, (1993). E. APA: Washington, DC; 61-87.
[6] Dayan, M. (2003)., New product team intelligence: ansequents and consequents, Doctoral Dissertation, Temple University.
[7] Deshpande., Zaltman (1982). Factors affecting the use of market reserach information: a path analysis., Journal of Marketing Research, February, 14-31.
[8] Gardner, H. (1983). Frames of mind:The theor y of multiple intelligences. New York: Basic Books.
[9] Glynn, M. A, (1996). Innovative geneous: a framework for relating individual and organizational intelligence to innovation., Academy of Management Review, 21,1081-1111.
[10] Halal, W. (1998). The Infinete resource: creating and leading the knowledge enterprise., Jossey-Bass.
[11] Hamzah, B.A. , Ports and Sustainable Development: Initial Thoughts, UNITAR
[12] Hunter, J. E. (1986). Cognitive ability, cognitive aptitudes, job knowledge, and job performance. Journal of Vocational Behavior, 29, 340-362.
[13] Jaworski, J. B., Ajay K. K. (1993). Market orientation: antecedents and consequenced, Journal of Marketing, 57, 43-70.
[14] Kasof, J. (1995). Social determinats of creativity: status expectationsand the evaluation of orginal products. Advances in group processes., 12, 167-220
[15] Klimoske, R., and Mohammed, S. (1994). Team mental model: Construct or metaphor?Journal of Management, 20, 403-437.
[16] Lynn, G.S, 1998. New Product Team Learning: developping and promoting your knowledge capital. California Management Review, 40, 73-94.
[17] McMaster M. D. (1996). The intelligence advantage: organizing for complexity, Newton. MA: Butterworth-Heinemann
[18] Moorman, C. (1995). Organziational market information procesess: culture antecedents and new product outcomes., Journal of Marketing Research, 32, 318-335.
[19] Paulus, P. B. (2000). Groups, teams and creativity: the creative potential of idea-generating groups. Applied Physcology: An International Review, 49 (2), 237-262.
[20] Quinn, J. (1992). Brain Intelligent Enterprise, The free press, NY
[21] Rouse, W.B., Cannon-Bowers, J.A., and Salas, E. (1992). The role of mental models in team performance in complex systems. IEEE Transactions on Systems, Man and Cybernetics. 22(6), 1296-1308
[22] Rouse, R., & Morris, N. M. (1986). On looking into the blackbox: prospects and limits in the search for mental models. Psychological Bulletin, 100, 349-363

[23] Rumelhart, D. E., & Ortony, A. (1977). The representation of knowledge in memory. In R.C. Anderson, R. J. Spiro, & W. E. Montague (Eds.), Schooling and the acquisition of knowledge (pp. 99-136). Hillsdale, NJ: Lawrence Erlbaum.
[24] Smith, J.B. (1994) . Collective intelligence in computer-based collaboration. Hillsdale, NJ: Lawrence Erlbaum.
[25] Sternberg, R. G. (1985)., Implicit theories of intelligence, creativity, and wisdom., Journal of Personality and Social Psychology, 49, 607-627
[26] West, M.A. (1990). The social pyschology of innovation in groups, MA, Westjale.
[27] Wilson, J. R., & Rutherford, A. (1989). Mental models: Theory and application in human factors. Human Factors, 31, 617-634.
[28] Thorndike, E.L (1911). Animal intelligence. New York: Macmillan

Contemporary maritime activities: a case study of transport and logistics research and education at Gdynia Maritime University (GMU)

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Abstract

Globalization and integration processes are important challenges for contemporary maritime activities. In particular, the growing importance of transport and logistics directly affects the whole sphere of international transport, and world maritime transport and seaports as well. This paper examines some substantial reasons and consequences of the ongoing changes in worldwide maritime transport and seaports' management systems. It also underlines a need for transport & logistics research and education at maritime universities. A case study of Gdynia Maritime University (GMU) shows how this institution tries to find practical solutions and to educate future generations in order to better serve the contemporary maritime community.

1 Introduction

Global trends in contemporary maritime transport and seaport policy are important challenges for the whole maritime community. In particular, the growing importance of transport and logistics directly affects the whole sphere of international transport, and world maritime transport and seaports, as well. Thus, there is a need for transport and logistics research and education at maritime universities. Gdynia Maritime University (GMU) is carrying out research and provides education in order to prepare practical solutions and educate future generations for the contemporary maritime community.

2 Global trends in contemporary maritime transport and seaport policy

The ongoing growth of the world economy in terms of GDP and industrial output accelerates the growth of international trade and consequently increases world seaborne trade. According to World Trade Organization (WTO) calculations, world seaborne trade accounts for more than 80 % of the world total trade in tonnage terms. Growth rates of seaborne trade were especially high in the last twenty years of the 20th century. In 2004 it reached 6.76 billion

tons of loaded goods. The annual growth rate reached 4.3 % over that of 2003, and the increase of the world merchandise exports volume was 13% higher at that time. The world merchant fleet grew to approximately 900 million deadweight tons (dwt), representing a 4.5% increase. The rapid increase in world seaborne trade boosts the development of maritime transport. As a result, it accounts nowadays for approximately 90 % of world transport in ton-miles. As a consequence, the total throughput of the world seaports has grown considerably, reaching (according to the provisional data) more than 14 billion tons (loaded and unloaded) (Przybylowski 2007).

Containerization has given shipping lines greater freedom to serve markets from a wider choice of ports, and thanks to so-called transferability (Fleming et al. 1994), has deepened the globalisation process. Ports no longer have control over inland markets and cannot be sure of trade even in their own local areas. They have to invest huge sums of money in superstructure and infrastructure development to participate in the container industry. However, profitability is not a guarantee, as some of them, despite having a container terminal, may be bypassed because of the reasons linked to the whole transportation chain, such as hinterland connections. The shipping lines, being the most important players in the logistics chain, widen their maritime services and extend control over landward movements. They certainly do not take into consideration the specific merits of a particular port, but the economies of scale and conditions of the entire chain. For instance, services in the Mediterranean have concentrated in entirely new southern pivot ports, such as Gioia Tauro and Algeciras, bypassing direct services with northern ports such as Livorno and Marseilles. Thus, port operations can be compared to a lottery (Slack 1993). Actually, the most dynamic increase of the handled volume of the biggest EU ports concerns the container traffic. There is a high level of correlation between the EU ports' development and their container handling volume. On the list of the top 20 container terminals only three EU ports are named: Rotterdam, Hamburg and Antwerp, ranking 7, 9, 11 respectively. However, the percentage change of container throughput in EU container terminals is above the world average level.

In the Baltic Sea Region the level of containerization is unfortunately the lowest in Poland (see fig. 1). However the latest investments in the seaports of Gdansk and Gdynia should increase their competitiveness.

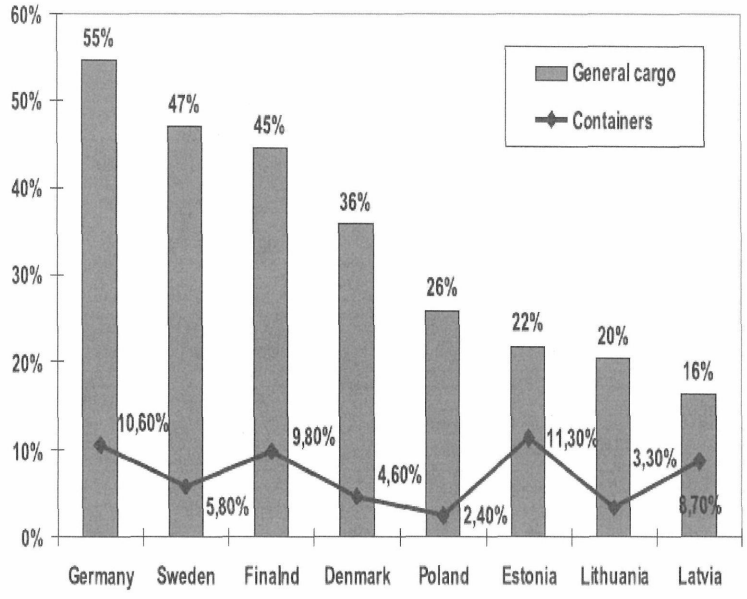


Fig. 1. Level of containerisation in external trade of the Baltic Sea Region countries

Source: M. Matczak, The Baltic Container Outlook 2007, Actia Forum, p. 26.

The changes in the maritime transport sector concern not only the growing volume of commodity flows and structure, but also ships' size, specialization, containerization and transport chain organization. The growth in ship size involves huge capital expenditures in ports. They refer to extensive dredging, greater dockside and handling capacity, for example. However, such anticipation may be a risky undertaking, as there is uncertainty over the ultimate size of the vessels. As far as the organization of maritime transport is concerned, some forms of cooperation such as strategic alliances (SAs) and equity merger and acquisition activities (M&As) have been developed. They refer mainly to the international container transport - Hanjin/Senator, P&O Nedlloyd, Hamburg-South-Group, etc.

The main result of this capital integration and other forms of cooperation is the enhancement of competitive position by improving learning capabilities and the timely access to technological knowledge and also vertical integration, control of intermodal and logistic cycles and logistics outsourcing, as well. Thus, the cost of transporting goods by sea have been decreasing and the effectiveness of the international combined transport chains has steadily grown. This process is still ongoing, despite huge unavoidable port investments (Grzelakowski & Przybylowski 2006). Major shipping lines formed strategic

alliances because the pressures of globalization require a presence in all the major markets of the world. As a result, formerly separate services of members are being integrated to create new service configurations, the outcome of which ports are unable to predict. Meanwhile, port operations become more capital intensive, labor saving and space consuming. Due to the liberalization of EU transport markets, seaports are under huge competitive pressure mainly from container transport operators committed in the logistic transport chains. Not all of them are able to face such a competitive environment.

The adjustment to the above mentioned globalization processes needs huge additional public investment in port infrastructure and the lowering of operational handling costs. Only the biggest terminals and port handling operators can meet the challenges and requirements set by the growing competitive environment (pressures from container operators, liners). Due to the relatively low port tariffs, ports are unable to increase their income. Therefore, they need to apply for huge public assistance and for access to the capital of parties involved in the multimodal transport chain. However, such a strategy is very often connected with the change of their contemporary role in the transport chain, and the evolution of their model of administration and management, in particular. Polish ports should consider specific approaches depending on the environment in which they operate, in order to face ongoing challenges.

Existing traditional seaport administration and management systems, as well as port policy objectives and requirements based principally on the concept of exclusively port-oriented management forms in Polish ports, no longer comply with the new logistic management challenges and the growing competitive transport environment. Traditional concepts and models of national seaport policy are steadily evolving, becoming much more global and transport chain oriented. Polish seaport authorities, confronted with the abovementioned processes, must adopt efficient survival strategies in order to resist global and integration pressures. Slack mentions two possible reactions that could be adopted by seaports: keeping pace with market demands, or pursuing customer-driven strategies. The Porter and Robinson studies suggest providing superior value-delivery to targeted customers at a cost that provides acceptable profit levels. The first strategy consists of carrying out expensive investments in superstructure and infrastructure in order to keep pace with shipping line expenses on larger vessels. The second is a response to concrete demands coming from shipping line clients. Certainly, large investments are not a guarantee of success and may not be even economically and economically sustainable. The third approach requires important adjustments in ports' functions to fit better into local, regional and global markets (concentration on passenger business or container feeder port role, f. ex.). This solution could be a good idea for Polish ports as their participation in the container market is relatively low.

A port authority may be not only a port operator but also a land developer. Sites that no longer have a port-use character can serve for urban redevelopment. Such an alternate use of port sites may bring a lot of income,

because waterfront land is of a great value (Slack 2001). As mentioned above, the necessary step is a full integration of those entities into the transport chains. Such a process has already started. It is performed by horizontal and vertical forms of integration. The first is caused by the ongoing process of privatisation of port terminals, mainly container ports. Global container operators, like HPH, take over container terminals becoming their owners in the world scale. The reason for this is an increasing rentability of port container terminal companies. According to Drewry Shipping Consultants, the leading container operators like HPH, CSX WT, PSA Corp., ICTSI and P&O Ports reach turnover rentability of 33%, 29%, 25%, 18.8% and 17.4% respectively. Vertical integration is based on capital concentration among port terminal companies and other logistic transport operators such as global container alliances (Maersk).

Until now, ports behaved passively when taken over by other operators' players/ carriers. Thus, despite the growing concentration of the commodity flows in the main EU ports which strengthen their competitive position on the open European seaport market, the majority of them seem unable to resist the enormous global challenges. However, since the mid 90s some European seaports have become much more pro-active on the global transport market, which is not yet the case for Polish seaports. The simplest form is the biggest EU container terminal operators (Eurogate) getting together with the strongest railway companies container railway services to operate as a global player on the European transport market. Such services connect the main European terminals (Bremen, Hamburg) with the main consumer and production centers in Europe. Consequently, European ports bind huge areas of the hinterland and the main initiative is overtaken by the container terminals.

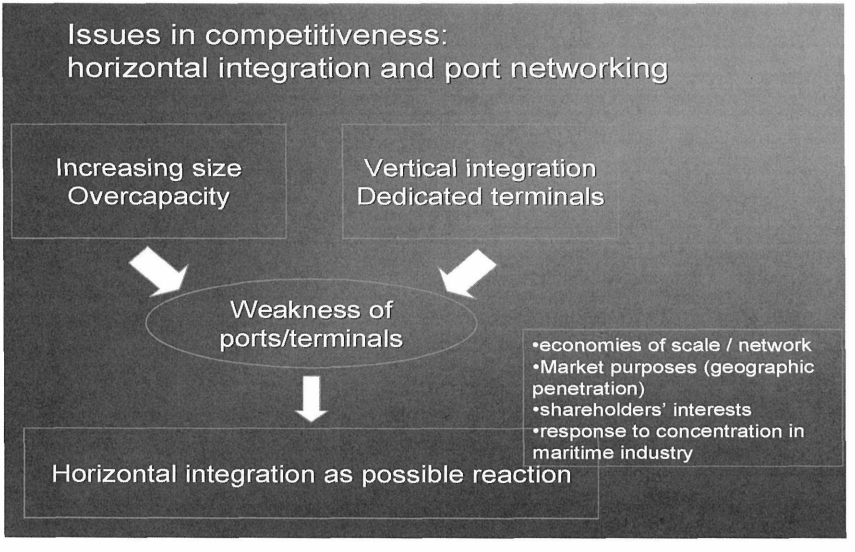
The wider concept, based on the stronger position of container terminal operators in land transport relations is aimed at strengthening their position in relation to the container transport operators (container alliances). Nevertheless, port container operators are partly overtaken by still stronger maritime transport operators. In fact, shipping lines become multimodal logistics providers controlling the routing of the flows in conjunction with the ocean services of the consortia. Thus, a port is an incidental entity in this global network system. Containerization has reduced the economic impact of ports on cities, because ships' crews are smaller than they used to be, and spend little time in port, considerably diminishing dock labour. As local economic benefits (employment) are declining, investing public monies in port areas is no longer justified. The European Commission wants to minimise subsides in accordance with proper competition policies and restrictions on public state aid.

The increased competitiveness of Polish ports can be achieved by establishing port clusters either via port authorities or via municipal governments. Port clusters may be defined as 'the set of interdependent firms engaged in port related activities, located within the same port region and possibly with similar strategies leading to competitive advantage and characterized by a joint competitive position vis-à-vis the environment external

to the cluster'(Hong-Seung-ROH 2004). There is an urgent need to enhance relationships between the port and associated companies in the port area in order to create an added value (Notteboom T. E. 2005). Moreover, the strategies for port competitiveness must take into account local impact in order to strengthen the link between the port and its city/region (Pando J. et al.2005).

Port management systems should also meet the criteria of sustainability, i.e. combining economical, ecological and social factors. A sustainable composition will be reached if all stakeholders having different goals are taken into account (Musso E. 2007). It is not an easy task, as port authorities may often be in conflict with legislation, environmentalists and the general public while trying to accommodate their sites to growing economic needs (i.e. access to water depths requiring frequent dredging). There is a need for more partnership solutions as regards port management, an for implementing ecological systems preventing pollution and excessive emissions. This requires paying more attention to local labour markets in order to avoid social protests (EU 'service' directive proposal, for example). The possible reaction leading to raising ports' competitiveness could also be horizontal integration and port networking and combining competition and cooperation (fig. 2).

Fig. 2 Horizontal integration and port networking



Source: www.enricomusso.it/VigoSlides3.ppt, 14.02.2007

So Polish seaports need to be much more efficient in micro and macroeconomic terms. They should become an integral part of the vertically integrated logistic transport chain. The simplest form of performing these

strategies is the development in their areas of distribution and logistics centres, for example. This is the case of three major seaports in Poland: Gdansk, Gdynia and Szczecin-Swinoujscie where such investments are taking place. They also need to enforce much more integrated and logistic transport chain-oriented sea port activities because of the still growing competitive requirements from maritime and land transport operators, as well as exporters and importers. This kind of seaport reorientation cannot be efficiently carried out without a transformation of their administration and management systems, i.e. going towards more partnership solutions, for instance. Some of them will have to find other solutions and cultivate niches as secondary ports. Others may be forced to be pro-active and work closer with logistics providers, railroads and truckers, raising the service attractiveness of the port (Przybylowski A. 2008).

However, the abovementioned strategies would require more partnership solutions, going far beyond the port area. Ports could also allocate berths to a single user in exchange for a long-term commitment, which would integrate and even completely attach shipping lines to the particular port. The development of logistics features; inventory control, data management, packing and processing, could also enhance the economic benefits of port operations, such as in the Port of Rotterdam. Horizontal port alliances seem to be a good solution for survival as well. A group of northern European ports have already gathered together to solve common problems. However, this process is quite a challenge because of the differences concerning port management models and systems.

3 Transport and logistics research & education at Gdynia Maritime University (GMU)

The abovementioned processes need to be constantly analyzed and taught within a transport and logistics research & education framework at maritime universities in order to prepare practical solutions and well-educated future generations better to serve the contemporary maritime community. This is conducted and coordinated at Gdynia Maritime University (GMU) by the Department of Transport Systems (formerly the Port Planning and Management Department), established in 1998 as a unit of the Faculty of Navigation. The Department cooperates with many Polish and foreign institutions and runs research and teaching activities which focus on the following topics:

- transport, logistics and forwarding,
- port planning, designing and maintenance as well as port management and economics,
- port - city relations and urban planning of seaport cities,
- EU transport and cohesion policy,
- preventing disasters from a collapse in transport structures (monitoring of structure reliability through intelligent materials application),

- development of maritime transport as well as railway, road, air, inland waterways and intermodal transport,
- transport infrastructure planning, financing and management.

GMU scientists provide theoretical justifications for practical solutions for the Polish government and for companies involved in transport and logistics. Some aspects of this research has been presented in the previous work.

As far as education is concerned, the curriculum for transport students provides subjects giving them a wide scope of transport and logistics issues. *Transport economics* (2 versions: 30 h and 20 h in the 4th semester) embraces such important elements as:

1. The role and function of transport sector in the national economy and in the global scale ;
2. Transport system – its structure and relations to the surrounding environment ;
3. Intermodal and combined transport - conditions of their development ;
4. Transport costs – micro- and macroeconomic aspects ;
5. Charging schemas for the transport services ;
6. Transport markets and their mechanisms ;
7. Models of transport markets regulations ;
8. Transport policy and EU regulatory measures .

Seaports economics (2 versions: 30 h and 15 h ; 6th semester) addresses the following topics:

1. Seaport economics as a didactic, educational and academic school and its place in the system of transport sciences ;
2. The role and relevance of seaports in the economy; macroeconomics aspects ;
3. Systems and models of seaport administration and management – their characteristics and evaluation in macro- and microeconomic aspects ;
4 Markets of seaports services as spatial and economic categories ;
5. Models of seaports markets' equilibrium and disequilibrium; economic consequences of both market conditions ;
6. Seaport costs and port dues, fees and charges ;
7. Methods and forms of seaports markets regulation;
8. Seaport policy in the EU and outside Europe .

Seaport companies' economics and management (15 h ; 2nd semester) deals with:

1. Seaport companies – their economic functions in the port system and their relation to the surrounding environment ;
2. Analyses of the economic activities of the port businesses;
3. The impact of external and internal factors on the effectiveness of seaport companies ;
4. Methods of evaluating the effectiveness of seaport companies' economic activity results;

5. Forms and methods of seaport companies management and stimulation of their development .

Maritime transport economics (15 h ; 3rd semester) concerns :

1. Maritime transport economics as a didactic, educational and academic school and its place in the system of transport sciences ;.
2. Maritime transport economic activity – its characteristics and analyses ;
3. Costs in maritime transport and their measures and classifications ;
4. Charging schemas and practices in maritime transport sectors ; freight indices ;
5. Freight markets and methods of their analyses ;
6. Tonnage investments and their effectiveness ;
7. Shipping Policy and regulation;
8. The role of maritime transport In the national economy.

Students also get acquainted with such other important subjects as:

- *Transport infrastructure,* presenting the main characteristics and parameters of transport infrastructure, the indication of the modal specific concern infrastructure, the state-of-art and future development plans of the European transport infrastructure and the financial aspects of the infrastructure development (including national budget structure, PPP, European Funds assistance);
- *Transport systems* - characteristics of the main elements and intra-relation of the transport system; mutual influence between the transport system and framework conditions; the functional potential of the particular modes of transport (including means of transport, turnover and performance); the challenges of the modal split redefinition in Europe; and the relation between transport policy and contemporary transport operation and development.
- *Logistics* - the definition, origin and main characteristics of logistics; basic rules and kinds of logistics systems; logistics of delivery, production and distribution, main challenges and solutions; spatial planning of logistics system location and development; characteristics and management of the integrated logistics chains/networks; and the role of transport in logistics management.
- *Benchmarking in transport* - presentation of benchmarking as the modern tool for management; crucial stages in the process of benchmarking research; implementation opportunities of benchmarking in transport systems; the utilization of the tool in analysis of the real and regulatory sphere of transport systems; and benchmarking in seaports.
- *Forwarding* - the essence of forwarding; participants in the forwarding market; troblems of transport and insurance commerce customs; the forwarding process in export and import of goods, procedures of

customs duties; methods of transport cost calculation; means of payment in commerce transactions; multimodal transport; the role of informatics in forwarding; international convention influence over forwarder work; international organization influence over forwarder wor; and basic documentation in transport and forwarding services.

- *Sea-port freight forwarding* - the basic notions connected with port-sea freight forwarding; prices for services in port-sea freight forwarding; influence of the General Polish Freight Forwarding Aptness 2003 on the work of the port-sea forwarder; role of wrappings in port-sea freight forwarding; the role of computer science and taking bar codes in port-sea freight forwarding; setting for forming loading units; and freight forwarding aspects in the multimodal transport.
- *Transport & Cohesion in the EU* - EU structural and cohesion funds in transport/infrastructure projects, and TEN-T as a basic instrument of ensuring cohesion within the EU territory.
- *Port Planning and Operating*:
    - Seaports - general considerations: definition, classifications, and function
    - Basic measures of seaports: ship's dimensions, port trans-shipment
    - Port infrastructure and superstructure: spatial configuration of functional elements of a port
    - Planning and designing of port water area: access channels, anchorages, port entrances, inner channels, turning circles, basins, docks
    - Designing of berthing line: general cargo terminal, container terminal, ro-ro and ferry terminals, dry-bulk terminals, liquid-bulk terminals
    - Designing of port terminals, storage facilities, cargo-handling systems: general cargo terminal, container terminal, ro-ro and ferry terminals, dry-bulk terminals, liquid-bulk terminals.

Besides working in class, students have to do a two week placement in seaports (2nd semester) and another individual one (7th semester) in institutions, companies or other entities related to transport and logistics.

4 Conclusion

1. Contemporary maritime activities are influenced by globalization and integration processes. The growing importance of transport and logistics directly affects the whole sphere of international transport, and world maritime transport and seaports.
2. The transport and logistics sector plays a major role in the economy and is a significant contributor at both the national and local level. It underpins the economy, enabling the movement of goods, services and

people as efficiently as possible. It is often described by the method of transporting goods – road, rail, sea or air. In reality, large logistics companies work across all types of transport and with multiple industries.

3. There is a need for transport and logistics research & education at maritime universities in order to prepare practical solutions and well-educated future generations for the better to serve the contemporary maritime community.
4. Gdynia Maritime University (GMU) has been carrying out research and providing education in this field for several years. GMU scientists elaborate theoretical justifications for practical solutions for the Polish government and companies involved in transport and logistics.
5. Students have an opportunity to receive proper knowledge and prepare for jobs in this sector, especially in maritime transport and seaport related institutions and companies. Also, those who study navigation may be willing to work in this business after their sea-experience. Thus, GMU provides courses enabling them to study transport management and logistics.
6. Transport and logistics research & education may be a solution for future activity of some maritime universities confronted with a serious shortage of seafarer candidates.

References

[1] Fleming, D.K and Hayuth, Y. (1994) 'Spatial Characteristics of Transportation Hubs: centrality and intermediacy'. Journal of Transport Geography 2.

[2] Grzelakowski A. S., Przybylowski A. (2006), The logistics supply chain management concepts and their impact on the development of the seaports in the global scale, INTLOG proceedings.

[3] Hong-Seung-ROH (2004), A conceptual model of port clusters and related assemblage, IAME IZMIR proceedings, vol. II.

[4] Musso E., la nueva dimension de los puertos en el siglo XXI, http://enricomusso.it/VigoSlides3.ppt, 14.02.2007.

[5] Notteboom T. E. (2005), Port regionalisation: towards a new phase in port development, Maritime Policy & Management, vol. 32, no. 3.

[6] Pando J. & al. (2005), Marketing management at the world's major ports, Maritime Policy & Management.

[7] Przybylowski A., Impact of globalisation and integration processes on the development of the EU seaports, IAMU Global Maritime Excellence proceedings, Odessa 2007.

[8] Przybyłowski A., Polish seaports' development in the light of integration and globalization, 4th International Congress on Transport Research in Greece, Athens 2008.

[9] Slack B. (2001), Globalisation in Maritime Transportation: competition, uncertainty and implications for port development strategy, Fondazione Eni Enrico Mattei.

[10] Slack, B. (1993) 'Pawns in the Game: ports in a global transport system'. Growth and Change 24.

Methodological issues of preparing and conducting computer-assisted exercises on maritime security matters

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1 Introduction

Computer-assisted exercises (CAX) have established themselves as the most effective form of preparing personnel engaged with crisis management, including the training future merchant marine officers in the broad-ranging and often contradictory issues of safety and security.

This paper is based on the thesis that CAX should become the main form of the all-around training for the future specialists from the maritime transport system (MTS) for issues of security. Only if they are actively utilized can the above-mentioned issues and contradictions be overcome. They are not a panacea, but only a tool that provides highly adaptive training at relatively low costs. In order to be effective, this tool should be utilized correctly from a methodological, organizational and technical point of view.

On this basis, the paper presents some methodological issues related to preparing and conducting computer-assisted education and training for maritime officers, focusing on computer-assisted exercises in maritime security matters.

2 Current status of maritime security officer education and training

The current maritime safety and security related education and training (E&T) process suffers the following practical problems:

- Ship officers have little knowledge of the whole maritime safety and security system, the functioning of which has become significantly more important in the light of the ISM [3] and the ISPS Code [4]. Very often, the lack of this knowledge leads to demotivation of the main participants in the process of maritime transport;
- The training pursuant to the ISPS Code relies on the acquisition of standard tactical and technical methods of protection, which provides general standard basic knowledge and skills. Even though this is

necessary, it contradicts the idea of proactiveness and creative problem solving;

- The increased requirements of the STCW Convention [7], which already cover all the categories of maritime transportation system security officers, now demand a new system of training and a suitable learning environment;
- Developing and maintaining such an environment requires significant expense and the employment of a very well-prepared team, which is beyond the resources for many maritime training institutions.
- These problems are exacerbated by some contradictions in the computer-assisted E&T process:
- Developing and maintaining an expensive and complex environment for CAX is not affordable for most maritime training institutions;
- Training in security issues should not be confined only to the framework of the merchant marine;
- The future watch officer should receive a much broader range of training in the issues of safety and security than the minimum required in order to be an active organizer and an adaptive participant in the processes occurring in the world ocean;
- The total time for training future maritime officers is reduced; because of this, the necessary balance must be struck in their fundamental training in safety and security, and a new level of knowledge and skills must be achieved by applying both traditional and new training techniques.

These issues are a practical and direct result of the lack of common methodology for preparing and conducting computerized training related to the general subject area of maritime security.

3 Analysis of goals and objectives of security officers education and training in maritime safety and security matters

When providing education and training (E&T) for maritime security personnel, the most significant problem we usually meet is "How do we provide practical orientation of the E&T process for a wide range of possible security situations in a relatively unpredictable environment?" The problem is exacerbated by the fact that the training addresses an audience from different institutions.

The classical approach for dealing with similar obstacles suggests that the E&T process has to be focused on the concrete objectives of the Maritime Safety and Security System (MSSS).

Notwithstanding the rationality of this approach, the risk of incorrect operationalization of the objectives is significant. A strong argument is provided by the fact that the factors, which the MSSS is to counter, are organizations

which perform continuous adaptation of their strategy and/or structures in the circumstances of the dynamic conflict environment.

This fact provokes the idea that the "*traditional approach*"[1] for defining the objectives of the MSS suffers two typical defects: "*subjectivism*" and "*excessive practicality*".

