World Maritime Excellence

Edited by
Dmitriy Zhukov

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8TH IAMU Annual General Assembly at the Odesa National Maritime Academy, Odesa, Ukraine

Foreword to the Proceedings

Dear Colleagues!

It is a great honor and privilege for me to welcome honorary guests and participants of the 8th Annual General Assembly (AGA8) of the International Association of Maritime Universities (IAMU) in Ukraine at Odesa National Maritime Academy (ONMA). Now IAMU unites 48 members from 23 countries from all over the world. At the International Maritime Organization (IMO) Council meetings held from 25th to 29th June 2007 in London the IMO Council decided to grant Non-Governmental Consultative Organization (NGO) status to IAMU. It is significant that the Assembly is being held on the threshold of the final decision of IMO to award the Association with the NGO status. IAMU has a unique possibility to elaborate its own Maritime Education and Training (MET) standards, corresponding to modern requirements of shipping industry and their implementation in world shipping, to take part in IMO discussion on review of the STCW Convention and Code.

The main theme of the AGA8 is "**World Maritime Excellence**". This book consists of selected by experts 36 academic papers in sub-themes: Globalization and MET, Maritime Safety and Security, Maritime English, STCW Convention/Code Review, IAMU Standards Implementation, IAMU Competence Certification System, Response of World MET to Industry Request.

We hope that the 8th Annual General Assembly of the International Association of Maritime Universities in Odesa will become an important milestone in the development of Maritime Education and Training in the world.

Prof. Dr. Mykhaylo V. Miyusov
ONMA Rector
IAMU Senior Vice-Chair
Chair of LEC IAMU AGA8

Contents

Dual Diploma Program between Two Maritime Institutes: A Three-Year Overview

Ata Bilgili[1], *Cemil Yurtören*[2]

Abstract

In recent years, world maritime institutes have been investigating possible new models to come up with a better maritime educational system in the near future. Several programs have been proposed, including international educational agreements between two maritime institutes. The Dual Diploma Program between the Istanbul Technical University Maritime Faculty (ITUMF) and the State University of New York Maritime College (SUNYMC), which was established three years ago, is one of these programs. Our experience during the first three years shows that although the educational advantages are obvious, it comes with several problems that need to be resolved. These include but are not limited to social, personal and cultural problems related to students and academic/financial problems that arise from the educational agreement itself. In this study, we are summarizing some of these existing problems with proposed solutions. Possible future problems are also investigated.

1. Introduction

As requirements for a better world emerge and problems start to present themselves in more complicated ways in increasingly larger space and time scales, the interdependence in many areas including but not limited to economics, industry, ecology and politics, commonly referred to as "globalization", becomes unavoidable. Under these circumstances, it is only intuitional to predict that the qualified people of tomorrow will

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have to be experts not only locally but also globally to be capable of performing under highly varying situations and locations. This implies being familiar with the state-of-the-art world knowledge but also with different cultures and consequently with different ways of thinking. Although these two can be acquired separately time-wise, it can be argued that since they are interconnected, a synoptic acquisition would be more productive and profitable. Assuming that a certain amount of maturity is required to consciously acquire this kind of interrelated education, high schools and higher education institutions have traditionally been the official bodies where this opportunity of so-called "globalization education" is given to students in the form of exchange programs at small scales such as agreements between two universities or at larger scales such as the Socrates-Erasmus program. However, the length of stay in these programs are short, usually only lasting one semester, and students usually do not benefit fully since most of their time is spent acclimatizing to their new environment and "self-adapting" to cultural and language differences instead of concentrating on "self-education". To overcome these disadvantages of the exchange programs, a relatively new different format has emerged under the name of the "dual-diploma program" (or DDP). This consists of a longer stay (as much as 2 years) at a host institution away from a home institution and specified courses passed at the host institution will be accepted for credit towards the degree at the home institution and vice versa. This way, students from each institution are able to study academic degrees at both institutions following a specifically designed curriculum and graduate and get diplomas from both. Note that this arrangement does not extend the length of the studies and the cadets get two diplomas within the time frame of one. The overall goal remains the same: to enhance educational and cultural experiences of involved students and faculty.

In order to achieve the overall goal stated above, the State University of New York (SUNY) and several higher education institutions in Turkey have initiated a dual diploma program in 2003. Istanbul Technical University (ITU) was one of the first universities to take part in this organization and there are currently 9 programs within ITU which are being carried out as dual diploma programs with different SUNY campuses (Nasuf et al., 2007). Two of these programs, namely the Marine Engineering and the Maritime Transportation and Management Engineering, are being carried out between the SUNY Maritime College (or SUNYMC) and the Maritime Faculty at ITU (or ITUMF) (Cline & Sag, 2003a; Cline & Sag, 2003b). Although these programs can be classified as successful academically, there have been many predicted or unpredicted problems that arose during the actual implementation and operation. This paper will concentrate on the operations of these programs, rather than their history, and will try to summarize the encountered problems, also attempting viable solutions when possible for the benefit of the Maritime Education and Training (MET) community.

2. Program Description

The ITUMF/SUNYMC DDP's are both 5 years long with the first "preparatory" year at ITUMF reserved for the required non-credit STCW (or Standards of Training, Certification and Watchkeeping) certificate courses complemented by an orientation program. The students without the required language proficiency also take English classes, while attending the TOEFL exams. The fall semester of the second year, during which basic engineering and maritime English education are given, is also taught at ITUMF. The students have until the end of this semester to satisfy the language requirement. The cadets then head to SUNYMC around the end of December to attend the 1 week intensive Indoctrination program. A faculty liaison from ITUMF escorts the cadets at this point and stays with them for one semester to help with their adaptation but also to participate in teaching and research activities as a visiting scholar. Once they are successful, they start the SUNYMC portion of their studies, starting with the spring semester of the second year. The third year is fully spent at SUNYMC. During the summers of the second and third years, the cadets go onboard the SUNYMC's training vessel T/S Empire State VI to attend two 2-month-long Summer Sea Terms (or SST's). The cadets then return to ITUMF for the fall semester of the fourth year. After one semester at ITUMF, they go onboard national or international commercial vessels to get their 8-month-long Long Term Sea Training (LTST). The fifth year is spent entirely at ITUMF. Having satisfied the requirements of both institutions, the cadets receive two diplomas from both institutions at the end of their studies.

The total length of the exchange part of the program is 20 months, all of which is spent at SUNYMC. Although the program was formulated for reciprocal exchange, it has been a one-way exchange from ITUMF to SUNYMC until now, with ITUMF being the "home" and the SUNYMC being the "host" institutions. Each program is run by a so-called "program coordinator" who is responsible for all the operational (both academic and financial) aspects and who is directly responsible to the ITU Rectorate. The coordinator is also responsible to take the lead on issues such as class equivalencies, curriculum development and disciplinary actions and activate the necessary commissions. The coordinator works closely with the SUNY DDP central office in Ankara in issues such as visa interviews.

As of today, there are 60 students enrolled in the Maritime Transportation and Management Engineering Program. 43 of those are already in the undergraduate program while 17 are in the preparatory class. In the Marine Engineering Program, the total number of students is 40. 31 of these are in the undergraduate program while the rest is in the preparatory class. ITUMF gives full scholarships to one cadet from each program, while SUNYMC awards 2 scholarships for every 10 students with one earmarked as a merit scholarship for a female cadet. The programs will give their first graduates in the summer of 2008. It should also be noted here that a cadet who is dismissed from either institution for academic or disciplinary reasons is dismissed from both institutions and dismissed from the DDP.

3. Operational Issues

3.1. Academic

One major problem on the educational side turned out to be the situation of students who failed a large number of classes originally scheduled to be taken at SUNYMC. The questions related to this problem would be "how many credits can a student fail in one institution to be taken at the other institution", or "what is the minimum number of failed credits above which the student should be sent back to the host institution". Note that without such a limit, a student can theoretically go to SUNYMC, fail all the classes that he/she needs to take there and then return to ITUMF and ask all those classes to be opened at ITUMF. Although we set this minimum limit to 7 initially, we had to increase it to 12 since one needs to take at least 12 credits per semester to be considered a full-time student under the F-1 visa per the United States Citizenship and Immigration Services (USCIS) regulations. In other words, this means that if a cadet fails more than 12 credits at SUNYMC at the end of the SST 2 in the 3rd year, then he should go back there sometime before graduation to complete these credits. Note that this issue is made more complicated by course prerequisites. Also, it should be noted that international travel and transfer arrangements are necessary and that this brings a very important financial burden on the student's part whenever he needs to travel back and forth between the home and host institutions. This proved to be an issue which is very hard to explain to students' sponsors who did not want to pay any more than necessary. Thus it is extremely important that these issues have to be explained very clearly in the program documentations and the students/sponsors be warned beforehand.

Another major problem originates from a combination of incompatible academic calendars between the institutions and academic probation issues. The original dual-diploma program agreement between SUNYMC and ITUMF states that the GPA's at both institutions are to be kept separate. This keeps an ITUMF student from increasing his cumulative GPA during his/her SUNYMC residence. It is also agreed that a student who is on probation at the home institution (a GPA of 1.9) cannot start his/her residence at the host institution. This original idea turned out to be inapplicable because although the cadets need to be sent to SUNYMC at the end of December to attend the Indoctrination, the grades from the finals at ITUMF are not available till after the 3rd week of January. This means that all of the students in the program, whether on probation or not, need to be issued visas and sent to SUNYMC at the end of December since the system does not know if a student is academically in good standing or not at that time. What this does is that, a student who is in the probation list during his 3rd semester at ITUMF finds himself to be still on probation when he comes back to ITUMF in the beginning of the 4th year, whether or not he/se was successful at SUNYMC. This keeps him/her to take more than 12 credits a semester at ITUMF and combined with the Long Term Sea Training, creates all kinds of class scheduling programs, possibly extending the length of his/her studies. This rather unjust situation still continues and the agreement needs to be corrected. This and the problem explained in the previous paragraph prove that the dual diploma program is not tolerant to failure on student's part and it requires a considerable effort to rearrange the curriculum to incorporate each cadet's situation.

Another academic problem that we faced is related to the language of instruction. According to the initial agreement, all classes in the program, whether taught at SUNYMC or at ITUMF, were to be in English. This caused problems for cadets who failed a class at SUNYMC and wanted to take an equivalent summer school class from a Turkish higher education institution since the class was not always offered in English. This undesired situation was eliminated by mutual agreement between SUNYMC and ITUMF with the assumption that the acquisition of knowledge is more important than the language it is provided in, especially if the cadet has already proven his/her language skill through proficiency exams and during his/her SUNYMC residence. The students can now take the classes that they attend in Turkey in Turkish based on approval from both home and host institutions.

The program is also not free from common maritime education problems such as a high number of credit or non-credit courses that needs to be incorporated in the curriculum to meet various standards set forth by the STCW, ABET (Accreditation Board for Engineering and Technology) and ECTS (European Credit Transfer System). This includes the effect of the SST's and the LTST and the resulting difficulties in curriculum development while trying to fulfill the above mentioned requirements. To minimize related problems, curriculum development needs to be very carefully handled through close interaction of the responsible parties of the host and home institutions, both before the launching of the actual program and dynamically during the first 4 years of its operation. The course equivalencies and prerequisites should be very carefully defined. We found out that this is especially important during the second year when basic engineering classes such as Mathematics, Physics and Chemistry are given, since the advanced classes have all these basic classes as prerequisites. For instance, we have run into problems with Math I, which is taught at a higher level than SUNYMC at ITUMF during the fall semester of the second year, just before the cadets head for SUNYMC. The majority of students failed this class in Turkey but when they took the equivalent class at SUNYMC, they passed with good grades. A quick investigation of the cause of this incident showed that the ITUMF equivalent had advanced topics which did not really fit into the maritime curriculum. It is now being realigned to match its SUNYMC parallel. Also, the students need to be warned that not failing the basic engineering classes during the first year of the program is extremely important in the sense that there is a high probability that they will not be able to complete the SUNYMC part of their studies in time if they do so because of scheduling and prerequisite problems.

Another problem specific to the maritime programs is that it is very hard to organize summer school sessions due to scheduling problems since the students need to attend summer sea terms (or SST's) to fulfill the STCW requirements. This becomes a problem in the case of students on probation lists since they have no opportunities to make up for failed classes other than attending them again during regular school semesters. ITUMF never opened summer school for the dual-diploma program students and it is unlikely that it will do so in the near future. However, it is possible for students to attend summer school at SUNYMC after the summer sea term terminates but the logistics are complicated and usually expensive due to overseas travel.

3.2. Financial

Presently, ITUMF has the responsibility of collecting the tuition and the fees for both institutions from the cadets. The amount estimated for the entire length of the studies (5 years) before the national university entrance examination (or OSS) is announced in the Turkish Higher Education Council's (or YOK) official guide for the programs each year. This amount includes preparatory year fees, which consists of the STCW courses and the English education, ITU tuition and the SUNYMC part, which includes tuition as well as regimental fees and SST fees. The latter is wired directly from the bank to US every semester once we receive the official bill from SUNYMC. An issue with this setup is that it requires individual based accounting and it is very hard to keep track of the amount each student owes to the system since there are many other factors that affect this calculation, such as drug fees, room damage fees and tech fees. This requires an incredible amount of bookkeeping on the program coordinator's part, especially considering that he/she does not have anyone assigned to help with the finances. We believe that finances should be kept separate and the cadet should pay to SUNYMC and ITUMF separately for what he/she owes to these institutions.

Another important issue with financial grounds here is that currently the DDP's are completely separate from the regular undergraduate programs on the ITU side. This means that the DDP students cannot sit in the same class as their regular ITUMF counterparts even if the course has full equivalency, and the reason for this has nothing to do with the academics. The rationale is that no fool-proof formula was found on the ITU side to financially justify the situation of having the same hourly-paid instructor giving the same education to paying and non-paying students in the same class. Practically, this means that it is possible to have two versions of the exact same class in the same semester, one for the DDP students and one for the regular ITUMF students. There is also the possibility of having to open a class for only one or two irregular students, who failed that specific class at SUNYMC but left less than 12 credits and returned to ITUMF. This latter opens up another related discussion as to how the hourly-based salary of the course instructor can be extracted from one or two students taking the class. These issues currently have no viable solutions.

We would like to emphasize here that one of the most serious problems which endangers the future of the programs is the fact that according to the new YOK regulations, it is not possible to make any payments to the program coordinators, research assistants and the staff involved in the day to day operation of the programs (YOKD, 2006). The reader should note here that the above mentioned people are doing this work in addition to and not instead of their normal administrative and academic duties of teaching and research. This issue will negatively affect the program in which relatively high paying students or their sponsors are asking for privileged education. ITU is working with YOK and other higher education institutions involved in DDP's to solve this problem.

3.3. OTHER

Several other problems were faced, that act to amplify the effect of the more systematic problem subdivisions stated above. For instance, the first cohort of students who went to study at SUNYMC without getting the proper orientation in a yet to settle system faced psychological problems. Our belief is that this situation was mostly due to the fact that the amount of real and imaginary problems that they were facing was overwhelming to them. Coupled with the fact that they were in a foreign regimental system in a non-native country, this caused them to turn inwards and form a closed circle of "Turkish students" who did not involve in extracurricular activities or other cadets. A direct result of this was failed classes for the majority of the students. Several other problems related to this have also emerged resulting in disciplinary action, including out-of-regiment authority questioning between different cohorts and cheating incidents. This overall unwanted situation, which is against the unifying intercultural nature of the DDP, got eliminated starting with the second cohort, as a result of better orientation and better communication between the coordinators, the cadets and their advisors. The members of the second and third cohorts are now very active outside the classroom and among themselves. For instance, the second cohort distinguished themselves by receiving a record number of academic honors for their coursework. Twelve out of twenty students received academic honors at SUNYMC. Eleven of these were in the Dean's List (GPA > 3.0) and one was in the Admiral's List (GPA > 3.5). It is also important to note here that although the cadets spend their SUNYMC residence under a structured military style regimental program, their ITUMF residence is not as stringent. For instance, although the cadets have a uniform based campus life self-regulating under a strict discipline code, they are however free to choose between civilian on campus housing or going home after school hours. The authors believe that switching from the more relaxed ITUMF environment to a stricter one at SUNYMC without advance warning and proper orientation also helped in the creation of this problem for the first cohort.

The program is also very sensitive to changes in the national level university entrance examination procedures and how the scores are calculated. For instance, due to such a change in the 2006 entry exams, a student had to be at least 44,764th to be accepted to the Maritime Transportation and Management Engineering dual-diploma program, while in 2005, a ranking of 85,138 was enough. The same numbers are 70,433 and 99,045 for the Marine Engineering program respectively. To put these numbers in perspective, note that the minimum score for placement in an undergraduate program has been acquired by 987,963 candidates in 2005 out of 1,671,603 versus only 377,086 out of 1,510,302 in 2006. As a direct consequence of this and since the priority always goes to programs with less tuition, only 4 students have registered into each program. This number is way below the announced quota of 29 and it is clear that a sustainable program is impossible to achieve if the problem persists. However, this and similar situations are temporary and we believe that normal enrollment numbers will return once stability is reached.

Over the past three years, the majority of students have had hard time acquiring the required TOEFL score of 550 to start the program. Note that this score of 550 was not required by SUNYMC but by Istanbul Technical University's (ITU) old directive for DDP's (ITUD, 2003). Considering that SUNYMC's TOEFL score requirement was 535, this issue raised quite a bit of questions from the student's side as to why a Turkish university requires a higher TOEFL score than an American college. A new directive on the ITU side now allows the partners in the DDP's to set their own language requirements. SUNYMC and ITUMF have recently agreed that the absolute acceptance score should stay at 550, but that a conditional acceptance should be offered to students if they receive a score between 535 and 550. These students are accepted into the program but they remain in conditional status until they pass the English class offered at SUNYMC with a grade of C or better. Note that a student cannot graduate from the DDP while in conditional status.

We have noticed that promoting the programs is extremely important for recruiting students. The main reason for this is that the dual-diploma programs are considerably expensive than the regular ITUMF maritime programs and the potential candidates need to have a very clear idea of what more is offered and why they are paying the extra tuition to receive another diploma from another college to perform the same job. The promotion material need to concentrate on this issue and students need to be reminded of the advantages that they receive by enrolling in the program, such as the opportunity to work in well-respected worldwide companies with higher wages and better benefits, acquiring a global point of view though intercultural relations and better language skills. Enough funds should be reserved to distribute the promotion material nation wide and to participate in student recruiting fairs throughout the country.

A minor operational problem comes from the fact that the regular ITUMF system is non-residential (implies non-regimental) but the DDP is, both at SUNYMC and ITUMF. The absence of residential facilities at the ITUMF campus has been partly solved by using our training ship M/V Akdeniz as a student hall in a static role. The ITUMF part of the program has been switched to non-residential in 2005; however we still have to provide this service until the cadets who entered the program before that date graduate. The fact that the regular students do not have access to any residential facilities like their DDP counterparts has also received some reaction. This, however, is something that is not directly related to the DDP and will not be mentioned here.

An important issue that created quite a bit of reaction, especially with the first cohort, was the fact that the initial program documentation mistakenly stated that the Turkish cadets graduating from the DDP would be able to sit for the United States Coast Guard (USCG) third officer license exam and receive it. This, however, is not possible due to USCG regulations which state that you have to be a US citizen to acquire this license. ITUMF students currently are not allowed to even sit for the USCG license exam. SUNYMC is presently seeking approval for the DDP, since these programs are two-way programs so a US student could complete the DDP and expect to sit for the license exam. Also STCW requirements are international and the ITUMF STCW courses are assessed using the same criteria as the SUNYMC courses. Additionally, the USCG now allows cadets to complete their cadet observer in lieu of SST onboard foreign flag vessels. (Hoffman, pers. comm. 2007)

4. Conclusion

The dual diploma programs in today's world offer another option of spreading the knowledge and culture in an educational setting. Almost-standard engineering and MET classes can be offered in any credible international MET institution but intercultural relations are harder to establish in a world where a global point of view becomes a necessity. The DDP's fill this gap by offering a long-term exchange during which the professionals of tomorrow extend their horizons by diving into a multicultural world and interact with their future colleagues who will be performing the same job in the same global environment. This multi-faceted education also brings them top offers from world-renown companies, while establishing exemplary and highly intellectual working relationships between academic institutions, also leading to other cooperation such as faculty exchange and cooperative research.