The "*subjectivism*" is a result of limited predictability of the environment and the tendency to overcome this obstacle by applying a scenario-based approach when studying the objectives of the MSSS. The possible aftermath can be summarized as "*situational orientation*" of the objectives defined.

The necessity of the practical orientation is indisputable but the risk comes from the possibility of missing the moment of emergence of synergetic properties of the MSSS in the process of the decomposition of goals to the system of objectives.

As a result, there is a real danger in elaborating a concept of a virtual environment for E&T, which may suffer from incorrect basic assumptions.

In order to overcome the possible problems mentioned above, and taking into account the artificial nature of the MSSS, we applied the "*mission approach*" for functional analysis, which studies functional orientation of the objectives performed by the MSSS on the background of the "*life-cycle*" of the negative factors, presented by their evolution in the logical sequence: "*challenges – risks - threats*"[2].

Regardless of the variety of possible approaches for deconstruction of a system's goals of functioning, there are two groups of goals:

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[1] The "*traditional approach*" [1, p.62-68] suggests the following sequence:

- Definition and analysis of the MSSS goals;
- Decomposition of the goals to the system of objectives for their achievement;
- Elaboration of a strategy as a set of objectives arranged in time perspective, whose fulfillment ensures the achievement of a separate goal. In practice, this process is a synthesis of an operational structure;
- Elaboration of a technology as a relationship between the strategy and the existing system's structure.

[2] For the purpose of this study, we consider any factor that threatens maritime security as an organization whose evolution follows the sequence: "*emergence of a challenge – evolution to a risk – formation of a threat*". In fact, we propose a different point of view presenting the terms "*a challenge*", "*a risk*", and "*a threat*" as three different stages of the process of formation of an organization.

For a more detailed explanation of the sequence "*a challenge – a risk – a threat*", the "*mission approach for functional analysis*" and its application on studying MSSS functioning see: *Mednikarov B. and K. Kalinov, "An alternative of the system approach to functional aspects analysis of the Maritime Crisis Management System", Information and Security. An international Journal Volume 22,2007* [5].

- The first one includes these functional directions, which are related to the reason for the establishment of the system[3]:
- Preparation for reaction in response to a manifestation of a negative factor or a combination of negative factors;
- Reactions in terms of short-term adaptiveness, long-term adaptiveness, and evolutionary adaptiveness[4];
- Acquisition and analysis of information concerning the environment and the negative factors.
- The second group of goals is related to the self-reproduction and self-maintenance of the system. Classically, this set of functional directions includes educational, administrative, and legislative activities.
- The general congruence between negative factors' "*life-cycle*" and the main functional directions in MSSS's functioning is given in *fig. 1.*

[3] The practical dimensions of the reason for MSSS establishment could be summarized as a counteraction, in the sense of reaction, to the negative factors' manifestations. In this context, it is possible to unify the different reactions in function of adaptation. The MSSS performs predominantly adaptive functions in relation to the suprasystem. When applying such an approach, it should be considered that there are three different levels of adaptiveness: short-term adaptiveness, long-term adaptiveness, and evolutionary adaptiveness. Taking into account that the reactions of a system are based classically on preliminary preparatory for action and acquisition of the information necessary, we have to add to this group these functional directions, which have a direct relation to the achievement of the global goal of the system: acquisition and analysis of information concerning the negative factors and the environment, planning, and training.

[4] Short-term adaptiveness is a process of adaptation to the current situation. That is why it is a process of direct and situationally-oriented adaptation. It is performed predominantly by functional adjustment. Long-term adaptiveness is a process of adaptation to relatively predictable future conditions of the environment. It is performed by elaboration of structural prerequisites for functional adjustment to possible future situations. Evolutionary adaptiveness is observed in unpredictable situations. That is why it is performed by elaboration of structural prerequisites for the necessary system's properties for adaptation in cases of emergency.

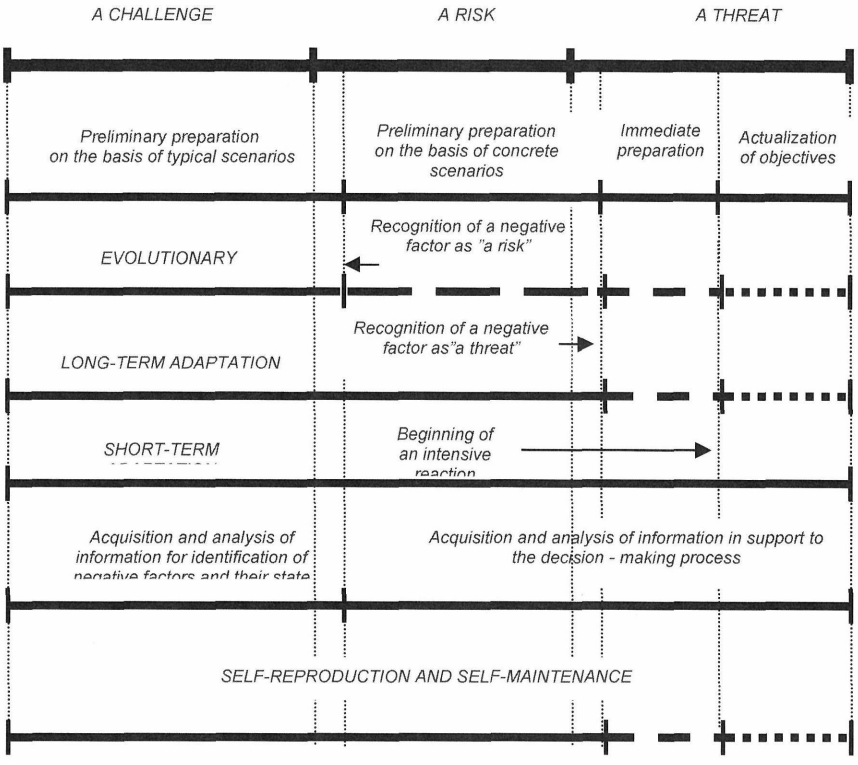

Fig. 1 General correspondence between negative factors' "life-cycle" and the contents of the functional direction of the MSSS's functioning

In fact, the MSSS's E&T process is a part of the functional direction known as "*preparation for reaction in response to a manifestation of a negative factor or combination of negative factors*"[5].

[5] In fact, the E&T process belongs both to the functional direction "*preparation for reaction in response to a manifestation of a negative factor or combination of negative factors*" and the functional directions of the self-reproduction and self-maintenance of the system. For the purpose of this study, we are interested in these educational and training patterns, which are directly related to the

As a result of applying the mission approach to study the MSSS's functioning, we derived the following conclusions[6]:
The MSSS is formed after the recognition of the negative factor as "*a risk*".
The recognition of the negative factor as "a risk" finalizes the preliminary preparation on the basis of typical scenarios.

After the recognition of a negative factor as a threat, the short-term adaptation process becomes dominant in relation to any other functional direction.
Every conclusion poses concrete requirements to the E&T process. That is why it is appropriate to consider all of them.

The fact, that the MSSS is formed after the recognition of the negative factor as "*a risk*", means that we have a complex of interacting components rather than a system. The aftermath is that the MSSS has almost no practical experience. Obviously, the main "*source*" of practice is the E&T process. This E&T process relies predominantly on the Computer-Assisted Exercises (CAX) conducted in a virtual environment provided by simulators. The logical recommendations are:

The virtual environment for the MSSS's E&T process has to provide both "*technical experience*" and "*management practice*" for the personnel. The "*sub-recommendations*" are:
The simulators have, on the one hand, to be in full compliance with the equipment, and on the other – to "*reflect*" the existing organization of the MSSS;
Both the simulators and the CAX methodology must be flexible enough in order to "*shift the emphasis*" of the training from "*predominantly technically oriented*" to the "*predominantly management-oriented*".
The virtual environment for the MSSS's E&T process has to model a great variety of possible safety and security situations.

Any reaction in a particular situation is based on behavioral models which have "*worked*" in similar situations. The lack of real practical experience of the MSSS leads to the idea of providing the MSSS with an "*artificial memory*". This means using an opportunity to acquire data of situational games in virtual environment, analyzing the data collected, deriving indicators for recognition of the particular situation, and suggesting a management decision. The recommendation is:

The simulators have to provide an opportunity for "*case management*" by modeling specific situations, acquisition and analyzing data and suggesting a particular course of action.

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reaction of the MSSS to crises or emergencies. That is why we do not examine the E&T functions, related to the self-reproduction and self-maintenance of the system.

[6] The paper presents only these conclusions which are directly related to the MSSS's E&T process.

Taking into account, on the one hand, the dynamic nature of the security environment, and on the other – the abstract charge of the social comprehension for "*safety*", the next recommendations are:
The simulators have to provide an opportunity for upgrading and modernization;
The CAX methodology and the supporting base (databases, software, workstations, etc.) must be flexible enough to allow their adjustment to the changeable organization of the MSSS.
The necessity of the simulators and CAX methodology flexibility can be developed in one more direction – the idea of using the virtual environment for scientific purposes. The possibility of testing different realizations of the MSSS's architecture is to be provided by specialized software.
The second conclusion suggests that there are distinctive "*accents*" of the E&T process.
Preliminary preparation is performed on the basis of typical scenarios. The E&T process is carried out in circumstances posed by "*an unidentified risk*"[7] .
Logically, the recommendation is:
The simulators have to support the following activities:

- Development of typical scenarios;
- Development of typical reactions in context of the typical scenarios;
- Examination of the MSSS's functioning in the environment described by the typical scenarios.
- The simulators support the following activities: training, planning, and research.

The recognition of the negative factor as "*a risk*" finalizes the preliminary preparation on the basis of typical scenarios and the focus of the E&T process shifts to preliminary preparation on the basis of concrete scenarios. The recommendation is: The simulators and the CAX methodology have to be able to select scenarios adequate to the current situation and to provide reliable prognosis for the possible development of the situation.

The last conclusion of the analysis led us to the idea that the short-term adaptation process becomes dominant in relation to any other functional direction. In fact, after the recognition of a negative factor as "*a risk*", the other functional directions, in practice, stop and "*melt*" into the background of the short-term adaptation. Obviously, the paramount role of the short-term reactions suggests that the E&T process first has to provide "*technical experience*" for the operative personnel and "*management practice*" for the low hierarchical level managing staff[8], and only after that – to put attention on the preparation of long-

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[7] "*An unidentified risk*" means that the negative factor is in a stage of "*a challenge*" or it has already evolved to a state of "*a risk*" but the security system has not recognized that development of the factor.

[8] It should be noted that the short-term reactions will be undertaken predominantly at a local level – at the level of the crisis and/or conflict. This

term oriented adaptive reactions. This motive led us to the idea to try to answer the question, is there is any relation between the different accents of the E&T process and the safety and security concepts?

Professor Donna J. Nincic provides an interesting metaphor explaining the difference between safety and security concepts: "*safety is doors open to allow free access for escape or rescue in a dangerous or unsafe situations. Security, on the other hand, is doors closed to prevent access to those who might wish to do us harm*" [6, p.147]. Assuming, that "*security can be considered protection from active malicious agents*" and "*safety, on the other hand, can be considered protection from accident, maritime casualties...*"[6, p.147], we went one step further and say that safety is an "*effect-oriented countering*" concept, which means short-term oriented. On the contrary, security is a "*cause-oriented countering*" concept or long-term oriented. Logically, the E&T process has to consider that safety related E&T is the basic prerequisite for the security related E&T[9]. The recommendation is: The CAX methodology has to provide correct balance between the safety and security orientations of the E&T process.

4 Conceptual model of computer-assisted education and training in maritime security matters

Obviously, the computer-assisted E&T process has to overcome current E&T problems and meet the requirements formulated above. We can formulate additional requirements: efficiency, effectiveness, universality, etc. But we are addressing one aspect of the flexibility of the computer-assisted E&T process, which reflects the overall logic underlying in the E&T process. It comes from comprehending that one's reactions to a particular situation are an original "*cocktail*" of previous experience and the ability to estimate and respond to the particularity of the situation.

The initial E&T process has to establish behavioral models necessary for quick response to a familiar situation. In other words, the purpose is to give the trainee an adequate "*memory*". For this reason, the basic level of the computer-assisted E&T has to provide a typical situation in a typical environment.

The next stage of the E&T process is to make the trainee "*overcome*" the framework of the behavioral models learned, to "*recognize*" the specificity of the situation, and to elaborate a proper (which means specific) response. In order to support this idea, the computer-assisted E&T has to provide a non-routine situation in a non-routine environment.

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results in the fact that the preparation of the operative personnel and the low hierarchical level managing staff is of vital importance for the final result.

[9] The idea is not to make a clear distinction between safety E&T and security E&T, but to underline that more technically-oriented safety E&T should precede more "*creative*" security E&T.

The next level of the E&T process explores the idea of giving the trainee the ability to make logical relations in unrelated (at a first glance) processes and events, to recognize the patterns that they have in common and "*cause - effect*" relations, and on this base, to elaborate basic and widely applicable behavioral models.

Obviously, the computer-assisted E&T has to be flexible enough in order to be able to "*shift*" the accents of the overall E&T process.

Taking into account the recommendations and the idea that the MSSS's overall goal is adaptation of "*a suprasystem*" (the society) to the dynamic safety and security environment, we defined three different stages in the E&T process: general (short-term reactions oriented) E&T, long-term adaptation oriented E&T, and evolutionary adaptation oriented E&T. Table 1 presents general description of the E&T processes.

Table 1
General description of the E&T stages and the measures to satisfy the requirements

Stages	1st level E&T	2nd level E&T	3rd level E&T
General description	Short-term reaction oriented E&T More "*safety oriented*" than "*security oriented*" Focused on technical experience and standard management procedures (tactical management) Object oriented approach to safety and security matters	Long-term adaptation oriented E&T Dynamic balance between safety and security orientation. Focused on the management of the system in a dynamic environment (strategic management) Zone-oriented approach to the safety and security matters	E&T is evolutionary adaptation oriented Predominant "*security orientation*" Focused on management in "*extreme*" situations (continuity of operating) Optimization of the performance Critical infrastructure understanding
General goal	To provide basic technical and management skills To establish behavioral models for standard situations	To provide sound management abilities To create abilities for "*overcoming*" the standard behavioral models and for elaborating reactions adequate to the particularity of the situation	To provide strategic management abilities To create abilities to "*overcome*" the "*preventive - responsive*" nature of MSSS functioning and to perform active management of the security environment
Targeted audience:	Operative personnel and low hierarchical level managing staff	All hierarchical levels of the managing staff	High hierarchical levels of the managing staff. Research institutions personnel.

Stages	1st level E&T	2nd level E&T	3rd level E&T
Objects for modeling in virtual environ-ment	Technical systems Organizational structures Typical scenarios Real past situations (lessons learned)	All of the previous stage objects Not typical scenarios Adaptive opposing agent (pirates, terrorists, etc.)	All of the previous stages objects Scenarios for "*extreme*" situations Non-existing organizational models and technical systems
Objectives of computer-assisted forms for E&T	Acquisition of technical experience Learning standard operational procedures Learning tactical management procedures Learning procedures for interagency cooperation Certification of the personnel	Actualization of the previous level E&T Learning strategic management procedures Testing technical systems and/or organizational decisions Case management	Actualization of the previous level E&T Developing long-term security environment prognosis Testing viability of different variants for optimization of the MSSS

5 Estimating the applicability of some simulation systems

The main instruments for conducting CAX are different simulators, simulation systems, simulation environments, etc. For the purposes of one of the studies conducted by the authors,a comparative analysis, has been carried out, some of the results of which are shown in Table 2.

Table 2
Results of the comparative analysis of some simulation systems

The main indicators for the analysis	**Simulation system type**		
	Oriented to the ship	**Oriented to the entire maritime transport system**	**Oriented to a common national (regional) security system**

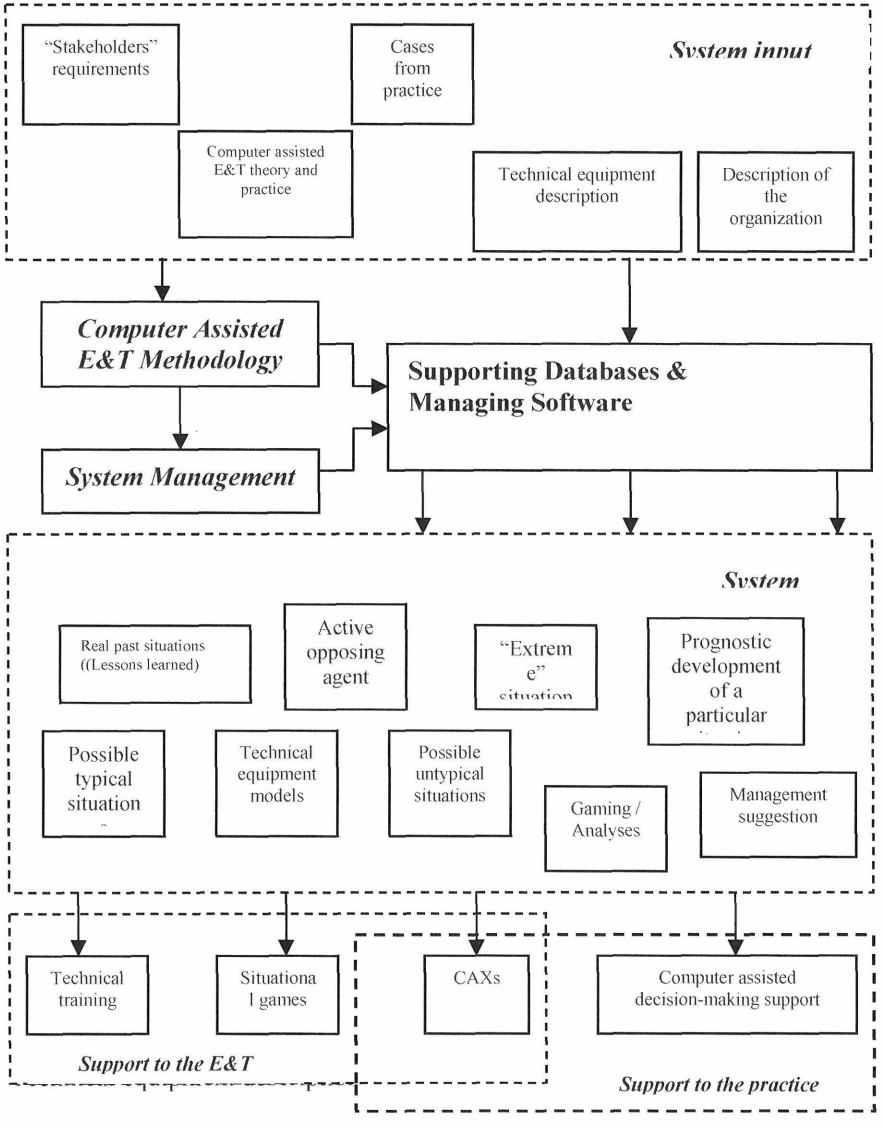
Example realization	**"Mars2" Maritime Safety and Security Training Environment** Rheinmetall Defence Electronics GmbH (Düsseldorf, Germany),	**Crisis Management System, integrated with a simulator** Tranzas (UK, Russia)	**"EU-TACOM SEE 2006" Simulation environment for conducting CAX in the civil security sector** Institute for Parallel Processing, Bulgarian Academy of Sciences
Purpose	In compliance with ISM and ISPS Code, preparation and training for seafarers in all aspects of safety and security in the course of the operations of a merchant vessel	All aspects of crisis management in MTS and its separate branches	All aspects of crisis management in the civil protection system with a focus on the protection of critical infrastructure
Personnel trained	Watch offices and other personnel with special responsibilities concerning the safety and security of the ship	Crisis response teams from the port and the flag state; Consequence management teams Coordinators and operators in C2 and C4IPS systems;	Crisis response teams on an institutional and state level; C2 teams for crisis situations; Management personnel; Research teams
Mode of training	Individual training; Training of a crisis response team from a ship	Mainly – group training; Individual training for management personnel; CAX	Mainly – group training: Mainly – group training of several command positions; CAX
Main objectives	Fundamental training for students at the maritime Academy; Refresher training; Company training (particularly for special high-risk vessels); Certification / verification / assessment	Fundamental and refresher training of a broad group of MTS personnel Fundamental and refresher training of teams; Vocational training; Retraining and enhancing qualifications;	Fundamental and refresher training of a broad group of security system personnel; Working on interagency interaction Fundamental and refresher training of teams; Academic research

		Academic research work; Testing of plans	work; Testing of plans
Visualization	Detailed graphic display of: all the decks; functioning systems	No data	2D electronic chart display; For separate sites - 3D display (optional)
General characteristics	Specialized simulator	Possibilityof integrating different simulators	Possibility of federating different simulation environments
Models used	Relatively constant, with a possibility for fixing them to a particular ship	Preset typical models of different crisis situations	Broad-ranging, adaptive models

The main disadvantage of the analyzed systems leads to the conclusion that, in spite of being applicable to the process of computer-assisted E&T, they do not cover the whole E&T period and do not satisfy the requirements described above.

6 Conceptual model of computer-assisted education and training system in maritime safety and security matters

The considerations taken into account when elaborating the model of computer-assisted education and training systems are presented by the following "*trinity*": formulated recommendations, existing decisions, and the idea to serve not only the E&T process, but also the practice.
The conceptual model of computer-assisted E&T system in maritime safety and security matters is presented in *fig. 2*.



Fig, 2 Conceptual model of a computer assisted education and training system

Description of the organization.
"*Input*" serves the following functions: Elaboration of a computer-assisted E&T methodology and data acquisition.
Taking into account the particular purpose of the E&T process and related computer-assisted E&T methodological procedures, the managing body (system) of the E&T process formulates the desired "*output*" products. This task is supported by a specialized case software.
Different combinations of the products are "*unified*" by the managing system (using the support of related managing software) in different E&T forms and/or forms of providing computer assistance to the decision-making process.

7 Conclusion

Even a passing glance on the proposed conceptual model of a computer-assisted E&T system proves the important role played by the computer-assisted exercises in the whole system for maritime safety and security management and related E&T process.

Taking into account the indisputable importance of CAX, we are conscious that the system proposed is a kind of "*perpetuum mobile*" for the moment. But many things that were "*fiction*" in the past are parts of our life nowadays. The real problem for elaboration of a similar computer-assisted E&T system is not "*technical*", but it is related to our willingness to solve it.

References

[1] Anfilatov, V., S. Emelianov and A. Kukushkin. System analysis in management. - Moscow: Finance and statistics, 2003.
[2] International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW 78/95), (www.austlii.edu.au/cgi), 22.05.2008.
[3] International Safety Management Code (ISM Code), (http://www.imo.org), 22.05.2008.
[4] International Ship and Port Facility Security Code (ISPS Code), (http://www.imo.org), 22.05.2008.
[5] Mednikarov B. and K. Kalinov, "An alternative of the system approach to functional aspects analysis of the Maritime Crisis Management System", Information and Security. An international Journal Volume 22,2007
[6] Nincic, D. "Maritime Security Education and Training: Establishing a Learning Community and Framework for Program Goals and Outcome". World Maritime Excellence. Odessa, 2007
[7] Seafarers' Training, Certification and Watchkeeping Code (STCW Code), (www.austlii.edu.au)), 22.05.2008.

Some recommendations to the ship master in order to evacuate a cruise ship due to tsunami arrival

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Abstract

Disaster mitigation is very important to minimize huge accidents which may occur due to the arrival of a tsunami. A possible way to minimize huge economic losses and to reduce the danger to human life is to have ships which are located in the port around Osaka Bay immediately evacuate to a safe area. The guidance for seafarer competency is regulated by the STCW (International Standard Training Certification and Watchkeeping) convention and STCW (Sea farer training certification and watchkeeping) Code. In relation to disaster mitigation, there are minimum-requirement capabilities which have to be achieved by the seafarer. However, there is no clear mention of any competencies required for the seafarer in case of a marine disaster, such as a tsunami arrival, since the tsunami case is considered very rare and it is difficult to predict when a tsunami might arrive in Osaka Bay. In this paper, some recommendations for masters to evacuate their ships in the case of a tsunami arrival is shown; the time evacuation of large passenger vessel is carried out and the initial position of the large passenger vessel is assumed and not changing based on data obtained from Automatic Identification System (AIS). The recommendations of ship evacuation shows where and how the ship has to evacuate from inside port in order to minimize a huge disaster.

1 Introduction

As of January 2008, the possibility of an occurrence of the Nankai and Tou-Nankai Earthquake as shown in Fig.1 in the next 30 years is estimated at 50% and 60% to 70% respectively. This condition causes not only the rise of free surface but also strong horizontal water movement in a bay. It also sets ships adrift and possibly destroys many parts of Osaka Bay, which would cause huge economic loss and endanger human lives. Moreover, in Osaka Bay, there are many cruise ships that carry many passengers and come in and out of Osaka Bay. Therefore, it could jeopardize any passenger inside a cruise ship, in the case of a tsunami arrival. However, there are problems which may be faced by ship masters, if they have not had any prior experience regarding tsunami disasters. Moreover, there are no specific procedures in STCW 1978/1995 as amended. Therefore, guidelines of disaster mitigation for ship masters are required. It should be available onboard any vessels which proceed to areas which are prone to tsunamis, such as Japan.

Basically, there are two risk control options, which are possible to be carried out by ship masters. First, a ship master may evacuate all passengers from on board to the port then evacuate the ship, if the initial position is alongside the port. Second, a ship master with passengers on board may evacuate his ship to shelter area. This paper describes an analysis of second risk control option as disaster mitigation which has been not investigated previously. During the conduct of a ship evacuation, the traffic density inside port area has to be taken into account. The traffic management is required in order to avoid collision disaster among vessels while proceeding to shelter areas.

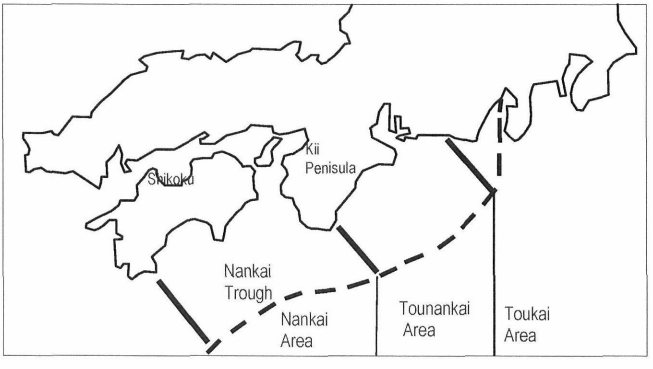


Fig. 1 Earthquake location in Nankai Trough

This paper is composed of three main sections. In the first section we give a brief introduction to the Automatic Identification Systems (AIS); how ship speed data can be taken from AIS and how AIS data is used in this paper by using the Geographic Information System (GIS). In the second section, a

mathematical model of a tsunami is presented, showing the prediction for a tsunami arrival in a given spot; and general discrete event simulations for a cruise ship evacuation assessment as well as the result of time prediction are described. The clustered data of ship evacuation, which is input data for discrete event montecarlo simulation is also developed. Thirdly, the results between the tsunami arrival prediction and time evacuation of ships are evaluated and compared in order to investigate the time needed for cruise ships to evacuate to shelter areas. Then, the procedures of cruise ship evacuation as basic guidance of tsunami disaster mitigation are proposed.

2 Investigation of a cruise ship

2.1 Installation of AIS

AIS is possible to recognize for any ships of 300 GT for an international voyage and more than 500 GT for domestic route now. Ship data can be obtained as static and dynamic information. Static information is included as following the vessel's maritime mobile service identity (MMSI), name of vessel, calling name, ship length, draught of ship, IMO number, ship width, type of ship, antenna position. However, dynamic information is as follows: longitude; latitude; time; course; rate of return; speed over ground; navigation information; draught ship; destination; and type of cargo (Leica Geosystems Inc 2001). The actual data of cruise ships are obtained from AIS (Automatic Identification System) equipment which is installed in Kobe University, Fukae, Japan. It is possible to record the time of large passenger vessels leaving and arriving in Tempozan Ferry Terminal in Osaka Bay. The principle of AIS installation is shown Fig. 2. Ship data is recorded by the AIS receiver and then transferred and saved to a laptop or a notebook computer. Those data, which are saved in a laptop, can be taken from other laboratories through a local area network (LAN).

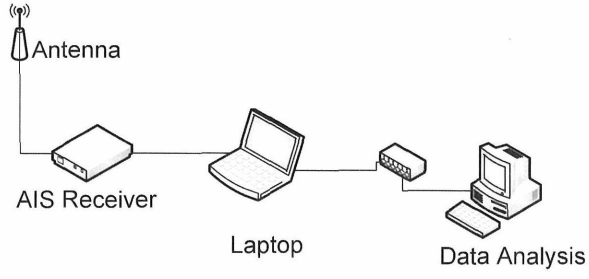


Fig. 2 The principle of AIS installation

2.2 AIS and GIS data analysis

There are several cruise ships which were in Tempozan Ferry Terminal as shown in Fig. 3 and which can be recorded by AIS receiver equipment.

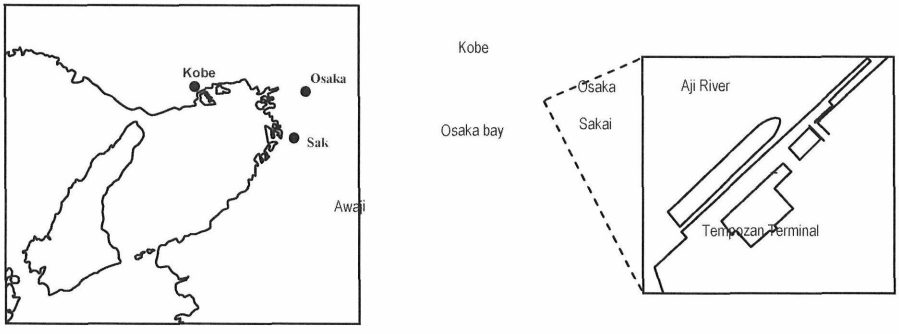


Fig.3 Location of cruise ships port

The cruise ship's data, which were collected in 2006 and 2007, are as shown in Table 1 below. It shows the principal dimension of cruise ships which were visiting in Tempozan Ferry Terminal.

Table 1 Cruise ships arriving at tempozan terminal

DATE	SHIPS	LOA(m)	B (m)	D(m)
18/3/2007	A	270	32.2	7.9
7/3/2007	B	293.5	32	9.8
14/10/2006	C	290	37.5	8.05
3/5/2007	D	219.5	30.78	-
16/4/2007	E	238	30.2	7.6
08/11/2006	F	241	29.6	7.5
20/10/2006	G	166.65	24	6.55
23/02/2007	H	162.3	21.34	7.9
10/03/2007	I	193	24.7	6.33
06/10/2006	J	167	24	6.33
16/12/2006	K	183.4	25	6.5
8/8/2006	L	102.9	15.4	4.3
22/2/2007	M	154.6	-	-

The largest one is "C" ship, which was 290 m in length (LOA), 37.5 m in beam (B) and 8.05 m in draft (D). The largest cruise ship (C) can accommodate a maximum of 4160 passengers (Onoguchi et al. 2004). It has 1339 passengers and 650 crew cabin respectively. The second largest one is B ship and the third one is A ship as shown in Table 1. From August – December 2006, it is shown that six (6) cruise ships are recognized by the AIS receiver. In 2007, it is shows that the number of vessels is seven (7) cruise ships.

Before carrying out an investigation of ship evacuation, it is very important to know the ship movement's behavior as shown in Fig. 4. It shows that from port the vessel speed rises gradually and the goes down, since the vessel is too large and cannot turn a circle in Tempozan Ferry Terminal. After she obtained space for turning back, the ship proceeded toward the outside Osaka of port and the ship speed is increased gradually. Then, the speed of vessel slowed again, since she was close to the harbor pilot station. Then, the pilot came on board as shown in Fig. 4. After that, the ship increased her speed toward Tomogashima channel. After passing that channel, the ship speed is constant and then reduced when she comes close to the bay pilot station.

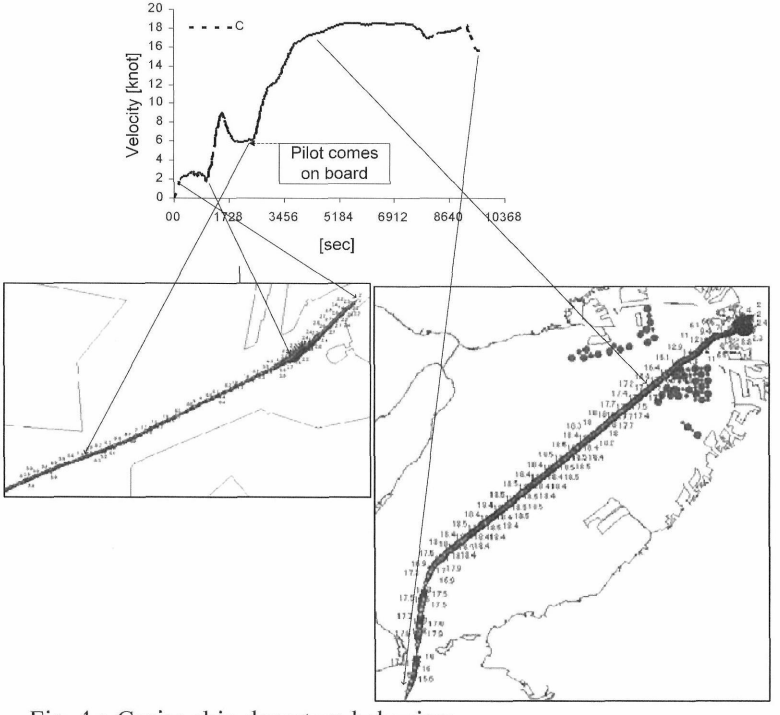


Fig. 4 a Cruise ship departure behaviors

2.3. Traffic density in berths

The number of ships in Osaka Port can be seen in Fig. 5. Those data were recorded on October 14 2006, when a large cruise ship arrived at Tempozan Ferry Terminal. The data shows there were around 10 ships along side the berth at 14.00-15.00. That number was considered the largest number in that day. In this simulation, the initial position of evaluated ships are along side berths, since that initial position is the most dangerous position in case of a tsunami arrival inside Osaka Port.

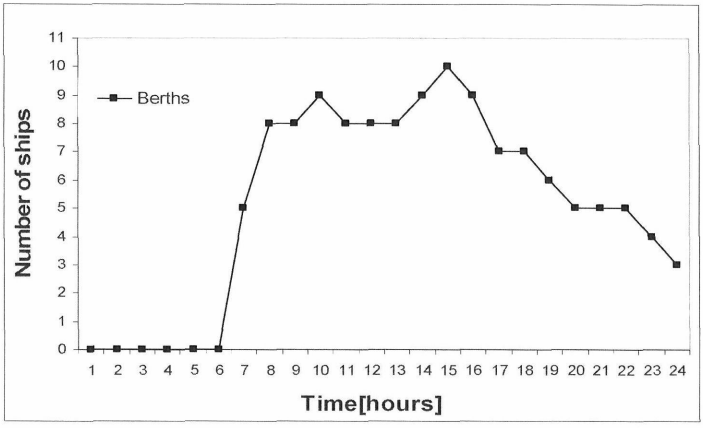


Fig. 5 Traffic density alongside berths

3 Mathematical model of tsunami

In order to predict a tsunami arrival in Osaka Bay, we used a mathematical model of a tsunami (Kobayashi et al. 2006). The characteristic of tsunami is expressed as the following form in the coordinate system shown in Fig.1. and formulated as following:

$$\left.\begin{aligned}
&\frac{\partial \eta}{\partial t}+\frac{\partial M}{\partial x_0}+\frac{\partial N}{\partial y_0}=0 \\
&\frac{\partial M}{\partial t}+\frac{\partial}{\partial x_0}\frac{M^2}{D}+\frac{\partial}{\partial y_0}\frac{MN}{D}+gD\frac{\partial \eta}{\partial x_0}+\frac{\tau_x}{\rho}=0 \\
&\frac{\partial N}{\partial t}+\frac{\partial}{\partial x_0}\frac{MN}{D}+\frac{\partial}{\partial y_0}\frac{N^2}{D}+gD\frac{\partial \eta}{\partial y_0}+\frac{\tau_y}{\rho}=0
\end{aligned}\right\} \qquad (1)$$

where :

η : elevation from still sea water, t :time

x, y : coordinate system, g :gravity acceleration

ρ : density of water, D :depth of water (η +h)

τ_x, τ_y : sea bottom friction in x,y direction

M, N : x,y direction flow volume flux

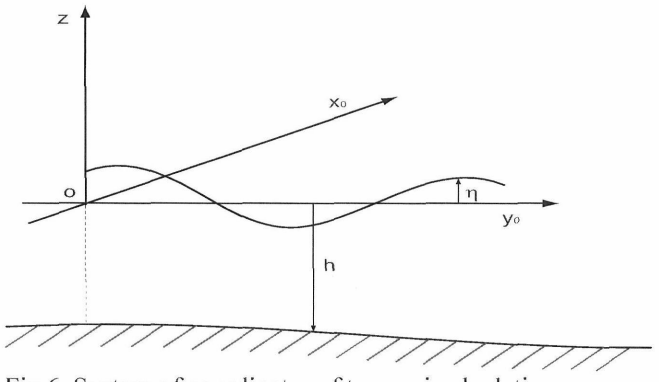


Fig.6. System of coordinates of tsunami calculation.

4 Tsunami arrival

From the mathematical model of the tsunami mentioned above, it generates a time prediction of a tsunami, which arrives in representative spots in the Osaka Bay area as shown in Fig. 7. The spots of tsunami arrival time prediction are evaluated in spot 1 and spot 2 as shown in Fig. 7 which are located in 135.43 longitude and 34.65 latitude as well as 135.39 longitude and 34.64 latitude respectively.

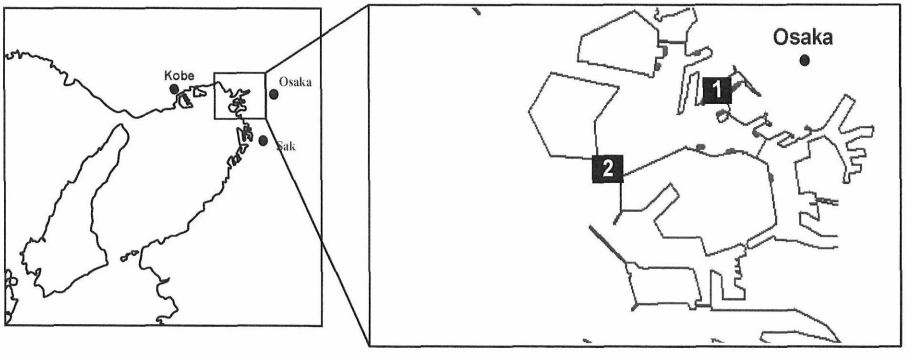


Fig.7 Tsunami arrival point assessments

Table 2 Coordinate of tsunami prediction assessments

Spots	Longitude	Latitude
1	135.43	34.657
2	135.395	34.64

The elevation and velocity time histories in one of the berths which is at point 1 are shown in Fig.8. It shows that the first tsunami arrival time is around 6810 sec and the first peak arrival time is around 8130 sec. Elevation and velocity in the first peak arrival time is around 1.5 meter and 0.55 m/s. The highest velocity is around 1.5 m/s and having elevation about 0.46 m. If it is observed that a vessel may destoy a berth and endanger the crew or passengers on board, since sea water is flowing and changing in different direction in finite different time during tsunami arrival, the immediate actions of evacuation may have to be taken in order to avoid huge disaster.

Fig. 9 shows the time histories of the elevation of the surface of the sea and velocity component in point 2, which is considered as narrow point in Osaka port area. The first time tsunami arrival is around 6410 sec and the first peak tsunami arrival time is around 7570 sec. Elevation and horizontal velocity in the first peak tsunami arrival become around 1.1 m and 2.1 m/s.

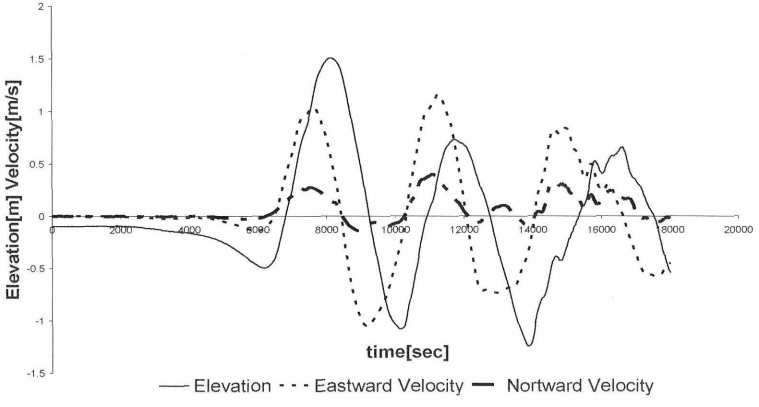


Fig. 8 Tsunami arrival in point 1 of Osaka Port

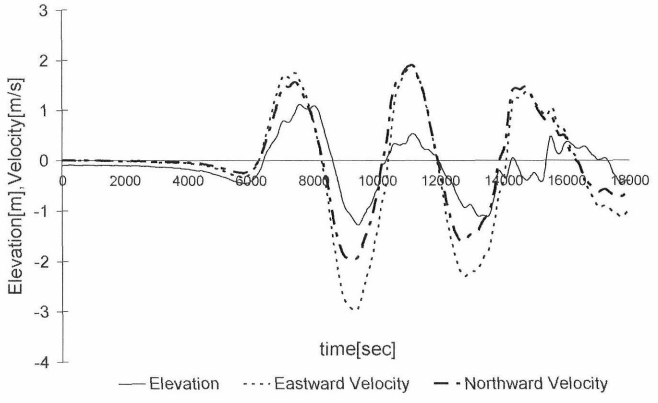


Fig.9 Tsunami arrival in point 2 of Osaka Port

5 Ship evacuation simulation

Ship evacuation simulation is conducted based on a discrete event montecarlo simulation, which is usually only called a discrete event simulation. It can develop a model with the assumption that the state variable changes instantaneously at separated points of time (Law 2007). The DSS characteristics also regard an individual entity as more important than aggregate entities. It means that each passenger ship is assumed to alter instantaneously at specific time. Moreover, the simulations do not assume that each entity is as group of movement, but individual movement is more the important aspect (Law 2007). The authors use this approach, since there is uncertainty about ship speeds during departure to outside the port area. Therefore, the authors note that this approach can predict the time needed for a ship to proceed from one point to another point.

If DES is compared with the analytical approach, it shows that DES have stochastic and uncertainty characteristics. However, analytical have opposite characteristics such as deterministic and certainty. It means that the result of the assessment has exact value. The calculation of the total time needed for each vessel for evacuation generally can be expressed as follows:

$$T_{total} = t_1 + t_2$$

$$t_2 = \sum_{i=1}^{n} T_i \qquad (2)$$

$$T_i = \frac{dS_i}{\overline{V}_i}$$

where:
T_{total} = total time needed of each vessel to spend in all nodes.
t_1 = response time of the captain to realize the existence of disaster
t_2= time for each ship to reach the end of its destination, which are divided by n cluster,
T_i = time needed of each vessel in node i
dS_i = distance spent by each vessel in each node i
$\overline{V}_i$= average speed in node i, which is obtained from AIS data and then generated by using pseudorandom number generator.

Each speed data of a ship obtained from AIS is analyzed by a goodness of fit test to ensure the specific probability distribution of velocity data. After that, it is known the type of distribution and then new data are randomly generated using random generator. Then, the average speed of each speed in each node is calculated. From the average speed, the time needed of each node can be calculated.

5.1 Modeling

Evacuation simulation in this paper is modeled as shown in Fig. 10. The time needed by each vessel is divided by several clusters e.g, Leaving 1; Leaving 1B; Leaving 2; Arrival 1; Arrival 2A and Arrival 2B, since the character of each speed of vessel is different. Each vessel has to spend its time in each node, which is assumed to follow a specific probability distribution.

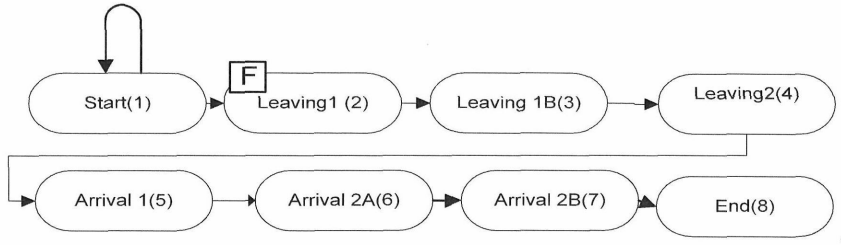


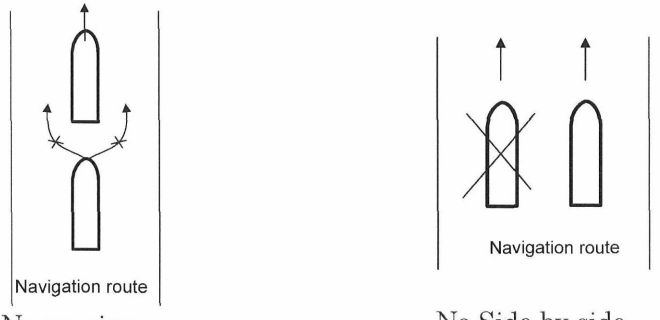
Fig. 10 Modeling of evacuation simulation

Leaving 1; Leaving 1B; and Leaving 2 time nodes are assumed to follow a normal probability distribution. The Arrival 1 time node is assumed to follow log logistic probability distribution and the rest e.g. Arrival 2A and Arrival 2B nodes are assumed to follow logistic probability distribution.

6 Ship evacuation study

6.1 Restriction of Passage

In normal conditions, there are several restrictions for any vessels departing from their berth (Port & Harbour Bureau City of Osaka 2005). For any vessels which have size more than 10000 GT, it is mandatory for that vessel to have a pilot on board. They have to proceed in that area with moderate speed and should not go through the navigation route standing side by side with each other in order to avoid danger to other ships as shown in Fig. 11(b). A ship also is not allowed to go ahead of another ship in the navigation route as shown in Fig. 11(a). In case there are several vessels wanting to depart to outside of the harbor area, the larger ship has the first priority to evacuate. In this assessment, the author also evaluates the possibility of evacuating one by one as the applicable regulation in Osaka Port.



No passing
(a)

No Side by side
(b)

Fig.11 Restriction of navigation passage

6.2. Distance between vessels

The distance between vessels during departure from inside to outside of the harbor is assumed around 8L + 2 L1 as shown in Fig. 6 (Yoneda et al. 2006). L means length of vessel behind fore vessel and L1 mean length of fore vessel.

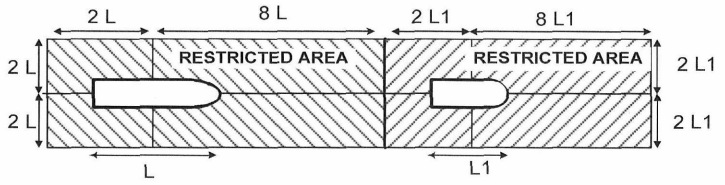


Fig.12 Distances between vessels

The distance between those ships as shown in Fig.12 is assumed as a safe area, which is considered by several captains (Yoneda et al 2006). They have to keep that distance in order to avoid a collision condition. In case of a tsunami arrival, all ships which are moored in berths have to evacuate immediately (Port of Kobe-Harbor Manager 2006). However, there are no specific areas which are used as a shelter area. In this simulation, it is assumed that ships have to evacuate to the anchorage area.

6.3 Initial position

The positions of ships which are along side berths are considered the most dangerous position. It may destroy the port and endanger people on board when a tsunami arrives. Therefore, the initial positions of ships are assumed along side of berth, which was recognized by AIS receiver. It was recognized that the maximum number of ships was around 10 (ten) which were located alongside the berths.

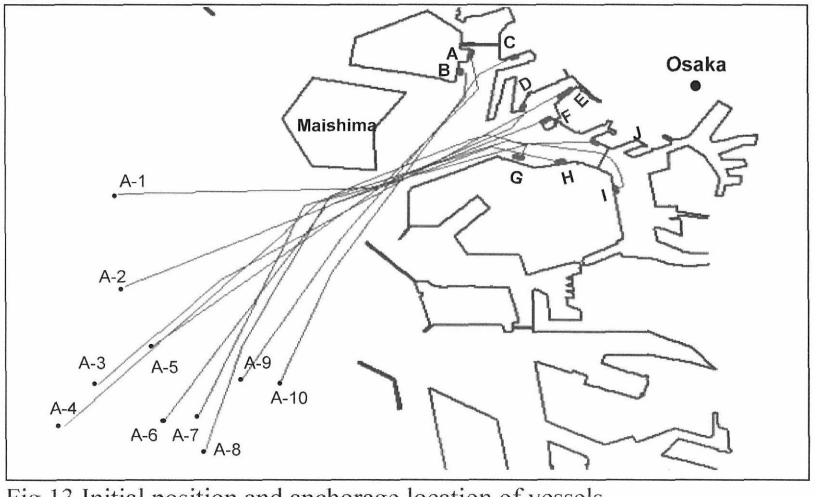


Fig.13 Initial position and anchorage location of vessels

The detail type and location are shown in Table 2. It shows that there are

various types of vessels which are located along side in berths. A till J are the name of berths, where vessels are anchored.

Table 2 Initial position of vessels

Ships type	Number	Location
General cargo	1	D
Container	2	H,1
Ferry	1	G
Cruise	1	E
Refrigerated cargo	1	A
Vehicle carrier	1	B
General cargo	1	C
Bulk carrier	1	F
General cargo	1	J

6.4 Scenarios

All vessels are initially assumed to anchor alongside in port, which was previously explained. When the information regarding a tsunami is announced, ships are to evacuate immediately to anchorage areas such as A-1; A-2 till A-10 as shown in Fig. 13. The largest passenger vessel is assumed to evacuate first in all scenarios, since it carries many passengers and it will be jeopardized if it is not evacuated immediately. Moreover, ships are assumed to follow normal Port of Osaka regulations. They cannot pass each other due to the narrow channel and area. They are assumed to proceed at a moderate speed, which is around 3–5 m/s. In case a tsunami arrives, all ships inside Osaka port area have to evacuate to the anchorage area, which have a depth of 15-16 m. For cruise ships, the foreside faces in bound, therefore, the ship has to move back and look for room to turn back. The pilot also is assumed to have come on board before the ship proceeds to anchorage area.

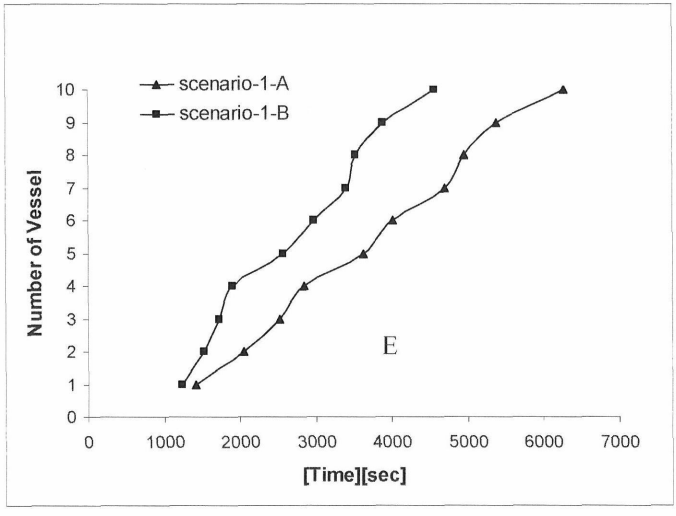
The scenarios are basically divided by 2 clusters as following: scenario 1 and scenario 2. Scenario 1 (one) consist of scenario 1-A and 1-B. Both scenarios 1-A and 1-B assume that the largest vessel, which are based on Gross Tonnage (GT) have to evacuate first. Moreover, in scenario 1-A, each vessel has to keep distance as shown in Fig. 12 However, in scenario 1-B, the distance between two vessels are half of scenario 1-A distance or 8L+2L1 as shown in Fig. 12. The order of vessel for conducting emergency evacuation is as following: E-F-B-A-G-I-C-D-H-J as shown in Fig. 13. It means that ship "E" evacuate first, then it is followed F till J.

As same as scenario 1, Scenario 2 is also divided by two scenarios as following: Scenario 2-A and Scenario 2-B. In this scenario, the closest distance of vessels from the bottleneck evacuate first, then it is followed by those farther

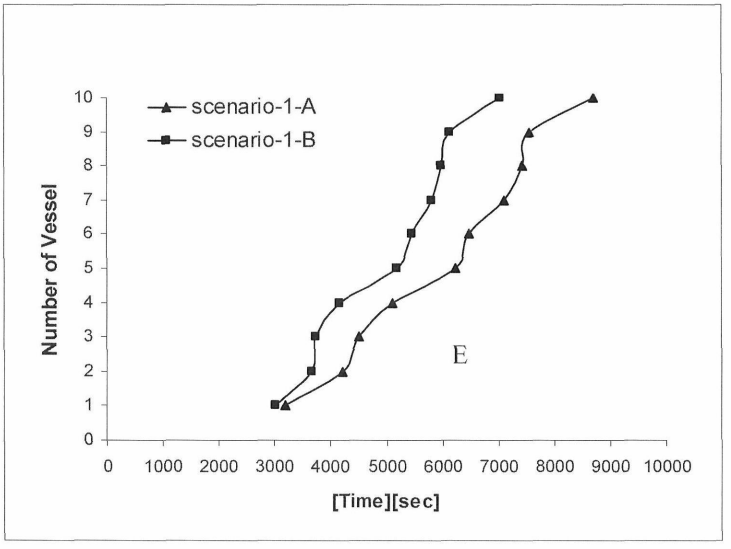
from the bottleneck evacuating to the shelter area. The distances between two vessels are shown in Fig. 12. In Scenario 2-B, the Scenario is similar to Scenario 2-A, however, the distance of the vessel is half of the distance of Scenario 2-A. In both of those scenarios, the order to evacuate vessels are as following: E-D-G-F-B-A-C-H-J-I as shown in Fig. 13. The distance of the anchorage port to the bottleneck is measured based on ship tracking line, which is recorded by AIS.

7 Results of simulation

The result of the simulation can be seen in Fig. 14 and 15. Those figures represent the result of Scenario 1 including Scenario 1-A and 1-B and Scenario 2 including Scenario 2-A and 2-B respectively. Fig. 14(a) shows the time needed for any vessel passing the bottleneck of the channel. By using scenario 1-A, it shows that the last ship that evacuates may face the first tsunami arrival. However, in scenario 1-B, all ships avoid the first tsunami arrival, since the time needed to proceed to the bottleneck of the channel is below 6000 seconds. However, Fig.14 (b) shows that several vessels may face the first tsunami arrival, when they arrive in their anchorage point. However, large passenger vessel, which are represented by "E" and carry many passengers may be able to proceed to her anchorage point before tsunami arrival as shown in Fig. 14(b).



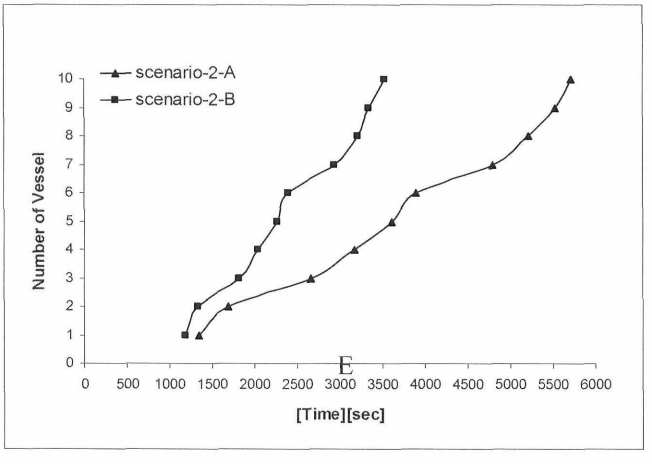
(a)



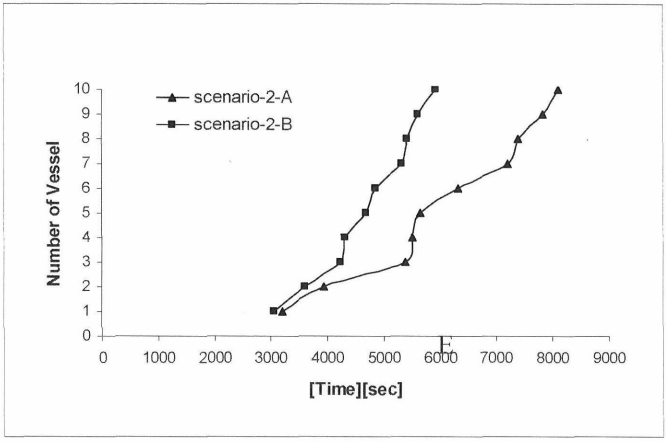
(b)

Fig. 14 Results of scenario 1 simulation

By using this scenario, Fig. 15(a) shows that all vessels may not face the first tsunami arrival at the bottleneck. However, from Fig. 15(b), it shows that by using scenario 2-A, around 5 (five) ships will probably face the first tsunami arrival. However, by using scenario 2-B, it is possible for all vessels to carry out emergency anchoring in anchorage area before the tsunami arrival.



(a)



(b)

Fig. 15 Results of scenario 2 simulation

From all scenarios, if this ship evacuates first, it seems that it is possible for a large passenger vessel which is in anchorage in Tempozan Terminal to evacuate safely, since average time needed is around 3200 seconds which is far below from the first tsunami arrival time.

8 Conclusion

In this study, several considerations have to be taken into account by the ship master, who may be piloting a cruise ship in Osaka Bay and use the largest passengers vessel as a representative of cruise ships. It shows that if the cruise ship is evacuated first, a cruise ship may be able proceed to the anchorage safely. However, if port authority decides for a large passenger vessel not to proceed first; it is not recommended for ship master to keep distance as normal distance condition, since it will spend a longer time to evacuate to the anchorage area. It is possible for the ship master to use moderate speed in order to avoid a collision in case of a tsunami arrival. Even if the fore side of ship faces inward of the port, it is possible for a cruise ship to evacuate from inside the port area. Moreover, the ship master must conduct immediate emergency anchorage in shelter area by following port authority instructions, if any, since the initial position of the vessel is not spacious enough and it may destoy the berth and any facility along side the berth. Moreover, it will be better for any ships which carry many passengers or dangerous goods to evacuate first.

Ship masters have to communicate with the Port Authority regarding a tsunami arrival. Moreover, they have to follow the instruction from the Port Authority, if any, since the traffic density inside the port also has to be taken

into account.