Even though the advantages of the DDP's are obvious, they come with a number of challenges, some of which are explained in this paper based on our own experiences.

It seems that the best suggestion we can provide would be to start small and grow with the program since there will be quite a bit of "learn as you go" during the process. We also can not emphasize enough the importance of intra and inter-institutional flexibility and goodwill since the programs require some kind of autonomy and independence. As far as students are concerned, it is observed that most of their issues can be solved by effective and advance orientation, counseling and advisor availability. The financial restrictions that keep the coordinators and staff working on the day to day operation of the program from getting paid should also be eliminated as the programs require considerable time and effort to run.

Although this paper concentrated mostly on problematic issues to guide in the creation of future programs of the same nature, it should be noted that the program is very successful overall. Cooperation in graduate studies and possibilities of cooperative research are being investigated. We are also investigating possibilities of having SUNYMC cadets at ITUMF but due to US licensing procedures, only intern-option students such as the ones in the Naval Architecture program, may do so for summer programs. We are also planning on having SUNYMC faculty at ITUMF for teaching curriculum elective classes for one semester. To conclude, we highly recommend creation and continuation of such culturally and academically enriching programs as the advantages for the students and institutions far overweigh the difficulties encountered in the operation.

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We would like extend our sincere gratitude to Prof. Osman Kamil Sağ (ITUMF ex-Dean) and Dr. William Gehring (SUNYMC ex-Provost) for the effort they put to create and operate the programs during the first years. We would like to thank Dr. Joseph Hoffman (SUNYMC Provost) and Prof. Erkin Nasuf (ITU Vice-Rector) for all their help in the day to day operations of the programs and in problem solving. We would also like to thank Prof. Aydın Şalcı (ITUMF Dean), Dr. Gil Traub (SUNYMC Freshman Dean) and Dr. Kathy Olszewski (SUNYMC Science Department Chair) and Captain Rick Smith (SUNYMC T/S Empire State VI Master) for the help they provided in various issues during the operation of the programs.

REFERENCES

1. Cline, K. & O.K. Sag, 2002a, Transfer and Articulation Agreement between State University of New York Maritime College, New York, USA and Istanbul Technical University Maritime Faculty, Istanbul, Turkey. 4 pp.

2. Cline K., & O.K. Sag, 2002b, Memorandum of Understanding between State University of New York Maritime College, New York, USA and Istanbul Technical University Maritime Faculty, Istanbul, Turkey. 3 pp.
3. Nasuf, E., Anday, F., Genc, T. & D. Korur, 2007, Istanbul Technical University Dual Degree Programs Report, SUNY Dual Degree Programs Annual Meeting, Feb 2007, Izmir, Turkey, 41 pp.
4. ITUD, 2003. Istanbul Technical University International Undergraduate Dual Diploma Program Directive (İstanbul Teknik Üniversitesi Çift Diplomaya Yönelik Uluslar Arası Ortak Lisans Programları Eğitim ve Öğretim Yönetmeliği), in Turkish. 4 pp.
5. YOKD, 2006. Turkish Higher Education Council International Cooperative Higher Education Programs Directive (Yükseköğretim Kurumlarının Yurtdışındaki Kapsama Dahil Yükseköğretim Kurumlarıyla Ortak Eğitim ve Öğretim Programları Tesisi Hakkında Yönetmelik), Official Gazette, No: 26390, Dec 28th, 2006. In Turkish. 3 pp.

The Development of Links between Maritime Facilities in Europe. A UK View

Steve Bonsall[1]

Abstract

The development of the wider understanding of MET on a global basis depends on closer links between Maritime Departments and Faculties. So much is clear and has been known for some time. The physical development of that premise is much more difficult to achieve.. In Europe the Erasmus programme helps both the framework of collaboration and the finance required to carry out that collaboration. Unfortunately the development of maritime collaboration has been largely unsuccessful in UK establishments. This lack of success is due to two main reasons; firstly, the paucity of undergraduate degree programmes in the maritime discipline leading to the UK maritime universities tending to deliver programmes to non seafarers with seafarers studying at the sub degree level and secondly the fact that UK students, for the most part, only speak English and thus exchange of students means that largely the flow is to the UK not from the UK. A further barrier to student flow is the synergy between programmes.

The first problem is getting worse rather than better with the few maritime universities finding that the bulk of seagoing students prefer to attend a Nautical College. Additionally the UK certificate system does not require that the teaching and learning of underpinning knowledge is tied to an undergraduate degree. From September 2006 the UK Chamber of Shipping preferred route into the UK Merchant Navy is via a Foundation Degree (FD) rather than the BSc (Hons) Nautical Science, however the first of these FDs are provided by Nautical Colleges rather than the maritime universities even though these universities will provide the validation accreditation. The second problem is starting to get better as parts of programmes in European universities are beginning to be delivered in English. A one-way flow of students has begun but two-way is yet to start, however the mechanism is in place to allow this to happen. UK students have to be persuaded that it is worthwhile spending some of their academic time in another

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institution. Evidence shows that students do benefit from short term student exchange however it is necessary to provide the opportunities for this to take place and to actively promote the process.

Key Words:- Student Exchange, Erasmus, CPD, STCW, Foundation Degree

1.0. Introduction

The flow of students between educational establishments worldwide particularly at the university level is something that has happened for many years. This has always been the case with students studying languages but has also occurred in most other disciplines. In the maritime field it is relatively new although there are examples going back several years. Whilst foreign universities have had ongoing connections with UK universities the flow of students, except for languages has been heavily weighted towards the flow into the UK rather than UK students moving out of the UK.

2.0. Literature Review

Student exchange is reasonably widely written about in all sections of the academic press. Students have been visiting and studying at establishments other than their own for many years however it would seem that the movement of maritime students is relatively recent.

2.1. Processes

There are various ways in which students can study in other establishments. Generally there needs to be a formal link. This is becoming important with UK universities particularly as all students must be registered and this becomes difficult without the formal link. Important aspects such as library cards and e-mail facilities are dependent on formal registration which cannot take place without formal enrolment to a programme of study and payment of fees even if these are waived through an agreement such as Erasmus.

Thus the formal link is an important first step in the development of student exchange. Often this is achieved by a visit from an academic of one institution to another. The reason for the contact is usually ad hoc in that it will occur through acquaintance or chance meeting. A speculative request to an institution may result in an offer to host a visit and from that links can be made. The Erasmus initiative is widely used within Europe with 150,000 people taking advantage of this opportunity annually (ERASMUS 2007)

2.1.1. GENERAL EXPERIENCE

Students from all disciplines can study outside their parent institutions. Sixth form students have performed engineering projects in Helsinki (Professional Engineering 1997) whilst other students have travelled to Africa from the USA (Timiraos 2006) & (Dana 2007). Students in Australia have been reluctant to travel (Guest 2006) although this article was specifically referring to science students. Indian universities have cooperated with US universities on collaborative research (ACS 2006) and this has included graduate student exchange programmes. Students from Holland have travelled to Arizona on exchange programmes from community colleges (CCW 2007).

2.1.2. ERASMUS EXPERIENCE

Within the EU and some associated countries such as Norway students can exchange between universities participating in the Erasmus programmes. The Erasmus initiative was set up in June 1987 with 3244 students taking part in the first year (ERASMUS 2007). There are now 31 participating countries and the programmes encourage student and teacher mobility. 90% of European higher education establishments work within the scheme and it gives many European university students their first chance to live abroad (ERASMUS 2007). Over 1.5 million students have participated and this is expected to reach 3 million by 2012.

Examples of student Erasmus exchange are Civil Engineering from Prague (Huml 2006) and Astrophysics from Bucharest (Rusu & Stavinschi 2007). The University of Salford UK has also had some experience (Sykes 2003).

2.2. COUNTRIES

The opportunity to study overseas exists for all countries and nationalities and it is in the hands of individual establishments and students to establish whether a place can be found. Some countries seem to excel in making opportunities available to students. These include the Baltic countries of Norway and Sweden and the European continental countries of Poland and Germany. French students also seem to be able and willing to study abroad. Chinese students also study abroad however except for isolated instances such as Main Maritime Academy (Tyler pers comm 2007) they seem to attend full time courses rather than short or exchange programmes. The USA does have opportunities via "Fulbright Scholarships" (Fulbright 2007) where students, teachers, professionals and scholars can receive grants to teach, lecture and conduct research overseas from the USA. This programme was started in 1946 to "enable the government of the USA to increase mutual understanding between the people of the United States and the people of other countries" (Fulbright 2007). Study in more than 150 countries is now possible for US citizens. There is some evidence of students using Fulbright for the finance of their maritime programmes (Hoffman pers comm 2007a)

2.3. Problems

Problems of student exchange programmes include for students the difficulties of language and finance and for institutions lack of interest, drain on resources and administration.

2.3.1. Finance

Finance is an important and possibly an overriding consideration in any student exchange. Some programmes (Tyler pers comm 2007) have required students to cover their incidental expenses whilst institutional fees have been waived where reciprocal exchange is possible. In Europe the Erasmus programme provides student funding which covers some but not all of the costs (Sutton pers comm 2007). Fulbright scholarships are available for study with USA institutions and these provide some funding.

The costs that have to be considered with the exchanges are course fees, accommodation, travel to and within the overseas destination and general living costs. Students will have already paid or will be prepared to pay for course fees once but naturally not twice. Accommodation fees may be problematic particularly for short courses as university accommodation is normally paid for a whole year and short term payment may be difficult. Polish maritime students studying at LJMU for semester one only and Swedish maritime students studying for semester two only have overcome this problem by renting in the private sector. Normally accommodation costs are carried by the student and they have overcome the problem at home and overseas. One student (Sutton pers comm 2007) achieved this by living at home for the home based part of course.

2.3.2. Student Numbers

Exchange student numbers are generally small and in the region of 2 to 7 (Jinks pers comm 2007). Cohorts of students larger than this are usually a one way flow. One American naval college receives around 60 students from Turkey annually (Hoffman pers comm 2007a) taking part in courses on Marine Transportation and Marine Engineering. A Russian college does have an exchange programme sending 6 students to Korea and receiving 17 students (Malyavin pers comm 2007). The UK maritime experience is very patchy with a few students going to the USA some years ago but not now (Hoar pers comm 2007). LJMU and Plymouth maritime have not as yet had any students go overseas on exchange programms.

2.3.3. Language

Language is a problem for UK students studying overseas but is an attraction for overseas students studying in the UK or other English speaking countries. Whilst students to whom English is foreign language do not cite being taught in English as a reason for exchange study, it is clearly one advantage to them. Within the maritime industry particularly, a good working knowledge of English is a decided advantage when looking for jobs. Even in the UK students can find ready work if they speak both English and another language. For UK students studying overseas the language difficulty can be the deciding factor that stops the exchange. Clearly if they cannot understand the lectures then there is no point in going.

2.4. Maritime Student Exchange Experience

Maine Maritime Academy was able to send two American students to Dalian Maritime University (DMU) for 5 months in the spring of 2006 (Ross & Salkaln 2006) and intends sending more students in the future (Tyler pers comm 2007) however this seems to be somewhat of an isolated instance. The main maritime experience is with overseas students studying at English speaking establishments (Hoffman pers comm 2007a) & (Hoar pers comm 2007). This provides them with technical knowledge which they can use on their programmes, the experience of studying abroad and also the opportunity to speak and learn in English which they can then use at a later date. English is often taught in primary and secondary schools worldwide because it is a good second language, whereas English speaking nations find it difficult to adopt a second language at the secondary level. Instances of a second language being taught at primary level in the UK are rare but increasing (Bevis & Gregory 2004). French, German and Spanish languages are widely taught at secondary level, however the learning of modern foreign languages is no longer compulsory and past experience has shown that even when a language has been studied to first high school exam level at 16 years old, it is rarely used later in life (Hook 2006). The problem for English speaking nations is that almost wherever they go they can find someone to speak English, thus reducing the necessity to learn another language.

2.5. BENEFITS

2.5.1. TO STUDENTS

There is no doubt about the benefits students gain from studying in a country not their own. Table 1 shows the survey items/ questions asked in a 2004 survey (Dwyer & Courney 2004) of 3,400 US students for the Institute for the International Education of Students (IES). The survey response rate at some 23% was very high and noted that "studying abroad is usually a defining moment in a young person's life" (Dwyer & Courney 2004).

An outsider's view of native English speaking maritime students studying in China for a short while noted "They learned so much about the Chinese people, the culture and the educational system" (Tyler 2006). It would seem that the benefits are not connected with the technical content of the course they study and it may even be that this is less relevant or even irrelevant to both students who go abroad and to the programme leaders who make overseas study possible.

Table 1. *Possible Benefits to Students from Study Abroad (Dwyer & Courney 2004)*

	Area	Specific Benefit
1	Personal Development	Increased Self-confidence
2		Served as a catalyst for increased maturity
3		Lasting impact on world view
4	Academic Commitment	Enhanced interest in academic study
5		Influenced subsequent educational experiences
6		Reinforced commitment to foreign language study
7	Intercultural Development	Helped me better understand my own cultural values and biases
8		Influenced me to seek out a greater diversity of friends
9		Continues to influence interactions with people from different cultures
10	Career Development	Acquired skill sets that influenced career path
11		Ignited an interest in a career direction pursued after the experience

2.5.2. TO INSTITUTIONS

Institutions gain through having a culturally diverse student population, however this is mainly achieved through foreign students studying full time courses at institutions rather than students studying for short periods such as a semester. In fact the number of exchange students as a percentage of all the students in a class is in some cases so small that their presence makes little or no difference to the class (Lees pers comm 2007). Institutional gains seem to be related to gains by students (Hoffman pers comm 2007b): "the sharing of cultures is a very rich experience for both the American and Turkish students" (Hoffman pers comm 2007b).

3.0. DATA COLLECTION AND METHODOLOGY

Interviews were conducted face to face; by telephone and by e-mail. A questionnaire was e-mailed to all IAMU member institutions and seven replies received. This is a 15% response rate which is good for questionnaires where a 3% response is often the case. This primary data provides the underpinning support for the ideas and considerations held by the author and tend to support the experience at LJMU Maritime.

3.1. LJMU SCHOOL OF ENGINEERING EXPERIENCE

The School of Engineering at LJMU has been receiving students for short period study for about 20 years. This has been through both the Erasmus scheme and other specific arrangements with individual institutions.

Table 2 lists the short course programmes of the "student exchange" type currently running or previously run in the LJMU School of Engineering. Two of these programmes are from the maritime section and take students studying maritime business and/ or logistics whilst a further course (no longer running) accepted French students. All students on these programmes will study alongside existing full time students. Sometimes special modules are developed for these students however normally the students are still taught alongside full time students. An example of this is where the CPD Maritime Business has the module "Shipping Business and Cruising". This module is the combination of half of two existing modules called "The Business of Shipping" and "Leisure Industry (Maritime)". These two modules are taught over 2 semesters which form the academic year in LJMU. The CPD Maritime Business however is taught only in semester one.

Table 2. *LJMU School of Engineering Short Courses (Exchange Type Programme) currently running and previously run.*

	Programme			Students			Remarks
	Type	Level	Years of Operation	Institution from	Nationality	No	
1	CPD	3 UG BEng	2	Angers	French		No

2	60 credit Top Up	Honours BEng	3	TAR	Malaysia	100+ pa	No
3	CPD Maritime	2 & 3 BSc	3	Maritime University Szczsin	Polish	3 pa	Theoretically Erasmus
4	CPD Maritime	2 & 3 BSc	4	Chalmers Lindholmen University	Swedish	Var. 1 – 7 pa	No
5	BSc Transport Unclass. Pathway	2& 3 BSc	5. Not now run		French	Var 1 – 3 pa	Curtailed in 2003

New collaborative programmes listed in table 3 are planned. The opportunity for UK students to study overseas is an element of two of the four planned or newly available programmes. These latter programmes are both within the Erasmus initiative.

3.2. OTHER EXPERIENCE IN LJMU

LJMU has many links with institutions overseas. These links are spread across the University however student exchange links are generally associated with the European Erasmus initiative. In 2001/2 about 160 students went overseas from these LJMU programmes falling to 75-80 in 2005/6. The vast majority (80%) of these are language students. This is in line with the UK average, which is between 65 & 85% (Harley pers comm 2007). The UK trend in students going abroad to study on the Erasmus programme is in decline with 12,500 going overseas in 2001/2 against 9,500 in 2005/6 also 70% of the students are female.

The two main problems cited are language followed by funding. The EU grant paid to Erasmus students has been increased and now stands at 433 Euros per month and tours are usually around 3 months. Usually the participating student places are undergraduate however, there are some postgraduate places plus summer research. The latter are attractive as this means that the academic year is not disturbed and thus students do not have the problem of accrediting their study abroad.

Table 3. *LJMU School of Engineering. Collaborative Programmes Planned*

	Programme		Students			Remarks
	Type	Level	Institution from	Nationality	Student Exchange Expected	
1	CPD Maritime	2 & 3 BSc	Vestfold University College	Norwegian	Yes Erasmus	1 Nor. student due in Jan 2007

2	CPD Transport 2 Programmes	2 & 3 BSc	Available to all	Available to all	No	Speculative Validation March 2007
3	Work Placement BEng	Not yet agreed	Ford Factory in Valencia	Spanish	Yes Erasmus	UK students will study a 3 month summer placement & Spanish students will study a semester or year

3.3. Erasmus Mundus and Bologna

Erasmus Mundus is a further initiative available for postgraduate Masters' students only. It involves three institutions in three different EU member states. The programme is open to EU and non EU students who must study in at least at two of the three institutions. All three must have the same programme. There is a 1500 euros per year grant available to the student with a maximum of 5000 euros. Non EU students can get all of their tuition fees paid and a grant towards their living costs of 3000 euros.

Table 4. *Broad Objectives of the Bologna Process (Bourke 2006)*

No	Objective
1	Adoption of a system of easily readable and comparable degrees
2	Adoption of a system essentially based on two cycles
3	Establishment of a system of credits
4	Promotion of mobility
5	Promotion of European co-operation in quality assurance
6	Promotion of the European dimension in higher education
7	Lifelong learning
8	Higher education institutions and students
9	Promotion of the attractiveness of the European Higher Education Area [EHEA]
10	Doctoral studies and the synergy between the EHEA and the ERA (European Research Area)

In the late 1990s, within Europe, an education philosophy was introduced called the Bologna Progress. This is an agreement between EU countries with the idea of creating a European Higher Education Area (EHEA) (Europe Unit 2007). In 1999 29 European countries met in Bologna and signed the agreement. It now has 45 signatory countries and decisions are made outside the formal decision-making framework of the EU.

The Bologna Process objectives or actions aimed to facilitate greater mobility of students across Europe and to foster the acquisition of skills required by employers. These skills included cultural maturity, increased confidence and language skills. The process provides a useful forum for networking and exchange of good practice across Europe.

4.0. STUDENT EXCHANGE AND MARITIME PROGRAMMES

Many academic disciplines are involved in student exchange however it seems that the maritime discipline has only played a minor role. The reasons for this are not clear but the element of "training" rather than "education" may be one reason. UK maritime seagoing education is concentrated in the Nautical Colleges which are part of the UK Further Education (FE) system rather than the University Higher Education (HE) system. Only three UK universities offer maritime undergraduate programmes of the type available for student exchange programmes. Even where these programmes exist, lack of synergy with similarly named overseas programmes may make student exchange problematic.