References

[1] Kobayashi.E., Kuno,M., Koshimura., and Suzuki. S. (2006) A Basic study on evacuation maneuver from tsunami attack. *The Journal of Japan Institute of Navigation*, Vol 114, Japan Institute of Navigation.

[2] Law.A.M, (2007). Simulation Modelling and Analysis, fourth edition, International Edition, Boston, Mc Graw Hill.

[3] Leica Geosystems Inc (2001), Marine GPS, the complete guide of Automatic Identification system (AIS)

[4] Onoguchi,Y.,Iwamoto,M.,Senju,H.,Kanaga,T.,Terada,S. (2004). Debut first large passenger cruise ship built in Japan for princes cruise. Technical review vol. 41 No.6, Mitsubishi Heavy Industries,Ltd.

[5] Port of Kobe-Harbor Manager(2006). Port of Kobe Entry Manual

[6] Port& Harbour Bureau City of Osaka (2005). Port of Osaka Entrance and Departure Manual

[7] Yoneda ,S. Kobayashi, E. Koshimura, S. Nanba ,S. Shimanoue(2006). A basic study of ship evacuation from tsunami attack. Conference proceeding of the Japan society of naval architects and ocean engineer, volume 2k.

Leadership style: the continuing gender debate

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Abstract

Leadership is one of the sustaining forces of organized societies and the term "leader" has been in the English language for centuries. It is not surprising then that after many years of studying the subject researchers have developed different theories that seek to explain the complex subject of leadership.

Over the past 30 years changes have taken place in the workplace, particularly with regard to greater gender diversity, that bring to light the importance of understanding the differences between genders. Although women now have gained increased access to lower and middle management positions, they are rarely seen in top leadership positions. Researchers believe it is becoming more important to understand any differences between genders that may exist in the work environment, especially in leadership roles.

The purpose of this study is to determine the leadership styles of maritime cadets at the California Maritime Academy and to determine the extent to which there are differences in leadership styles between genders. The Leadership Effectiveness and Adaptability Description (LEAD) questionnaire is used to determine the leadership style and style adaptability of the respondents. The data suggest that more than 72% of both men and women with a single primary leadership style were categorized as being both "high task" and "high relationship" oriented. Further, there was no statistically significant difference in the leadership style between genders.

Keywords: *Leadership, Gender, Situational Leadership, LEAD*

1 Introduction

Gender differences are the most basic differences between people and, generally speaking, all cultures differentiate how they organize their thinking about male and female behavior. Children, from a very early age, learn their gender role as part of the acculturation process (Nanda 2000). In some cultures girls may experience less active childhoods than boys and they may be taught to be reactive more often than proactive. Girls may learn to define themselves in terms of their relationships with others instead of their own achievements.

Boys, on the other hand, may lead a more active childhood and learn to become more task-oriented. They often are taught to be self-sufficient and independent (Carr-Ruffino 2002).

Western cultural values associated with gender include the idea that women embrace affiliation as the primary motivation and manner of relating to other people (Gardiner & Tiggemann 1999). Women are perceived as being more personal, communicative, and intuitive while men are perceived as being more self-focused, impersonal, and independent (Gardiner & Tiggemann 1999; van Engen et al. 2001; Carr-Ruffino 2002; Eagly & Karau 2002). Women tend to prefer a cooperative leadership style (Pratch & Jacobowitz 1996; Yammarino et al. 1997; Rosener 2000) while men prefer a more competitive leadership style (Eagly & Karau 2002; Vecchio 2002).

Based largely on the proffered stereotypical views of men and women in Western cultures, a myth persists that identifies men as being better leaders than women (Krug 1998). The next section of this paper will examine the concepts and constructs of leadership as they relate to gender in order to build a foundation upon which to examine if there are leadership differences between genders.

1.1 Gender Theories on Leadership

Two perspectives have dominated the discourse on gender differences in leadership. The first perspective consists of a collection of psychological theories that emphasize the differences in outlooks, attitudes, and values between men and women. Proponents of these theories argue that, "the central tendency is for women to demonstrate greater affiliation, attachment, cooperation, and nurturance, while men will tend to demonstrate more independent, instrumentally oriented, and competitive behavior" (Gentile 1996, p. 31).

Numerous studies have supported the idea that women tend to favor organizational approaches that are more inclusive (Rosenthal 1998). In fact, women tend to follow transformational leadership styles and use personal communications as a mechanism to build and reinforce relationships while men tend to be more hierarchical in their views of organizations and prefer task-oriented transactional leadership styles (Eagly et al. 1995; Gentile 1996).

One psychological theory that has evolved is the social-role theory. This theory suggests that people are expected to follow activities that are consistent with culturally defined gender roles (Eagly et al. 1995). Failure by a leader to act in a gender-consistent manner often results in pressure to conform and may even result in some prejudicial reactions by his or her followers (Eagly & Karau 2002). While this theory may be appealing because of its support of the normative social construct of gender behavior, it is a simplistic glimpse of

reality that relies on stereotypical views of gender and does not take into account important situational or contextual factors (Vecchio 2002).

Another psychological theory related to the social-role theory is the role-congruity theory. This theory suggests that followers have a predetermined, and often stereotypical, view in their minds of what attributes are required of a leader in a particular social role. If their stereotype view of the leader and the corresponding social role do not match, there is a potential for prejudice (Eagly & Karau 2002). The psychological theories, although intuitively appealing, are not able, by themselves, to explain all of the complexities of leadership.

The second perspective that dominates the discourse on gender differences in leadership, and the one of primary interest in this research, is the situational perspective. Advocates of the situational, or structural perspective (Eagly et al. 1995), believe that men and women will act in similar ways when put in a similar situation. That argument is based on the notion that any possible effects of gender cannot be isolated or studied independently of context or situational factors. In essence, the situational perspective suggests that either gender will perform in a similar fashion assuming each has similar opportunities, power, and resources (Gentile 1996).

Although some individual studies have found leadership differences between men and women, in the aggregate, there is no evidence to support the idea that either sex has a clear advantage in his/her role as a leader except in very specific fields (e.g. military) (Dobbins & Platz 1986; Izraeli 1987; Ragins 1991; Pratch & Jacobowitz 1996; Krug 1998; Vecchio 2002).

2 The Challenge

Maritime training programs, like those at the California Maritime Academy, emphasize the leadership component of that training. Although the maritime industry has traditionally been a male-dominated industry, over the last 30 years a growing number of women have entered the profession. Because more women are entering the work force, researchers such as Gentile (1996) believe it is becoming more important to understand any differences between genders that may exist in the work environment, especially in leadership roles. Therefore, the purpose of this study is to determine the leadership styles of maritime cadets at the California Maritime Academy and to determine if there are differences in the leadership style between men and women.

The theoretical foundation for this work is situational leadership theory. This theory suggests that leaders will behave in a similar manner in similar situations, regardless of gender (Eagly et al. 1995). Therefore, two separate null hypotheses will be tested. The first null hypothesis tested states that there are no leadership style differences between male and female maritime cadets and the second null hypothesis states that there are no leadership adaptability differences between male and female maritime cadets.

3 Methodology

Based on detailed work completed at Ohio State University, Hersey and Blanchard (1969) developed the life-cycle theory of leadership. The model of this theory, which considers situational factors, is depicted as a two-dimensional structure that describes leadership styles in terms of *task behavior* on the horizontal axis and *relationship behaviors* on the vertical axis. The quadrant characterized by high task behavior and low relationship behavior is descriptive of a telling (S1) leadership style; the quadrant characterized by high task behavior and high relationship behavior is descriptive of a selling (S2) leadership style; the quadrant characterized by low task behavior and high relationship behavior is descriptive of a participating (S3) leadership style; and the quadrant characterized by low task behavior and low relationship behavior is descriptive of a delegating (S4) leadership style (Hersey & Blanchard 1969).

The Leadership Effectiveness and Description (LEAD) questionnaire is a survey instrument that is based on situational leadership theory and the life-cycle theory of leadership (Hersey & Blanchard 1996). LEAD has been used successfully in many leadership research projects (Ates 2003) and it will be used in this study. The questionnaire is designed to measure self-perception of leadership style (S1-S4) and style adaptability (Hersey & Blanchard 1981).

Using the LEAD questionnaire, participants are asked to respond to 12 short leadership situations by choosing one of four behavioral alternative actions they think most closely characterizes their own behavior in that kind of situation (Ates 2003). Based on the response to each situation, it is possible to identify their primary (S1-S4) and secondary leadership style. In addition, using a point system that is incorporated into the scoring it is possible to determine the degree of adaptability and flexibility in the use of the leadership behavior. A high score category indicates that the leader accurately determines the ability and willingness of the follower for the current situation and is able to adjust their style accordingly. A moderate score category often indicates a tendency towards a pronounced primary leadership style with less flexibility to move into a secondary style. Finally, a low score category indicates an inability to diagnose task readiness and then to use appropriate leadership styles (Hersey 2005). The LEAD questionnaire has been found to have a reliability coefficient of .67 to .75 and moderate to high validity (Aphimonbute 1999; Ates 2003).

Due to the nature of the data gathered from the questionnaire, nonparametric tests are used to test the hypotheses. Although nonparametric test statistically are not as powerful as parametric tests for analysis because their underlying assumptions are less stringent (Cooper & Schindler 2003), nonetheless they do permit acceptable levels of analysis for categorical variables. The alpha level for all statistical tests of significance is set *a priori* at $\alpha = 0.05$.

The population for this study is a census of all enrolled cadets at the California Maritime Academy ($N = 693$). The California Maritime Academy is a campus of the California State University system and at the time of the study offered five undergraduate degree programs. All students, regardless of their academic major, participate in a leadership development program. In addition to earning an academic degree, students have the opportunity to earn United States Coast Guard licenses as either a deck or an engineering officer.

4 Results

The results of this study are generalized only for the cadets who volunteered to participate in the study. In total, 445 cadets participated ($n = 445$) and this represents 64% of the enrolled cadet population ($N = 693$). Approximately 15% of the entire cadet population is female and about the same proportion is present in the participants of this study. Participation by men ($n = 371$) and women ($n = 68$) as a percentage of enrolled cadets by gender is approximately the same at about 65%. When considering all of the demographic variables, the sample group accurately represents the enrolled cadet population.

To determine the leadership styles of maritime cadets at the California Maritime Academy and to determine if there is a difference in leadership style between men and women, the data that was gathered for leadership style and gender is used. Both leadership style (telling (S1), selling (S2), participating (S3), delegating (S4), and combined (C)) and gender (female, male) are nominal data. The "combined" category consists of those participants who scored equally high in at least two different leadership categories. In other words, these participants did not have a single primary style.

Table 1 shows a cross tabulation of leadership style and gender. By observation, it is possible to identify some apparent trends in the data. For example, the percentages, by gender, in each of the leadership style categories are approximately equal except for the leadership category S1 (telling). This leadership style category, which is characterized by high task orientation and low relationship orientation, is more heavily populated by men than women. Over 60% of the respondents are categorized as having a selling (S2) leadership style, which is characterized as having high task orientation as well as high relationship orientation. Finally, almost 80% of the participants have, as a primary leadership style, one that is characterized as having a high relationship orientation (S2 or S3).

Table 1

Cross Tabulation of Leadership Style and Gender

(n = 439, with 6 missing)

LEAD Primary Style		Gender: Female	Gender: Male	TOTAL
S1	Count	1	17	18
	% within Style	*5.6%*	*94.4%*	*100.0%*
	% within Gender	1.5%	4.6%	4.1%
S2	Count	46	229	275
	% within Style	*16.7%*	*83.3%*	*100.0%*
	% within Gender	67.7%	61.7%	62.6%
S3	Count	12	66	78
	% within Style	*15.4%*	*84.6%*	*100.0%*
	% within Gender	17.6%	17.8%	17.8%
S4	Count	1	7	8
	% within Style	*12.5%*	*87.5%*	*100.0%*
	% within Gender	1.5%	1.9%	1.8%
C	Count	8	52	60
	% within Style	*13.3%*	*86.7%*	*100.0%*
	% within Gender	11.7%	14.0%	13.7%
TOTAL	Count	68	371	439
	% within Style	*15.5%*	84.5%	*100.0%*
	% within Gender	100.0%	100.0%	100.0%

2 cells have expected counts less than 5.

In this analysis, because the table is not a 2 x 2 table, the Cramér's V statistic is used. The Cramér's V value is .157 and the observed significance level is .367. Based on the observed significance level, and using a level of significance of $\alpha = 0.05$ for testing, the null hypothesis stating that there are no leadership style differences between male and female maritime cadets cannot be rejected.

The LEAD questionnaire also permits analysis of the participants' adaptability score. Participants' scores were categorized into either a low,

medium, or high adaptability category following the appropriate scoring mechanism and the results are shown in Table 2 as a cross tabulation of leadership adaptability category and gender. By observations is appears that the percentages, by gender, in each of the adaptability categories are approximately equal.

Table 2

Cross Tabulation of Adaptability Category and Gender

(n = 439, with 6 missing)

LEAD Adaptability Category		Gender		
		Female	Male	TOTAL
Low	Count	25	159	184
	% within Category	*13.6%*	*86.4%*	*100.0%*
	% within Gender	36.8%	42.9%	41.9%
Medium	Count	41	200	241
	% within Category	*17.0%*	*83.0%*	*100.0%*
	% within Gender	60.3%	53.9%	54.9%
High	Count	2	12	14
	% within Category	*14.3%*	*85.7%*	*100.0%*
	% within Gender	2.9%	3.2%	3.2%
TOTAL	Count	68	371	439
	% within Category	*15.5%*	84.5%	*100.0%*
	% within Gender	100.0%	100.0%	100.0%

1 cell has an expected count less than 5.

In this analysis again, because the table is not a 2 x 2 table, the Cramér's V statistic is used. The Cramér's V value is .047 and the observed significance level is .621. Based on the observed significance level, and using a level of significance of $\alpha = 0.05$ for testing, the null hypothesis stating that there are no leadership adaptability differences between male and female maritime cadets cannot be rejected.

5. Discussion and conclusions

Western cultural values associated with gender have led to many stereotypical images of men and women. One such image is that women exhibit more relationship-oriented behaviors while men exhibit more task-oriented behaviors (Carr-Ruffino 2002). Using the LEAD instruments as the measuring tool, as was done in this study, this stereotypical image of men and women suggests that men typically would be expected to be found in the leadership category (S1) characterized by high task and low relationship orientation and that women would be expected to be found in the leadership category (S3) characterized by high relationship and low task orientation. The findings of this study do not support this stereotypical image of men and women. Although more men than women were found in the S1 category, the number was not statistically significant. In fact, there are stronger statistics to refute the stereotypical view. In this study more than 72% of both men and women with a single primary leadership style were categorized as being both high task and high relationship oriented. About 92% of the men with single primary leadership styles are categorized as having a high relationship orientation and about 78% of the women with a single primary leadership styles are categorized as having a high task orientation.

The situational perspective of leadership dominates the discourse on gender differences and it is that perspective that provided the theoretical foundation for this study. Advocates of the situational perspective of leadership believe that men and women will perform in a similar fashion assuming each has similar opportunities, power, and resources (Gentile 1996). In this study, each participant was asked to put themselves into the twelve situations created in the LEAD questionnaire and then to choose one of the four alternative actions for each situation. Based on the data, there is insufficient evidence to reject the hypothesis that there are no leadership style differences between genders. It appears that the maritime cadets, regardless of gender, would behave in a similar fashion assuming each has similar opportunities, power, and resources and this finding supports the situational leadership theory. There was also insufficient evidence to reject the null hypothesis stating that there are no leadership adaptability differences between male and female maritime cadets. Over 40% of the participants were categorized as being in the low adaptability category.

There may be many reasons for this including that fact that the participants are undergraduate students with little or no practical leadership experience.

As with many studies, although the primary research questions were answered, more questions came to light. This study considered all maritime cadets regardless of their class standing, academic major, age, or license status. Perhaps there are leadership differences if other confounding variables were considered. The results of this study apply to the maritime cadets and the California Maritime Academy. It would be interesting to conduct additional studies, at other maritime institutions, in the hopes of making these results more generalizable.

Acknowledgement

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References

[1] Aphimonbute, T. (1999). Life cycle theory of leadership style and leadership style adaptability: Public versus private higher academic professionals in Thailand. Bell & Howell Information and Learning Company. (UMI No. 9950856)

[2] Ates, C. (2003). The perceptions of African American community college presidents
concerning their leadership styles and use of power. ProQuest Information and Learning Company. (UMI No. 3117825)

[3] Carr-Ruffino, N. (2002). *Managing diversity: People skills for a multicultural workplace*. Needham Heights, MA: Simon & Schuster.

[4] Cooper, D., & Schindler, P. (2003). *Business research methods* (8th ed.). Boston: McGraw-Hill Irwin.

[5] Dobbins, G., & Platz, S. (1986). Sex differences in leadership: How real are they? *The Academy of Management Review*, 11(1), 118-127.

[6] Eagly, A., & Karau, S. (2002). Role congruity theory of prejudice toward female leaders.
Psychological Review, 109(3), 573-598.

[7] Eagly, A., Karau, S., & Makhijani, M. (1995). Gender and the effectiveness of leaders: A meta-analysis. *Psychological Bulletin*, 117(1), 125-145.

[8] Gardiner, M., & Tiggemann, M. (1999). Gender differences in leadership style, job stress and mental health in male- and female-dominated industries. *Journal of Occupational & Organizational Psychology*, 72(3), 301-315.

[9] Gentile, M. C. (1996). *Managerial excellence through diversity: Text and Cases*. Prospect Heights, IL: Waveland Press.

[10] Hersey, P., & Blanchard, K. (1969). Life cycle theory of leadership. *Training and Development Journal*, 23(5), 26-33.

[11] Hersey, P., & Blanchard, K. (1981). So you want to know your leadership style? *Training and Development Journal*, 35(6), 34-54.

[12] Hersey, P., & Blanchard, K. (1996). Great ideas revisited. *Training and Development Journal*, 50(1), 42-47.

[13] Hersey, P. (2005). *Processing tips for the LEAD directions*. Center for Leadership Studies, Inc., Escondido, CA.

[14] Izraeli, D. (1987). Sex effects in the evaluation of influence tactics. *Journal of Occupational Behaviour*, 8(1), 79-86.

[15] Krug, J., (1998). Some myths about team dynamics. *Journal of Management in Engineering*, 14(2), 14-15.

[16] Nanda, S. (2000). *Gender diversity: Cross-cultural variations*. New York: Waveland Press.

[17] Pratch, L. & Jacobowitz, J. (1996). Gender, motivation, and coping in the evaluation of
leadership effectiveness. *Consulting Psychology Journal*, 48(4), 203-220.

[18] Ragins, B. (1991). Gender effects in subordinate evaluations of leaders: Real or artifact? *Journal of Organizational Behavior*, 12(3), 259-268.

[19] Rosener, J. (2000). Ways women lead. *Harvard Business Review*, November-December, 120-125.

[20] Rosenthal, C. (1998). Determinants of collaborative leadership: Civic engagement, gender or organizational norms? *Political Research Quarterly*, 51(4), 847-868.

[21] Van Engen, M., Van Der Leeden, R., & Willemsen, T. (2001). Gender, context and leadership styles: A field study. *Journal of Occupational & Organizational Psychology*, 74(5), 581-599.

[22] Vecchio, R. (2002). Leadership and gender advantage. *The Leadership Quarterly*, 13(6), 643-671.

[23] Yammarino, F., Dubinsky, A., Corner, L., & Jolson, M. (1997). Women and transformational and contingent reward leadership: A multiple-levels-of-analysis perspective. *The Academy of Management Journal*, 40(1), 205-222.

Common seas, common shores: Development of e-Navigation Strategy

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Abstract

Advantages of the latest technical development in the field of automation, electronics, telecommunications, informatics, telematics, geomatics and global position fixing techniques, achievement in data storing, processing, analysing, transferring and visualisation should be taken into account and applied to maritime technology. In this paper, the author discusses a strategic vision of the development of the e-navigation concept using these new technologies and the main tasks of the maritime community for the near future in this new field. The author believes it is now the appropriate time to develop a broad strategic vision for incorporating the use of new technologies in a structured way and ensuring that their use is compliant with the various electronic navigational and communication technologies and services that are already available (Weintrit 2006).

E-navigation is the harmonized collection, integration, exchange, presentation and analysis of maritime information onboard and ashore by electronic means to enhance berth-to-berth navigation and related services for safety and security at sea and protection of the marine environment. E-navigation would help reduce navigational accidents, errors and failures by developing standards for an accuracy and cost effectiveness (NAV 53/13 2007).

E-navigation is, at the moment, a catchall phrase for a concept to bring existing and new technologies together to improve the safety of navigation, commercial efficiency and security. The challenge for the industry will be to produce a unified strategy for this integration and then (and only then) to develop specific systems to meet the needs. This is no small feat. Chart data and systems need to be brought to an agreed standard; position fixing systems need to be of high integrity; communication systems need to be established that meet the needs of e-navigation with agreed technology, protocols and payment plans. This all needs to be achieved with an acceptable cost/benefit balance.

Implementing technology is like a three-legged stool: if any one leg is inadequate, the whole system fails. Here, one leg is the technology itself; another is the procedure for how to use the technology (gained through testing and experience) and the final one is training, both in the operation of the

technology itself but most importantly in the use of the technology with agreed procedures to make good decisions. The development of well-balanced and highly qualified seafarers is possible. It should be one of most important objectives for IAMU members.

Keywords: *Navigation, Marine Transport, Safety at Sea, Communications, Telematics, Geomatics, Integration System, International Standardisation, E-Navigation,*

1 Introduction

The common objective shared by all the International Maritime Organization (IMO) is a commitment to deliver safe, secure and efficient shipping on clean oceans. The IMO has an opportunity to develop and map out a clear strategic vision for one common integration and utilization of all the navigational technological tools at our disposal to secure a greater level of safety and incident prevention which will, at the same time, deliver substantial operating efficiencies with resulting commercial benefits, while also continuing to respect the freedom of navigation rights (Mitropulos 2007).

It has been decided to add a new item on e-navigation to the work program of the IMO Sub-Committee on Safety of Navigation (NAV) and also to that on Radio-communications and Search and Rescue (COMSAR). The aim should be to develop a strategic vision for the utilization of existing and new navigational tools, in particular electronic and radio-communication tools, in a holistic and systematic manner.

E-navigation would help reduce navigational accidents, errors and failures by developing standards for an accurate and cost effective system that would make a major contribution to the IMO's agenda (Mitropoulos 2007; Weintrit & Wawruch 2006).

2 Definition and scope of the concept of e-navigation

E-navigation is the IMO-led concept based on the harmonization of marine navigation systems and supporting shore services driven by user needs. E-navigation is currently defined as (NAV 54/13 2008):

> "E-navigation is the harmonized collection, integration, exchange, presentation and analysis of marine information onboard and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment".

This central question of "exactly what is e-navigation?" has been the subject of prolonged IMO and IALA working groups' debates (IALA 2007a, 2007b). It was decided to treat e-navigation not as a physical installation, nor as the service provided, but as a strategic framework for developing existing and future technological infrastructure onboard and ashore. As such, the term e-navigation currently incorporates systems and services, but as an e-navigation user requirement is developed, it is envisaged that the term will also include an increased focus on more tangible elements. It should be noted that without e-navigation the multiplicity of systems and equipment would continue to evolve at varying degrees of effectiveness. The development of e-navigation is an opportunity to optimise these developments, and ensure the focus of future developments is on a holistic approach to safe navigation from berth to berth.

It is generally accepted that the IMO concept of "e-navigation" can be thought of as a brand, such as "iPod", without the need for "e" to be specifically defined. The "e" can stand for "enhanced" or "electronic", but this would unnecessarily limit what can be done within e-navigation. It must also be noted that generic electronic marine navigation already exists in many forms and should not be confused with this specific IMO initiative.

E-navigation is a broad, long-term, concept, involving many stakeholders and having the potential to impact the entire maritime community. Among those likely to be affected are mariners, vessels, marine pilots, equipment manufactures, vessel traffic services, coast guards, Coastal States, Port States and Flag States, hydrographic offices, ship owners, ship operators and ship charterers. Furthermore, the development of e-navigation will have a significant impact on all faces of training and modification of operating procedures (NAV 53/13, 2007).

3 The case for e-navigation

The rising trend in marine accidents, both in terms of numbers and costs, is mainly associated with collisions and groundings. There are numerous examples of collisions and groundings that might have been avoided had there been a suitable input to the navigation decision-making process.

Research indicates that around 60% of collisions and groundings are caused by direct human error. Despite advances in bridge resource management training, it seems that the majority of watchkeeping officers make critical decisions for navigation and collision avoidance in isolation, due to a general reduction in manning (NAV 54/13 2008).

In human reliability analysis terms, the presence of someone checking the decision-making process improves reliability by a factor of 10. If e-navigation could assist in improving this aspect, both by well-designed onboard systems and closer cooperation with vessel traffic management (VTM) instruments and systems, the risk of collisions and groundings and their inherent liabilities could be dramatically reduced. However, although e-navigation may be able to

improve the situations described above, there is also a need to recognize the role of the practice of good seamanship, the provision of suitable training, and the use of procedures.

4 Vision of e-navigation

A vision of e-navigation is embedded in the following general expectations for onboard, ashore and communications elements (NAV 54/14 2008):

- **Onboard**
  Navigation systems that benefit from the integration of own-ship sensors, supporting information, a standard user interface, and a comprehensive system for managing guard zones and alerts. Core elements of such a system will include, actively engaging the mariner in the process of navigation to carry out his/her duties in a most efficient manner, while preventing distraction and overburdening;
- **Ashore**
  The management of vessel traffic and related services from ashore is enhanced through better provision, coordination, and exchange of comprehensive data in formats that will be more easily understood and utilized by shore-based operators in support of vessel safety and efficiency; and
- **Communications**
  An infrastructure providing authorized seamless information transfer onboard ship, between ships, between ship and shore, and between shore authorities and other parties with many related benefits (Graff 2007; Korcz 2007).

There is a clear and compelling need to equip shipboard users and those ashore responsible for the safety of shipping with modern, proven tools that are optimized for good decision making in order to make maritime navigation and communications more reliable and user friendly. The overall goal is to improve the safety of navigation and to reduce errors. However, if current technological advances continue without proper coordination there is a risk that the future development of marine navigation systems will be hampered through a lack of standardization onboard and ashore, incompatibility between vessels and an increased and unnecessary level of complexity.

5 The core objectives of the e-navigation concept

The core objectives of an e-navigation concept using electronic data capture, communication, processing and presentation should (NAV 53/13 2007):

- Facilitate safe and secure navigation of vessels with regard to hydrographic, meteorological and navigational information and risks;
- Facilitate vessel traffic observation and management from shore/coastal facilities where appropriate;
- Facilitate communications, including data exchange among ship to ship, ship to shore, shore to ship, shore to shore and other users;
- Provide opportunities for improving the efficiency of transport and logistics;
- Support the effective operation of contingency response (e.g. distress assistance), and search and rescue services;
- Demonstrate defined levels of accuracy, integrity and continuity appropriate to a safety-critical system;
- Integrate and present information onboard and ashore through a human interface which maximizes navigational safety benefits and minimizes risks of confusion or misinterpretation on the part of the user;
- Integrate and present information onboard and ashore to manage the workload of the users, while also motivating and engaging the user and supporting decision-making;
- Incorporate training and familiarization requirements for the users throughout the development and implementation process;
- Facilitate global coverage, consistent standards and arrangements, and mutual compatibility and interoperability of equipment, systems, symbology and operational procedures, so as to avoid potential conflicts between users;
- Be scalable, to facilitate use by all potential maritime users.

6 What existing issues and trends in the maritime industry led to the call for e-navigation?

Existing issues and trends in the maritime industry are the following (Basker 2005; Patraiko 2007b; Weintrit et al. 2007b):

- There is an increasing demand by coastal states to seek more information from vessels transiting waters under their jurisdiction and adjacent waters and beyond, to manage the risks they pose and to have a positive means of communicating with them;
- There is an increasing tendency by port and coastal states to implement more rules/requirements for vessels arriving in and/or transiting waters within their jurisdiction;
- There is an increasing tendency among coastal states for regional co-operation;
- The volume of information exchanged among ships and shore organizations is increasing;
- Environmental concerns and future regulatory requirements are expected to continue to acquire ever-higher importance;

- Security concerns continue to have an impact on maritime and other modes of transport;
- Diversification of port services (e.g. pilotage, linesmen, tugs, etc.) will increase, therefore co-operation of allied services will become increasingly important;
- Competency of maritime personnel will continue to vary and skills will fade for those infrequently used skills;
- The use of new technology may necessitate changed training requirements and operational procedures;
- The use of formalised and increasingly precise systems to manage traffic at sea and in ports will grow;
- Although additional Global Navigational Satellite Systems (GNSS) service (e.g. Galileo) will become available and robustness will increase, such space-based systems will also be vulnerable to jamming and unintentional interference;
- Ship design and technology will continue to evolve;
- There will be increasing demands for rapid and predictable transportation and cargo handling schedules;
- The attractiveness of inland waterways as a means of transportation will increase;
- The competition for the use of navigable waters (high seas, costal and inland) will continue to increase (e.g. High Speed Craft, larger and faster commercial ships, recreational vessels, offshore structures, and renewable energy systems).

7 S-Mode concept of the nautical institute

The Nautical Institute endorses the concept of e-navigation and the need to bring together a disparate collection of electronic systems, together with traditional skills, to improve the safety and efficiency of shipping. Although the ultimate goal of shipping is to move cargo from point A to B in order to support the world economy and the needs of society, the shipboard component of e-navigation is critical to the success of the whole system. Following years of research and consultation with mariners, The Nautical Institute has proposed that an S-Mode may be able to play a pivotal role within the concept of e-navigation for improving the safety of navigation (Patraiko 2007a).

The concept of S-Mode builds on the concept of a 'default setting' by being a 'default mode'. This mode is made possible by the increasing use of Multi-Function Displays (MFD) where radar, charts, electronic position systems etc are inputs that can be arranged or re-arranged in any form on a display.

S-Mode would require all navigation displays, regardless of manufacture, to have a clearly identified button, that when pressed brings the display into a standard format with a standard menu/control system, standard interface (i.e.

keyboard/joystick etc.) and basic features. For example there may have to be tactical display, for near-time decisions (collision, and hazard avoidance) and another display for planning. At the press of a button the tactical display might revert to a 12-mile range radar view with targets showing relative vectors and perhaps hazardous depth contours (from vector chart data, such as used on a chart radar). This view would be standardised and familiar to all pilots and mariners, and then could be manipulated through a standard menu system for a limited, although adequate, functionality. The advantage to this would be that:

- Training for S-Mode could be standardised throughout the world;
- Any mariner or pilot would be comfortable reverting to S-Mode and be competent in using the system's layout and functionality, regardless of manufacturer;
- Masters or companies could impose S-Mode use only by crews until such time that they have proven they are competent to use further functionality that may have been provided by individual manufactures.
- S-mode could also be used at times when the bridge team is made up of multiple persons who need to share a common display for decision making.

With the performance of S-Mode secured and strictly governed by the IMO, manufacturers would be able to develop further functionality that they could market it to shipowners as a 'value added feature'. If, in time, these innovative features proved to be popular and effective, they could then be brought into 'S-Mode' in a controlled way by the IMO.

At a basic level, some ships might opt to only have S-Mode functionality installed, but there may be other vessels, which by the nature of their trade or quality of their training, can take advantage of new and innovative features that would be developed by the industry. This is a fledgling idea and the Nautical Institute is currently working with various organizations and stakeholders to further explore the possibility of developing S-Mode.

Ultimately, whether S-Mode is accepted or not, vessels navigation systems need to be designed to work both independently and jointly with shore service to improve the operator's ability to focus on the most critical aspects of safe navigation, limiting distractions and reducing single person errors. The application of technology for this goal will only be a single component, and must be equally supported by the establishment of 'best procedures' for use and effective training for both the operation of such equipment and the procedures.

8 Development of strategic vision for e-navigation

The following issues should be considered when developing a strategic vision for e-navigation (NAV 53/13, 2007):

- Global coverage of electronic navigational charts (ENCs);
- Training, competency and common language skills for all involved in ship operations, both at sea and ashore;

- Safety and environmental concerns relating to migration from physical to virtual aid to navigation;
- Technical improvement of GMDSS equipment;
- Workload and motivation of the watchkeepers; and
- Users' requirements.

In order to structure the task of developing a strategic vision for e-navigation using a holistic and top-down approach it is essential to provide a methodology and logical phases to define the essential elements of e-navigation. In this context, the IMO should develop a strategic vision taking into account the logical phases relating to:

- User identification;
- User requirements;
- User services;
- Identify existing systems;
- System requirements;
- Gap analysis;
- Role of cost benefit analysis; and
- System architecture.

It should be noted that this is not a comprehensive list of logical phases and that some of the work can be undertaken simultaneously.

The strategic plan for the International Maritime Organization for the period 2008-2013 recognizes that technological developments have created new opportunities, but may also have negative consequences. New opportunities therefore exist to further develop various IMO initiatives, from safety and security to environmental protection. Developments in communications and information technology will provide opportunities to develop knowledge management so as to increase transparency and accessibility of information. The challenge for the IMO is to:

- Ensure that the technological developments adopted are conducive to enhancing maritime safety, security and protection of the environment, and take into account the need for their global application;
- Ensure the proper application of information technology within the IMO and to provide enhanced access to that information for the shipping industry and others; and
- Ensure that new equipment for use on board ships is designed and manufactured with the needs, skills and abilities of all users in mind.

9 Potential users of e-navigation and their high level needs

A significant number of potential ship and shore-based users of e-navigation have been identified and are summarized by NAV Sub-Committee of IMO (NAV 54/13 2008). A methodology was used to capture evolving user needs. It

was based on the elements contained within the accepted definition of e-navigation and applied templates to define specific user needs based on the harmonised collection, integration, exchange, presentation, analysis and human element aspects for all users. Using extensive feedback from IMO member states, other maritime organisations, and interested parties, an analysis was conducted resulting in the identification of high-level generic user needs for both ship and shore users. Thus the needs of a typical SOLAS ship and a generic shore authority have been used as the basis for the identification of the high-level user needs reproduced below. More detailed user needs may have to be identified as a part of the implementation plan:

- **Common maritime information / data structure**
  Mariners require information pertaining to the planning and execution of voyages, the assessment of navigation risk and compliance with regulation. This information should be accessible from a single integrated system. Shore users require information pertaining to their maritime domain, including static and dynamic information on vessels and their voyages. This information should be provided in an internationally-agreed common data structure. Such a data structure is essential for the sharing of information amongst shore authorities on a regional and international basis.
- **Automated and standardized reporting functions**
  E-navigation should provide automated and standardized reporting functions for optimal communication of ship and voyage information. This includes safety related information that is transmitted ashore, sent from shore to shipborne users and information pertaining to security and environmental protection to be communicated amongst all users. Reporting requirements should be automated or pre-prepared to the extent possible both in terms of content and communications technology. Information exchange should be harmonized and simplified to reduce reporting requirements. It is recognized that security, legal and commercial issues will have to be considered in addressing communications needs.
- **Effective and robust communications**
  A clear need was expressed for an effective and robust means of communications for ship and shore users. Shore-based users require an effective means of communicating with vessels to facilitate safety, security and environmental protection and to provide operational information. To be effective, communication with and between vessels should make best use of audio/visual aids and standard phrases to minimize linguistic challenges and distractions to operators.
- **Human centred presentation needs**
  Navigation displays should be designed to clearly indicate risk and to optimize support for decision-making. There is a need for an integrated 'alert management system,' as contained in the revised recommendation

on IMO performance standards for Integrated Navigation Systems (INS), to be given to decision support systems that offer suggested responses to certain alerts, and the integration of navigation alerts onboard ships within a whole ship alert management system. Users require uniform and consistent presentations and operation functionality to enhance the effectiveness of internationally standardized training, certification and familiarization. The concept of S-Mode has been widely supported as an application onboard ships during the work of the IMO experts working group. Shore users require displays that are fully flexible supporting both a Common Operating Picture (COP) and a User Defined Operating Picture (UDOP) with layered and/or tabulated displays. All displays should be designed to limit the possibility of confusion and misinterpretation when sharing safety related information. E-navigation systems should be designed to engage and motivate the user while managing workload.

- **Human-machine interface**
  As electronic systems take on a greater role, facilities need to be developed for the capture and presentation of information from visual observations, as well as user knowledge and experience. The presentation of information for all users should be designed to reduce 'single person errors' and enhance team operations. There is a clear need for the application of ergonomic principles both in the physical layout of equipment and in the use of light, colours, symbology and language.
- **Data and system integrity**
  E-navigation systems should be resilient and take into account issues of data validity, plausibility and integrity for the systems to be robust, reliable and dependable. Requirements for redundancy, particularly in relation to position fixing systems, should be considered.
- **Analysis**
  E-navigation systems should support good decision-making, improve performance and prevent single person error. To do so, shipboard systems should include analysis functions that support the user in complying with regulations, voyage planning, risk assessment, and avoiding collisions and groundings including the calculation of Under Keel Clearance (UKC) and air draughts. Shore-based systems should support environmental impact analysis, forward planning of vessel movements, hazard/risk assessment, reporting indicators and incident prevention. Consideration should also be given to the use of analysis for incident response and recovery, risk assessment and response planning, environment protection measures, incident detection and prevention, risk mitigation, preparedness, resource (e.g., asset) management and communication.

- **Implementation issues**
  Best practices, training and familiarization relating to aspects of e-navigation for all users should be effective and established in advance of technical implementation. The use of simulation to establish training needs and to assess its effectiveness is endorsed. E-navigation should as far as practical be compatible forwards and backwards, and integration with equipment and systems should be made mandatory under international and national carriage requirements and performance standards. The highest level of interoperability between e-navigation and external systems should be sought where practicable.

10 Conclusion

E-navigation is, at the moment, a catchall phrase for a concept of bringing existing and new technologies together to improve safety of navigation, commercial efficiency and security. The challenge for the industry, working through IMO, will be to produce a unified strategy for this integration and then (and only then) to develop specific systems to meet the needs. This is no small feat. Chart data and systems need to be brought to an agreed standard; position fixing systems need to be of high integrity; communication systems need to be established that meet the needs of e-navigation with agreed technology, protocols and payment plans. This all needs to be achieved with an acceptable cost/benefit balance (Weintrit at al. 2007a).

Implementing technology is like a three-legged stool: if any one or more legs is inadequate, the whole system fails. Here, one leg is the technology itself; another is the procedure for how to use the technology (gained through testing and experience) and the final one is training, both in the operation of the technology itself but most importantly in using the technology with agreed procedures to make good decisions. The development of well-balanced and highly qualified seafarers is possible. It should be one of most important objectives for IAMU members.

The concept of e-navigation is a worthwhile and essential goal that we should embrace. However we should be aware that 'electronic navigation,' led by commercial developments, is already with us and flourishing. Systems already exist that have high levels of integration both onboard and via communication links to shore, and this will continue to develop regardless of the work of the IMO. E-navigation, however, gives us a chance to bring this development within a strategic vision (Bibik at al. 2007).

E-navigation is, at the moment, a catchall phrase for a concept of bringing existing and new technology together to improve safety of navigation, commercial efficiency and security. The challenge for the industry working through the IMO will be to produce a unified strategy for this integration and then (and only then) to develop specific systems to meet the needs. This is no small feat. Chart data and systems need to be brought to an acceptable standard;

position fixing systems need to be of high integrity; and communication systems need to be established that meet the needs of e-navigation with agreed technology, protocols and payment plans. This all needs to be achieved with an acceptable cost/benefit balance.

References

[1] Basker S. (2005), E-Navigation: The way ahead for the maritime sector. Trinity House, London, September.

[2] Bibik L., Krolikowski A., Czaplewski K., Duda D. (2007), Vision of the Decision Support Model on Board of the Vessel with Use of the Shore Based IT Tools. Advances in Marine Navigation and Safety of Sea Transportation, Chapter 10: E-Navigation. TransNav'2007 Monograph edited by A. Weintrit. Gdynia Maritime University and the Nautical Institute, Gdynia.

[3] Graff J. (2007), The Role of Operational Ocean Forecasting in e-Navigation. Advances in Marine Navigation and Safety of Sea Transportation, Chapter 10: E-Navigation. TransNav'2007 Monograph edited by A. Weintrit. Gdynia Maritime University and the Nautical Institute, Gdynia.

[4] IALA (2007a), The IALA Definition and Vision for E-Navigation. E-Nav 2-output 11, March.

[5] IALA (2007b). E-Navigation, Frequently Asked Questions. IALA e-Nav OPS WG MTG WP1, July.

[6] Korcz K. (2007), GMDSS as a Data Communication Network for e-Navigation. Advances in Marine Navigation and Safety of Sea Transportation, Chapter 10: E-Navigation. TransNav'2007 Monograph edited by A. Weintrit. Gdynia Maritime University and the Nautical Institute, Gdynia.

[7] Mitropoulos E. (2007), E--navigation: a global resource. Seaways, The International Journal of the Nautical Institute, March.

[8] NAV 53/13 (2007), Development of an E-Navigation Strategy. Report of the Correspondence Group on e-navigation, submitted by the United Kingdom. Sub-Committee on Safety of Navigation, International Maritime Organization, London, 20 April.

[9] NAV 54/13 (2008), Development of an E-Navigation Strategy. Report of the Correspondence Group on e-Navigation, submitted by the United Kingdom. Sub-Committee on Safety of Navigation, International Maritime Organization, London, 28 March.

[10] Patraiko D. (2007a), Introducing the e-navigation revolution. Seaways, The International Journal of the Nautical Institute, March.

[11] Patraiko D. (2007b), The Development of e-Navigation. Advances in Marine Navigation and Safety of Sea Transportation, Chapter 10: E-Navigation. TransNav'2007 Monograph edited by A. Weintrit. Gdynia Maritime University and the Nautical Institute, Gdynia.

[12] Weintrit A. (2006): Navitronics and Nautomatics. Advances in Transport Systems Telematics. Section III: Systems in Maritime Transport. Monograph edited by J. Mikulski, Faculty of Transport, Silesian University of Technology, Katowice 2006.

[13] Weintrit A., Wawruch R. (2006), Future of Maritime Navigation, E-Navigation Concept. Proceedings of 10th International Conference "Computer Systems Aided Science, Industry and Transport" TransComp' 2006, Zakopane, Poland, December.

[14] Weintrit A., Wawruch R., Specht C., Gucma L., Pietrzykowski Z. (2007a): Polish Approach to e-Navigation Concept. Advances in Marine Navigation and Safety of Sea Transportation, Chapter 10: E-Navigation. TransNav'2007 Monograph edited by A. Weintrit. Gdynia Maritime University and the Nautical Institute, Gdynia.

[15] Weintrit A., Wawruch R., Specht C., Gucma L., Pietrzykowski Z. (2007b): An Approach to e-Navigation. A discussion on the main tasks of the maritime community for the near future in the field of e-Navigation. *Coordinates*, a Monthly Magazine on Positioning, Navigation and Beyond, published by the Centre for Geoinformation Technologies, Delhi, India, Volume III, Issue 6, June.

The development of teaching material on life-saving appliances

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Abstract

Accidents involving lifeboats and launching appliances during periodic drills on board have increased in number. It is reported that these accidents are attributable to the crew's "lack of knowledge," "lack of experience," and "poor maintenance" of the device. The authors, in cooperation with several companies and MET organizations, have created a DVD program on life-saving appliances, aiming to educate both in-service and pre-service seafarers. While this DVD program focuses on the operation and maintenance of life-saving appliances, it also aims to provide seafarers with basic knowledge about life-saving appliances in general.

1 Introduction

Although maintaining the safety of life-saving appliances is crucial, there have been frequent reports of accidents taking place with lifeboats in the past years (Gibson 2008). Typical causes of accidents include an erroneous reset of the release device of the lifeboat, inadvertent operation of the release handle, and the malfunction of the On-load/Off-load release gear system (Sandberg 2007). The need to improve the status quo is already widely recognized, and the Paris and Tokyo MOUs, for instance, have a plan to launch a concentrated inspection campaign on lifeboats in 2009 (in Trade Winds 2007).
According to the analyses of accidents with lifeboats, the accidents are attributable mainly to two factors: lack of maintenance and poor training. So far, measures have been taken to establish a better maintenance and inspection system (MSC.1/Circ.1206), and training of service engineers for the lifeboat system is being promoted by the lifeboat and launching appliances makers worldwide. As for the second factor of the accident, providing seafarers with knowledge and skills on life-saving appliances, in conjunction with periodical drills, is supposedly the most effective solution to reduce the number of accidents.

In response to this need, the authors, collaborating with several manufacturers, shipping companies and MET organizations in Japan, have created a DVD program on life-saving appliances. The program covers the fundamentals on the operation procedures of lifeboats, rescue boats, and liferafts, as well as directions on how to use personal life-saving appliances and visual signals, with abundant visual information.

In this article, the summary and features of the developed material will be given first. Next, we will focus on the release gear and review how it is treated in the DVD program, since quite a few accidents involving failing of a lifeboat at the time of maintenance and inspection have been reported, and one of the major causes of these accidents is said to be a mishandling of the lifeboat release gear.

2 Features of the DVD program

The DVD program is titled "Life Saving Appliances," and the subtitle is "Operation and Maintenance Fundamentals." It is approximately 60 minutes long. The photo of the DVD cover is shown in Figure 1.

The DVD program consists of the Prologue and eight chapters. Following the Prologue, which provides general information about life saving appliances and contents of the program, the viewers may select one of the following chapters from the chapter list: "Totally-Enclosed Lifeboats," "Free-fall Lifeboats," "Rescue Boats," "Inflatable Liferafts," "Accessories for Lifeboats and Liferafts," "Immersion Suits and Lifejackets," and "Maintenance and Inspection of Life-Saving Appliances." Alternatively, it is possible to view them all. The program is meant to allow viewers to acquire the necessary knowledge and fundamental skills in handling life-saving appliances through self-study. In chapters dealing with rescue boats and liferafts, the launching appliances are dealt with as well. The contents of the DVD and the summary of each life-saving appliances included in the program are available in the Appendix.

For a mastery of safe handling of life-saving appliances, especially of lifeboat and rescue boat systems, it is essential that seafarers have a full understanding of the structure of the system as well as of the functions and movements of each component. However, there are certain systems, e.g., the On-load/Off-load release gear system, the water spray system, and the air spray system, which are built inside the boat hull and are usually invisible. With this type of device, it is not easy to grasp the whole structure. Furthermore, with such equipment as free-fall lifeboats, it is neither easy nor practicable to conduct frequent on-board lowering and recovery drills. It is therefore difficult for seafarers to accurately master the operation procedure for this type of equipment.

We believe that our DVD program is useful and beneficial, in that it offers prospective solutions to the difficulties mentioned above. For instance, one section is devoted to the On-load/Off-load release system, in which the structure and movements of the system are introduced and described in a comprehensive

way. Not only videos but also mock-ups and animation are employed for a better understanding.

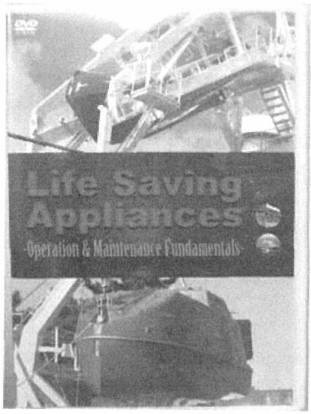

Fig. 1 Cover of the DVD

As for the operation of life-saving appliances, lowering and recovery operation procedures of the lifeboat, implemented in the orders given in Figure 2, are explained step by step, along with precautions required at each step. For the purpose of warning against mishandling, operations that are considered dangerous, such as inching operation at the time of gravity lowering, are demonstrated and presented using real video clips as well. In the case of the free-fall lifeboat, thorough descriptions and demonstrations of lowering and recovering are provided by video and animation.

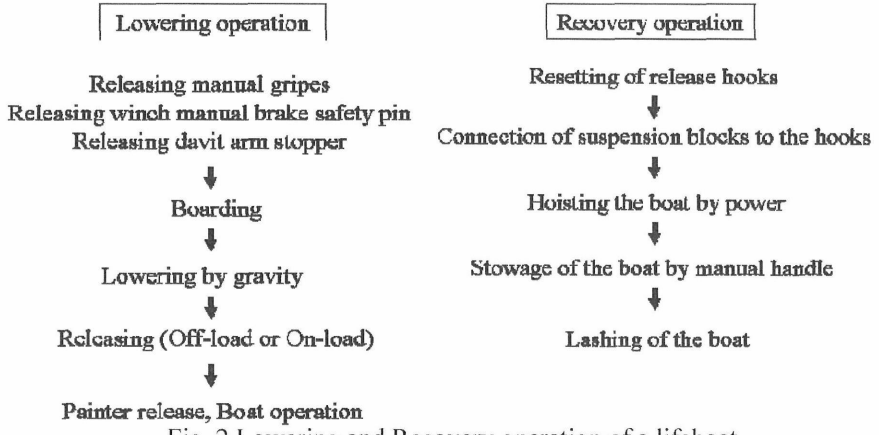

Fig. 2 Lowering and Recovery operation of a lifeboat

3 On-load/Off-load release gear system

In this section, we will focus on the On-load/Off-load release gear system of lifeboats, since this is the area where a large number of accidents have been reported. The structure of the system, the structure of each component, its functions and movements, on-load release operation, off-load release operation, and resetting operation, all of which are dealt with in the DVD program, will be succinctly explained and reviewed.

3.1 On-load/Off-load release gear arrangement

The release gear is composed of a hook unit, a release handle unit, a control cable, hydrostatic interlock unit, and an interlock cable. Since each component is assembled inside the boat hull, a computer graphic as in Figure 3 is utilized so that the viewer can obtain a clear image on how the units and components are connected and related to one another.

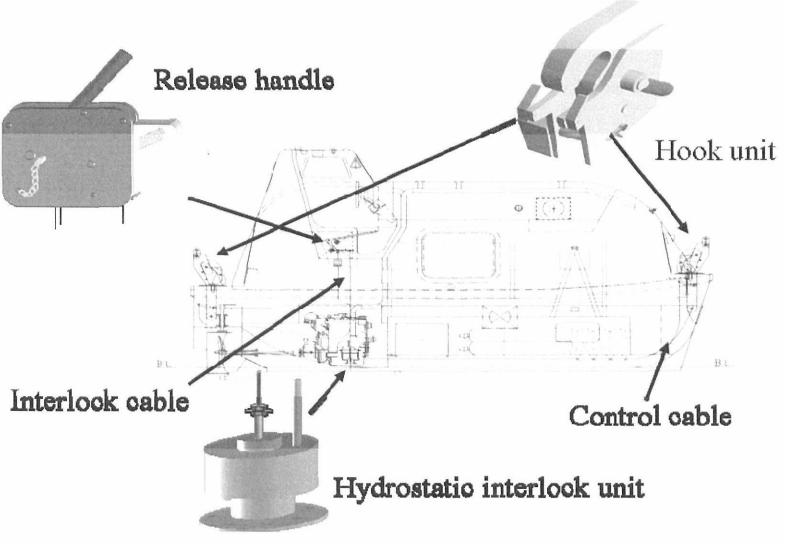

Fig. 3 On-load/Off-load release gear arrangement

The hydrostatic interlock unit, which prevents lifeboat falling that can take place due to erroneous operation, is usually installed inside the boat hull and is invisible. Thus, the structure and movements are explained by employing video clips and computer graphics as in Figure 4. In addition, two types of hydrostatic interlock unit are introduced in the following way:

There are two types of hydrostatic interlock unit: one is the "direct system," which controls the detected water pressure directly through an interlock cable, and the other is the "electric type," which electrically controls the interlock lever with pressure signals to operate the relay and the solenoid.

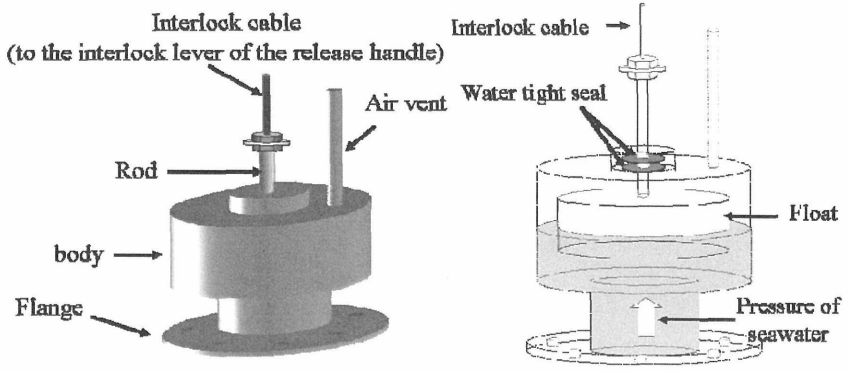

Fig. 4 Structure of the hydrostatic interlock unit

3.2 Off-load release operation

Off-load release operation is a normal way of release which is carried out when the lifeboat is waterborne and there is no load on the release hooks.

When the lifeboat is touching the water surface, the hydrostatic interlock unit described in 3.1 is activated. Thus, the release handle interlock is unlocked, and it becomes possible to operate the release handle. In the program, computer graphics as in Figure 5 were used to explain the mechanism, since the movement of the release handle unit is not visible from outside.

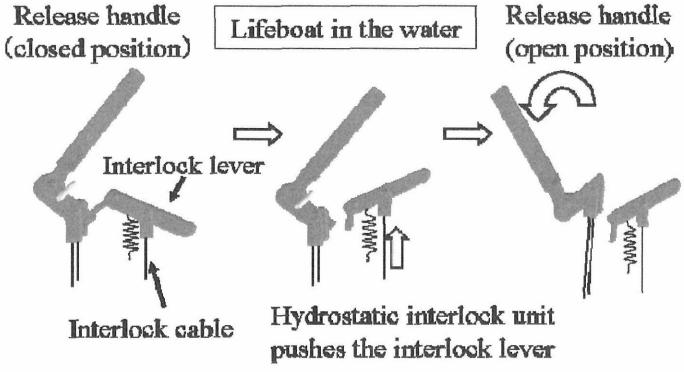

Fig. 5 Action of the release handle unit during off-load release operation

It is also necessary to understand the movements of the components after the release handle has been pulled down to the point where the release hooks are released. As is shown in Figure 6, by pulling the release handle, the cam lever pin is turned by the control cable and the lock piece is then made free, allowing the hook to be turned and released. In demonstrating this, a mock-up of the actual device is used.

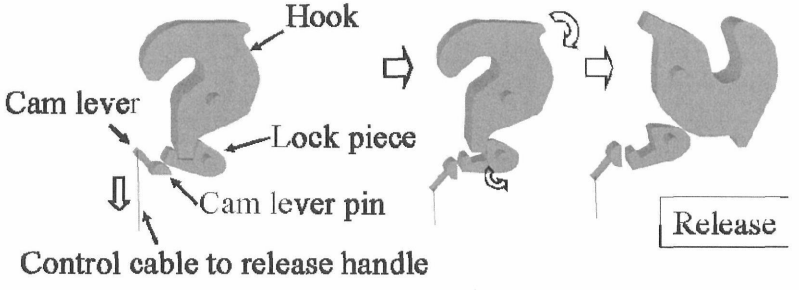

Fig.6 Release process of the hook unit

3.3 On-load release operation

"On-load release" is an operation which is performed when the hooks are not released due to malfunction of the hydrostatic unit, or when the sea is rough and a normal off-load release operation is difficult.

The seafarers should, therefore, fully understand that this operation is to be reserved for emergency use only, and they also need to acquire a good knowledge of how the device functions at the time of this operation. They must perform the operation under the command of an officer in charge and only after safety is confirmed, keeping in mind that a failure to do so may lead to a serious accident, such as falling of the lifeboat.

The general procedure of the on-load release is explained as follows, using a mock-up:

In conducting an on-load release, first, open the cover of the interlock device. Lift the hydrostatic interlock lever fully, and while holding it, insert the securing pin to release the interlock. Then, pull out the safety pin of the release handle, and pull the release handle to the fully open position by one action.

Movements of the release handle unit at the time of on-load release operation shown in Figure 7 are also demonstrated by making use of a mock-up.

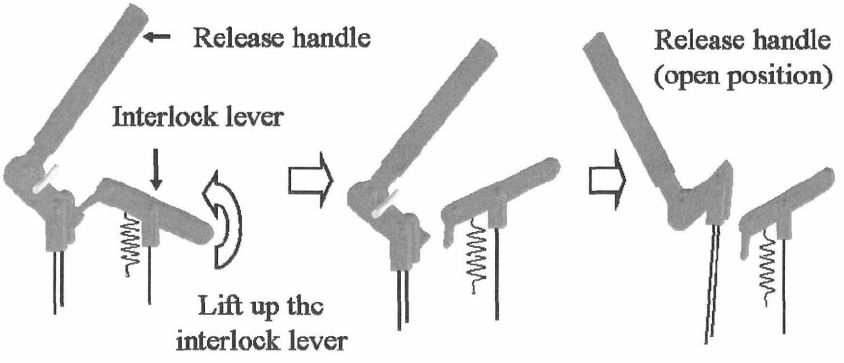

Fig.7 Action of the release handle unit during on-load release operation

3.4 Resetting procedure

Many accidents involving lifeboats take place at the time of recovery, 70% of which are said to be attributable to the inadvertent resetting of the release gear. Accordingly, it is essential to have the seafarers master the resetting operation, which is to be carried out by three operators in the procedure presented in Figure 8. It is also important to clear up the confusion of the users often caused by the existence of so many different types of release gear in use.

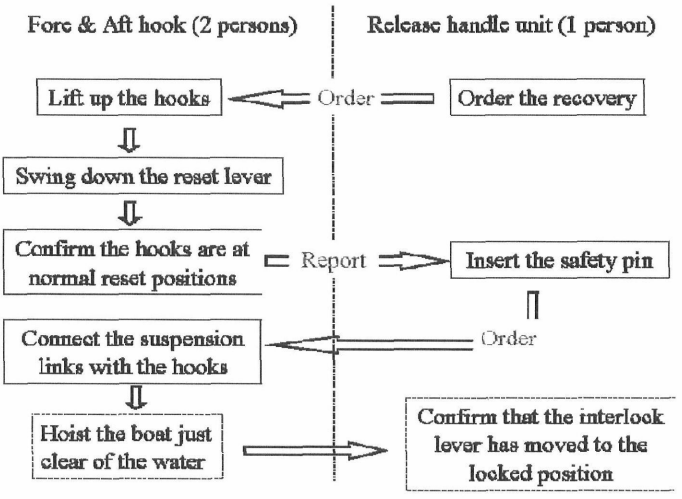

Fig. 8 Resetting procedure of release gear

As a solution to these problems, two different types of release gear were prepared, and while giving step-by-step instructions on the operation procedures, we clarified the following three points:
(1) Complete reset of the release hook is essential in recovery operation. Incomplete reset may lead to suspension by a single hook or falling of the lifeboat, resulting in a fatal accident.
(2) There are various types of release hooks. Regardless of the type, incomplete reset is suspected when the safety pin cannot be smoothly inserted or when an extra force is required in putting back the release handle.
(3) Ensure that the reset hooks have been reset normally, and insert the safety pin. If resetting is found incomplete, go back to the beginning of the procedure and redo each step.