The inability of UK students to find programmes with a similar curriculum is one of the reasons cited by programme managers (Lees pers comm 2007) & (Dowell pers comm 2007) causing difficulties and reluctance of students to study overseas for short periods. It would appear that some European countries have programme lengths of 3.5 years with a further half year available for students to study in another country. UK degrees do not have that element and thus any time taken out of their programme is time lost and this needs to be regained as an extension to their home programme. This is a problem also noted in other countries (Tyler pers comm 2007).

UK maritime seagoing programmes take place often over periods less than the standard academic year and include a quite rigid curriculum with quite definite learning outcomes. This can then provide more difficulties for student exchange.

4.1 MARITIME PROGRAMMES AND UNDERPINNING KNOWLEDGE.

Maritime programmes leading to seagoing Certificates of Competency are naturally structured to lead to the learning outcomes required by those Certificates of Competency. The underpinning knowledge provided and assessed is one of the elements inspected by accrediting bodies. In the UK the Maritime and Coastguard Agency (MCA) accredits programmes leading to the STCW certificates of OOW, Chief Mates, Master and Chief Engineer. The programmes of study will have quite rigid curriculums and exam timetables which leave little or no space for students to study overseas. It is likely that only if an equivalent curriculum can be found, which is also accredited by the MCA, could students on these programmes be enticed to study abroad. An opportunity for student exchange to take place exists where the curriculum is under the control of programme managers. This is the case with maritime business degrees. Even here difficulties are found. One respondent to the questionnaire noted that where maritime students know that they are going to have onboard training their travel abroad appetite is already satisfied (Barsan pers comm 2007). This may be the case however onboard training does not cover the intercultural issues cited as important aspects of study abroad.

4.2. LJMU Maritime and Transport programmes available for Incoming Students on a Student Exchange.

The accreditation of the study abroad is a problem to incoming students to LJMU and those studying overseas from LJMU. Programmes at LJMU are constructed from modules of 12 or 24 credits with each level requiring success in 120 credits. The University's main academic year is September to May in two semesters with semester one lasting from September to December and semester two stretching between January and May. Modules can last for one or two semesters and are assessed by coursework and examination or entirely by coursework. Honours degree programmes are of 360 credits gained over three levels with the work at each level becoming progressively harder. Whilst there is no prohibition to studying subjects at a higher level where the introductory knowledge has not been studied, it is preferred that this programme study takes place. Thus where students enter a programme at level two or three their previous study is inspected to assess whether they will be able cope with the programme. This same assessment needs to be made with exchange students. Accreditation of study overseas has been a difficulty for many programme managers when considering student exchange (Lees pers comm 2007).

Incoming students have been offered a range of modules from specific programmes (Lees pers comm 2007) & (Dickinson pers comm 2007) or put onto a specifically developed short programme under the Certificate of Professional Development [CPD] initiative (English pers comm 2007). Different schools have adopted these varying ways of allowing students to study for short periods in the University. The CPD process does allow the University to provide a certificate and official transcript. If individual modules are studied then a transcript can be provided however it will not have been discussed at all the examination assessment boards nor will a certificate be available, except for a Certificate of Attendance. As institutions become more electronically administered it becomes difficult to work outside the system. LJMU has a student administration system called OSS which has embedded in it the structure of all the University programmes including the modules. Programmes and modules may be existing (current), in preparation or redundant. Students are registered onto a current programme having a list of modules, which will be either core [must be studied] or option. Often at level one there are only core modules.

At present there are two maritime CPDs and two transport & logistics CPDs, each lasting one semester, available for exchange students. Table 5 lists these CPDs.

Table 5. *LJMU Maritime & Transport CPDs*

	Semester One	Semester Two
1	Maritime Business (MB)	Marine Insurance, Maritime Project and International Trade (MIMPIT)
2	Road Transport and Logistics(RT)	Rail and Intermodal Transport (RIT)

4.3. Programmes available for LJMU students wishing to study as an Exchange Student overseas.

LJMU students wishing to become an exchange student overseas face the problem of finding an institution that will accept them and also fitting in the study overseas with their home programme. In Earth Sciences as many as 10 students (Dowell pers comm 2007) & (Dickinson pers comm 2007) have expressed interest in study overseas but none have actually taken up the option as they have found that they would lose substantial time in their own courses as modules and study could not be accredited in LJMU. The maritime section has agreed with a Norwegian University College the possibility of UK maritime business students studying in Norway for one semester in semester two of their final year. This opportunity is open to Norwegian students from the same college and in 2007/8 two students will take up the opportunity. As yet there are no UK students indicating the wish to go to Norway, however there is interest from incoming students. For the programme team at LJMU overcoming the programme synergy problem has been less difficult than at first envisaged. The LJMU student will study 60 taught credits of the 120 credits required by the programme in semester one in Liverpool. In semester two in Norway two modules accounting for 24 credits will be studied: the remaining 36 credits coming from the final year project which will be started in Liverpool and completed in Norway. The LJMU student can therefore undertake the preliminary project work in Liverpool at level 2 and make initial progress on the project during semester one. Contact can be retained by e-mail with the LJMU supervisor and a further Norwegian supervisor can be provided by the Norwegian University College. The two modules studied in Norway have been validated as modules in Liverpool thus overcoming the problems of inputting the marks into the Liverpool OSS database.

4.4 Problems for LJMU UK Students studying overseas.

As well as the programme synergy problem of overseas student exchange, students will face accommodation problems. LJMU students have withdrawn from short term overseas study already because of this problem (Lees pers comm 2007) and it is not clear how this will be overcome for the Norwegian programme. Ordinarily LJMU students must pay university halls for 42 weeks accommodation even though courses are only 33 weeks long. The extra period is to cover time waiting for examination results. This payment is upfront and non-returnable. Private accommodation is available however and a student going to Norway for semester two would have to find accommodation for just one semester and this may be difficult. The idea of incoming exchange students moving into accommodation vacated by the LJMU student going overseas has not worked in the past (Lees pers comm 2007). One UK student (Sutton pers comm 2007) not on a maritime course lived at home during the UK semester in the year she undertook the exchange semester.

The language problem has been overcome with the Norwegian exchange as the teaching for the two modules agreed will be in English. Other English speaking maritime students studying overseas have also found it possible to get teaching in English in a maritime university (Tyler pers comm 2007). This of course detracts from one of the benefits to be gained by study abroad and that is the development of language skills. USA marine students on exchange in China did get 200 hours of Chinese language teaching (Tyler pers comm 2007) and this local language teaching may be something that is taken up by any LJMU students going to Norway. Unfortunately as discussed in section 2.3 ordinarily UK students do not speak foreign languages well enough to be able to interact within a classroom environment. Where students can speak the language (Sutton pers comm 2007) then the experience is enhanced.

4.5. UK Foundation Degree in Nautical Science

There is a clear possibility of UK maritime business students being able to study as exchange students if the problems of accommodation and language can be solved. UK seagoing students wishing to study as exchange students will still have to overcome the added problem of synergy with their studies unless they are prepared to extend their programmes. The UK has recently [September 2006] launched the Foundation Degree initiative which will provide the underpinning knowledge for OOW and Chief Mates/ Chief Engineer. The layout of this programme is individual to each institution delivering the course and is different to the previous HND layout. There is much less classroom contact and far more student centred learning. This may mean that finding suitable equivalent programmes overseas becomes easier however the programme is so new that those elements have still to be considered. LJMU will offer a FD Nautical Science from September 2007. The STCW requirement for seagoing maritime training does mean that the same learning outcomes are required by courses in all countries (Barsan pers comm 2007). This should then make it easier for institutions to cooperate and exchange students as the problem of compatible syllabi is removed. The UK BSc (Hons) Nautical Science and FD Nautical Science programmes embrace STCW and can possibly be used for exchange students if institutions work together effectively.

5. Conclusions

It is clear that student exchange is possible between maritime faculties and has taken place. What is less clear is the extent to which maritime faculties worldwide and in the UK in particular are willing and able to take part in such programmes and make them available to students. The institutional reluctance is centred on the gain to the institution from the effort exerted and this is reflected in the answers given in the data collection. Some maritime faculties particularly feel that there is nothing to be gained from such co-operation. Others however have embraced the concept and find gains however these tend to be concerned with the gains to students rather than any gains to the institution itself.

The advent of a Foundation Degree [FD] in the UK may present opportunities for maritime exchange however as reported some Faculties feel that students will gain the opportunity to travel with their role in the Merchant Navy thus their desire to travel abroad for study may be diminished. Students studying on the BSc (Hons) Nautical Science routes and those studying Maritime Law, Business or Logistics may have a greater appetite for travel.

The desire to set up student exchange courses is not universal amongst institutions. Students clearly benefit from these exchanges and there is some funding available. If these benefits, including the funding help available, are presented to students more effectively then perhaps more will embrace the opportunity.

References

1. ACS (2006) Northwestern, IIT Bombay Agreement. American Ceramic Society Bulletin. Nov. Vol. 85. Issue 11. pg 12.
2. Barsan E (2007) Personal Communication. e-mail attachment to questionnaire.
3. Bevis R. & Gregory A. (2004) Meeting of Minds. Times Educational Supplement. 6th April. P6-7.
4. Bourke T (2006) Guide to the Bologna Process. The UK HE Europe Unit.

5. CCW (2007) Netherlands Exchange Programme Extends to Arizona Administrators, but not Students. Community College Week. 26th March. Vol 19 Issue 15 p4.
6. Dana F (2007) A Global Exchange. Diverse: Issues in Higher Education. 2nd August. Vol. 23. Issue 26 pg 16-17.
7. Dickinson N (2007) Personal Communication. Professor of Earth Sciences. LJMU. Interview with author 21st May
8. Dowell S. (2007) Personal Communication. Director of School of Earth Sciences. LJMU Interview with author 23rd May.
9. Dwyer M.M & Courney K.P (2004) Benefits of Study Abroad. New Survey Confirms Significant Gains. Transitions Abroad Magazine March/April. Found at http://www.transitionsabroad.com/publications/magazine/0403/benefits_study_abroad.shtml. Accessed on 19th May 2007
10. English R (2007) Personal Communication. Collaborative Programme Manager. School of Engineering. LJMU. e-mail 19th may.
11. ERASMUS (2007) 2007 The Erasmus Programme Celebrates its 20th Anniversary. UK Socrates Erasmus Council 4th May. Available at www.erasmus.ac.uk/whatis.html. Accessed on 17th May.
12. Europe Unit (2007) Bologna Process. Available at http://www.europeunit.ac.uk/bologna_process/index.cfm. Accessed on May 17th.
13. Fulbright (2007) About Fulbright. The Fulbright Programme. Available at http://us.fulbrightonline.org/about.html. Accessed on 19th May.
14. Guest D (2006) Fostering International Student Exchanges for Science Students. Journal of Studies in International Education. Vol.10 Issue 4, pg 378 – 395.
15. Lees A (2007) Personal Communication. Professor of Sports Science LJMU. Interview with author 24th May
16. Harley M (2007) Personal Communication. Erasmus Coordinator LJMU. Interview with author May 21st
17. Hoar J (2007) Personal Communication. e-mail to author 25th May.
18. Hoffman J.C (2007a) Personal Communication. e-mail to author 25th May.
19. Hoffman J.C (2007b) Personal Communication. Questionnaire answer 25th May
20. Hook S. (2006) Loss of Languages hits job prospects. Times Educational Supplement. 11th March. Issue 4710, Special Section. P3.
21. Huml M (2006) Foreign Cooperation at the Faculty of Civil Engineering of the Czech Technical University in Prague. Czech Business and Trade Supplement. Pg8
22. Professional Engineering (1997) Insight into Finland Professional Engineering. Vol. 10 Issue 2 pg4.
23. Jinks T (2007) Personal Communication. Interview with author May 20th.
24. Malyavin E (2007) Personal Communication. Questionnaire information supplied to author June.
25. Ross C & Salkaln R (2006) Mariners Abroad. IAMU News. No 13 October

26. Rusu M & Stavinschi M (2007) teaching of Astrophysics at the University of Bucharest, Rumania, in the last 50 years. AIP Conference Proceedings: Vol 895 Issue 1 p24 – 26.
27. Sutton L (2007) Personal Communication. LJMU PhD Sports Science Student who studied overseas in Spain as an Undergraduate. Interview with author May 24th.
28. Sykes A (2003) Erasmus exchange with Salford. Synergy News April 10.
29. Timiraos N (2006) Map Widens for Study Abroad. Wall Street Journal – Eastern Edition. 19th Dec. Vol. 248 Issue 144 pB8. Tyler L.H (2006) Introduction to Mariners Abroad IAMU News No 13 October
30. Tyler L.H (2007) Personal Communication. e-mail to author May 18th.

Multi-campus Conferencing for Faculty Professional Development

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Abstract

In *Scholarship Reconsidered: Priorities for the Professoriate (1990)*, the Carnegie Foundation for the Advancement of Teaching delivers a powerful challenge:

...the work of the scholar ...means stepping back from one's investigation, looking for connections, building bridges between theory and practice, and communicating one's knowledge effectively to students.

Maritime colleges are in a unique position to affect the constantly changing nature of teaching and learning as well as the challenges surrounding the future of "faculty work." Scholarship Reconsidered should be the catalyst for redefining maritime education, with a focus on a seamless and interdependent relationship of learner centered activities. Maritime education, with its effective degree productivity and assessment, should serve as an exemplar for other professional preparation programs as well as for the traditional arts, sciences and humanities disciplines on comprehensive campuses. But, this will require that our faculties possess the same "intentionality" we strive to imbue in our students. And, if our faculties are to be able to intentionally share best practices with their students and peers in a two-way efficacious manner, our maritime institutions need to support their professional development, particularly in terms of addressing any shortcomings associated with narrowly focused or otherwise limited preparation for an academic position.

In order to provide this professional development in "added value" ways, multi-campus conferencing, introduced in the "Teaching & Learning in the Maritime Environment" Conference held at The California Maritime Academy in March 2007, provides an efficacious and replicable model for improving faculty work in professional disciplines within and beyond maritime education. Specifically, this approach includes best teaching and experiential learning practices, research findings, and exemplars of integration in areas such as curriculum development, enrollment management, simulation, and "semester-at-sea" or other "sea term" operations, and achieves the following outcomes:

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- Recognize the contributions of all faculty in the maritime *milieu*
- Introduce newer educators to the basics of contemporary pedagogy and scholarship
- Provide an opportunity for scholarly papers (including "Proceedings" publication) of best "learner-centered" practices in maritime education
- Strengthen the resource network of maritime and comprehensive university campuses

Keywords: scholarship, faculty, development, education, teaching.

I am now a Vice President for Academic Affairs at the smallest of the California State University institutions, The California Maritime Academy, with an array of challenges and opportunities ranging from familiar to novel (e.g., the ship as laboratory). During my first year in the position, I began to think about how best to use conferencing to address the most immediate needs of the campus, in particular the growing importance and utilization of "practice faculty" (also known as clinical or vocational faculty depending on the professional discipline in question). Whether it is the maritime vocational instructor moving from shipboard operations to an academy simulation laboratory, or other "practice" faculty such as the registered nurse moving from the hospital setting to the campus setting, the challenges of understanding and embracing the pedagogical and scholarly demands associated with a dynamic balance of theoretical and experiential education can be daunting for those who enter the faculty ranks from a primarily "industrial" rather than "ivory" (tower) professional preparation arena.

The current movement in higher education known as *Reconsidered Scholarship* has clarified the true nature of faculty work, and has also opened many avenues for non-traditional, "practice" faculty to make, and be recognized for, scholarly contributions while also creating a more seamless relationship between theory and practice in an academic environment. Nonetheless, many practice faculty need orientation to the pedagogical and scholarly enterprises if for no other reason than to better understand that their role is not to "teach" students what they (the practice faculty) know. Rather it is to guide the students to a place of being "intentional learners" capable of demonstrating that they are informed, empowered and responsibly engaged. Ironically, many of the more traditionally trained (Ph.D.) faculty have much to learn in this respect as well (witness the efforts of the CGS/Pew Professors for the Future project).

In order to more fully establish added value approaches to higher education, including "reconsidered scholarship" and "intentional learning", the "New Academy" needs to focus on proactively crafting "intentional <u>faculty</u>" who, themselves, are informed, empowered and responsibly engaged in the generation, preservation, and distribution of learning in a digital, "we don't own knowledge" world. Guiding such efforts should be the work of faculty professional development on every campus, and that work should address the needs of traditionally prepared academics as well as the needs of the growing cadre of practice faculty, particularly within professional schools and colleges. However, the establishment of campus-by-campus mechanisms to provide development for the dynamic acculturation of a "New Academy" may be a challenge beyond the capability of many smaller or specialized campuses with limited resources. And this raises the question: Is there an efficacious, "added value" way to approach this issue?

At the California Maritime Academy, a small campus with limited faculty development resources, and a significant cohort of "practice" faculty who are rich with industrial experience, we are examining new ways to nourish and equip all of our faculty to be "reconsidered scholars" adept at guiding students to become "intentional learners".

As a campus without "economy of scale" and with expensive instruction, Cal Maritime is challenged to have multi-purpose undertakings. Thus, and because we are associated with other "maritime" mission or milieu campuses, Cal Maritime spearheaded an unusual professional gathering in spring 2007. "Teaching & Learning in the Maritime Environment," drew more than 125 participants from maritime (and other) institutions, provided vastly different faculty, albeit with a common thread of "the sea," an opportunity to share and learn about best practices and new discoveries with sessions ranging from workshops introducing basic pedagogical approaches to the presentation of scholarly breakthroughs and exemplars across the "reconsidered scholarship" continuum of discovery, teaching, application and integration.

How did the Cal Maritime approach differ from the more traditional disciplinary association conference, which might have some of the above activities? Firstly, the final format and content of the program as well as the target audience was fashioned by faculty professional development personnel from an identified group of "maritime" campuses. Secondly, a matrix of reconsidered scholarship focal areas with topics for varying faculty audiences (e.g., practice faculty, research faculty) within each area, assured that there were utilitarian opportunities for faculty whose attendance was supported by their home campus to be (re)oriented to the "big picture" of contemporary higher education. Thirdly, assessment of the conference and a post-event debrief included attention to establishing what still needs to happen "back on campus." In addition to these and other differences, and to a focus of this presentation, the conference format and planning mechanisms are replicable for other groups of institutions and/or disciplinary areas.

This session is based on a 60 minute seminar format during which I will start with a presentation of the process by which the first "North American Conference on Pedagogy and Scholarship in the Maritime Environment" was planned and produced - from concept development across several campuses to project implementation and event management, with special attention to the replicable aspects of the project, and "lessons learned" for future undertakings. The presentation will be followed by an interactive portion, which will focus on audience input regarding perceived positives and negatives of the multi-campus conference concept, and "brainstorming" regarding specific situations on the campuses of the session participants. Framing the interaction will be the requirement that kudos and criticisms address the overall intent to use the conference as a utilitarian faculty development activity as well as an academic exercise of free choice.

Seminar attendees should emerge from this session with a comprehensive overview of the process "from scratch" necessary to assemble and implement a multi-campus (and/or multi-country) faculty development undertaking. In addition, attendees should come away with a better understanding of the nature and value of "practice faculty" as well as the challenges they face. Lastly, the session will provide a replicable model of "added value" and self-supporting faculty development when resources are limited. Note that this session addresses the "globalization and M.E.T." section (world maritime excellence) of the IAMU 8^{th} AGA at the Odessa National Maritime Academy in September 2007.