4 Conclusion

In this article, we reported on the contents and features of our new DVD program on life-saving appliances aimed at educating seafarers. The DVD deals with all sorts of life-saving appliances, with a special emphasis on lifeboat systems and On-load/Off-load release gear system of lifeboat, their operation, inspection and maintenance. This teaching material contains abundant visual information that cannot be always fully covered in ordinary training such as boat drills. By viewing the program, we expect that both in-service and pre-service

seafarers will find something new. It is hoped that every seafarer will obtain basic knowledge and skills on life-saving appliances essential in an emergency situation and that they can be further applied to specific life-saving appliances on ships they will get onboard.

References

[1] D A Gibson; Operating lifeboats, Seaways, March 2008, pp 3-4

[2] Alf Martin Sandberg; Lifeboat accidents with "on load" release hooks, Gard conference on lifeboat hooks, Oct. 18, 2007, Arendal, Norway

[3] MOUs to launch lifeboat campaign; Trade Winds, Nov. 9, 2007, p43

Appendix

Contents and Summary of *Life Saving Appliances: Operation & Maintenance Fundamentals*

I	Prologue: General Introduction
	By giving the number of accidents involving lifeboats and launching appliances, the significance and necessity to acquire operation and maintenance fundamentals is emphasized for accident prevention. This is followed by the overview of the contents.
1	Lifeboat standards/specifications/functions regulated by SOLAS Convention and LSA Code
2	Types of lifeboat: totally-enclosed, partially-enclosed, and fire-protected
3	Types of launching appliances: gravity-type and free-fall type
II	Totally-Enclosed Lifeboats
1	Outline of lifeboat system: Explains the structure of launching appliance and lowering mechanism of lifeboat.
2	Lowering & launching operation: Shows step-by-step procedures to be followed on the ship's deck prior to embarkation.
3	Post-boarding preparations: Deals with operations necessary inside the lifeboat for swing-out and lowering.
4	Off-load release & on-load release: Indicates when to use which release, and how. Structure and mechanism of release gear system is also provided.
5	Off-load release: Demonstrates step-by-step operations.

6	On-load release: Demonstrates step-by-step operations.
7	Recovery operation: Starts with reset procedure of release gear system, followed by operations for hoisting and stowage of the lifeboat.
8	Recovery strap: Shows how to use recovery strap in rough seas.
9	Fire-protected lifeboats: Describes operation with a focus on water spray system and air supply system.
III	Free-Fall Lifeboats
	Plenty of visual information on launching and recovery operations enables the viewers to obtain a clear image on the handling of free-fall lifeboats.
1	Outline of free-fall lifeboat: Mentions the requirements of bulk carriers of 500 gross tonnage and upwards to be equipped with a free-fall lifeboats. A schematic of the davit and winch is provided.
2	Launching operation of free-fall lifeboat: Describes general procedure on how to launch a free-fall lifeboat. Includes warnings peculiar to free-fall lifeboats as well, e.g., prohibiting the use of lifejackets by the crew onboard.
3	Launching by davit arm: Shows an alternative way to launch, i.e., to launch by use of davit arm.
4	Recovery operation of free-fall lifeboat: Serves as a precious visual aid to understand the operations which are usually reserved for boat drills.
IV	Rescue Boats
1	Succinctly describes the outline of rescue boat: Three types of rescue boats, their specifications and capacity, the outfit of the operator, well as the structure of the winch and the hook.
2	Lowering operation of rescue boat: Explains typical operations, as well as how to handle difficult situations e.g., when the power supply is cut off.
3	Recovery of rescue boat: Shows the operations to be followed one by one.
4	Recovery operation of rescue boat under bad weather: Describes how to use recovery strap in bad weather.
V	Inflatable Liferafts
1	Inflatable liferafts in accordance with 96 SOLAS: Explains general information, such as materials used, how they are stored, and what kinds of accessories are stored or attached and when they are to be used.
2	Dropping type liferafts: Describes the structure of dropping type liferafts with both weak-link type and older type, and provides in detail two ways of release, manual and automatic, along with their mechanism, and how the release is completed in various situations.
3	Automatic release device & weak link: Shows how the painter and the weak link are connected to the body or the cradle. Also gives cautions to be taken prior to drop launch.

4	Liferaft Embarkation: Explains ways and cautions at the time of embarking a liferaft, and what to do after the crew embark e.g., to cut the painter and read and follow "Instructions for Immediate Action." Describes items in the accessories bags and its usage. Also provides righting method of liferaft in an inverted position and a technique to adjust boat position with a use of sea anchor.
5	Launching of liferaft using davit: Shows the davit launching method. Describes when the raft inflates, how the crew get onboard and the liferaft is launched.
6	Launching of carry & drop type liferaft: First briefly gives the requirement of installation of carry & drop type liferaft, followed by showing operation peculiar to this type.
VI	Accessories for Lifeboats and Liferafts
	First shows common accessories for lifeboats and liferafts one by one. Also mentions kinds of distress signals and visual signals and their uses.
1	Accessories common to lifeboats & liferafts
2	Special accessories for lifeboats
3	Special accessories for liferafts
4	Optional accessory
5	Distress signals: EPIRB and SART
6	Visual signals: Self-activating smoke signal, buoyant smoke signal, self-igniting light, rocket parachute signal, rocket star signal, hand flare, lifebuoy, and line-throwing appliance.
VII	Immersion Suits and Lifejackets
	Specifications and performance of immersion suits and lifejackets, as well as how to don them, are given.
1	Immersion Suit: Discusses performances of immersion suits with inherent insulation and non-inherent insulation, as well as their required specifications. Those with buoyant type and non-buoyant type, as well as anti-exposure suit, are also dealt with.
2	Lifejacket: Describes lifejacket of rigid type and inflatable type. Also mentions the requirement of a buddy-line and a lifting loop from 2010 following the revised SOLAS.
VIII	Inspection and Maintenance
	Weekly and monthly inspection and maintenance to be carried out by the crew onboard a ship is covered. Checkpoints for components of the lifeboat/liferaft systems are listed.

Proposal for communication network support onboard ships in damaged areas

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Abstract

In 1995, the Great Hanshin-Awaji earthquake occurred in Kobe. At that time, cellular phones were not generally popular. But after that, information exchange with cellular phones in disasters was recognized as necessary. Cell-phone providers divided voice communication from packet communication and set up online bulletin boards and voice mail service at disasters. Unfortunately in 2007 at the Niigataken Chuetsu-oki earthquake in Japan, communications including packet communication could not work properly because of the damage to the Base Transceiver Station, major blackout, and so on. Some parts of the city were isolated from communications. Now, we realize the importance of a supporting network of volunteer ships from the sea during a disaster. In that case, a communication exchange between networks was considered using packet communication of a cellular phone as a way of communication, since the Niigataken Chuetsu-oki earthquake. From above background, we propose a concept of communication network support onboard ships in damaged areas.

We sent a questionnaire to 47 governments of municipalities in Ishikawa, Fukui, and Toyama prefectures according to the communication method at the Noto-Hanto earthquake in 2007.

For long distance communication at the disaster, it enables the use of a vessel as a relay base, which can provide the Internet to the areas which suffered a great deal of damage and became unable to use the Internet. Some wireless LAN (WLAN) has functions as a repeater. We can communicate from an isolated area by relaying a wireless communication of the Internet with this function as a repeater. However, only function as a repeater, not only the attainment distance of WLAN is limited but also from the viewpoint that fault-resilient, it is very weak. The bridge between the WLAN environments where plurality differs, and its network is carried out securely, to reserve a long distance communication and recovery to an obstacle. This network has the advantage that ships are maneuverable and it can also provide a power supply and WLAN devices at low cost. We conceive of the construction of a coast area communication network using ships; a small-scale experiment verification was performed. It carried out the check of operation of the communication in short distance. It may become a valuable tool of serving an information-

communication function as emergency communication way at large area disasters.

1 Introduction

The Great Hanshin-Awaji earthquake occurred on January 17, 1995. Land transportation infrastructure was heavily damaged. In the disaster, measures used to send supplies to the damaged areas were over land and by air. However, in the case of Kobe, helicopter landings were not permitted due to the danger of aftershock. Also land transport faced difficulties because of destroyed roads and traffic congestion. Therefore marine transportation had to take a lead. During the Great Hanshin-Awaji earthquake ships carried both supplies and casualties, etc. Ferries moored at the quays in the harbor became accommodations for victims. Many kinds of ships played a large role throughout the recovery.[1)]

As many earthquakes occur, Japan is called *"Jishin Taikoku."* This means a country of earthquakes. In the Tokai, Nankai and Toh-Nankai areas, which face the Pacific Ocean, a big earthquake happens from between every 100 to 150 years. The Nankai and Toh-Nankai earthquakes have a possibility of occurrance of more than 80% within 50-years.[2)] When this earthquake happens, the possibility of a Tsunami is very high. Such an earthquake would create serious damage.

By organizing a support network utilizing ships as a countermeasure support would become most effective.

2 Supports by ships at disasters

2.1 Great Hanshin-Awaji earthquake

Many ships, especially small ships, were used in various ways during the immediate aftermath of the Hanshin-Awaji earthquake. These ships were used 1) for the transportation of supplies by fishing boats of the Japan Fisheries Association and other volunteers; 2) supplies and human resources carried by ships chartered by some companies; 3) emergency shuttle 'bus' for maritime transportation, 4) as commuting vessels to larger ships at anchor, 5) establishment of a sea lane by small high-speed boats; 6) transport of supplies, and as backup members of rescue crews by fireboats; 7) transportation of workforce and casualties by patrol boats and so on.

Transportation of supplies and supporting personnel using ships started from day two of the earthquake. Various ships, such as tug boats, water boats, plying boats, fishing boats and patrol boats were used. According to statistics,

about 30,000 tons of supplies were brought to Kobe port from sea by the end of February.[3)]

2.2 Response of fishing ports as supporting bases

Fishing ports are scattered throughout and along the shore. They are freed up in many places to do fishing activities and many fishing boats, which have a tight turning circle, are berthed at these ports. It is believed that these ports play an important role as a supporting base to bring in supplies and human resources into the damaged area and for transportation of victims, as required there.

In order to utilize fishing ports as a supporting base, it is necessary to cooperate with neighboring fishery administrators and the fishery associations to construct a network to best deal with such disasters. Additionally, it is also necessary to create an information infrastructure for communication with such fishing ports and to inform on the post-disaster situation immediately. In order to construct a network between fisheries areas, we must look to preparing a fishing port as a disaster prevention facility and base, from the point of view of disaster prevention.

Fishing ports can handle seaborne transport supplies and evacuees immediately after disaster. They can support the transport of commodities until public facilities can be restored when a great earthquake occurred. The term 'like these ports' is used to mean here a fishing port used for disaster prevention.[4)]

At the great Hanshin-Awaji earthquake the route of transported supplies to Kobe/Awaji from the fishing ports of neighboring prefectures is shown in Figure 2.1.

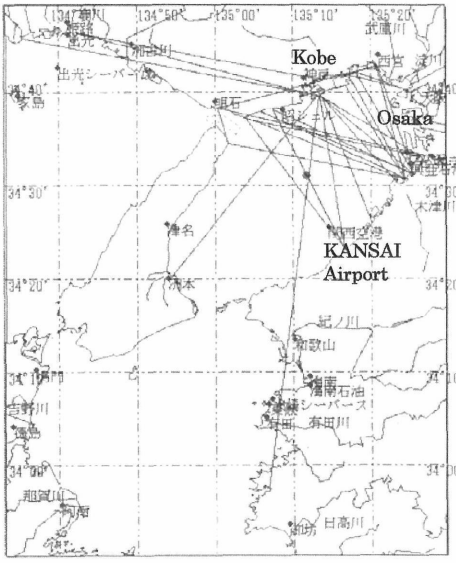


Figure 2.1 Route of supporting for Kobe by Small ships at the earthquake[1)]

3 Nankai and Toh-Nankai earthquake

The Nankai and Toh-Nankai areas of the main island of Japan face the Pacific Ocean. In these areas, great earthquakes occur within a period of about 100 to 150 years. The scale is magnitude 8. The governmental "Earthquake Research Committee" announced on September 1, 2004, the possibility of Nankai and Toh-Nankai earthquakes happening at 50% within the next 30 years.[2)] And 80% during the next 50 years. The next Nankai earthquake is predicted to strike near Kochi prefecture and at an intensity of 6 or more, on the Japanese scale.

Moreover, such an earthquake will cause a tsunami in all coastal areas in Kochi. This tsunami will be 3 meters to over 10 meters, which is predicted to reach coastal areas in Kochi within 3 to 30 minutes. This earthquake and tsunami will bring widespread damage to the whole of Kochi, and access to neighboring areas would be disrupted.[5)]

4 Support network of volunteer ships deployed to a disaster

Well-organized support from the sea could hold the most potential for effective support systems in any kind of disaster that may happen in Japan. In order to construct an immediate, supporting network, we researched into the

case of Kochi city, in Shikoku Island. Figure 4.1 is an image of the supporting network.[6)]

During ordinary times this network will spread the idea of volunteer ships, educate and train those joining the network, and create a map which will show the place where small ships can gather off shore.

1) Once a disaster happens, a volunteer ship network will collect information from on-site headquarters and others, in the damaged area.
2) Collected information will be analyzed and released by the volunteer ship network.
3) People joining the network can get information such as on how many and what kinds of supplies are required; where the safe shores and beaches are, and so forth.
4) Early after a disaster, medicines, water, food and rescue teams are placed in the highest priority.

By constructing this supporting network, information exchange will become smooth and more effective. Support from the sea by small vessels will be easily possible. It will be a center for countermeasures after the disaster has struck. This informational exchange is very important for this supporting network.

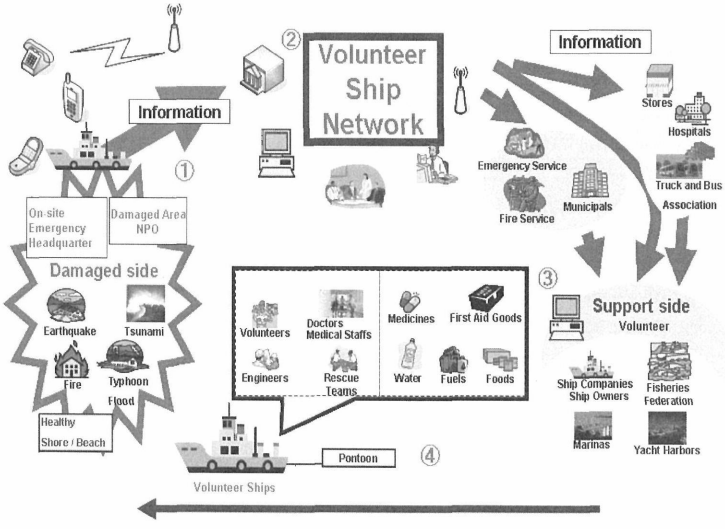


Figure 4.1 Image of the supporting network of volunteer ships from the sea

5 Communication situation at the disaster

5.1 The great Hanshin-Awaji earthquake

On January 17, 1995, the great Hanshin-Awaji earthquake, magnitude 7.3 struck Kobe. The battery and auxiliary engine for backup were installed in the telephone switchboard of the damaged area. However, electrical supply became impossible because of the fall of the battery by earthquake tremor. In addition, supplying fuel also became impossible because the light oil supply pipe to the auxiliary engine was cut by the quake. For this reason, the switchboard stopped and telephone service of about 285,000 circuits stopped. In addition, telephone communication to the damaged area was down for around five days. Telephone communication for reservation for important communications, must be regulated, being 50 times more than usual peak concentrations.[7)]

5.2 The Noto Hanto earthquake

On March 25, 2007, the Noto Hanto earthquake struck. Fixed telephone and cellular were service were seldom available until four hours after the earthquake in parts of Ishikawa and Toyama prefecture. According to Nippon Telegraph and Telephone Corporation (NTT), immediately after the earthquake, telephone service to the damaged areas was largely impossible because of telephone call concentration. However satellite telephone and e-mail could function allowing a check of the damage situation in lieu of the telephone.[8)]

5.3 Te Niigata Chuetsu oki earthquake

On July 16, 2007, the the Niigataken Chuetsu-oki earthquake hit. Cellular phone calls of 3 cellular phone providers were lost because of facility failure in parts of Niigata and Nagano prefectures were unable to use about 300 circuits in parts of Kashiwazaki city, service was restored soon after. Moreover, cell phone and fixed line were seldom available and communication became focused instead on satellite and E-mail.

Telephone call restrictions started immediately after the earthquake and lasted for at least two to three hours. In addition, a base station was downed because of the blackout. Delay here was of course prolonged.[9)]

6 Communication method

Generally, as a communication method, fixed telephone, cellular phone, the Internet, and radio (amateur radio etc.) are mentioned. Most familiar to us is certainly the phone. A fixed telephone has ISDN system and an analog by the telephone circuit of a cable formula. These communication means have

both good points and bad points. If 100 calls concentrate the analog formula of a fixed telephone in 1 second, congestion will happen. However, even if electric power failure happens, minimum voice communication is securable. A cellular phone can talk over a moving phone since it is a radio formula. Moreover, by separation of a voice circuit and a packet circuit, as for regulation of a packet, it becomes loose from a sound also at the time of a calamity. However, if a base station suffers damage, use of a cellular phone will be difficult.

7 Questionnaire survey

We sent a questionnaire to 47 governments and municipalities of Ishikawa, Fukui, and Toyama prefecture concerning their communication method at the time of the Noto-Hanto earthquake of 2007 -- 32 were answered.[10] Of these 24 responses answered the question in which way communication was used and frequency of usage. Table 7.1 shows results summary.

Table 7.1 Numbers and usage & Communication way

	use	no use
fixed telephone	19	3
cellular phone	15	3
PC (Internet)	13	7
maritime radio		17
ham radio	1	17
others	3	

Usage rate of fixed telephone and cellular phone are high because they are highly popularized. In some regions, fixed telephone and cellular phone were seldom connected or disconnected. So, they were used for special communications by government or ham radio. Special communication system is the network of national and local public entities. They were installed to collect disaster information and ensure a communications means during emergency situations.

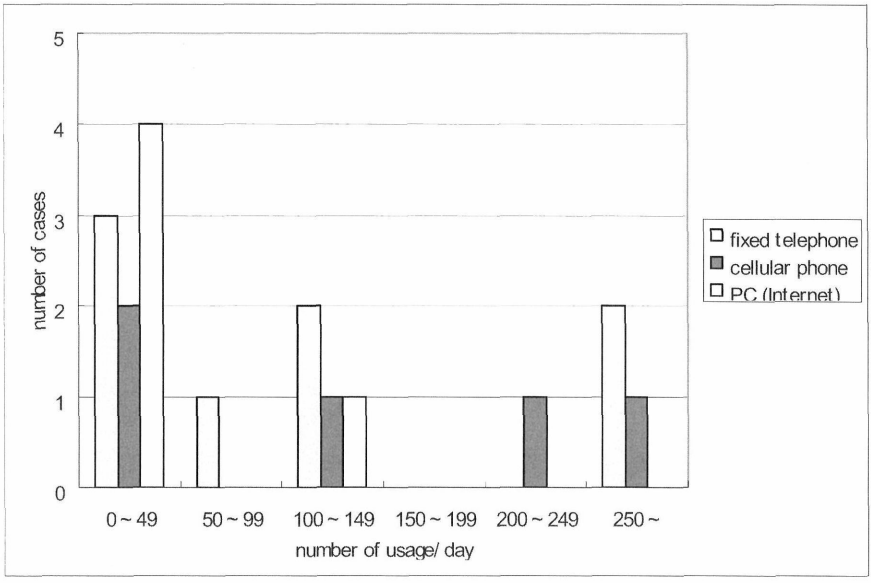


Figure 7.1 The frequency of usage by communication method, on the day

Figure 7.1 is the results of the frequency of usage by communication method on the day of the disaster. Fixed telephones were used the most frequently. Two municipalities used it more than 250 times, followed by cellular phone. PC was less frequency used.

8 Communication network support on shipboard

8.1 Outline of network

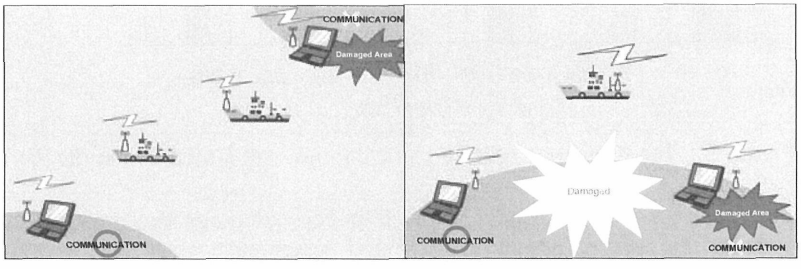
Informational exchange is very important at the time of disaster. At the time of the 1995 Great Hanshin-Awaji earthquake, cellular phones were not yet generally popular. However, after that, information exchange by cell-phone during disasters became more possible as cellular phones have become so popular. So, each cellular phone provider now can divide voice communication from packet communication and set up online bulletin boards and voice mail service at disasters. Unfortunately in 2007 at the Niigataken Chuetsu-oki earthquake, communications including packet communication became impossible because of the damage done to the Base Transceiver Station, major blackout, and so on. Some parts of the city were isolated from communication. Now, we realize the use of a supporting network of volunteer ships from the sea at disaster. In this case, communication exchange between networks considered to use the packet communication of a cellular phone as a

way of communication. Since a problem like this has occurred, the necessity of examining communications for when not to use cellular phones came out. Using the Internet, not only for the exchange of E-mails but also for audio exchange, will be most helpful. From the above background, we propose a concept of communication network support by sea at the damage area.

According to questionnaire result, PCs had a high frequency of use, next was the fixed telephone and then cellular phone

For long distance communication, a vessel can be used as a relay base for those areas that suffered a great deal of damage and became unable to use the Internet. Furthermore, this network has the advantage that ships are maneuverable; they can also provide a power supply and wireless LAN devices at low cost.

Figure 8.1.1 Image of communication network support on ship in damaged areas



IEEE802.11 b and g which is the standard of wireless LAN can perform personal computer communications using a frequency band (2.471-2.497GHz and 2.400-2.4835GHz), respectively. IEEE802.11 b and g are can be used in the open air, and no license is necessary. In IEEE802.11 b, communication speed can reach up to 54Mbps.[11] Some wireless LAN have functions as repeaters. We can communicate from isolated areas by relaying a wireless communication of the Internet with this function as a repeater. However, only function as repeater, not only the attainment distance of wireless LAN is limited but also from the viewpoint of fault-resilience, it is very weak. The bridge between the wireless LAN environments where plurality differs, and its network is carried out securely, to reserve long distance communication and recovery to an obstacle.

A repeater (WDS: Wireless Distribution System) is a function to relay radio wave of wireless LAN between access point and wireless LAN adapter. This function is much used to cover areas not reached by radio waves of a wireless LAN.

But this time, the function as a repeater is used to increase the transmission of wireless LAN distances. There is a mechanical limit of usage

to a repeater (max 6). We connected a segment with another segment to overcome that limit.

Bridge connection is a function to connect multiple network segments in the same network. A network bridge literally works as a bridge to exchange packets from LAN to LAN.

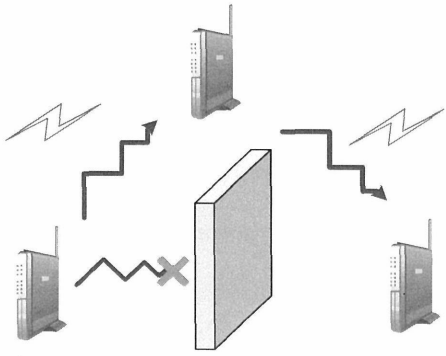


Figure 8.1.2 Image of repeater

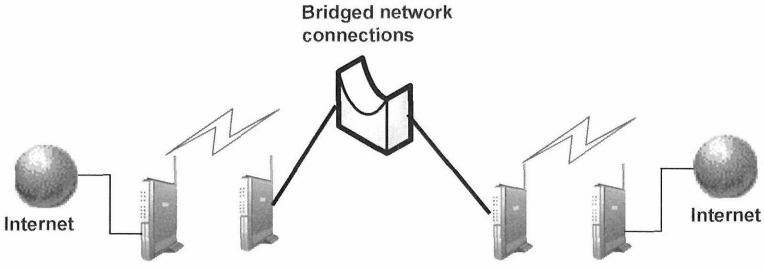


Figure 8.1.3 Image of bridge

8.2 Experiment verification of wireless LAN

In conceiving the construction of a coast area communication network using ships, a small-scale experiment verification was performed.

We built a wireless LAN network by a wireless LAN broadband router having the function as a repeater, and tried to connect a notebook computer with wireless LAN to the Internet. In general, it is said that data transmission speed is slow and communications quality is low because of radio wave interference by using wireless LAN devices. Therefore we will confirm communication environment in case of multiple devices connected.

The experiment description is shown as below.

1) Verification of function as a repeater availability
2) Time test of file downloading
3) Ping test

Ping is a program to test TCP/IP network. It works usually by sending 32 bytes of data, test whether network is connected and packet round trip time. These experiments have 2 cases. They are shown as below.

Case 1 6 wireless LAN repeaters connect in series.

Case 2 Bridge connection of 6 and 2 wireless LAN repeaters connect in series

For comparison, we will examine in case of wireline connection. Figure 8.2.1 and 8.2.2 shows repeater connection status.

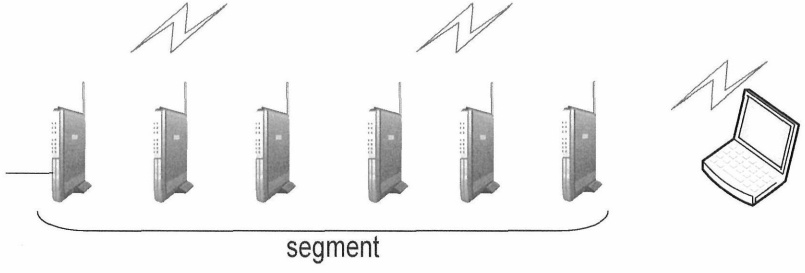


Figure 8.2.1 Image of Case 1

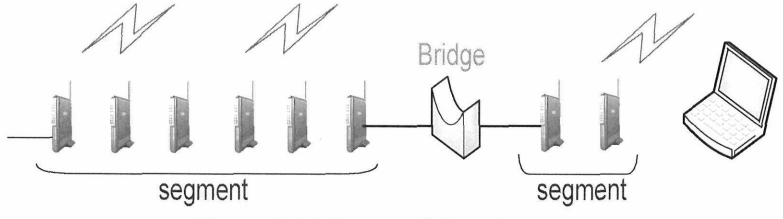


Figure 8.2.3 Image of Case 2

8.2.1 Time test of the file downloading

A notebook computer with wireless LAN connects to the Network (2 cases), and we will time file downloading with a stop watch total of 5 times. For comparison, we will examine in case of wireline connection as before. The result is shown as follows.