COMPREHENSIVE REVIEW OF THE STCW 78 CONVENTION AND CODE: SOME CONCEPTS AND TRENDS

Ivan Kostylev, Vladimir Loginovsky[1]

ABSTRACT

The 38th session of IMO's Sub-Committee on Standards of Training and Watchkeeping (STW 38) was held from 22 to 26 January 2007. One of the main STW 38 agenda items was *Comprehensive review of the STCW Convention and the STCW Code.*

The paper analyzes the information background before the development a set of new amendments to STCW 78 by textual information from articles and other documents published in 585 media , internet and IMO materials, which are thematically close to maritime education and training (MET) , human element, situation awareness (SA), safety and security issues. Leximancer software is applied for the research.

Keywords: STCW Convention, Leximancer, safety, security, situation awareness, education, training.

1. INTRODUCTION

The International Convention STCW 78 (as amended in 1995) is the primary mandatory international instrument determining the MET and Certification Standards for Seafarers in the World. During the next two years IMO will carry out a holistic review of STCW 78 and all amendments. While the Convention is directed first of all to review the mandated training of seafarers, it is becoming clear that the Convention will also need to address the training needed for competent shore based personnel who are involved in maritime safety management, environmental protection , security and MET. The dynamic development of the shipping industry will challenge the IMO to align the STCW regulations to these emerging industry needs and public interests. As a result MET institutions are no longer in a position to keep utilizing any MET techniques and

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pedagogy that do not address the demands for competency and knowledge assessments in the newer definitions of a competent and knowledgeable mariner, afloat or ashore.

Extracts from the last STW Sub-Committee report: "Comprehensive review of the STCW Convention and the STCW Code is included by MSC 81 in the STW Sub-Committee's work program aiming at ensuring that the Convention meets the new challenges facing the shipping industry today and in the foreseeable future, the Secretary-General hoped that the Sub-Committee would respond to the Committee's expectations and, among other things, would take into account new and innovative training methodologies, including the use of simulators in training and e-learning to ensure that properly trained and competent seafarers were available to man and operate the ships in the service of seaborne trade," (STW 38/17, 2007). The main objective of this paper is to explore if the relationships between some main trends and concepts in shipping industry and MET are considered in mass media before the new set of amendments to STCW 78 is developed by IMO.

To reach the stated objective of research we used Leximancer software. What is Leximancer and why do we use it? Leximancer is a data-mining tool that can be used to analyze the content of collections of textual documents and to visually display the extracted information. A big amount of textual information cannot be read and analyzed without special software. So, it is the main reason to use 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). The following concepts as *STCW, MET, SA, workload, overload, fatigue*, *safety* and *security* were selected for research.

Concepts *STCW* (minimum standards) and *MET* (possible enrichments of minimum standards) were intentionally separated to explore the appropriate level of discussion in different documents and articles.

In this context, we need to take into consideration that STCW Convention is one of the four pillars of the international regulatory regime (together with the SOLAS, MARPOL and ILO 186 Conventions) aiming at quality shipping, that is why the topic is extremely important.

2. Literature overview

Let's note the following information from media:

i. INTERTANKO records all reported incidents involving tankers reported by Informa and the press. The most significant occurrence in **2006 was the 64% increase in the number of incidents,** (INTERTANKO,2007).

We should take into account that tankers form 25 % of the world commercial fleet.

ii. UK officers' union Numast has urged the government to limit the duration of Crew Equivalence Certification (CEC) following a series of casualties on UK ships that the union claims have revealed a decline in crewing standards, (Fairplay Daily News, 2006).

iii. The results of research revealed that 71% of human errors were SA related problems. Of the SA errors identified during the manual coding process, 58.5% were level 1 SA errors (Failure to notice significant events), 32.7% were level 2 (Failure to comprehend the events detected), and 8.8% were level 3 (Poor at prediction of consequences), (Grech & Horberry, 2002).

iv. 61% of officers often or always experienced fatigue when on duty, (Gander, 2005);

v. Shipping Industry is very close to Pareto optimal border! In Pareto optimal system no further Pareto improvements can be made without allocation of additional resources, (IRMETS, 2005).

Taking into account the above notes (i-v) we produced an analysis of 585 collected documents and papers from different maritime sources as per Table 1, using Leximancer software.

Table 1. *Sources of information*

	Source	Index	Year	Number
a.	Internet publications on *workload* on seafarers	WP	2004-2005	69
b.	Casualty reports (IMO, MAIB...) and Situation Awareness Internet publications	Casualty	2004-2007	118
c.	The International Maritime Human Element Bulletin, (The Nautical Institute)	Alert No.1-14	2003-2007	14
d.	Lloyd's List (articles on manning)	LL	2004	33
e.	INTERTANKO News, No. 18- 43	INTERTANKO	2006	25
f.	IFSMA Newsletter No. 24- 51	IFSMA	1999-2006	29
g.	Seafarer's International Research Centre	SIRC	2001-2006	39
h.	IMO STW Sub-Committee, 34 Session	STW34	2003	47
i.	IMO STW Sub-Committee, 35 Session	STW35	2004	34
j.	IMO STW Sub-Committee, 36 Session	STW36	2005	45
k.	IMO STW Sub-Committee, 37 Session	STW37	2006	62
l.	IMO STW Sub-Committee, 38 Session	STW38	2007	63

The conceptual features of the following concept chain: *MET-STCW-workload-overload-fatigue-SA-security-safety*, were extracted and explored.

One of the main principles approved by STW 38 for comprehensive review of Convention sounds as *do not down scale the existing standards* or by other words not to lower the safety level of shipping industry.

Taking into account this principle, we put a question if there are any relationship between such very important parameters of shipping as *safety* and *security*, such Human Element components as: *fatigue, MET level, workload, overload, SA* and *STCW* Convention as per mass media and IMO STW Sub-Committee papers . All these parameters are used as concepts in this research.

In this paper we follow SA ideology from (Loginovsky et al.,2006) and suppose that the loss of *SA* by OOW followed by inappropriate decision making and then inadequate performance of actions is the main reason of lowering the safety and security level on board the vessel. In the beginning of development of new set of STCW 78 amendments it is important to explore the media information background and understand how different bodies of maritime society feel and discuss this very important for industry issue.

3. CONCEPTS AND TRENDS

3.1. AN EXAMPLE: 69 INTERNET PUBLICATIONS ON WORKLOAD ON SEAFARERS

After processing the scripts (a) from Table 1, the following map was extracted:

The map on Figure 1 displays five important features of information about the texts.

These features in Leximancer terms, are:

- Concepts and their frequency (the most frequent concept is the most important in set of texts . It is a *workload*). The most important themes are also ***workload*** and ***vessel.***
- Relationship between concepts (how often concepts occur close together within the text. It reveals the degree of their impact in the discussing theme). The strength of direct association between concepts is indicated by the brightness of the link between concepts on the map. Concept *workload* relates to *SA, work* and *information,* Fig.2.
- Centrality of concepts (number of times a concept co-occur with other defined concepts). The most central are *vessel*, *workload* and *SA*;
- Contextual similarity (the more closer together the concepts appear the more contextual similarity they have). So, *workload*, *information* and *SA* are the most contextually similar concepts, Fig.2.

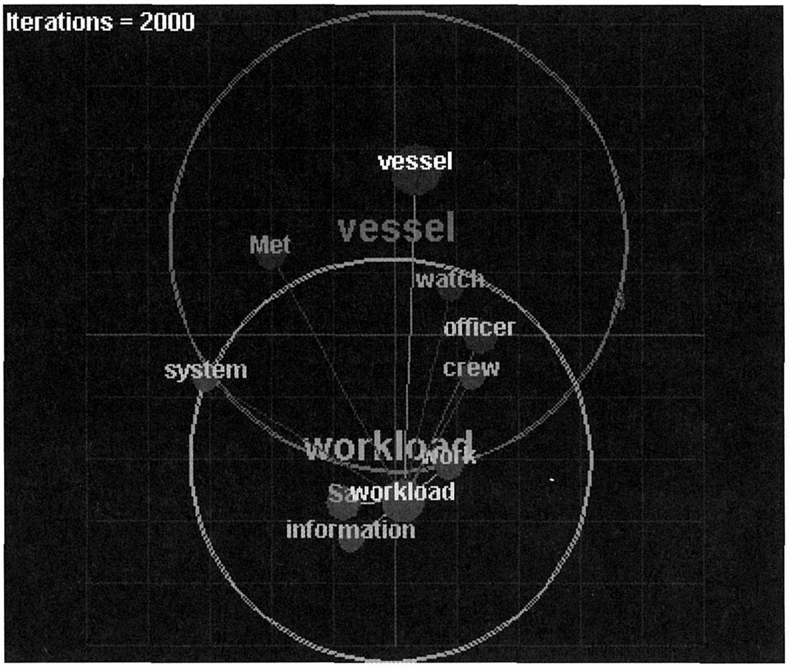

Fig.1. Contextual map (WP scripts)

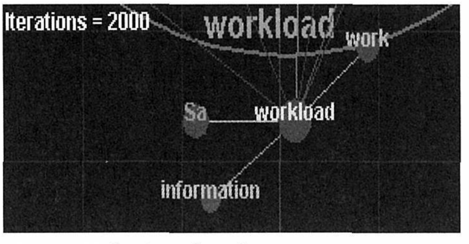

Fig. 2. Relationship between concepts

3.1. CONCEPTS AND THEIR FREQUENCY

Table 2 contains frequency of selected concepts in per cent relative to the main concept in the set of texts (a)-(l). Number 100 shows that this concept is the dominant (the most frequent and that is why most important) in this set of papers.

We should emphasize that with research ideology, the concept *STCW* is in free mode of traveling through the set of texts. No additional seed words are used. It is a seed word itself and this concept develops automatically. In principle the concept *MET* ideologically is close to *STCW* but it is formed by the following key words *as education, training, skills, learning, understanding, programs,...*etc. That is why we can see different results.

Table 2. *Frequency of concepts*

Source % Concept	WP (a)	Cas (b)	Alert (c)	LL (d)	INT (e)	IFSMA (f)	SIRC (g)	STW34 (h)	STW35 (i)	STW36 (j)	STW37 (k)	STW38 (l)
fatigue	13	7	8	23	5	11	8	7	5	4	4	7
MET	33	22	50	0	6	39	39	51	100	100	100	100
overload	4	2	0	0	0	3	0	0		0	1	0
Sa	48	20	85	96	2	57	30	100	24	98	89	50
safety	21	100	24	25	18	53	23	16	17	19	14	17
security	7	1	4	0	9	26	4	29	16	18	26	14
STCW	2	0	1	0	0	1	1	6	4	4	7	4
workload	53	11	1	15	0	1	1	0	1	1	2	0

The boxes ticked in the table show the most frequent (important) concepts discussed by selected sets of papers.

So, the results from Table 2 are the following: the concept *MET* is the most important in sources (i)-(l). *SA* is in the first place in (h) and *safety* is the first in (b).

3.2. RELATIONSHIPS BETWEEN CONCEPTS

The relationships between Concepts are determined by relative frequency (probability). Below on Fig. 3 it is possible to see some results of data processing of all the selected texts (Table 1). .

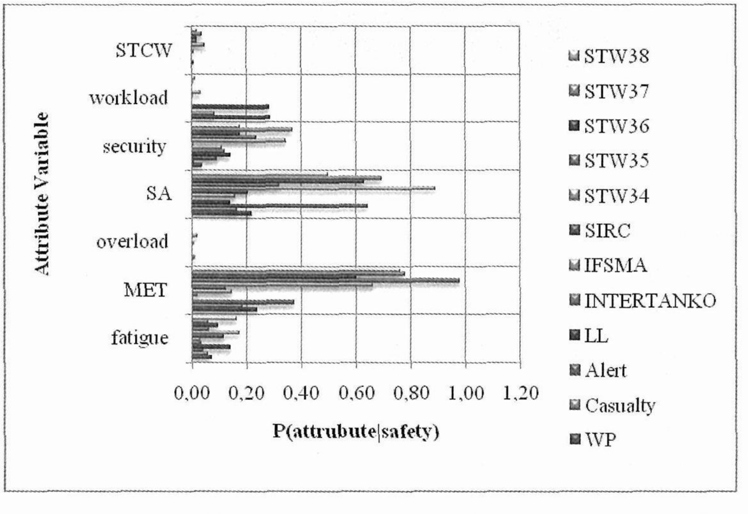

Fig.3. Relationships between concept safety and some its attributes

Figure 3 shows that intratext information mined from set of texts is as follows:

- Concept *safety* has probabilistic relationships with all the concepts proposed for investigation.
- *MET* and *SA* occur more frequent with *safety* than *fatigue, overload and workload.*
- *STCW* as a concept has a very low frequency in all the scripts (automatic identification);
- By all the papers, the concept *security* relates to *safety* more frequent than to *fatigue, workload* and *overload.*
- STW Sub-Committee paid great attention to *SA* though the words *SA* and *safety* never sounded in STW documents together. It is intratext mined information.
- Concept *overload* is not paid attention by almost all the sources.

All of this confirms the findings and results from (2005, IRMETS), that "the industry needs some Coordination Instrument" for regulatory activity and to maintain integrity between all the basic concepts influencing *safety.* In this context *SA* may be considered as one of the important concepts influencing *safety*. That is why it is obvious to propose to transfer concept SA from intratext status to explicit one to be included in new STCW amendments

The concept *fatigue* has relative relations with the concept *MET.* But nevertheless it is impossible to find any direct link of *fatigue* and *MET* in the set of 585 of researching documents. There is no one sentence where the concept fatigue co-occurs together with the concept *MET*, except MSC/Circ.1014 context. But this relation also exists at intratext level.

It is common knowledge that nowadays the mental and cognitive workload on seafarers increases. It means also that STCW 78 standards level should meet this trend.

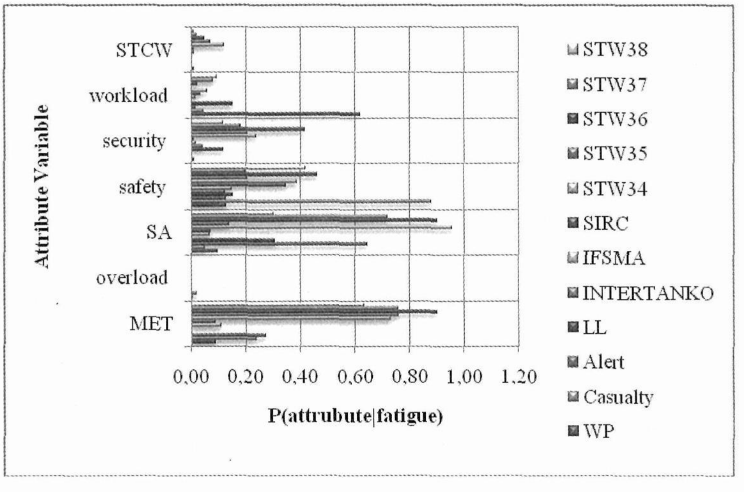

Fig.4. Relationships between concept fatigue and some its attributes

Increasing workload demands all the functions on board the vessel to be executed faster without any compromising the quality. It means also, that general SA level should be higher than, say 10 years ago, so the principle *"do not down scale the existing standard"* should be less flexible, that means the MET STANDARDS are to meet the shipping industry trends and they are to be enriched.

Practically there is no any relationship between *fatigue* and *overload*, though the both concepts are in texts. It indicates to some "needless delicacy" of some authors not to show the real situation in industry. The synonyms for *overload* are applied quite rarely. The concept *workload* was used more frequently in casualty reports.

Research confirms the strong relationship of *fatigue* and *SA* that is obviously. Fatigue does not promote the OOW's SA improvement. The less attention was paid to relationship between *safety* and *security*, but these concepts are related to each other in any case.

The investigations show that information background of all the above sets of texts form an integrated system with its links and gaps. That is why it is important to understand the advantage of similar system review of STCW 78.

Fig. 5 shows the relative frequency of concept *MET* together with *safety* and *workload* extracted from different sets of scripts. It is important to note that, in spite of the fact that in STW37 package relative frequency P(*MET/workload*) is very close to 0.8, nevertheless it is impossible to find any sentence where it was mentioned directly.

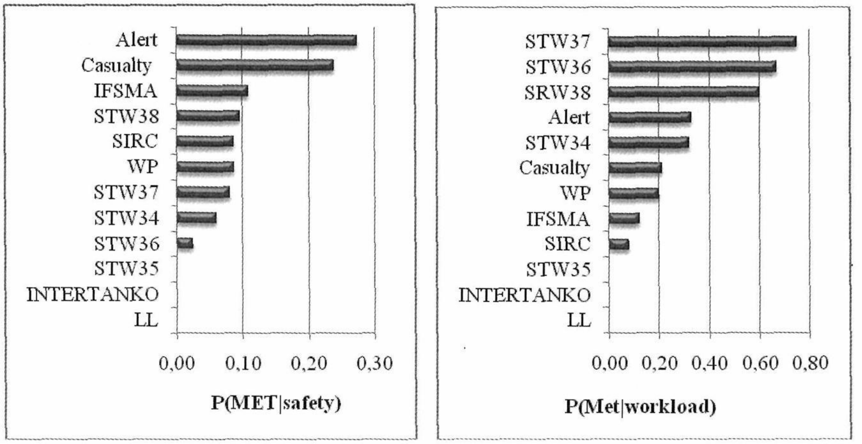

Fig.5. Relationships between concepts MET, safety and workload

It is obvious that well educated and trained seafarer can do every job easier, quicker, better and with less stress and workload. So, the *MET-workload-fatigue* integrated chain of concepts is one of the main to keep safety and it is inadmissibly to ignore it, especially when the mental load on seafarer increases in industry day by day. It is hardly to say that *workload* is not influenced by education, training, skills, and professionalism.

In principle this consideration matches very close with the following statement from (IRMETS, 2005): "Decreasing of seafarer's qualification is equal to increasing his/her *workload.* It means the increasing the fatigue level and reducing the level of safety, security and as well the attractiveness of shipping industry."

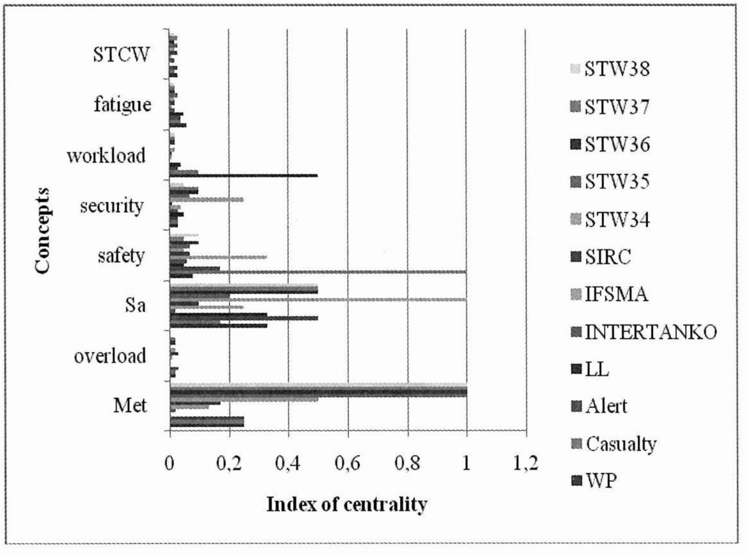

Fig.6. Centrality of concepts

The above graphs reveals that concepts MET, *safety* and *workload* are in the attention zone of the majority of papers.

3.4. CENTRALITY OF CONCEPTS

It is possible to change the number of concepts that are visible on the map, Fig.1. This allows to view only the most central concepts contained within the text. The centrality (C) of a concept is defined in terms of the number of times a concept co-occurs with other defined concepts. That is, a concept will be central if it is frequent and appears in contexts surrounded by the other concepts that Leximancer has extracted, (Leximancer, 2002). To make the demonstration of centrality more clear the inverse proportion C^{-1} is used, Fig.7.

We can observe the practical matching of frequency and centrality of concept *MET* in IMO papers, but the centrality of such concepts as *workload, fatigue, overload, SA* is rather low. The maximum level of centrality of intratextual concept *SA* is in STW 34 documents and *safety* is in "Casualty" papers.

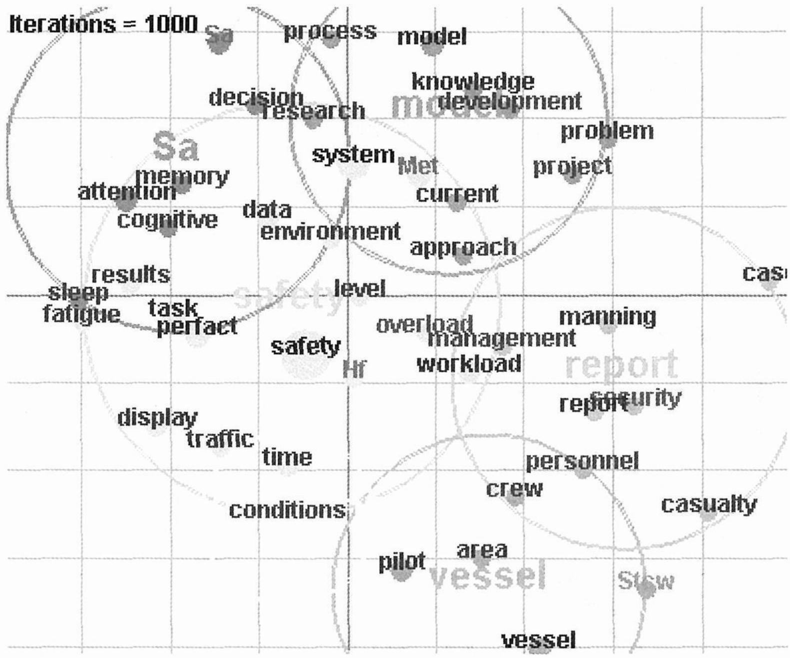

Fig.7.Contextual similarity of scripts as per (b, Table l)

3.5. CONTEXTUAL SIMILARITY

Concepts with similar attractions to all other concepts will become clustered together.

Contextual map presented on Fig. 7 shows , that SA is very close to concepts fatigue, workload, safety, security and others from selected set of concepts. Here the sizes of themes are equal to 50% in accordance with hierarchy of relevance of concepts included in themes.

In this package of publications the concepts MET and STCW have weak contextual similarity. All other sets of papers are of the same feature with respect to MET and STCW. The formal reason of it is that MET is more generalized concept and described by more seed words, comparing with STCW. It is right. MET field in principle and in its sense is much wider than STCW Convention.

Concept SA is much closer by contextual similarity to MET which is included into the theme safety where such concepts as safety, workload, overload, fatigue are located. Concept security is in report theme, but safety and report circles have the common intersection area, that reveals the existence of relative connectedness between them.

Statistical links quite easily may be interpreted by logical way: concepts MET and SA which should have the contextual similarity with STCW contribute to safety . In other words industry needs joint investigations (and opened publication) on SA, general MET, and STCW. The researches on foresight of their contribution into safety, and on possible enrichment of STCW Convention and Code are also desirable.

Concepts workload and overload are close to MET, but they are beyond the SA theme.

Concepts fatigue and MET are of weak similarity because they are not investigated together. Industry needs such investigations also.

4. Findings and results

The investigations show that information background of all the above sets of texts forms an integrated system with its links and gaps. That is why it is important to understand the advantage of similar system review of STCW 78.

There are concepts which are not discussed in media, but they are relatively and directly connected with safety and efficiency of shipping industry. One of these concepts is situation awareness. Intratextual concept SA fundamentally based on MET is to be included in into STCW 78 Convention and Code as an evident concept.

In the majority of researched documents and papers such important concepts as workload, overload, fatigue, security and MET and others are treated as independent and irrespective of other concepts. Taking into account the reduced and limited number of crew such an approach is not efficient.

Practically in all the researched materials the concept STCW has a low level of centrality, i.e. it is examined irrespective of other concepts and other IMO instruments. So, to raise the centrality level this concept should be considered more widely not restricting by the competences prescribed by STCW Code. The enrichment of concept education in STCW 78 Convention and Code is desirable.

References

1. STW 38/17, Report to MSC, 2007, IMO;
2. Leximancer Manual (Version 2.2, 2005);
3. INTERTANKO News No. 3/2007;
4. Fairplay Daily News 20 Jul, 2006;
5. Grech M.R., et al. 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;
6. Gander P.H. ,New Zealand Maritime Report, 2005;

7. Loginovsky V.et al., IRMETS, IAMU Final Report, Admiral Makarov State Maritime Academy, St Petersburg, the Russian Federation, 2005.
8. Loginovsky V. et al., Situation awareness at sea : VTS support, IAMU 7 AGA Proceedings , Dalian, China, 2006.

STCW and Beyond: Minimal Requirements and Additional Knowledge for Marine Engineers

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Abstract

MET has become an international enterprise. The across the borders mobility of maritime graduates has enhanced interest in assessing the quality of the educational programs and setting the minimal requirements. The international certification has been initiated by IMO based on the Convention on Standards of Training, Certification and Watchkeeping (STCW), which was adopted in 1978, and substantially revised and updated in 1995.

The principal objectives of this paper are the analyses of the STCW interpretation in marine engineering programs, and of specifics of undergraduate program development beyond the STCW requirements.

The STCW is introduced into legislations of all maritime countries and sets the minimum level of training of seafarers. Other guidance documents assessing the required training which are discussed in the paper are the IMO Module Course 7.04 and the American Code of Federal Regulations 46 CFR. The content of this paper is based on the results of a research project sponsored in 2005-06 by the IAMU. Bearing in mind the importance of their proper interpretation, another attempt to quantify the STCW requirements in terms of academic credit hours has been undertaken.

Aside from complying with the STCW requirements, marine engineering colleges enhance their programs in order to make them more attractive for the candidates, as well as for the employers. Both, compliance with the STCW requirements and the need to further enhance the programs, might require adding new courses and projects, repackaging existing courses, and dropping certain subjects and courses. Rapid development of continuing education as a part of MET makes it necessary to set admission requirements, especially where the special certification is resulted.

Keywords: STCW, marine engineering program, certification and accreditation, admission requirement, license and degree components of the curriculum

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1. Introduction

Marine Education and Training (MET) has become an international enterprise. For various reasons, economic, demographic, cultural, and many others, the primary sea powers are simply unable to fill the requirements in ship officers with the graduates of their own maritime schools. The across the borders mobility of maritime graduates has enhanced interest in assessing the quality of the educational programs and setting the minimal requirements. Marine engineering education, in particular, has been following the major internationalization trend in engineering practice over recent decades. The fact that marine engineering graduates might easily find jobs onboard ships, as well as ashore (in shipyards, ship service and design institutions) allows them to seek employment across national borders. This international mobility of marine engineering graduates has enhanced interest in the accreditation of the institutions and programs, which educate them. Employers, maritime schools, and licensing boards all have a keen interest in the quality of education received by marine engineering graduates who are looking for an employment in another country.

For years, the maritime industry has been developing a variety of methods and procedures for assessing the educational programs in terms of their uniformity and compliance with the national and international regulations. The component of the marine engineering program which contains the subject courses and other educational activities required for a mariner's license is a subject of a substantial scrutiny by national and international organizations. First of all, it has to comply with the regulations and requirements of the National Maritime Authority, like Ministry of Transport in some European countries, USCG and similar Government bodies in other countries. These authorities approve the programs (and individual courses, when required, mainly for the continuing education), initiate and conduct the license examinations, set the requirements for training institutions.

Very substantial part of the world commercial tonnage is sailing under the foreign Registry Flags. The Maritime Authorities of these countries like Panama, Liberia, Cyprus, Bahamas, and others are involved in certifying the maritime educational centers for compliance with their requirements. Such certification makes it easier for the graduates of the accredited schools to obtain employment with the companies whose ships are sailing under the jurisdiction of the Authorities.

Classification Societies have also offered their services in assessing MET. As active maritime international organizations, the Societies have been providing an alternative type of certification, which has appeared useful specifically for the companies whose ships are classed by those societies. Their offer is that maritime schools subject themselves to a thorough inspection in order to have the programs and the schools certified. A good example has been set by DNV that bases its certification effort on their own standard developed together with several engineering and consulting companies. According to DNV, the **standard ensures that all educational aspects are carried out under controlled conditions and in a consistent way**, and that the Maritime School or Academy is operated according to established practices and specific requirements.

Eventually, the comprehensive international certification of the maritime schools and of their graduates has been initiated by IMO. Almost thirty years ago the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) set qualification standards for personnel on seagoing merchant ships. It was adopted in 1978 and entered into force in 1984. Currently approximately 98 percent of the world's merchant vessel tonnage belongs to 133 countries who are the participants to the Convention.

2. Assessing and Standardizing Marine Engineering Curricula

The International Maritime Organization (IMO) as a specialized Agency of the United Nations prescribes the international standards concerning maritime and environmental safety. The IMO has developed a comprehensive series of conventions to establish a framework of international law covering the subject. Bearing in mind that the most important element in the safe operation of any ship is the competence and experience of its crew, a key component of this legal framework is the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), which lays down minimum standards of competence for all ranks of seafarers.

The STCW Convention prescribes minimum mandatory requirements for training, vocational qualifications, assessment and certification of seafarers. It sets the minimum levels of proficiency to be achieved by candidates, for the proper performance of functions onboard ship, in order to obtain certificates of competency. The international maritime training and certification requirements of the STCW Convention were introduced into legislations of all maritime countries, setting the minimum level of training of seafarers.

In order to have a marine engineering program accredited by either a national accreditation board, or by any International Institution, very substantial changes should be made. Compliance with all requirements might require adding new courses and projects, repackaging existing courses, and dropping certain subjects and courses. Realizing that the demand for competent seafarers will grow in the years to come, structured education and training are vital elements to meet this demand and expectations to the shipping industry. This has also been acknowledged in the revised STCW 95 Convention, which incorporates requirements to quality assurance principles in all mandatory maritime education and training and in the operation of related facilities. Among other new ideas, the revised Convention sets the STCW Code, or basic requirements which are then enlarged upon and explained in the Code. The revised technical regulations specify minimum standards of competence for the range of certificates to be issued under STCW. The standards are presented in tables with four columns: a) 'competence' or ability to be established; b) area of 'knowledge, understanding and proficiency' within each competence; c) 'methods of demonstrating competence', and d) 'criteria for evaluating competence.'

While this paper has been prepared, an attempt has been made to quantify the specific requirements of STCW relative to the Marine Engineering program. The following three steps have been carried out. First of all, the appropriate courses and/or practical/laboratory exercises have been identified to match each competence in accordance with the required knowledge, understanding and proficiency. At the next step the approximate academic load (credit hours) for each course, laboratory session or sea project has been estimated. As a base for this exercise the proposed earlier by the author standard breakdown of a program has been used. This breakdown has been used as a skeleton of a standardized Marine Engineering program which had been developed in the research project sponsored by IAMU, and presented to AGA6 in Malmo [5]. The principal standard elements of a ME curriculum, which have been named Curriculum Components (CC) and Subject Groups (SG), are presented in Table 1. A code SG is assigned to each academic subject that allows to later summarizing the academic loads.

Table 1. *Building Blocks for License and Degree Oriented ME Program*

Program Building Blocks	
Curriculum Components (CC)	**Subject Groups (SG)**
I. Mathematics & Science	**1. Mathematics**
	2. Science
II. Engineering Science	**1. Mechanics**
	2. Materials
	3. Electrical
	4. Fluids
	5. Thermodynamics
	6. Theoretical Naval Arch.
	7. Computer Science
III. Marine Engineering	**1. Drafting**
	2. Propulsion Plant
	3. Machinery
	4. Practical NARC
	5. Electrical Engineering
	6. Electronics Engineering
	7. Engineering Design

IV. Operations	**1. Engineering Operations**
	2. Ship Operations
V. Safety & Medicine	
VI. Humanities & Social Sciences	**1. Social Sciences**
	2. Humanities
VII. Economics & Management	**Economics**
	Management
VIII. Physical Education	
IX. Sea Training & Internships	**1. Sea Training**
	2. Internships
X. Final Examinations	

The Table 2 lists all competences as per STCW (with our code numbers), their specific content (knowledge, understanding and proficiency) and the list of suggested academic subjects. The last two columns contain the approximate academic credit hours per each subject, and their allocation to the appropriate Subject Group (SG).

Table 2. *Estimate of STCW-Required Credit Load for Engineering License*

Comp. Code	Knowledge, understanding and proficiency	Suggested Courses and/or Practical/Lab Exercises	Credit hours	SG
Function1 - Marine engineering				
1.1	Materials for ships and equipment Processes for fabrication and repair System properties and parameters Safe working practices	Fundamentals of Materials Manufacturing Processes 1.Basic Marine Engineering 2. Machine Shop	2 2 2 1	II-2 IV-1 III-3 IV-1
1.2	Equipment design characteristics Machinery drawings and handbooks Equipment operational characteristics	Engineering Drawing	1	III-1
1.3	Electrical systems safety Design and operational characteristics of electrical systems and equipment Electrical test and measuring equipment	Basic Electrical Engineering Electrical Circuits Shipboard Electric Equipment Engineering Shop	2 1 2 1	II-3 III-5 III-5 IV-1
1.4	Maintaining an engineering watch	Basic Ship Eng. Operations ER Resource Management Engine Room Simulator	2 1 .5	IV-1 IV-1 III-2
1.5	Knowledge of English	Maritime English	3	VI-1
1.6	Main and auxiliary machinery operation	Marine Engineering (Steam) Steam Simulator	2 1	III-3 III-2
1.7	Pumping systems	Auxiliary Systems	2	III-3
Function 2: Electrical, electronic and control engineering				
2.1	Power generating plant Control systems	Electric Machines Control	2 3	III-5 III-6
Function 3: Controlling operation of ship and care for persons on board				
3.1	Ship stability Ship construction	Basic Naval Architecture Basic Ship Design	3 2	II-6 III-4

3.2	Fire prevention and fire-fighting appliances	Fire Fighting Basic Chemistry	.5 3	IV-2 I-2
Function 4: Maintenance and repair				
4.1	Marine systems Safety and emergency procedures Fundamentals of maintenance and repair	Basic Safety Basic Maintenance and Repair	1 1	 IV-1 IV-1
Function 5: Controlling operation of ship and care for persons on board				
5.1	Pollution prevention	Basic Pollution Prevention	.5	IV-2
5.2	Life-saving systems and appliances survival at sea techniques	SOLAS Personal Safety	1 1	IV-2 V-1
5.3	Medical aid	Ship Medicine	1	V-1
5.4	Safety regulations	Basic Ship Operations	1	IV-2
Total			**45.5**	

At the final step of quantifying the STCW requirements in terms of needed academic hours the data in Table 2 summarized by Subject Groups and the structure of the academic load is identified. The results are presented in Table 3. For comparison and further analysis, some additional information is also included here: a) academic structure and course load for Module Course 7.04 which has been developed for IMO by the Norwegian Maritime Directorate [6], b) sample Associate Engineer program and c) standard Bachelor in Marine Engineering Program developed by the author [5].

Table 3. *Comparison of STCW Credit Load with Marine Engineering Curricula*

Curriculum Components and Subject Groups		STCW Approx. Credit Load	IMO model course	Associate Eng. Programw	BEng. Program, std	Add. Credits BSEng. vs. STCW
I. Mathematics & Science		3	2	7	20	+17
1	Mathematics		0	14.0	14	
2	Science	3	2	6.0	6	
II. Engineering Science		7	21.6	22	30	+23
1	Mechanics		4.8	6.0	6	
2	Materials	2	2.9	5.0	5	
3	Electrical	2	5.8	5.0	5	
4	Fluids		1	2.0	2	
5	Thermodynamics		3.4	6.0	6	
6	Naval Architecture	3	3.7	2.0	2	
7	Computer Science		0	4.0	4	
III. Marine Engineering		18.5	19	38.5	44	+25.5
1	Drafting	1	0	4.5	4.5	
2	Propulsion Plant	1.5	3.1	9.0	9	

3	Machinery	6	1.8	12.0	12	
4	Practical Naval Architecture	2	4	4.5	4.5	
5	Electrical Engineering	5	6	5.0	5	
6	Electronics/Automation	3	4.1	6.0	6	
7	Engineering Design				3	
IV. Operations		12	8.3	5.5	12	0
1	Engineering Operations	9	6		6	
2	Ship Operations	3	2.3	6.0	6	
V. Personal Safety & Medicine		2	0	0	2	0
VI. Humanities & Social Sci.		3	0	8	18	+15
1	Social Sciences	3			6	
2	Humanities			6.0	12	
VII. Economics & Management		0	4.1	0	6	+6
1	Economics				3	
2	Management		4.1	3.0	3	
VIII. Physical Education		0	0	0	4	+4
Program Total		45.5	59	90.5	136	+90.5

Analysis of information in the above tables brings the following important points:

a) STCW-related subjects require one third of the total academic load in the BS in Marine Engineering program. Without a subject breakdown this share of STCW hours appears quite substantial, which suggests that there is still sufficient room for the degree-related knowledge items in the BS program.

b) Comparing the numbers with the IMO Model Course, one can conclude that while Marine Engineering subjects are equally presented, some additional subjects have been considered vital, such as 15 credit hours of engineering science and 4 hours of management. It might be argued that the knowledge, understanding and proficiency as per the STCW code deserve further evaluation towards increased requirements of science competences.

c) The license-leaning Associate degree program contains substantially more mathematics and science, which is appropriate when a college degree is granted, although an associate one. This program provides for much more Marine Engineering courses which is another ground for a discussion on sufficiency of that knowledge in the STCW requirements.

There is a wide variety of the STCW competency assessment methods and procedures in various maritime schools, and an appropriate quantification has not become an accepted practice yet. As an example, Table 4 contains the STCW courses and projects used in USMMA for assessing the competences. This list is approved by the USCG, a licensing body in the U.S.

Table 4. *STCW Competency Courses for Class of 2007, Officer in Charge of Engineering Watch*

Courses and Projects	Credit Load		Number of Competences
	Total Credit Hours	Approximate Competence Related Hours	
ACADEMIC COURSES			
Maritime Professional Studies	2	2	1
Strength of Materials	2	1	1
Materials Engineering Lab	1	1	2
Internal Combustion Eng	3.5	2	1
Diesel Simulator	1	1	2
Intro to Marine Engineering	3.5	2	1
Naval Architecture	3	2	3
Engineering Shop	1	1	3
Marine Refrigeration	3.5	2	1
Intro to Electrical Engineering	2.5	2.5	6
Electric Machines	3.5	2.5	1
Sub-Total Academic Courses	*26.5*	*19*	*22*
SEA YEAR COURSES			
Marine Propulsion I (Diesel)	1	1	2
Marine Propulsion I (Steam)	1	1	2
Ship Systems I	2	1.5	9
Marine Propulsion II/III	2	1.5	3
Electrical Engineering	1	1	1
Ship Systems II	2	1.5	2
Maintenance Management	1	.5	1
Naval Architecture	2	1.5	1
Sub-Total Sea-Year Courses	*12*	*9.5*	*21*
Total per Program	***38.5***	***28.5***	***43***

Total number of 28.5 credit hours appears to be much less than the total academic load per STCW estimate. Apparently, additional analysis and evaluation might be required.