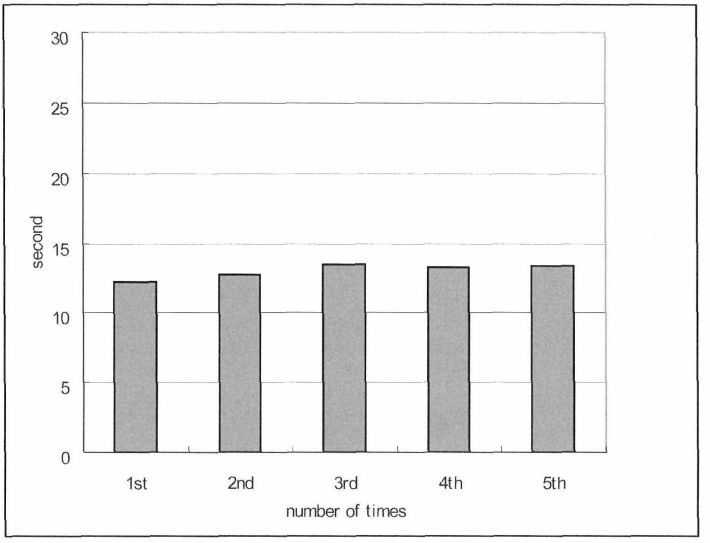


Figure 8.2.1 Result in Case 1

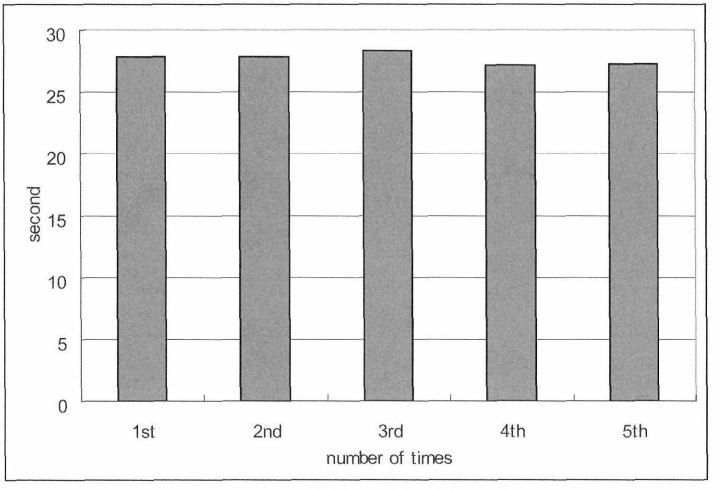


Figure 8.2.1 Result in Case 2

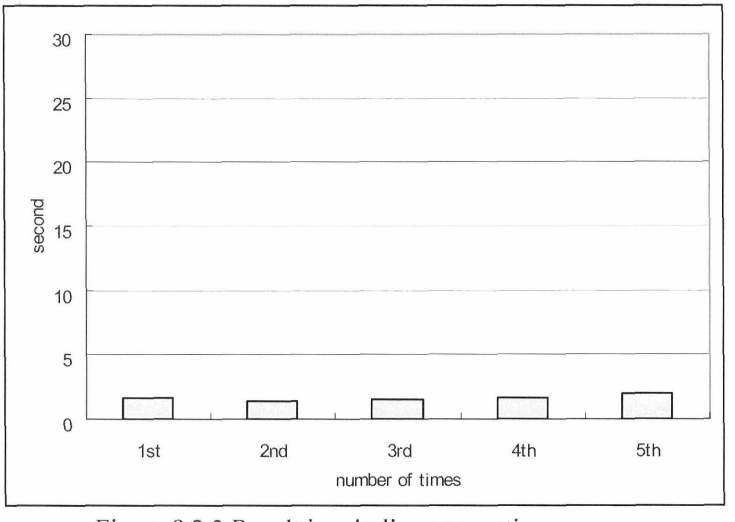


Figure 8.2.3 Result in wireline connection

According to results, it turned out that file downloading time in Case 1 is about 13 seconds, Case 2 is about 28 seconds. Compared the two cases, the result is a differences of only a few seconds. In the case of wireline connection, time was about two seconds. There will be many changes because of time zone and connection environment. Although data communication was trouble free and relatively stable, it is predicted that communication situation become worse because of radio wave interference. But it is considered that function as a repeater is effective because the wireless LAN is good performance

8.2.2 Ping test

It connects with the network in two cases, measure the round trip time to server on campus by executing Ping commands. The data of 32 bytes is transmitted 5 times by one execution, and obtain average round trip time. This procedure repeats 5 times. The result is shown as follows. The unit is "ms" (=millimeter second).

Table 8.2.1 Result in Case 1

Case 1		Case 2		Wireline	
	Average time (ms)		Average time (ms)		Average time (ms)
1st	2	1st	31	1st	0
2nd	6	2nd	42	2nd	0
3rd	2	3rd	5	3rd	0
4th	1	4th	32	4th	0
5th	4	5th	10	5th	0
Average of 5 times tests: 3ms		Average of 5 times tests: 24ms		Average of 5 times tests: 0ms	

The result of average obtained by running the test five times was three ms in Case 1, 24 ms in Case2, and 0ms in case of connection.

In Case 2, it took a little longer than Case 1 and case of wireline connection because radio wave attenuation by six wireless LAN repeaters connects in series and bridge connection.

But the Case 2 as bridge connection is affordable range even though connect up to different segment just like downloading time.

9 Conclusion

From past disasters, the problem of communication over such as fixed telephone and cellular phone became more apparent. Therefore, it turns out that we need to ensure alternate communication methods instead of them.

Here we propose to establish a communication network which makes a vessel a relay station. To apply existing materials, such as a vessel and wireless LAN has a great advantage of easy way and at low cost.

In addition, according to experiment verification, it is expected that wireless LAN method utilized widely gives a good performance. It is hoped that to enable prompt information exchange immediately after disaster strikes is useful in the transmission of safety information and getting information about a damaged area. Moreover, with a supporting network of volunteer ships from the sea, it may become a standard technique of serving an information-communication function during an emergency and as a way to get information concerning shore conditions for volunteer ships and also help the immediate needs of the shocked sufferers.

References

[1] Tabuse H. et al., Survey of supports from the sea at disasters and utility of ships for contingency plan, Review of the Faculty of Maritime Sciences Kobe University, 2004, pp. 13-18

[2] The Headquarters for Earthquake Research Promotion, Vol.1 Explanation of probabilistic seismic movement calculation map by Earthquake Research Committee, 23 March 2005, p. 61, Available at: http://www.jishin.go.jp/main/chousa/05mar_yosokuchizu/bunsatsu1.pdf, [accessed 10 July 2006].

[3] The Kansai Society of Naval Architects, Research and surveys about aspect and existence of maritime transportation system at disasters, December 1995, pp. 4-5, 21-24

[4] Fisheries Agency, Guideline for make fishery area resistant disasters, March 2006, pp. 80-82, 119-120, Available at: http://www.jfa.maff.go.jp/release/18/031301/guideline.pdf, [accessed 10 July 2006].

[5] Headquarters of Kochi prefecture for Nankai earthquake, Basic policy of prepare against Nankai earthquake, February 2005

[6] Sakabe K., Immediate countermeasure simulation supporting by ships at disasters, Thesis for a degree of Kobe University, (2006)

[7] Jichitai-kikikannri-kenkyuukai, Jissen kara manabu kiki kanri in Japanese (Learn from practice Emergency Management), pp.360-361, Toseishinposha

[8] Cabinet Office, Government of Japan, Emergency Information of Disasters, Available at: http://www.kantei.go.jp/jp/kikikanri/jisin/niigatajoutyuuetu/0707161700.pdf, [accessed 28 September]

[9] Prime Minister of Japan and His Cabinet, Emergency Information., Available at:http://www.kantei.go.jp/jp/kikikanri/jisin/niigatajoutyuuetu/0707161700.pdf, [accessed 28 September]

[10] Watanabe K, Questionnaire survey for volunteer ship network at disasters – Hokuriku Area Fishermen's cooperative and Autonomy-, Thesis for a degree of Kobe University, (2007)

[11] Ministry of International Affairs and Communications, Current Situation of Spectrum of Use in Japan., Available at:http://www.tele.soumu.go.jp/search/myuse/use/960m.pdf, [accessed 21 January 2008]

On-board training and experienced officers

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Abstract

The rapid increase in the number and tonnage of certain types of merchant vessels (VLCC, LNG, High-Speed Car Carrier, Mega-Containership and etc.) creates a vital problem for maritime safety by the lack of experienced crewmembers, and especially officers for such type of the vessels.

We have two kinds of inexperienced officers:
First – the experienced officers without experience on certain type of vessels (LNG Carrier for example).
Second – the junior officer, recently graduated from a maritime education and training institution. Good seagoing service cadets get on board the training ship. But it is extremely costly for MET institutions to acquire and maintain own training ship for their cadets.
The next problem is – certain type of vessels require certain experience.
The STCW 78/95 convention requires both deck and engine cadets to have seagoing service with following requirements:
- deck cadets should get twelve months of seagoing practice
- and engineering cadets six months of seagoing service towards certification.

Cadets' seagoing service should be "closely supervised and monitored by qualified officers aboard the ships in which the approved seagoing service is performed". It is the company's responsibility to organize such procedures (designate the training officer on board of the vessel) strictly to follow the STCW and ISM Requirements. Such procedures are vitally important to companies that have interest in cadets as future Company deck or engineer officers. Unfortunately this important responsibility is lost among the daily routine jobs of the crewmembers. As objective evidence of the seagoing service should be "The Approved Training Records Book (STCW Convention 78/95 Para II/1 for deck officer and Para III/1 engineer officer)"

Following this IAMU, decided to set "On board training" as the one of the Common Themes of the Integrated Working Group. This paper will present ONMA experience to solving these problems, agreements between MET

institutions and Shipowner Companies, and the Cadet program as part of educational process.

Keywords: *Seagoing Service, On-board Training, Training Officer, Training Record Book, Company's Responsibility, and Cadets Program.*

1 Introduction

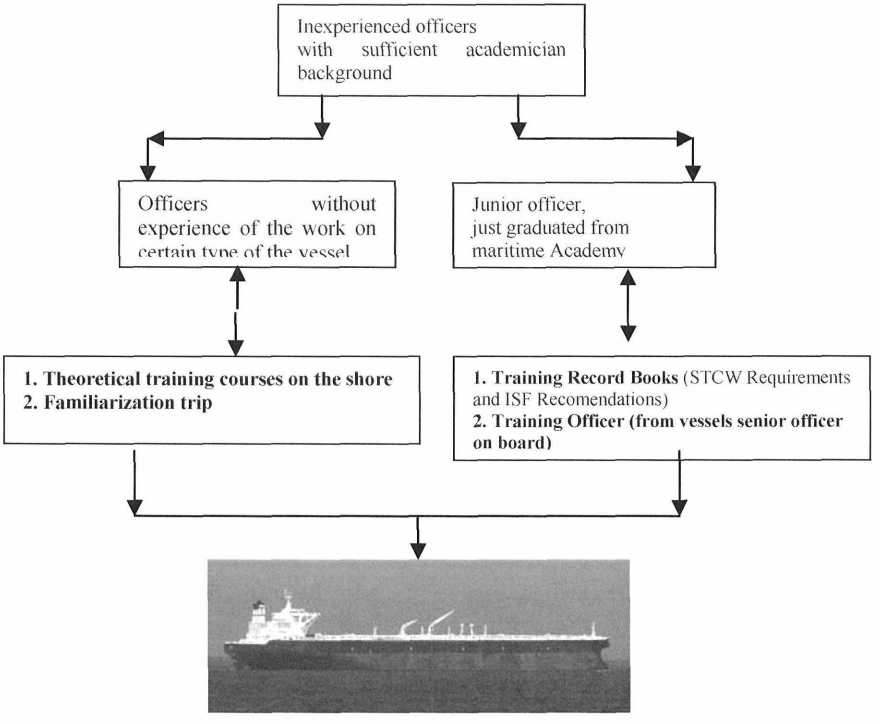
International STCW Convention 78/95, Chapter II Regulation II/1 "Mandatory minimum requirements for certification of officers in charge of a navigational watch on ship of 500 gross tonnage or more" section 2.2 requires: "have approved seagoing service of not less than one year as part of an approved training program which includes on-board training which meets the requirements of section A-II/1 of the STCW Code and is documented in an approved training record book ".

But neither Convention, nor any other regulatory document, explains how the practice should take place and where the border between getting real-life knowledge and "objective evidence" in the form of the certificate lies.

A Rapid increase in the number and tonnage of certain types of merchant vessels (VLCC, LNG, High-Speed Car Carrier, Mega-Containership and etc.) causes vital problems for maritime safety by the lack of the experienced crew members, and especially officers for such type of vessels.

2 Question's dualism

We can divide the problem with inexperienced officers in two streams:



First – the experienced officers without experience on certain types of vessels (LNG Carrier for example). For these officers - special training courses (STCW requirements for certain type of the vessel), short familiarization (refreshment) theoretical courses on shore and one familiarization trip on the new vessel vessel will be enough; here you can see the procedure that was clear defined in ISM Code (Para 6.3, 6.4, 6.5).

Second – the junior officer, recently graduated from a maritime education and training institution. Good seagoing service cadets get on board of the training ship. But it is extremely costly for MET institutions to acquire and maintain their own training ship for their cadets. Third – certain type of vessels requires certain experience.

Convention STCW 78/95 requires both deck and engine cadets to have seagoing service with following requirement:

- deck cadets should get twelve months of seagoing practice

- and engineer cadets six months of seagoing service towards certification.
Cadets' seagoing service should be "closely supervised and monitored by qualified officers aboard the ships in which the approved seagoing service is performed". And this is the company's responsibility to ensure such procedures (designate the training officer on board of the vessel) strictly follow the STCW and ISM Requirements. Such procedures are vitally important to companies that have an interest in cadets as future company deck or engine officers. Unfortunately this important responsibility is lost among daily routine jobs of the crewmembers.

Following this, the IAMU decided to set "On board training" as the one of the Common Theme of the Integrated Working Group.
But unfortunately for some reasons it is only a decision for the moment.

Keeping in mind that it is quite difficult to organize OBT systems for officers without experience on certain type of vessels (LNG Carrier for example), we proposed the following OBT system for our cadets.

3 One sea - one ship.

There are 48 member institutions in the IAMU. There are eight IAMU member institutions on the Black Sea:

1. Novorosiysk Maritime Academy (NMA, Novorosiysk, Russia)
2. Batumi State Maritime Academy(BSMA, Batumi, Georgia)
3. Istanbul Technical University Maritime Faculty (ITUMF, Istanbul, Turkey)
4. Nicola Y. Vaptsarov Naval Academy (NVNA, Varna, Bulgaria)
5. Constantza Maritime University (CMU, Constantza, Romania)
6. Kyiv State Maritime Academy (KSMA, Kyiv, Ukraine)
7. Odessa State Maritime University (OSMU, Odessa, Ukraine)
8. Odessa National Maritime Academy (ONMA, Odessa, Ukraine).

But from this eight - only ONMA has its own training ship. This three mast sailing ship "Druzhba" with length overall - 108.6 m and total area of sails equal to 3000 sq.m. was built in 1987 in Poland. There are 24 four bed cabins, 4 two bed cabins and 1 three bed cabins on the "Druzhba". Full accommodation facility is enough for 108 cadets.

Owner	Odessa National Maritime Academy Port of registry Odessa, Ukraine
Class of ship	KM1F
Length overall	108,6 m (with the bowsprit) Length of the hull 94.8m
Beam	14.0 m

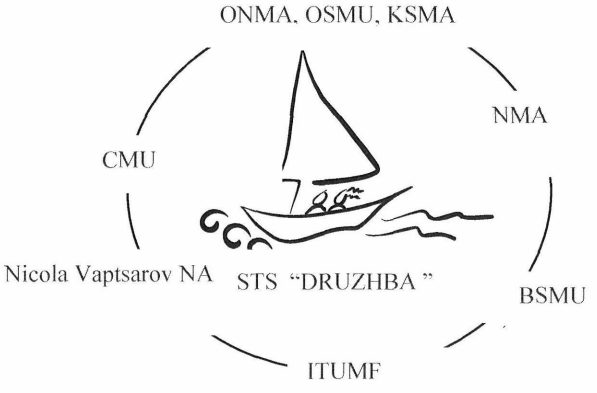
Height to the upper deck	10.05 m
Height to the main (bulkheads) deck	7.815 m
Maximum average draft	6.37 m (in the sea water)
BRT	2384.85 t
NRT	335.37 t
Displacement	2946.0 t
Height of the foremast	49.5 m
Height of the mainmast	49.5 m
Height of the mizzen	46.5 m
Sail area	3015 sq m
Auxiliary engine	Cegielski – Sulzer type 8 AL 20/24 2 * 750 PS (552 kW)
Speed under power	economy speed: 9 knots maximum speed: 12 knots
Permanent crew	40 persons

Figure 2. Details of Sailing Training Ship – "DRUZHBA"

Only on a sailing vessel a future navigator might get a feeling whether he is on the right place or not and get initial familiarization with the chosen job. The training vessel allows a combination of real-life conditions at sea and training process under the surveillance of qualified and experienced academic staff. Not leaving Black Sea borders, STS "DRUZHBA" can provide on-board training for junior navigational cadets for 8 universities - IAMU members, i.e.: NMA, BSMA, ITUMF, NVNA, CMU, KSMA, OSMU and ONMA.

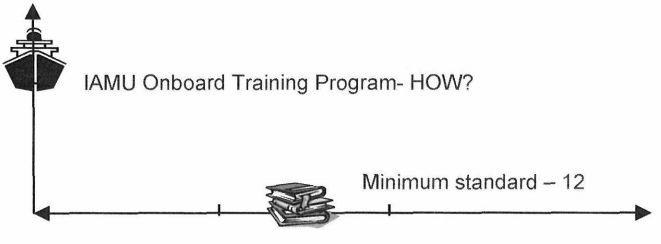
Using the STS "DRUZBA" for these Black Sea region Universities makes it possible to avoid transportation expenses for cadets to rich the port of origin

We think that such common activity of our Universities get a real tangible result of the IAMU IWG on OBT. We hope that our colleagues from Black Sea region support our idea and on the next AGA we can inform the Assembly about the first result.



4 On-board training program idea.

At present, IAMU combines and unites major leaders of worldwide maritime education and training (MET). Its main objective is to promote global maritime excellence. On-board training should be an integral part of MET. To achieve it, strong and continuous feedback regarding the improvement of current existing systems is vital. IAMU members should not only analyze and discuss the standards, but participate in their realization as well.



Research is based on the experience of countries with leading and historically - prevalent MET's.
Following a split for 12 months of on-board training (as shown below) is the most effective way of gaining proper results:

<table>
<tr><th>IAMU standards
of on-board training for navigational cadets</th><th>STCW 78/95
Requirements</th></tr>
<tr><td>4 months
Sailing Training Ship
(program of training)</td><td rowspan="3">12 months
seagoing experience, including on-board training</td></tr>
<tr><td>4 months
Training Vessel or training on merchant Vessel for small group cadets under supervision of the training officer from the Academy
(program of training)</td></tr>
<tr><td>4 months
Certain type of the Vessel, training under supervision of the training officer from Shipping Company
(program of training)</td></tr>
</table>

The main goal of the IAMU IWG on OBT is to develop IAMU standard program of on-board training based on criteria mentioned above.

5 Conclusion

In our opinion, the IAMU should consider and decide to start operating its own standards of cadets' on-board training, mentioned above, on a level higher than those offered by STCW, being a minimum.IAMU member universities located in the Black Sea area should be directly involved in this activity realization and create a live networks of active IAMU members in Black Sea Region.

References

[1] International Convention on Standard of Training, Certification and Watchkeeping for Seafarers, 1978, as amended in 1995 (STCW Convention), IMO, 2001.

[2] Laczynski B., 2007, Role and situating of practical training of deck students on training ship in practice of Gdynia Maritime University, Proceeding of the 8th IAMU Conference – pag. 101 -113. Odessa, 2007.

[3] Barsan E., 2007, Key roles played by shipping companies in the MET process, Proceeding of the 8th IAMU Conference – pag. 363-376. Odessa, 2007.

[4] Solanki I., Nakazawa T., Empowering seafarer – role of Maritime Universities Proceeding of the 8th IAMU Conference – pag. 387 -398. Odessa, 2007.

Maritime education and training: IAMU and IMO-Formal research of main concepts and trends

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Abstract

This research is devoted to a formal joint intratext analysis of the papers submitted to IAMU 8th Annual General Assembly (AGA 8) under the title "World Maritime Excellence," and materials submitted to IMO STW 38/39 sub-committee sessions, the basic theme of which was "Comprehensive review of the STCW Convention and the STCW Code". The main links and gaps of basic concepts extracted from two sets of papers were defined.

1 Introduction

The main objective of this paper was to analyze the actual and most vital subjects discussed by universities during the AGA8 Assembly and compare them with the main items which were considered by IMO's STW 38/39 subcommittee sessions. In principle, a degree of conformity was obtained. This information can be used for understanding whether institutions feel and follow the requests of industry and vice versa – how industry influences the MET institutions' core activities. To evaluate links and collaboration we used those publications and working materials available in electronic format. The total amount of researched material was 432 AGA 8 pages (Odessa 2007) and more than 1,500 STW 38/39 pages (IMO 2007-2008).

To reach the stated objective of our research, we used the Leximancer software. Leximancer is a data-mining tool that can be used to analyze the content of collections of textual documents, and visually to display the extracted information. A large amount of textual information cannot be read and analyzed without specialized software, which is why we used Leximancer.

"Concepts" in Leximancer are collections of words that "travel together" throughout the text. So, in this paper, "concepts" are sets of associated words that are extracted automatically by the system. Researchers can also interact

with this process, creating concepts that are of interest to them (Leximancer Manual 2002).

2 IAMU AGA 8 and IMO STW 38/39

It is clear that the closest relations of IAMU MET logically should be with the STW subcommittee of the IMO. This closeness of subject areas can be measured by textual materials presented by the organizations from its conferences.

Let us assume that the level of importance of any concept which can be mined from the text is equal to the frequency of its recurrence in the text. The importance of components (attributes) included into a concept can also be defined by their conditional frequencies (probabilities) using the Leximancer software. So, the more frequently the concept occurs in the text, the more important it is considered to be.

Leximancer software extracted the main concepts considered during IAMU AGA 8 (AGA 8 2007) and also from materials of STW 38 (2007) and STW 39 (2008). Fig.1 shows these main concepts discussed by the two organizations.

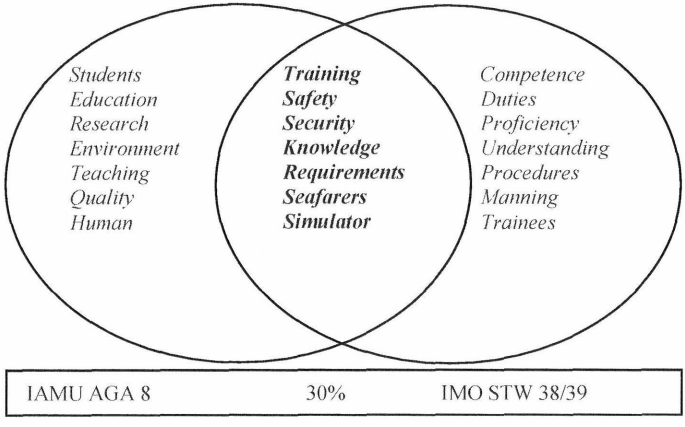


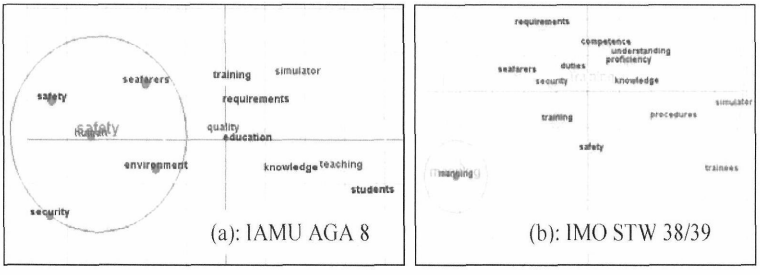
Fig.1. Main concepts as per IAMU AGA 8 *Proceedings* and IMO STW 38/39 materials

We observe that 30% of concepts were considered as common ones. In other words, both sides paid great attention to *training,* but for example, *manning* was not interesting to the IAMU, and *education* was not a hot topic for STW 38/39.

Fig.2 (a, b) shows the uniting of concepts into themes. For AGA 8, two main themes were *training* and *safety*. For STW 38/39 the main themes were *manning* and *safety*. It can also be seen that intersection areas are rather small. This indicates that, in principle, the themes were discussed in both organizations almost independently; this can hardly be considered a correct procedure.

Fig. 3 shows the conditional probabilities (relative importance) of components used in the deliberation of three main concepts: *safety, security* and *knowledge*. In other words, we can see the importance of main concepts determined by participants of two conferences. The intratext information mined from set of texts is as follows:

Safety: As per STW documents, the most important components in the concept *safety* were *training* and *requirements,* but *teaching* and *research* were not mentioned in principle. AGA8 papers recognize that the most important components of the concept *safety* are *understanding* and *security*. *Training* is not used in this context at all.



(a): IAMU AGA 8 (b): IMO STW 38/39

Fig.2: Concepts related to themes: (a) *training* and *safety* (IAMU), (b) *training* and *manning* (IMO)

Security: The STW version of the concept points out that *training*, *duties* and *requirements* were the most important components but *education* and *research* were beyond their consideration. AGA 8 papers show that there was a poor link with *safety* and *training* . It is rather strange but there was no logical connection of the concept *security* with *duties, competence* or *manning* at all.

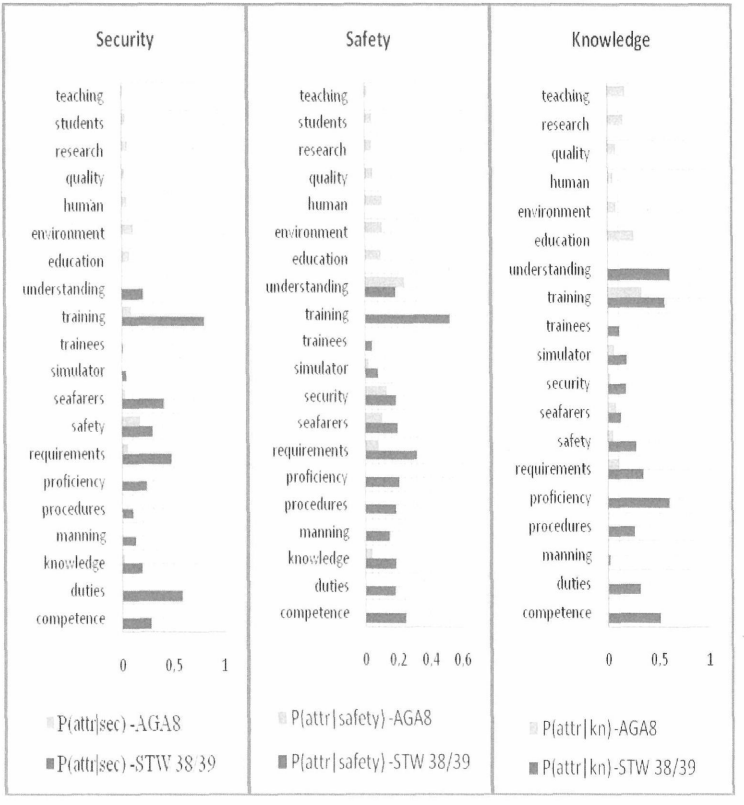


Fig.3: Components of the concepts *safety, security,* and *knowledge* and their relative importance

Knowledge: In the STW version of this concept, the terms *understanding, training, proficiency* and *competence* are the most important components. In the IMO, this discussion went within the framework of the STCW Code, which is why these terms are not correlated with *research, teaching* and *education.*

As per AGA 8 the version, the concept of *knowledge* is significantly linked with *education* and *training*. This is quite natural. But the absence of any connections with *understanding ,proficiency* and *competence* can be considered as a negative.

3 Conclusion

The preliminary formal analysis of texts facilitates analytics to find implicit, intratext, and logical connections between main concepts to improve their deliberation during conferences and to develop research tasks. For example, by

the materials processed (fig.3), the following research projects might be considered as logically vital and important for industry:

(a) *Training* techniques for improving *safety* at sea (How to train better?)
(b) A comprehensive review of conflicts between the concepts *safety* and *security* in the ISM /ISPS codes.
(c) Research into, and development of, an optimum *knowledge/training* ratio for seafarers.

References

[1] Leximancer Manual, Version 2.2, 2005.

[2] World Maritime Excellence . Proceedings of the 8th Annual General Assembly and Conference of IAMU, ONMA, Odessa, Ukraine, 17-19 September 2007

[3] STW 38 working materials , IMO , London, 2007.

[4] STW 39 working materials , IMO , London, 2008.

Guidelines and considerations for ship evacuation from a tsunami attack

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Japan

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Abstract

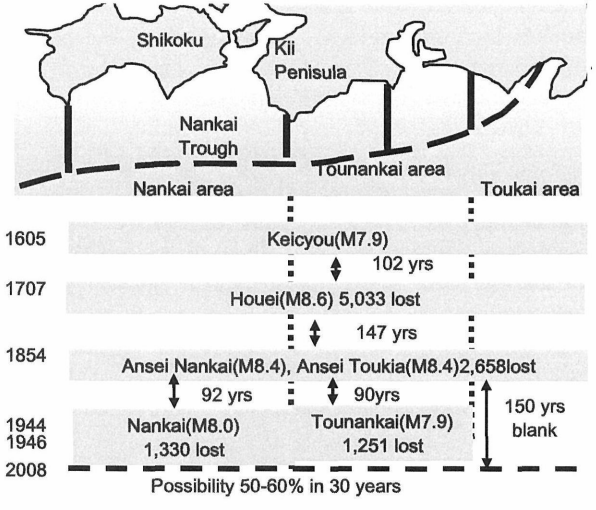
Earthquakes have continuously occurred along the Nankai trough off Kii Peninsula in Japan for more than 1000 years. The tsunamis generated by these earthquakes reach Osaka Bay within approximately one hour of the earthquake. The tsunami causes the slow phenomenon of coming and going of the horizontal water flow, and the rise and descent of the water level in the Osaka Bay. Many oil-related facilities, power plants and petrochemical complexes are located in the landfill area along the Osaka Bay coast, and many cargo vessels transporting hazardous materials navigate the bay. Such ships should be moved outside the port area in the event of an earthquake and a tsunami is expected. However, specific procedures for such evacuation measures have not been developed. In this study, evacuation guidelines for an LNG carrier, representative of a hazardous cargo carrier, were considered in the case of the ship entering Sakai Senboku Port, where many power plants and chemical complexes are located.

1 Introduction

Large earthquakes, such as Keichou in 1605 with a magnitude of M7.9, Houei in 1707 (M8.6), Tou-Nankai in 1944 (M8.4), and Nankai in 1946 (M8.4), have occurred for at least the last thousand years along the Nankai Trough which is located off the Toukai area, Kii peninsula and Shikoku area in Japan, where the Philippine plate subducts the Eurasian plate, as shown in Fig. 1(Watanabe1985). As of January 1st, 2008, the probability of occurrence of the next Nankai and Tou-Nankai earthquakes in the next 30 years is estimated at 50% and 60% to 70%, respectively (Web site of the Headquarters for Earthquake Research Promotion; http://www.jishin.go.jp/main/choukihyoka/kaikou.htm). The tsunami that will be generated by such earthquakes will arrive at Osaka Bay within one and a half hours after the earthquake occurrence. The general characteristics of tsunamis in Osaka Bay are the receding and approaching of the horizontal water flow associated with the sea surface slowly rising and falling.