3. STCW and Admission Requirements

A very important subject, unfortunately almost forgotten, concerns the admission requirements into an STCW certified maritime program, and specifically, marine engineering program. Secondary school graduates enrolling in the Marine Engineering Program have very different level of readiness. If this subject is considered globally, the problem becomes even more drastic – secondary educations in different countries varies quite substantially, not only in duration, but also in content and in intensity.

In order for a student to obtain competence, for instance, in electrical equipment operations and safety, in auxiliary machinery and systems, etc., certain basic knowledge of physics is a must. However, many maritime schools are getting freshmen who had one-two quarters of physics, and even that was on a very low level. Another area where the school fundamentals are vitally needed is English. If the school programs have not provided sufficient language proficiency, the maritime school would not be able to assure that the graduate gets competence in English language. As a result, maritime school and colleges are forced to offer extensive language practicum far beyond the approved curriculum, and also various watered down mathematics and science courses. In many cases what is called a college mathematics or science course is in reality an advanced secondary school subject.

It appears necessary to set certain admission requirements in conjunction with each STCW competence, a kind of admission competences. Similar to the STCW format, for each of these admission competences the following information might be identified: a) knowledge, understanding and proficiency, b) methods for demonstrating competence, and c) criteria for evaluating competence, or rather methods and procedures of pre-admission testing. Some maritime schools are utilizing various types of screening candidates in order to find out what additional classes and tutoring should be provided. The way it is done now not directly aimed towards STCW competences

4. Assessing the Results of STCW Certification

Among the most important provisions of the STCW 95 is the introduction of quality standards systems (QSS), as an oversight of training, assessment, and certification to ensure that training, certification and other procedures are continuously monitored by means of a quality standards system. STCW, as amended, will require all training and assessment activities to be "continuously monitored through a quality standards system to ensure achievement of defined objectives, including those concerning the qualifications and experience of instructors and assessors." The 1995 amendments require those responsible for instruction and assessment of the competence of seafarers to be qualified for the type and level of training or assessment involved. Persons performing these roles are expected to have received guidance in instructional techniques and assessment methods. The U.S. Coast Guard has drafted policy guidance for use in qualifying and managing training and assessment personnel.

However, another quite important component appears to be missing from the QSS – evaluation of the results of the competency assessment, or using the STCW terminology, "... to ensure achievement of defined objectives". The primary objective of MET is the level of competency of the graduates, and the assessment of this level is required. The engineering community has developed a comprehensive system of such assessment. The principal engineering accreditation institutions, the American Accreditation Board for Engineering and Technology (ABET) and the British Institute of Marine Engineering (IMarEST) base their accreditations on a program outcome assessment by a group of experts. The method is quite comprehensive, although very structured and formalized. The industry uses less formalized and structured approach, although also based on the expert evaluation. For instance, DNV has created a SEASKILL Committee of Experts made up of members from the Industry with in-depth knowledge and experience in the specific areas and in STCW standards. This Committee is involved in certification of the maritime educational programs "with an objective to ensure uniform quality of training in the maritime industry, regardless of location, operation and training methods".

It is a firm believe of this author, that a similar system might be created by the maritime educational institutions. In most of cases, it should be an appendix to the existing program assessment system. For example, all U.S. Maritime Institutions are periodically accredited by regional accreditation bodies which are assessing the schools of a certain area, on the outcome assessment basis.

To be accredited a substantial ground work has to be carried out. The programs must have defined Competence Educational Objectives developed with input from the key constituencies (typically current students, alumni, and employers); they must regularly evaluate their progress at achieving those objectives; and must continuously improve their educational program based on that evaluation. The core of the competency assessment process should be the evaluation of the outcomes, based on surveys of graduates, shipping companies, and also current students. Specific assessment tools should be created, and numerical goals established. The level of success of the school or academy is found by comparing those goals with the outcome assessment results.

The following are the suggested steps in setting the outcome assessment system:

a. First of all, a permanent Committee has to be established with a task to define the procedures and to set a system of continuous assessment of objectives and outcomes, and for applying the results for the program improvement,
b. The next step is to develop a set of the objectives. This task requires to clearly identify the constituency, to survey the constituency in order to find out what

the needs are, to create the Industry Advisory Board to steer the program in the direction of continuous assessment of the objectives and re-emphasizing the specific areas when the change is required

c. The longest and the most labor-consuming component is the actual development of the system, including the outcomes themselves and the tools for their assessment.

5. References and Bibliography

1. International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1995 Amendments, IMO, 1995
2. Guidance on STCW Quality Standards Systems (QSS) for Merchant Mariners courses or training programs, U.S. Coast Guard, 1997
3. Websites of Maritime Universities, Academies and Schools
4. Butman B., Harbach J., Study on Accreditation of Marine Engineering Programs, IAMU, AGA6, Malmo, 2005
5. Butman B., Study in Standardizing of Marine Engineering Curriculum, IAMU, AGA6, Malmo, 2005
6. Engineer Officer in Charge of a Watch, Module Course 7-04, IMO, 1999
7. ABET accreditation documentation and procedures, Accreditation Board for Engineering and Technology, Criteria 2000
8. DNV official Website
9. Satya, Rating of Rating of educational institutions in India by independent agencies - a working model to follow, March 2008 (website)
10. M. Pourzanjani, et. al., Maritime Education and Training (MET) in the European Union, JAMU Journal, Vol. 2, N. 2

Total Quality Management in Maritime University: Philippine Model

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ABSTRACT

The shift to knowledge economy brings education back to the hub of human empowerment. The present age brings into play the key elements of education and training in the global dimension. Expectedly, learning institutions must facilitate the development of knowledge and skills vital for global competitiveness. Higher education is thus continuously challenged to be more responsive to the current demands and be efficient and effective in the implementation of all aspects of operation. To date, the paradigm of education directs its system to align institutional goals and objectives to the world's standard. This changing pattern gives rise to the concept of quality as an inherent component of success. Since the quality of education is appraised by the very same individuals it produces, learning institutions must take a holistic view of quality. Among maritime schools, whose main goal is to produce technical manpower for global seafaring market, quality is not an option but a mandatory requirement should they aim for "world-class" status. In addition, STCW '95 stresses the need to fortify the state of affairs of maritime schools and training institutions to ensure the development of competent manpower.

The John B. Lacson Foundation Maritime University (JBLFMU), the only maritime university in the Philippines, has pioneered adherence to ISO standards in the country and in Asia. The only maritime school to implement the Philippine adaptation of the Malcom Baldrige Education Criteria for Performance Excellence, the JBLFMU is among the three learning institutions in the Philippines serving as benchmark for the practice of total quality management.

This study highlights the implementation of TQM in the JBLFMU's operation in the areas of leadership; strategic planning; student stakeholder and market focus; measurement, analysis, and knowledge management; faculty and staff focus; and process

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management in relation to organizational approaches, deployment of approaches, and organizational results.

Keywords: total quality management, maritime training and education, Malcom Baldrige Education Criteria for Performance Excellence.

INTRODUCTION AND BACKGROUND OF THE STUDY

Serving as intermediaries between the needs of an academically qualified workforce and the requirements of the industry, higher education institutions (HEI's) have to find ways to generate graduates armed with skills and competencies demanded by the global market; thus, schools must aim for world-class status through high-quality delivery of educational services. Consequently, globalization of education makes the quest for quality no longer an option but an essential requirement.

This research was linked with the management theory advanced by Deming and Juran (1954), known as the Total Quality Management (TQM) or the Continuous Quality Improvement (CQI). Goetsch and Davis (1995) clearly delineate the theory as follows:

The TQM consists of continuous improvement activities involving everyone in the organization - managers and workers - in a totally integrated effort toward improving performance at every level.

As an administrative approach, the TQM is geared towards long-range success through customers' satisfaction. Its key elements include ties to an institutional plan, employee empowerment and teamwork, continuous improvements, collaborative work, and the use of a scientific approach to process analysis. This philosophy expounds that improving quality improves customer satisfaction which, in turn, improves institutional performance.

The John B. Lacson Foundation Maritime University (JBLFMU) is an institution that provides high-quality maritime education and supplies world-class maritime manpower to the global shipping market. The JBLFMU is acknowledged as among the few standard bearers of maritime education and training of excellence in the Philippines and in the world. It has established competitive advantage through continuous organizational improvement and innovations.

With the TQM or CQI serving as guide, this research employed the Education Criteria for Performance Excellence of the Philippine Quality Award (an adaptation of the Malcolm Baldrige Education Criteria for Performance Excellence) as a systems approach for appraising the JBLFMU's organizational performance management. The criteria includes such elements as leadership; strategic planning; students/ stakeholders focus; measurement, analysis and knowledge management; faculty/staff focus; process management; and the dimensions of approach, deployment and results. These criteria help organizations use an aligned approach to organizational performance management that results in delivery of ever-improving value to students and stakeholders, improvement of overall organizational effectiveness and capabilities and organizational and personal learning (Black, 2002).

The JBLFMU was thus presented in this study in the light of the Malcolm Baldrige Education Criteria for Performance Excellence, underscoring the best practices in its implementation of total quality management.

The Organization

The JBLFMU, initially established in 1931 by Capt. Juan Bautista J. Lacson as a review school for the upgrading of marine officers, has evolved from being a non-stock corporation (1948-1957) to a foundation (1985-present). The school has likewise undergone change in name from Iloilo Maritime Academy (1938-1953) to Iloilo Maritime Academy and Lacson Vocational Institute (1954-1958), Iloilo Maritime Academy (1959-1984), John B. Lacson Colleges (1985-1992) and John B. Lacson Foundation System (1993-2007) and now the John B. Lacson Foundation Maritime University, the first maritime university in the Philippines.

Dynamic, innovative and visionary in its pursuit of excellence in maritime education and training, the JBLFMU is the first maritime institution to earn Level III re-accredited status in the Philippines and among the 30 fully autonomous colleges and universities in the country. It is the first DNV-certified maritime school in the Philippines and third in Asia to be ISO-certified; first to publish a Maritime education Review; first to establish a maritime high school in the country; and first to be granted the Expanded Tertiary Education and Equivalency Program (ETEEAP) for Maritime Education.

Among the first three educational institutions awarded the Philippine Quality Award for Management Excellence in 2005, the JBLFMU is a member of the Phi Delta Kappa, an international association of professional educators, and is among the organization's key chapters in the world.

The JBLFMU is the Graduate Center for Maritime Courses of the Fund for Assistance to Private Education (FAPE) and the Regional Assessment Center for Deck/Engine ratings.

The JBLFMU includes three campuses: the JBLFMU-Arevalo and the JBLFMU-Molo, both in Iloilo City; and the JBLFMU-Bacolod in Bacolod City.

The mandate of the JBLFMU as an educational institution emanates from the Board of Trustees (BOT) and the Executive Council (ExCon). The Board, headed by the Chief Executive Officer, is the top policy making body; the ExCon, is the top management committee. Members of the ExCon are the unit administrators, the internal auditors and the legal counsel. A collegial body, the ExCon is vested with the general management of the university.

Basically customer-oriented, the JBLFMU takes as top priority the satisfaction of its students and other stakeholders. Its focus as maritime education and training institution is giving the country a competitive edge in the world maritime manning industry which acknowledges the Philippines very significant 25% share of the world's seafarers.

Education Programs and Services

The specific subject of this research was the JBLFMU-Arevalo (JBLFMU-A), one of the three academic units of the University. The mainstream of the JBLFMU-A student segment is the Bachelor of Science in Marine Transportation degree program. Covered by a four-year residency program, which consists of a three-year academic study and a year's apprenticeship training on board local inter-island or international commercial vessels, the academic program is principally designed for education and training of future deck officers. The Seaman's Rating Course is a sub-student segment guided by a one year competency program and a two-month on-board training. Its primary purpose is to develop deck skilled seafarers' rating. The JBLFMU-A also runs a Graduate School which offers maritime-related master's, doctoral and management-level courses.

The academic curricular programs include courses that are systematically sequenced and designed to meet the needs of diverse sectors in the maritime industry. They are in accordance with the enriched competency-based curriculum as per IMO and government guidelines. The curriculum provides a balance between academic excellence (with emphases on science, mathematics and English) and applied skills.

Delivery of instruction incorporates learner- centered approaches and hands-on learning through the use of state-of-the-art maritime simulator; computers; laboratories in natural and applied sciences, languages and maritime communication; and internet services. Providing authentic exposure to students, the school maintains a mock ship and a mock bridge which are realistic replications of the facilities on board ships.

Formal preparation for apprenticeship training is made by exposing students to the real ship environment by means of a seven-day navigational trip onboard domestic vessels. This is a major component of the three-year academic study to earn the BSMT degree and to eventually become a deck officer. The students' academic performance is evaluated by an independent academic assessment office through a multi-layered system.

ORGANIZATIONAL CULTURE

The learning environment for the holistic development of globally competitive but nationalistic graduates is deeply rooted in and anchored on the JBLFMU culture of quality education, training and instruction. Armed at producing world-class technical and professional maritime manpower, its advocacy of ethical standards is manifested by its undertakings which address environmental and community concerns.

In its continuous pursuit of excellence, the JBLFMU undergoes both required and voluntary accreditation. Findings vital to improvement undertakings include: (a) the Norwegian International Ship registry's marked preference for scholars from the JBLFMU to those from other schools; (b) Norway's ODJFELL Shipping's firm resolve to hire only cadets from the JBLFMU; (c) sustained placement of JBLFMU scholars in the different shipping and manning firms despite sporadic economic slumps; (d) JBLFMU's strict conformance with government requirements; (e) the JBLFMU's higher national board exam passing percentage than the national rate (average national passing percentage in 2006 was 47.61%; JBLFMU's average passing percentage in the same year was 64.66%); (f) constant income increase due to regular enrolment growth; and (g) continuous faculty and staff educational upgrading.

As a maritime institution, the JBLFMU-A adheres to the policies, standards, guidelines and safety requirements of regulatory government bodies and the IMO.

MAJOR TECHNOLOGIES, EQUIPMENT, FACILITIES

The JBLFMU-A strategically sits along the shoreline of Guimaras Strait on a 2.9 hectares land area. Its location is most suitable for maritime training. Aside from the required facilities for a learning institution, the institution also boasts of updated and upgraded maritime-related laboratories and services as well as instruction-enhancing audio-visual and other electronic equipment. An office takes charge of the production of audio-visual and CBT materials.

In conformance with requirements, the University has RADAR, ARPA, ECDIS, GMDSS simulators and Liquid Cargo Handling simulator to enhance instruction and learning. The simulators are handled by instructors and assessors with appropriate training and certifications. Also available are the Automatic Identification System (AIS) and a Ship Security Alert System (SSAS).

Equipment and apparatuses are maintained according to manufacturers' instructions. Maintenance records are properly kept and regularly updated.

A Local Area Network (LAN) linking all offices is in place to facilitate faster and more convenient processing of data like the automated enrollment system which encompasses accounting, cashiering, and registration procedures. Further, it makes the students' grades, research abstracts and other information available for immediate perusal at the internet via the school's website www.arevalo.jblcf.edu.ph. The LAN has also automated the recording of the faculty and staff's entry and exit recording.

ORGANIZATIONAL DIRECTION AND THRUSTS

The JBLFMU is challenged to meet the demand of the global market for the supply of qualified workforce. With this challenge comes the institution's continuous improvement of its priority thrusts: (a) enhance employment of graduates; (b) productivity development; (c) student development and productivity; (d) faculty/staff productivity; (e) management enhancement; (f) curricular enhancement and innovation; (g) technology development; and (h) meeting the challenge of competitors.

LEADERSHIP

The JBLFMU-A has always adhered to, adopted and employed the consultation and participation models of management as it directly addresses the vital need for lower-ranking personnel to participate in planning and decision making.

Depending on necessity, urgency and other situational factors, the JBLFMU employs tried-and-tested participation style alternatives. Often, the administrator, department heads, faculty and support personnel meet as a group, freely share information and, as an entire collegial group, make decisions.

Its top management, the ExCo, regularly meets twice a month but holds special meetings for urgent concerns.

The ExCon's recommendations are submitted to the BOT for approval during its regular monthly meetings. Items approved by the Board are disseminated among all units and departments for implementation.

The guiding management principle of JBLFMU is shown in Figure 1.

Short-term and long-term institutional plans prepared by the administrator and the department heads, are anchored on the school's vision, mission, quality policy, goals and objectives. Prior to the start of the school year, the deans, in collaboration with the academic department heads, prepare the Academic Plan. All plans are based on data gathered through internal scans among the faculty, staff and researchers and through external scans among the students, regulatory and accrediting bodies, shipping and manning agency, and other sectors concerned. The plans are submitted by the administrator for the ExCon's recommendation and for the BOT's approval.

Curricular proposals, revisions, modifications and other changes are collaborative efforts among the deans, academic department heads and faculty in coordination with the students, alumni, regulatory and accrediting agencies shipping and manning agencies, and other stakeholder. Curricular concerns are officially forwarded by the administrator to the Academic Council which, in turn, endorses them for the ExCon's recommendation for approval by the BOT.

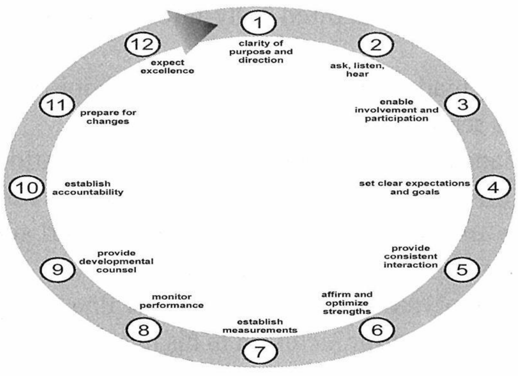

Figure 1. Management Principle

An annual management review, as provided in the Quality Management Manual SIV, is conducted to determine and analyze the current status of the institution in terms of accomplishments and opportunities for improvement as well as its policies –to ascertain the institution's continuous improvement. Other related activities include the continuous improvement request (CIR); quality management audits, academic and financial audits; and accreditation. To validate all these, the institution conducts periodic surveys among students, service providers and other stakeholders to draw suggestions, recommendations and other related data exigent to institutional improvement efforts.

Appropriate communication is disseminated to internal stakeholders regarding improvement plans for the learning-centered processes and the operation as a whole through management reviews, consultative meetings, and memoranda. The survey method, feedbacking system, correspondence and telecommunication are employed to communicate with external stakeholders.

The school's feedback mechanism draws strength from its explicit inclusion in the QM Manual which lucidly delineates the treatment and response procedures for feedbacks from various stakeholders and other sectors.

The Quality Management System of the institution is emphatic on the faculty and non-teaching personnel's role and participation in organizational development; thus, they are actively involved in feedback activities, post-activity surveys and evaluations.

GOVERNANCE AND SOCIAL RESPONSIBILITIES

As a formal educational institution, the JBLFMU-A is governed by government laws, policies, rules and regulations as well as the requirements of international monitoring and evaluating groups and organizations in the industry. This has brought beneficial results to the institution as an accredited, fully autonomous and ISO certified maritime university.

Financial control is made possible through the administrator's submission of the proposed budget for a school year for the BOT approval.

A three-tiered financial audit reviews the financial operations of the school. Audit is first conducted by the Accounting Office, then verified and validated by the JBLFMU Internal Auditor who ensures that accepted accounting and auditing procedures are observed. Verification and validation are done twice a year and an annual external audit is conducted by a private auditing firm. A daily financial performance report is submitted to the administrator for inclusion in his monthly report to the BOT.

STRATEGIC PLANNING

The JBLFMU-A establishes its strategic objectives through a focus on the accomplishment of its mission and vision, reflective of the standards set by authorized agencies in the maritime industry. Target goals are made every semester after evaluation processes are implemented and multi-sectoral feedbacks are brought in as input prior to planning. Thus, a continuous improvement effort is in place to serve the stakeholders.

A long-term five-year development plan outlines the activities for the accomplishment of objectives and goals. Short-term academic plans, training plans and action plans are accomplished in a year's time.

To accomplish the plans, budgetary allocations are made based on a forecast and approval of expected expenditures for equipment, facilities and services.

Information gathered from internal and external stakeholders identifies the institution's strengths, weaknesses, opportunities and threats. Data received from the evaluation, assessments and reviews serve as bases for the modification of strategic objectives and organizational goals as well as reference for the update of curricular programs.

The department heads' and students' evaluation of the faculty and of the staff are analyzed to determine their training needs for performance and productivity improvement. The efficiency of the operational system is also subjected to analysis to facilitate ease in achieving target goals.

Accreditation and internal audits assure the proper maintenance of facilities and equipment for efficient institutional performance and productivity. Educational reforms and major shifts in technology, student and community demographics, markets, competition or the regulatory environment move the institution to adopt certain measures to adjust to an ever-changing society and the intricate developments in the industry.

Measures include curriculum revision and allocation of resources for purchase of equipment and expenses for marketing and training. The development plan follows a modification process as needs arises.

The curriculum is modified to meet the demands of the market through the integration of reforms in the course offerings.

Strategy Deployment

The JBLFMU-A uses a systematic approach for strategic development of objectives, which utilizes inputs from both internal and external stakeholders in the maritime industry, particularly maritime education and training institutions. Results of reviews, assessments, evaluations and surveys are presented as relevant data for the development of objectives, which are incorporated in the institutional plans.

Student learning and faculty development outcomes are given adequate and appropriate emphasis. Learning outcomes are identified and evaluated. Careful analysis is made to establish a need for improvement of the curriculum or instructional approaches. The school offers scholarship grants for the professional advancement for the faculty and non-teaching staff.

To ascertain conformance with institutional goals and objectives, monthly departmental reports are submitted to the administrator. The year-end review of plans for the outgoing year serves as an opportunity for a critical estimate and discussion of why some plans succeeded while others faltered. Most unaccomplished plans are considered, as a whole or in part, for re-implementation.

Students, Stakeholders and Market Focus

The Students' Manual and the Employees' Manual clearly delineate the school's policies and regulations as well as the students' and personnel's rights and obligations. The QM Manual, on the other hand, is a documentary demonstration of the institutional procedures to be observed and specifies the personnel's work descriptions.

To train the students in responsible and committed leadership and governance, the school promotes and encourages active participation of the Student Executive Council in certain school affairs, particularly those directly concerning the students. The school has institutionalized the students' representation in the Unit Management Review. Also duly recognized are various student clubs and organizations which are vigorously involved in community outreach and extension activities.

The JBLFMU-A Admission Board sets entry requirements based on government and regulatory guidelines as well as develops and implements mechanisms in introducing school offerings and marketing programs to feeder schools and other student providers.

Promotional campaigns include radio and television advertisements; career orientation program for secondary school students; and campus tour familiarization activities.

The JBLFMU-A's market segment stretches nationwide as the institution caters to students coming from the different regions of the country.

COMPLAINT AND FEEDBACK MECHANISM

The school encourages student feedbacks regarding both curricular and non-curricular concerns during the annual management review. During the Management Review, an internal scan is conducted to gather feedback and information from students. The results are collated by the Guidance Office and submitted to the Quality Assurance Manager for analysis and deliberation with the departments concerned.

Verbal complaints about curricular, co-curricular and related matters from students and stakeholders are accepted and recorded, stating the person or office directly affected by the complaint, and submitted to the Conduct Board.

The Conduct Board, chaired by the Dean of Maritime Programs, is tasked to hear cases of students brought before it in view of their violations of government and school rules and regulations and recommends corresponding penalties and similar measures. The Board strictly observes due process of law in the discharge of its functions.

MEASUREMENT, ANALYSIS, AND KNOWLEDGE MANAGEMENT

CURRICULAR ASSESSMENT PROCEDURE

The JBLFMU-A, being an educational institution, is concerned with students' scholastic performance. Data, in this regard, are generated from the students' scores in short quizzes, long periodic tests, class participation, and curricular papers and projects. All student performance data are collected, analyzed, evaluated and integrated by the Academic Assessment Office (AAO). Major examinations are checked using the Computer Optical Scanner for faster and more accurate results.

To supplement student performance data, semestral evaluation of faculty, courses offered, and laboratory facilities and equipment is conducted among the students by the Academic Committee (AC).

The results point out curricular strengths and weaknesses in terms of classroom instruction, degree programs and student learning and serve as bases for remediation or innovative interventions.

The multi-layered quality of assessment and academic audit system ensures the high quality of graduates and sets forth a very effective tool for identifying proficiencies and deficiencies among both faculty and students as well as for the immediate establishment and implementation of adequate and appropriate remediation.

Recognized as one among the best maritime school in the Philippines, the JBLFMU-A takes a proud stand and enjoys a very certain and confident edge over other similar institutions as reflected by the positive feedbacks from local and international shipping companies and manning agencies as well as by its graduates' constantly outstanding performance in the board examinations. Also noteworthy is the institution's continuously increasing industry linkage and sponsoring companies.

The internet keeps the school regularly updated with the latest trends and innovations in performance measurement and evaluation, such as the use of portfolio, walk-in assessment, on-line verification of competencies and other learner-centered procedures. Journals and other publications of shipping and manning establishment, are also a great help with their comprehensive reports on outstanding processes and performances among maritime institutions.

The JBLFMU-A's best practices and achievements serve as vital comparative data or information upon which innovation plans are anchored. Its organizational status scanning is made relative to the performance of similar institutions. This comfortably facilitates analysis, comparison and adoption of processes and procedures which best fit the organization. It further provides opportunities to fill in performance measurement gaps and select appropriate alternatives as well as make practicable projections and employ necessary interventions to effect improved programs and services.

Data are updated through maritime conventions and fora which usually delineate the latest trends, issues and concerns in maritime education and in the maritime industry. Such events are graced by experts both from the government sector who, in view of their professional work and position, are the best sources of first-hand maritime-related information.

The JBLFMU-A shares relevant research-based information and data with its various stakeholders through their publication in research journals and availability on-line. An annual research colloquium for students likewise serves as venue for sharing best practices based on empirical data.

Due to the immense and comprehensive organizational data amassed at rapid pace by the JBLFMU information system, electronic processing is of imperative and indispensable value. The institution's electronic data system has made acquisition, preservation, retrieval and release of scholastic and other organizational data efficient, easy, convenient and fast, resulting in significant cost-cutting in terms of time, effort and money as well as in ultimate satisfaction among students, faculty, support personnel and other stakeholders.

Faculty and Staff Focus

The institution has a strong faculty and staff profile. Of its 209 employees (SY 2006-2007), 44 % belong to the faculty group; 56 %, administrative staff. Among the faculty are general education instructors (51%) and professional instructors (49%). General education instructors are specialists in Mathematics, Natural Sciences, Language, Physical Science, and Social Sciences. Twenty percent (20%) of the general education faculty are holders of doctoral degrees; 24% have master's degrees; and 17% have bachelor's degrees and pursuing their master's degrees. Professional instructors are marine deck officers, 67% of whom have master's degrees; and 33% have bachelor's degrees with master's units.

The faculty and staff's educational and skills enhancement needs are determined and appraised before the start of every school year. The Human Resource Management Office, in consultation with the department heads, identifies the faculty and personnel with urgent need to pursue appropriate graduate degrees or to attend relevant seminars, workshops or trainings. Upon their return to station, seminar or workshop participants conduct "echo" conferences to share learned concepts with the rest of the faculty or staff of the institution.

As per government policy, only general education instructors with master's degrees are hired. On the other hand, only licensed deck officers are accepted as professional instructors.

Visiting lecturers from government and reputable private organizations are regularly invited to enhance regular instruction at the graduate level.

To achieve the mission of the school to provide quality education, the faculty members are formally evaluated at the end of the semester using two (2) evaluation tools: (1) Classroom Observation Form (COF); and (2) Efficiency Effectiveness Competence Form (EECF).

The staff are likewise evaluated twice a year using the Efficiency Effectiveness Competence (EEC). Each employee is evaluated by the department head, peers, and administrator and him/herself.

Hiring and Career Progression

The standards for hiring and career progression include knowledge/education requirement, skills and abilities needed for the job. Potential faculty and staff are required to accomplish an application form. The teacher applicant is also required to perform a classroom teaching demonstration to gauge his/her teaching skills.

The school follows the criteria for succession planning program. In case of a vacant teaching position, the applicant who meets the qualification requirements is considered for the position. For temporary absences, an officer in charge is appointed.

Faculty and Staff Well-Being and Satisfaction

The school has committees composed of faculty and staff, which handle the tasks of improving workplace health, safety, security and ergonomics.

Emergency plans and fire prevention equipment are strategically located in the office; s and seminars and trainings on safety are regularly conducted. Emergency procedure devices are regularly evaluated and maintained by the safety committee and safety-related activities are conducted.

The school strongly acknowledges the employees' important role in the success of the organization. After all, the employees are the frontliners in the delivery of the institution's services to its stakeholders. The school appropriates funds to ensure the employees' safety, well-being and satisfaction through wellness programs, adequate compensation, legislated benefits and recognition of exemplary performance.

The school maintains its commitment to workplace safety and security through the head of discipline who closely works and coordinates with the school's security officer, chief of plant and facilities and the local police.

The institution has provisions for the professional faculty's ship-board upgrading leave to enable the faculty to learn current trends and technologies onboard international ships so that, when they return to the school, they can share these with the students. The policy provides that professional instructors on ship-board upgrading leave/retains their tenure in school provided that they go back to teaching when they disembark.

Data on absenteeism and grievances are used by management as reference in identifying the services and benefits needing improvement. The employees' productivity performance is utilized in determining promotions and allocation of benefits and privileges.

Process Management

The University continues to develop appropriate processes needed for the delivery of quality education and training aligned and in consonance with government requirements.

Institutional surveys and internal and external scans are utilized in the development of curricular and training programs for highly employable and globally competitive graduates. Key learning-centered processes include instruction, assessment, certification and placement designed to produce graduates with knowledge and competences required in the local and global markets. The processes employed ensure that the JBLFMU-A objectives are met.

The University's productivity undertaking is greatly focused on the development of instructional materials, training aids and innovative tools. Periodic assessment is done to ensure the students' best possible learning and their certification for placement.

The fulfillment of key learning-centered process requirements is determined through the school's accreditation. The surveys conducted among students, faculty and staff, parents, and shipping companies draw exigent feedbacks and recommendations.

The University annually reviews its curricular and other programs to ensure that their contents remain relevant to the current requirements of the industry and other stakeholders. Information obtained from the annual review serves well in the development of approaches to enhance student performance as well as recognize the contributions and determine the needs of the faculty and staff.

References

1. Alexander, F.K., (2000). The changing face of accountability. The Journal of Higher Education, Columbus.
2. Belohlav, J., Cook, L., Heiser, D., (2004). Using the malcom baldrige national quality award in teaching: one criteria, several perspectives. Chicago.
3. Besterfield, D., Besterfield, C., Besterfield, M., (1995). Total quality management. New Jersey.
4. Black, L. (2002). Excellence in education. Retrieve at (http:webs.wichita.edu/deptools)
5. Evans, J. (2003). Validating Key Results Linkages in the Baldrige Performance Excellence Model Quality Management Journal, Vol. 10., Number 2. Alabama
6. Goetsch, D. and Davis, S., 1995. Implementing Total Quality. Prentice Hall, New Jersey.
7. Gall, Gall and Borg, (2003). Educational research, an introduction, seventh edition .USA. Pearson Education, Inc.

8. Hertz, H., (2004). Baldrige national quality program, education criteria for performance excellence. Gaithersburg.
9. Mukhopadhyay, M., (2001). Total quality management in education. National institute of educational planning and administration: New Delhi. India.
10. Thalner, D., (2005). The practice of continuous improvement in higher education, a dissertation. Western Michigan University, Michigan.
11. Unal, O.F., (2000). Application of total quality management in higher education institutions. Azerbaijan.

On the New Pilot Education and Training System in Japan

Yoko Uchida, Hideo Yabuki And Naoyuki Takagi[1]

Abstract

In Japan, due to a significant reduction in number of Japanese flag oceangoing vessels and Japanese seafarers, a supply shortage of pilots is expected in the next several years to come. In order to maintain a constant supply of experienced pilots, the Japanese government has introduced a new education and training system for prospective pilots at designated maritime education and training institutions. As of April 2007, Tokyo University of Marine Science and Technology (TUMSAT) started a new pilot training program as one of its master's programs in its graduate school.

This article presents a summary of the newly-established education and training system for pilots in Japan and describes the curriculum for pilot training at TUMSAT which, as a new attempt, aims at training college graduates with limited sea experience.

1. Introduction

High quality pilot service for foreign oceangoing vessels that enter and depart from Japanese ports is indispensable for the prevention of marine casualties and pollution. In order to ensure safe vessel traffic in the Japanese territorial waters and ports, some 640 pilots are engaged in their service in 35 designated pilotage districts.

The career opportunity to become a pilot has long been open only to ex-masters with experience onboard oceangoing merchant ships, since the pilot certificate qualification requires a career history of having been onboard vessels of 3,000 G.T. or more for a period of 3 years or longer as a master. On the other hand, the Japanese flag vessels have recently experienced a drastic drop in number, which has led to an on-going decrease of ex-masters who satisfy the above-mentioned requirement. As shown in Fig 1, the recent number of Japanese oceangoing seafarers is about 3,000 and this figure is

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35% of the number of seafarers 10 years ago. Another problem is their aging: 35% of officers are aged 50 years or older, as is shown in Fig. 2. This being the case, a supply shortage of pilots is expected to take place in the next several years.

In order to keep a constant supply of experienced pilots, the Japanese government has introduced a new line of pilot certification system by training those who wish to become first-grade pilots (open to those with experience as a master), second-grade pilots (open to those with experience as a chief mate), and third-grade pilots (college graduates who hold the certificate of class III deck officer), at one of the maritime education and training institutions designated by the government.

As such an institution, Tokyo University of Marine Science and Technology (hereafter TUMSAT), as of April 2007, started a new pilot training program as one of its master's programs under the Course of Maritime Technology and Logistics. The program is composed of a number of classroom lectures dealing with such topics as safety management for pilots, ship handling and Maritime English, as well as training sessions using the ship maneuvering simulator and onboard pilotage training directed by active pilots.

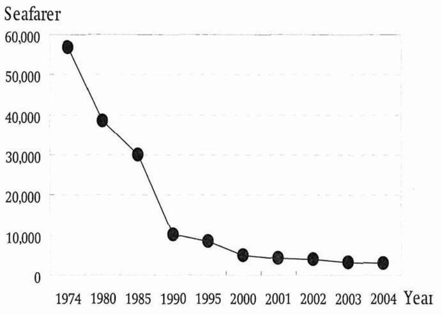

Fig. 1 Drastic drop in the number of Japanese seafarers

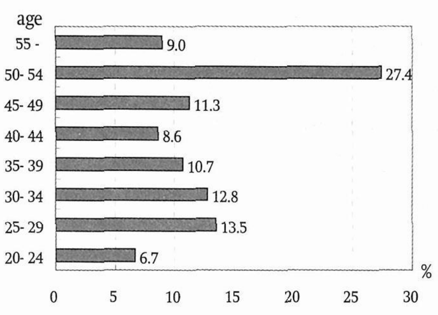

Fig. 2 Age distribution of officers

2. Reform of Pilot Education, Training and Certification System

In response to the possible shortage of pilots in the near future mentioned in the previous section, the Japanese government decided to modify the pilot certification system and put it into effect as of April, 2007, and concurrently to adopt a new pilot education and training system. This section describes this new pilot certification system and the new pilot education and training system.

2.1. Pilot Certification System

The former pilot certificate qualification required a career history of having been onboard vessels of 3,000 G.T. or more for a period of 3 years or longer as a master. However, considering the situation that the number of Japanese seafarers onboard oceangoing vessels is decreasing drastically (see Fig. 1), the qualification requirements for prospective pilots have been altered. Having experience as a master is not necessarily a prerequisite in the new certification system, which opens the opportunity for younger deck officers to become pilots, thus leading to a stable supply of pilots.

In accordance with the loosening of qualification requirements, three levels or "grades" have been introduced to the pilot certificate. The "grading" is based on the career history and qualifications (e.g., the holder of certificate of deck officer) of prospective pilots, and the size of vessels they can give service to also depends on the grades.

2.1.1. Grade-based Certification System

The grade for which each applicant is eligible depends on his/her career history. 1st grade requires experience as a master as before, 2nd grade requires experience as a chief mate, and 3rd grade is open to college graduates who hold the certificate of class III deck officer.

2.1.2. Grade-based Qualification Requirements and Range Of Service

The grade-based qualification requirements and the range of service that a pilot can offer in terms of the vessel size for each grade are summarized in Table 1.

Table 1. *Requirements of the pilots and their approved service range*

	1st grade pilot	2nd grade pilot	3rd grade pilot
Certificate	Class III deck officer certificate holder		
Sea service experiences	Master 3,000 G.T. or more 2 years or more	Chief mate 3,000 G.T. or more 2 years or more	Cadet or officer 1,000 G.T. or more 1 year or more
Range of pilot service	None	not exceed 50,000 G.T. (Dangerous cargo ship ; not exceed 20,000 G.T.)	not exceed 20,000 G.T. (dangerous cargo ship handling not allowed)

Only masters are eligible for the 1st grade certificate. Sailing time required used to be 3 years, but it has been shortened to 2 years under the new system in view of the fact that masters now enter and leave ports more frequently due to increased vessel speed and shorter cargo work time in port. For the 2nd grade pilots, a career history of having been onboard vessels of 3,000 G.T. or more for a period of 2 years or longer as a chief mate is necessary.

The size and cargo of vessels that can be served by a pilot is also limited according to the grade, since handling large ships or ships with dangerous cargo requires more experience: 2nd grade pilots are eligible for pilotage of vessels 50,000 G.T. or less (as for vessels with dangerous cargo, 20,000 G.T. or less); 3rd grade pilots are allowed to work onboard vessels 20,000 G.T. or less, and are not eligible for pilotage of vessels with dangerous cargo.

2.2. Introduction of the Pilot Education and Training Program

Following the loosening of qualification requirements, the level of knowledge and skills of pilots may be degraded. In order to prevent such an outcome, the government has established a new system of educating and training those who wish to become pilots at one of the three designated maritime education and training institutions. Under this system, there are two types of educational programs, one for newly-recruited pilots and the other for those who seek for a higher-grade certificate.

As for expenses to educate and train newly-recruited students, pilotage revenue is allocated, considering the significance of maintaining a sufficient number of pilots and providing high-quality pilot service.

2.2.1. Structure of the Education and Training Program

The following education and training is provided in the program. As for the period of education and training required for each grade and for each item, see Fig.3.

(1) Classroom lectures to obtain knowledge necessary for a pilot

	1st grade pilot	2nd grade pilot	3rd grade pilot
Classroom lecture	3.5 months	6 months	9,5 months
SMS Training	1.5 months	3.5 months	6 months
Onboard Training (Training ship) (Domestic merchant ship) (Ocean going merchant ship)			4 months (1 month) (1 month) (2 months)
Tug boat training		0.5 months	0.5 months
Pilotage training	4 months	8 months	10 months
	National examination		
Pilotage training	3 months	5 months	6 months

Fig.3 Duration of pilot education and training

(2) Ship maneuvering simulator training (hereafter SMS training) to obtain practical skills

(3) Training with tug boats which is used as a supplementary means of maneuvering

(4) Training onboard merchant ships to experience maneuvering various ships

(5) Practice of pilotage to obtain knowledge and skills necessary in actual pilot service (Additional training is mandatory after passing the national examination, as shown in the figure.)