There are also numerous petroleum, power and chemical plants on the reclaimed land along the coast of Osaka Bay. In particular, there are key industries such as petrochemical refineries, factories, power stations, and their associated industries, companies and facilities in the adjoining area of Sakai-Senboku Port, which runs 10 km north to south, 10 km east to west, and covers an area of 9000 ha. The port is a particularly important harbor, and it extends over Sakai City, Takaishi City and Izumiootsu City; numerous ships enter the port transporting raw materials that are hazardous.

Fig. 1 Historical occurrence of earthquakes along the Nankai Trough.



When an earthquake occurs, and a tsunami attack is expected, ships are basically required to evacuate outside those ports. However, specific procedures for ship evacuation for these areas have not yet been developed. A ship transporting liquefied natural gas (LNG carrier) and entering the Sakai-Senboku Port area is the focus of this study, and is used as an example of a cargo ship transporting hazardous materials.

Although the depth of the water in the area near Sakai-Senboku port is approximately 12-15 m, a waterway that is 16 m in depth, 300 m in width and 7,000 m in length was built from the central part of Osaka Bay to the LNG berth, because an LNG carrier, which is usually 13 m in draft, must proceed along this waterway due to draft restrictions. In this study, an evacuation procedure for an LNG carrier arriving at or departing from the port in the tsunami attack was investigated.

First, for a situation involving an LNG carrier, the locus and variation of the ship speed was analyzed using automatic identification system (AIS) equipment. Secondly, tsunami simulation around Osaka Bay was performed to elucidate the arrival time, horizontal velocity and elevation at several important points. Furthermore, evacuation times and anchoring performance were discussed using ship-maneuvering simulations. Finally, evacuation guidelines for a tsunami event were investigated from several perspectives.

2 Investigation of LNG locus by AIS

2.1 Installation of AIS

Actual sea traffic conditions of LNG carriers entering at Sakai Senboku port in Osaka Bay were investigated using AIS receiver equipment installed at the Kobe University. The main component of the AIS system, the Euronav AI3000, was used exclusively for receiving AIS data and was connected to a PC by RS-232C serial connection. All AIS data received by the PC were continuously and automatically stored in the hard disk of the PC. That data could be retrieved through the internet and analyzed on another PC at any time. The AIS data-receiving system and the system configuration are shown in Fig. 2. Important AIS data of ships in Osaka Bay can be obtained with relative ease as the installation of onboard AIS systems is now required for all ships of more than 3000 GT on international routes and all domestic ships of more than 500 GT. It is possible to receive static information, dynamic information, and navigation information and some additional data from installed onboard AIS.

Static information includes the vessel's maritime mobile service identity (MMSI), the name of the vessel, radio call sign, ship length, the draft of the ship, the IMO(International Maritime Organization) number, ship width, type of ship, and antenna position. Dynamic information includes the longitude, latitude,

time, course, rate of turn, and speed over ground. Navigational information includes the draft of the ship, the destination, and the type of cargo.

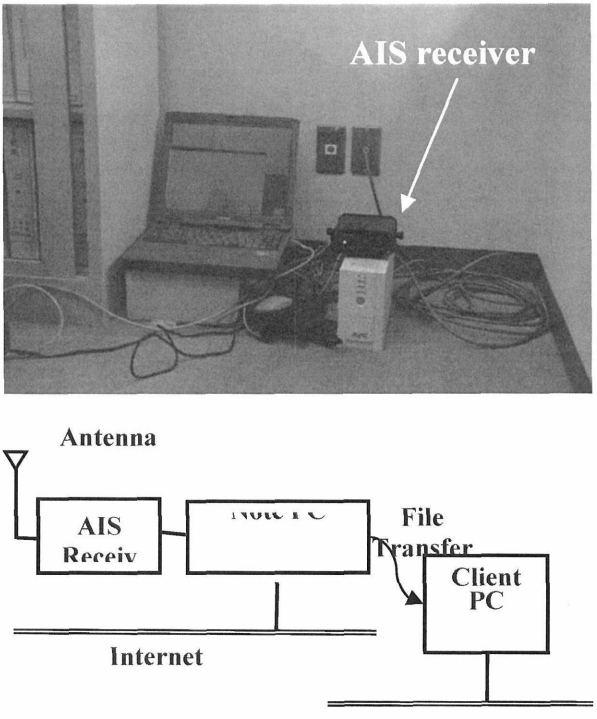


Fig. 2 AIS receiving system.

2.2 AIS Data Analysis

The analysis results of representative LNG's entering and departing from Osaka Bay using the AIS data receiving system are shown in Fig. 3. At the time of arrival in Osaka Bay, after passing through the Kii Channel in a northward direction, the LNG carriers reduce speed to allow the bay pilot at a pilot station 34°10.2"N and 134°5 9.8" E, located in the southern area near the Tomogashima Channel, to board the ship. The ships then increase speed and after passing through the Tomogashima Channel, proceed in a northeasterly direction through the western area of Kansai International Airport Island.

The AIS data obtained for LNG carriers that went through the Hamadera Passage and either docked at or left from the LNG berth were analyzed from July to September 2006. Most LNG ships that passed through the passage were

of the 125 km3 type, and were moved to one of four berths. The summarized AIS data analysis shows that three LNG ships passed through the Hamadera Passage every four days.

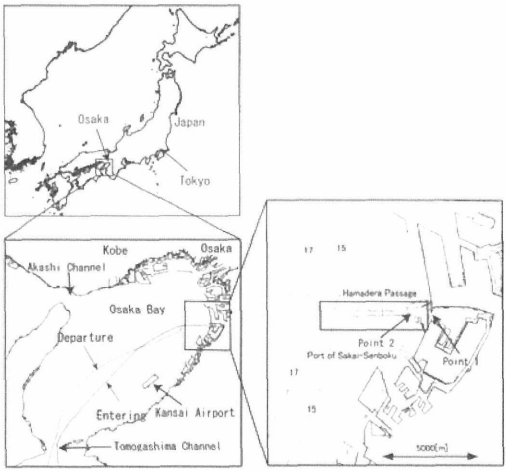


Fig. 3 Ship locus for the Sakai Senboku Port and Hamadera Passage.

3 Simulation model

A tsunami consists of long waves that are generated by the change in seafloor topography caused by an earthquake. Tsunami phenomena can be expressed by both continuity and momentum conservation equations based on non-linear long wave theory, which provides a uniform distribution of horizontal velocity in the direction of water depth using the coordinate system shown in Fig. 4.

$$\left.\begin{aligned}
&\frac{\partial \eta}{\partial t}+\frac{\partial M}{\partial x_0}+\frac{\partial N}{\partial y_0}=0 \\
&\frac{\partial M}{\partial t}+\frac{\partial}{\partial x_0}\frac{M^2}{D}+\frac{\partial}{\partial y_0}\frac{MN}{D}+gD\frac{\partial \eta}{\partial x_0}+\frac{\tau_x}{\rho}=0 \\
&\frac{\partial N}{\partial t}+\frac{\partial}{\partial x_0}\frac{MN}{D}+\frac{\partial}{\partial y_0}\frac{N^2}{D}+gD\frac{\partial \eta}{\partial y_0}+\frac{\tau_y}{\rho}=0
\end{aligned}\right\} (1)$$

where

η : elevation from still sea water, t : time, x, y, z : coordinate system, g : gravity acceleration, ρ : density of water, D : depth of water, τ_x, τ_y : sea bottom friction in the x,y directions, M, N : x,y directional volume flux.

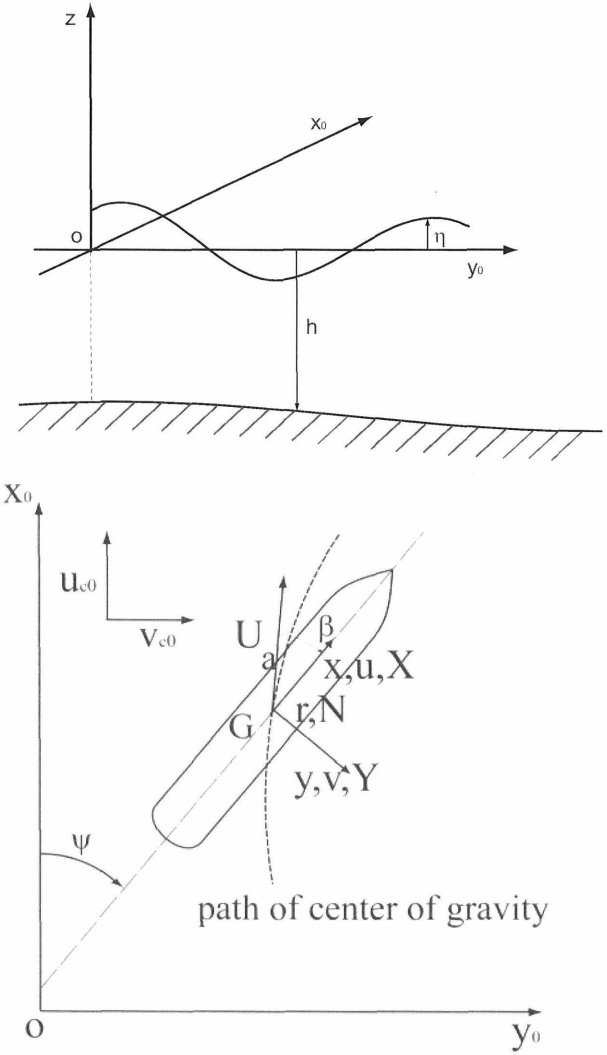


Fig. 4 System of coordinates used for the tsunami calculation (left) and ship maneuvering simulation (right).

Solving the above mentioned equations using the finite-difference time-domain method with 50 m 150 m, 450 m and 1350 m-mesh systems, horizontal velocity

components u, v are obtained. Ship maneuvering motions can conventionally be expressed by the following equations using the coordinate system shown in Fig. 4:

$$\left.\begin{aligned} &(m+m_x)\dot{u} - (m+m_y+X_{vr})vr \\ &-(u_{c0}\sin\psi - v_{c0}\cos\psi)(m_y - m_x + X_{vr}) = X_H \\ &(m+m_y)\dot{v} + (m+m_x)ur \\ &-(v_{c0}\cos\psi + v_{c0}\sin\psi)(-m_y + m_x)r = Y_H \\ &(I_{zz}+J_{zz})\dot{r} = N_H \end{aligned}\right\} \quad (1)$$

where,

m : mass of the ship,

m_x, m_y : added mass of the ship in x,y directions,

I_{zz} : mass moment of inertia of the ship about the z-axis,

J_{zz} : added mass moment of inertia of the ship about the z-axis,

u, v : velocity components in the x,y directions,

u_{c0}, v_{c0} : velocity components by the tsunami in the x,y direction,

r : rate of turn,

X_H, Y_H, N_H : longitudinal and lateral forces, and the moment acting on the ship.

4 Tsunami calculation

The tsunami simulation was carried out to determine the effect of an event at a representative point along the Osaka Bay coastline using the abovementioned method. Fig.6 shows the elevation of the sea surface and lateral velocity components in easterly and northerly directions at the center of the Tomogashima Channel. Based on these calculations, the water level rises to a peak value of 1 m, the velocity component in the northerly direction becomes 1 m/s, and the velocity component decreases in an easterly direction within approximately 1 hour after the earthquake occurrence.

Fig. 6 shows the time histories for the elevation of the sea surface and the velocity components at the narrow point(Point 1 in Fig. 3) between breakwaters built at the mouth of the Hamadera anchoring area where the Hamadera passage ends. The horizontal velocity increases to 2.5 m/s and the sea surface elevation reaches 1.5 m one hour and forty minutes after the earthquake. The horizontal velocity becomes 4.5 m/s by the time the second tsunami arrives, which is two hours and thirty minutes after the earthquake.

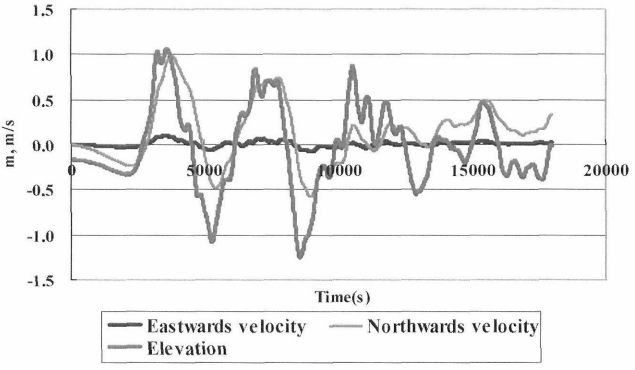


Fig. 5 Computed sea water level and velocity components during a tsunami event in the Tomogashima Channel.

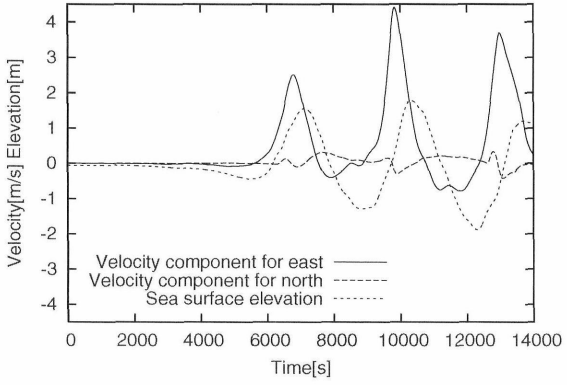


Fig. 6 Computed sea water level and velocity components during a tsunami event at Point 1.

5 Evacuation scenarios

When the next Nankai earthquake occurs, and a tsunami heading toward Osaka Bay is expected, all of the ships in the port should be evacuated to a safety zone outside the port as quickly as possible, where they should be anchored if necessary. The following choices for an evacuation scenario are considered in the event that an LNG carrier enters Osaka Bay after passing through the Tomogashima Channel:

(1) Making a u-turn and proceeding toward the Pacific Ocean after passing through the Tomogashima Channel again.

(2) Going to Harimanada after passing through the Akashi Channel.
(3) Anchoring at an appropriate area in Osaka Bay.

According to the numerous concerns associated with so many ships being evacuated from ports along the coastline of Osaka Bay into the center of the bay at the time of a tsunami event; scenarios for evacuating as many ships as possible from Osaka Bay were examined in this study.

Since a tsunami event affecting Osaka Bay is likely to be associated with slow horizontal flow, and because ships can easily navigate the Tomogashima and Akashi Channels before the arrival of the tsunami, the investigation of evacuation scenarios was carried out according to the following conditions:

(1) A ship's crew recognizes the potential for a tsunami within 10 minutes after the occurrence of an earthquake.
(2) The ships pass through the Tomogashima or Akashi Channels 10 minutes prior to the arrival of the first tsunami at those points.
(3) Ten minutes are required to turn the ships around.
(4) Depending on proximity, evacuation begins by passing through either the Tomogashima or Akashi channel.
(5) Ships anchor themselves unless they are passing through the channels.

Fig. 7 shows the evacuation patterns obtained from investigations using these conditions. A ship in a northward zone after passing through Tomogashima Channel can avoid contact with a tsunami by changing the heading direction by 180 degrees and going south through the channel. When the ship is in a more northern zone, the ship can avoid the tsunami attack by going through the Akashi Channel. When the ship is in the western zone of the Hamadera passage, it can anchor itself at an appropriate position. Conversely, a more detailed investigation is necessary for a ship that enters the Hamadera passage, because the ship could not go anywhere from the passage nor can it change its heading angle in such narrow area.

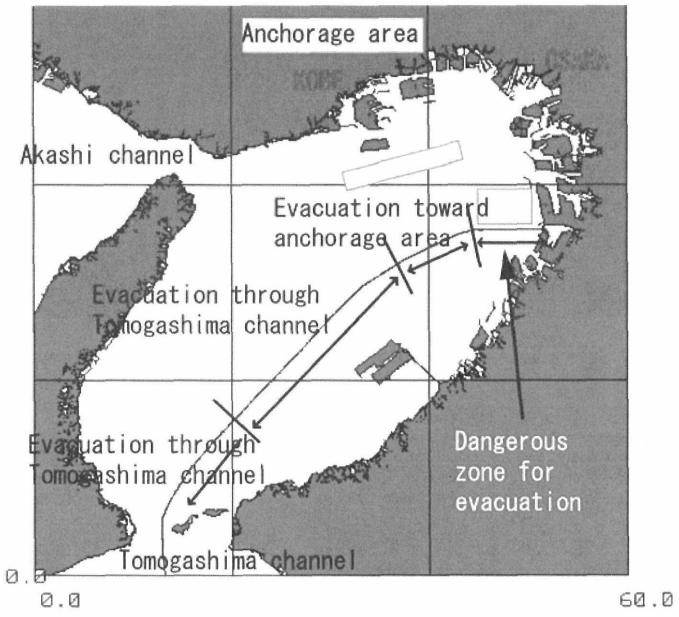


Fig. 7 Evacuation patterns of arrival.

6 Simulation study

An LNG carrier entering the Sakai Senboku Port should initially proceed through the Hamadera Passage, which is 7000 m in length and 300 m in width, with the assistance of four 3000 hp-class tug boats, and berth.

Computer simulations were conducted to determine and evaluate an evacuation scenario under the most dangerous conditions where an LNG carrier, whose principal diminutions are listed in Table 1, is proceeding through the passage. In Case 1, it is assumed that the worst scenario is that the number of tug boats near the berth is insufficient, and it takes 60 minutes after the occurrence of the earthquake to leave the berth. Thus, the LNG ship, moored in the inbound direction, leaves the pier with tugboat assistance, then changes its heading angle in the Hamadera turning basin, before proceeding through the passage in a westerly direction.

In Case 2, it is assumed that the ship moored in the outbound direction rather than the inbound direction, which is the standard procedure at the berth. In this case, it is assumed that it takes 30 minutes to leave the berth, because there is no need to change the heading angle and because additional tugboats are not required for departure.

Table 1 Principal dimensions of the LNG carrier

Length between perpendiculars(Lpp)	270.0 m
Breadth	44.8 m
Draft	10.8 m

The computer simulation results for Case 1 and Case 2 are shown in Fig. 8 and Fig. 9, respectively. For Case 1, the ship drifted slightly to the inner area of the port by the tsunami-generated flow when the ship is turning in the basin.

When considering ship evacuation from a tsunami event, simulations for LNG ship evacuation from Sakai Senboku Port indicate that outbound mooring is preferable to inbound mooring. However, despite having tugboat assistance, it can be dangerous to attempt turning in-situ in a narrow area with a full load of hazardous cargo to achieve outbound berthing. Further investigations focus on considerations and evaluations of reductions in tsunami event risks and the additional in-situ turning risk

Next, the evacuation of a ship having entered the Hamadera Passage was examined. As mentioned above, a ship proceeding through the passage cannot deviate from the passage. It is therefore assumed that the ship either returns to the entrance of the passage, or goes ahead until the end of the passage, turns around in the turning basin located in the eastern area of the passage, and then proceeds through the passage again in a westerly direction. To this procedure, an additional 30 minutes is required for leaving the berth.

The time required for evacuation into the open sea on the western side of the passage was examined by computer time domain simulation, with actual navigation situations acquired from the AIS data analysis considered in the analysis.

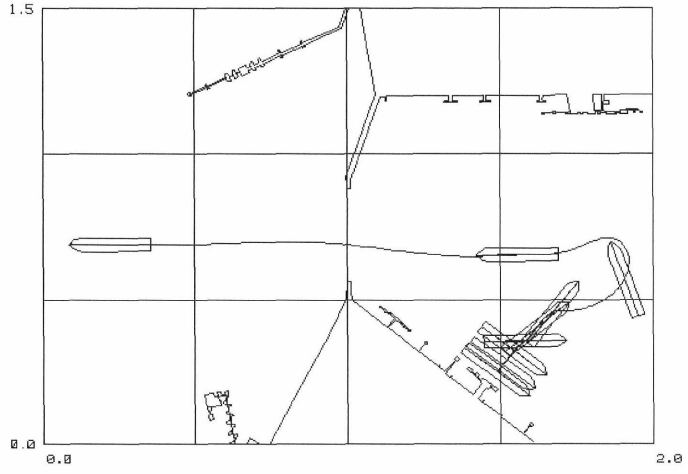


Fig. 8 Estimated evacuation locus during a tsunami event in the Sakai Senboku Port from an inbound mooring position (Case 1).

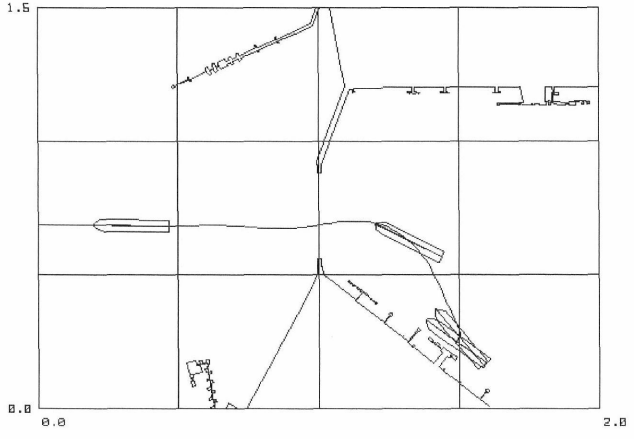


Fig. 9 Estimated evacuation locus during a tsunami event in the Sakai Senboku Port from an outbound mooring position (Case 2).

Moreover, anchoring computer simulations were carried out to confirm the safety under tsunami attack by use of a the three-dimensional lumped mass method that cables and an anchor are expressed as many springs and mass points. The anchoring position was set at 1.5 km western from the west end of the Hamadera Passage. The length of chains in this simulation was set as 4D +

145 m, where D: depth of the water. One of the results of calculation is shown in Fig. 10. The initial heading angle of this case was in the western direction. Although the ship was forced to move slowly by horizontal flow induced by tsunami, the anchor was not dredged when the flow is strongest.

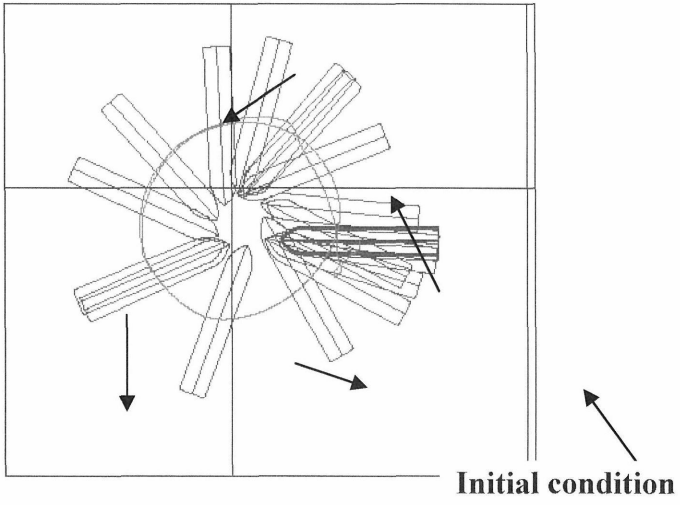


Fig.10 Ship locus under tsunami attack in anchoring condition

The results of the simulation are summarized as follows:

(1) During navigation: if the distance from the ship to the western end of the passage is less than 4,000 m.
The time required for evacuate the passage is less than 90 minutes.

(2) During navigation: the distance from the ship to the western end of the passage is greater than 4,000 m.
The time required for evacuate the passage is less than one hour and 30 minutes.

(3) During berth: Inbound direction.
The time required for evacuating the passage is less than one hour and 55 minutes.

(4) During berth: Outbound direction.
The time required for evacuate the passage is less than one hour and 30 minutes.
(Time required for recognizing the earthquake occurrence, 10 minutes; preparation for leaving, 30 minutes; unberthing procedures and moving to the entrance of the passage, 25 minutes; proceeding through the passage, 25 minutes)

(5) During anchoring:

The anchor was not dredged under horizontal current induced by the tsunami.

7 Conclusion

In this study, evacuation guidelines for an LNG ship, which is representative of a hazardous cargo carrier, were considered for the case of a ship entering the Sakai Senboku Port.

A ship in the Hamadera Passage can be successfully evacuated from the first tsunami event, such as one that has been estimated to arrive one hour and thirty minutes after the occurrence of the earthquake, by returning down the passage if the ship is less than 4000 m from the passage entrance. The ship can also be evacuated by going ahead, turning around and proceeding down the passage once more if the ship is already more than 4000 m down the passage.

It is possible that the ship may encounter the first tsunami event in the case where the ship begins to evacuate from an inbound mooring direction. However, in the case where the ship is moored in the outbound direction and is oriented toward the open ocean, it is likely to overcome the potential threat of the first tsunami event.

It is also possible to anchor in the appropriate evacuation area during a tsunami attack.

Acknowledgements

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References

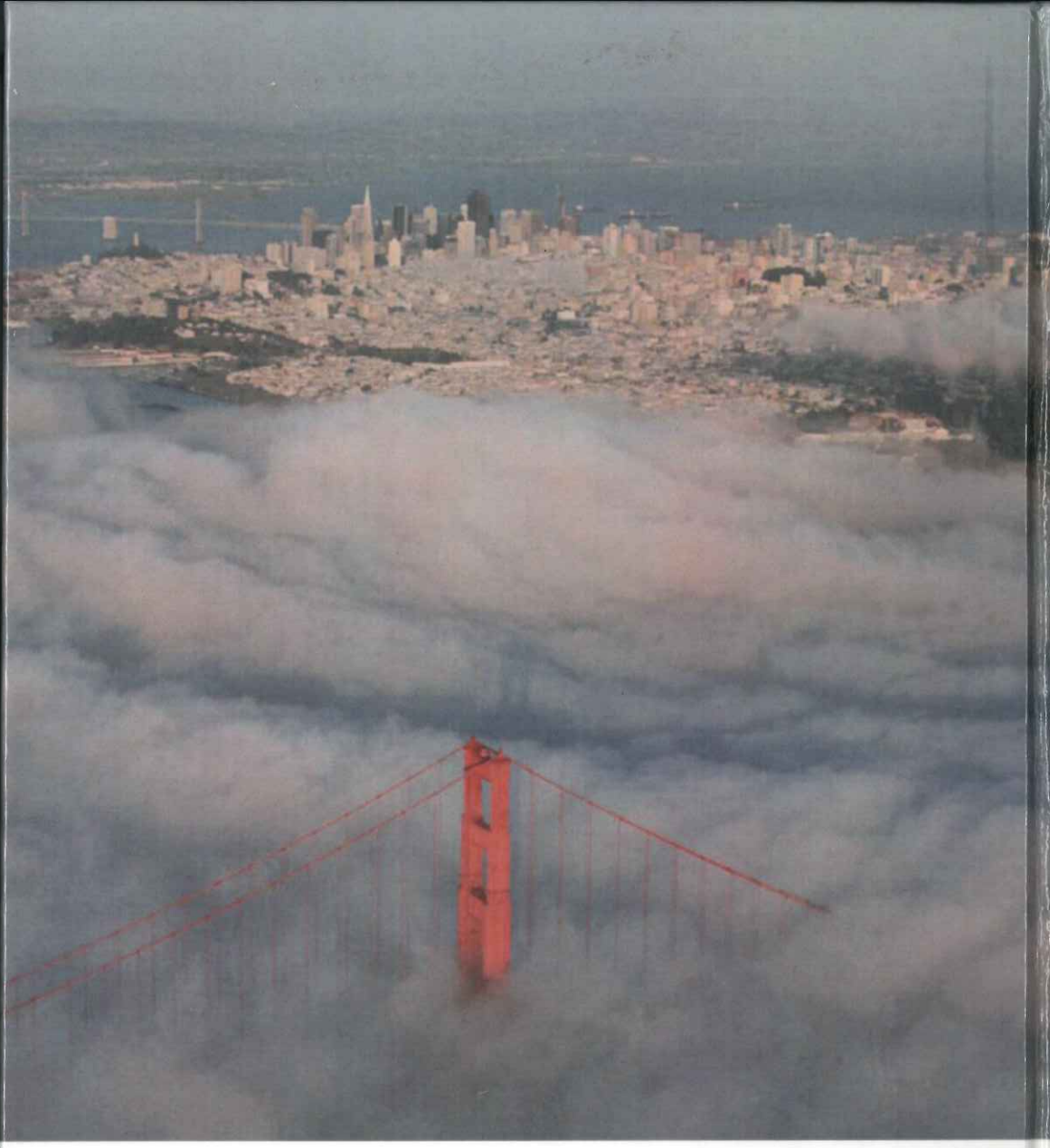
[1] Imamura, F(1996). "Review of Tsunami Simulation with a Finite Difference Method, Long-Wave Run-up Models", World Scientific, River Edge, World Scientific, River Edge, NJ, pp.43-87.

[2] The Japan Association of Marine Safety(1975). "The maneuvering guide for super large vessels", Seizando (in Japanese).

[3] Kobayashi, E., Shunichi, K., Kubo, M (2005). "A Basic Study on Ship Drifting by Tsunami", Journal of Kansai Zosen Kyoukai, Vol. 243, pp.49-55(in Japanese)

[4] Watanabe, H. (1985). "The compendium of tsunami disaster in Japan", Tokyo University Press(in Japanese) .

[5] The Headquarters for Earthquake Research Promotion, http://www.jishin.go.jp/main choukihyoka/ kaikou.htm(in Japanese).



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