2.2.2. Obtaining a Pilot Certificate

Those who have completed the education and training program at one of the maritime education and training institutes designated by the government are eligible to take the pilot examination administered by the government, and by passing the examination, a pilot certificate is issued. Pilot examination consists of a physical test, a written examination, and an oral examination.

2nd grade and 3rd grade pilots are eligible to take an examination for a pilot certificate of a higher grade. Its prerequisite is experience of pilot work for a certain period of time following a completion of the education and training course at a maritime education and training institute. By passing the pilot examination, they are able to obtain a pilot certificate of a higher grade. Requirements and the procedure to obtain a pilot certificate of a higher grade are as shown in Fig. 4.

	Promotion to 1st grade pilot	Promotion to 2nd grade pilot
Certificate	2nd grade pilot	3rd grade pilot
Pilotage experiences requirement	2 years or more	2 years or more
Education and training (Classroom lecture) (SMS training)	3 months (1 month) (0.5 months)	6 months (2 months) (1 month)
Pilotage training	1.5 months	3 months

National examination

Fig.4 Promotion procedure

3. PILOT EDUCATION AND TRAINING COURSE AT TUMSAT

3.1. SUMMARY OF THE PROGRAM

Education and training of pilots at TUMSAT is implemented in its graduate school (Master's level), under the Course of Maritime Technology and Logistics. The pilot education and training course is comprised of classroom lectures, SMS training, tug boat training, training onboard various types of ships, and pilotage training, as shown in Fig.3.

The 3rd grade pilot course is two and a half years long. After 2 years of classroom lectures, SMS training, onboard training, as well as pilotage training for 4 months, as a fulltime graduate student, the students are allowed to take further pilotage training of 6 months as a credited auditor, upon completion of which they are entitled to take the pilot examination. In addition to the course requirements, students of the 3rd grade pilot course must write a Master's thesis. After a successful submission and defense of the thesis, they are awarded the Master's Degree (Engineering).

The 2nd grade pilot course, open to those with experience as a first mate, is a year and a half long. It is obligatory for the students to spend their first 10 months taking 6 months of classroom lectures, SMS training, and tug boat training. This is followed by pilotage training for 8 months, upon completion of which they are entitled to take the pilot examination.

The 1st grade pilot course, open to those with experience as a master, is 9 months long. After fulfilling requirements of classroom lectures and SMS training which last for 5 months and 4 months of pilotage training, they become eligible for the pilot examination.

3.2. CURRICULUM OF THE 3RD GRADE PILOT COURSE

Table 2 shows the curriculum of the 3rd Grade Pilot Course, designed to train and educate newly-recruited college graduates.

Classroom lectures consist of 13 subjects (26 credits) that are relevant to navigation, ship maneuvering, maritime traffic laws. Special emphasis is placed on practical Maritime English necessary for pilots onboard foreign vessels. In addition to providing a broad knowledge essential to pilots, advanced theories and achievements of the past research on ship navigation are introduced and taught.

SMS training comprised of six subjects (6 credits) is a core basis of the technical education. Active pilots with abundant experience are invited as instructors and lead the class, using a full-mission ship maneuvering simulator that has been newly installed for the training. Training sessions include passage navigation under various conditions such as strong wind and restricted visibility; docking and undocking practice; BRM (bridge resource management) training; and communication training in English.

Table 2. *Curriculum for 3rd grade pilot*

Classroom lectures		Training	
Subject	Credit	Subject	Credit
Route planning	2	SMS Training	6
Navigation engineering	2	Onboard Training	5
Mobile communication system	2	(training ship)	(1)
Advanced navigation information	2	(Domestic merchant ship)	(1)
Navigation performance	2	(Ocean going merchant ship)	(2)
Design on shiphandling system	2	(Tug boat)	(1)
Stochastic analysis of ship motion	2	Pilotage Training	9
International safety management at sea	2		
Environmental predictions	2		
Safety management of pilotage	2		
Maritime traffic law	2		
Health care and marine	2		
Advanced maritime English	2		
Research (master's thesis)	8		

Repetitive onboard training of passage navigation as well as docking and undocking practice in Tokyo Bay is conducted using the university training ship, Shioji-maru. Appropriate use of tugboats as a supplementary means of shiphandling at the time of docking and undocking is taught through the tugboat training. Training onboard merchant ships allows students with limited practical experience as a navigation officer onboard merchant ships to experience navigational watch, passage navigation, as well as docking and undocking in both domestic and international waters and ports under various vessel traffic environments. This training enables them to attain a better understanding of the actual navigation circumstances. Both oceangoing merchant ships and domestic merchant ships are used for this training.

Pilotage training is aimed at having the students learn the work procedure and practices of a pilot, and therefore, the training takes place onboard an actual ship, under the instruction and supervision of an active pilot in the pilotage district where the students will be working in the future.

The milestones of education and training based on the curriculum is shown in Fig. 5.

The education and training of 3rd grade pilots, which lasts for two and a half years, are divided into five semesters. In Semester 1, SMS training is carried out along with classroom lectures, and at the end of the semester, ship-maneuvering training using the university training ship is given followed by training onboard domestic merchant ships. Classroom lectures and SMS training are continually given in Semester 2, at the end of which training onboard oceangoing merchant ships is given. Students start to work on a research topic of their own choice for their master's thesis in Semester 3. At the beginning of this semester, students also go through tug boat training, followed by 2 months of practice of pilotage.

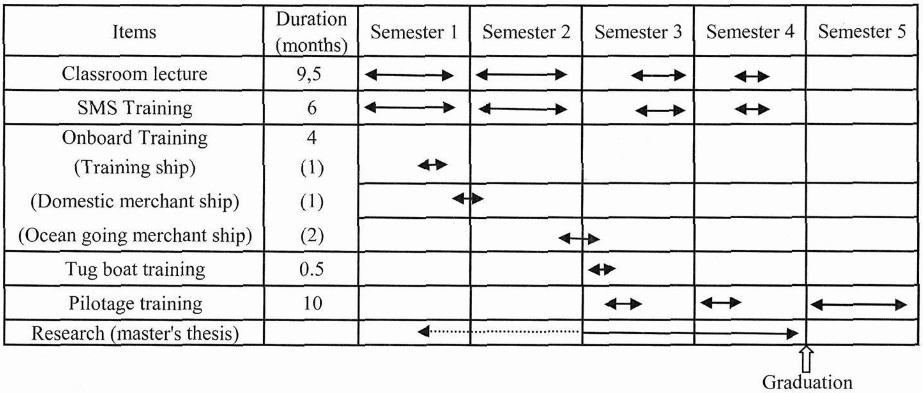

Fig. 5 Education and training milestone for 3rd grade pilot

With this experience, they have practical SMS training while having classroom lectures at the same time. In Semester 4, after 2 months of pilotage training, further practical SMS training is provided. In addition, it is required that each student finishes comes his/her thesis and defends it at the end of the semester.

After having been awarded the Master's Degree Semester 5 comes. This semester is entirely devoted to pilotage training, which lasts for 6 months.

4. SUMMARY

We have given an overview of a newly established pilot education system in Japan, and have described the pilot education and training program at TUMSAT.

Peculiar to this new system is the attempt to educate and train, as 3rd grade pilots, college graduates who do not have any experience as deck officers onboard merchant ships. Since the majority of pilots are eventually expected to be 3rd and higher grade pilots who have been trained under this new system, it would not be too much to say that the safety of the Japanese territorial waters and harbors rests on the quality of the pilot education and training at our institution.

Advanced theories and new research findings on navigation and maneuvering can be taught through classroom lectures while technical mastery of maneuvering is attained through the SMS training and the practical training onboard the university training ship and merchant vessels. In doing so, cooperation of our institution and active pilots is essential. Making the best use of feedback and advice offered by experienced pilots during both SMS and onboard training, we hope to provide our students with the best education and training possible where theory and practice complement each other, thus producing a number of intelligent pilots with a Master's Degree (Engineering).

Practice and Research of Maritime Education and Training aided by Engine Room Simulator based on "Eligibility Appraisal"

Huang Jia-Liang[1], *Cai Zhen-Xiong*[2], *Yang Guo-Hao*[3]

Abstract

Using computer simulation, engine room simulator (ERS) is a kind of new technology plant which is economical, safe and highly efficient to teach and train modern engineers, International Maritime Organization (IMO) has already adopted it as one of mandatory requirements, and given detail specifications of general performance standards and suggestive standards of ERS. At the same time, the maritime education and training project (MET) of IMO proposes that maritime education should be performed in real or at least simulating environment. Obviously, with the improvement of the automation of modern engine room, the comprehensive training of automatic engine room to marine engineers appears even more necessary. Designed and organized carefully, we can fully utilize the advantage of ERS. In addition, preset operating condition and fault conveniently in advance, and analyze, and solve the problem. It is useful to improve the comprehensive ability of seafarers.

Key words: Maritime education and training (MET); Engine room simulator (ERS); Marine engineering; Eligibility appraisal; Practical teaching

To train qualified crew, to meet the demands of marine transport, "the International Convention on Standards of Training, Certification and Watchkeeping for the Seafarers" (STCW Convention), issued by International Maritime Organization (IMO) was amended it several times. The 1995 amendments to the Convention entered into force in 1997, and then had been implemented in August. The standards for training in Simulators is mandatory required, the STCW 78/95 Convention provides that engine room simulator(ERS) can simulate the operation of the equipment in ships, achieve the practical level of required goals of the training, and include such equipment per-

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formance, limitations and possible errors. To meet the performance requirements on the simulator —"the controllable operating environment, the level of real physical, behavioral truth, abnormal situation of simulation", STCW 78/95 requests that engine room simulator must have adequate emulation environment, so that the trainees can receive training and can demonstrate the required target skills, which can help trainees to improve ship operation which is the capacity for rapid reaction and safe operation capability that the sailors must have.

Seaman is the subjective factor in safe navigation. Crew's competency standard, according to the generally accepted international standards listed in the STCW 78/95 Convention, is the standard or level of knowledge, comprehension, technique proficiency which required normally when carrying out the related duties on board. Ocean ship engine room simulator can emulate with modern whole container ships as mother ship, and can real-time physics emulate the entire process of marine systems and equipment as core as computer system and as base as physical processes modeling, adopting the real-time computer simulation technology, multi-media technology and automatic control technology. The simulation has the same functional operations plate and operational interface as the real ship and has similar training environment as the real ship engine room.

According to relevant requirements of simulator training and assessment in the STCW 78/95 Convention and the requirements in the "Marine Seafarers Certificate of Competency Examination, Assessment and Certification Rules" issued by the People's Republic of China promulgated Maritime Safety Authority(China MSA), the crew which apply the applications for certificates of competency, must participate in the corresponding professional training, and must pass competency assessment before participating in the appropriate theoretical examination. It may reflect the actual regarding degree for the crew's operation ability in "the Convention" and "the Rules" from this requirement.

1. The Requirements for Teaching in the "Eligibility Appraisal" Criterion

1.1. Requirements for Teaching Content

The training aim established by the marine major (undergraduate) in the "Ordinary College Undergraduate Catalog and Professional Profile" issued by the Ministry of Education(MOE, China) promulgated is —Marine Engineering: bring up the senior technical talent which has mechanical principles and engineer systems knowledge, and can be engaged in manipulation of marine engineering, ship power plant maintenance and repair supervisor and the construction work in the marine transportation and other institutions, and has third or fourth engineer of qualification in the similar ships. Meanwhile, it must cover complement requirement of training, certification and watchkeeping for the ship crew ruled by the STCW 78/95 Convention in the training objectives of marine engineering professional. The content of each assessment projects in "Eligibility Appraisal" criterion must be executed by interrelated content of "the Seafarers Examination and Evaluate Outline" issued by China MSA, which establishes specific requirements, standards and procedures for the each assessment of the project.

According to the requirements of "Eligibility Appraisal" standards, the engine room simulator teaching content is divided into three projects: (1) manipulation and management of ship main engine and control system; (2) the control and management of paralysis ship renewed power and each power system; (3) the operation and management of ship power plant. While students in each class (30 persons) are divided into A, B and C groups, each group has one and a half days to complete the training project in turn. During the training process, in the fifth day, A, B, C-group online paralysis ship starts depart from port and manipulating examination of the finished engine to put in the port.

Evidently, through the normal teaching, the guiding ideology of engine room simulator training helps the students to fully meet the "Eligibility Appraisal" norms and related contents. Meanwhile, students can understand the automation equipments of modern ship's engine room and its daily operations management, and have a popular perception for the organic links between the entire power plant equipment and control system. In order to fully meet the needs of the STCW 78/95 provisions of the convention "Suitable Assessment of the Project" and "Continuing to Demonstrate Proficiency", as well as the requirements of "Power Station Automation training" and "Automation System Training" and the corresponding of "Engine Room Simulator Training Evaluation Norms" which ordained by China MSA.

1.2. The Request of Teaching Methods and Means

The "Eligibility Appraisal" norms integrate the practice of teaching courses of some courses such as the "Marine Diesel Engine", "Ship Auxiliary", "Marine Engineer Maintenance and Repair" and "Marine Power Plant Technology Management" as the assessment projects for the "Power Equipment Disassembly and Assembly" and the "Motivation Equipment Operations"; and the practice of teaching courses of the "Ships Electrical Equipment and Systems", "Ship Power Station and Automatic Devices", etc, can combine as a project of the "Ship Power Plant Operations". They indicate the requirements, which relate to the professional marine engineering courses which integrated use of experimental capacity by the "Eligibility Appraisal".

In "Eligibility Appraisal" norms, students not only need to master the principles of equipment related engine room simulator assessment project, but also need to master the structure and get involved for the corresponding operation skillfully. Meanwhile, students should have an integrated operation, maintenance and management capabilities of equipment on ship engine room. Therefore, the new requirements for the simulator practice teaching methods and means of teaching have been put forward. That is through using modern teaching methods and fully utilizing all types of simulators to improve the theory and practical skills of the students.

1.3. THE REQUEST EQUIPMENT OF TEACHING

At the "Eligibility Appraisal" norms, the simulator for marine engineers to assess projects must meet simulation equipment operation training requirements which were in charged by the STCW 78/95 Convention and the Chinese authorities in charge of the ship electromechanical. An operational training content contains the five module systems, namely: ship power station operating systems, main propulsion power plant operating systems, ship auxiliary equipments operating systems; teachers assess evaluation system, power supply devices. Within this total, the ship power stations operating system includes diesel generators, power stations and ship load components, etc; Main propulsion system is composed of the power plant and marine diesel engine services for the mainframe's power system components; Ship auxiliary equipment operating system operated by the auxiliary boiler control, oily-water separator operational control, fuel / lube oil lightering / decontamination / separator operational control, the sewage treatment plant operational control, ballast water and fire control operation, the fresh water generator operational control components; The teacher evaluation system mainly contains the fault settings or parameters settings platform by teacher, assess performance appraisal system management platform and the self-checking function device components; The UPS offers the electric power supply to device uninterrupted.

With the rapid development of modern marine engineering technology and Internet network, a large number of engineers need to adapt the training requirements of the modern ship engine room highly automated management skills. Develop and research ocean ship offshore virtual network operation simulator training platform which based on 3D virtual reality simulation technology and powerful Internet technologies, and which has an advanced international level and reveal the true these five systems on the simulator module operation, control, status and parameters, sound and light alarm function, etc, in order to achieve practical operation visualization training. The practical operation training systems displayed can visualize practical operation training and test far way or spot via the Internet or local operating platform to implement the main propulsion power plant control system. The virtual platform offers the simulation effects of the manipulation results. By the Internet, it can rapidly and efficiently learn and intercommunicate to realize the ship electromechanical equipment operation training for students' simulating operations.

2. REFORMS AND PRACTICE OF TEACHING SYSTEM

2.1. COURSE SETTING

In order to achieve the training aims of the marine engineering undergraduate course and meet the vocation development needs, a frame round of advanced engineering education should be required to draw in the course system and embody the marine professional characteristics and the post requirements in the teaching content, optimizing and regrouping the course system in order to better formulate the teaching outline of the engine room simulator practical operation. Teaching contents mainly include the three items: the manipulation and management of the main propulsion power plants and the controlling system, the manipulation and management of the paralysis ship propulsion power and all power system, the manipulation and management of the ship power station. The chief engineer training also includes: the manipulation and management of the step by step remote control system, the manipulation and management of the shaft power generation, the manipulation and management of the engine room concentrating monitoring and the grouping extend and the alarming system, the fault analysis and eliminating of the main engine and diesel generator and the main switchboard and so on.

In addition to the practice operation of the engine room simulator, the foremost importance needs the students understanding and digesting. Teaching practice demonstrates that the training time of the engine room simulator better include to the simulator laboratory after the students studying the professional courses and finishing the training of the "Marine Engineering Automation Engine Room".

2.2. TEACHING MODE

Course teaching is the fundamental way to the aim. In the teaching process sufficiently exerting the students' main function and the teachers' leading function, as well as the engine room simulator's function, giving the students more independent operational opportunities to simulate the ship operation, raising the student's interest in learning at the same time improving the student's integration ability and diathesis of analyzing and solving the problems.

Marine engineering students have more opportunities to the international shipping market and more market demand. In order to enhance the marine engineering students' international competition, the engine room simulator training courses gradually boost bilinguals(i.e. English-Chinese)teaching, the aim not only provides a real engine room operation environment but also enhances the teaching effect of the professional English.

2.3. The Supervision of Teaching Quality

According to the requirements of the STCW 78/95 Convention and the marine education teaching outline established by the ministry of communications(MOC, China) and the practical operation evaluating outline issued by China MSA, authorizing the integrated engine room simulator practical operation instructor, establishing the integrated teaching management system documents, including the experiment teaching plan, the experiment teaching task book, using register of the large-scale teaching laboratory equipment, the laboratory log, the graded standards of the experiment practical operation and so on.

Assure that the whole process of the practice teaching is under the control, a scientific and canonical system needs to be established to evaluate the practice teaching quality. Formulating the strict teaching plan to each of the practice teaching step and reasonably arranging every practical operation, establishing the process inspection and the results examination. Strengthening the examination means and consummating the examination procedures and bringing the students practice teaching into the normal achievement management in order to enhance the students understanding of the practice teaching significance and continuously improve the teaching quality of the engine room simulator practical operation.

We should build and use a dynamic students competence appraisal system to accurately appraise students' competence, fully develop the competence of human resource, improve productivity and provide a new appreciation chance for the development of enterprise so as to fully use and utilize students' labor resource, and make students management more scientific, standard and modernized.

3. Conclusions

It is essential to accelerate the growth of seafaring personnel to satisfy the need of the high automation of Engine Room and none-lifetime employment of seamen, thus, all kinds of modern training means emerge. Engine room simulator is one of them. The newly incremental contents of the STCW 78/95 Convention are to stimulate the studying motivation which different levels, functions and subjects are required to achieve. That is to say, trainees should demonstrate competence before holding a post on board. The eligibility can be developed by means of approved ERS training as appropriated.

In a word, to achieve the request of the engine room simulator teaching mode and teaching content based on "Eligibility Appraisal" criterion, the key is establishing the cultivating mode adapting to the knowledge economy times, the marine profession training pay attention to incarnation of the international currency and the position pertinence and the law regulations, strengthening in training the marine students' patriotism, management capacity, foreign language proficiency, emergency ability and practical operation capability. Through the engine room simulator practical teaching and integrated training about evaluating items based on "Eligibility Appraisal" criterion, improving the students' ability of the fault analyzing and eliminating, and the students' ability of the modern ships' marine engineering management.

REFERENCES

1. IMO, United Nations. International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended in 1995. [S]. Beijing: China science and technology publishing company, 1997
2. Maritime Safety Authorities, the People's Republic of China (China MSA). Training, Examination and Certification for the Chinese seafarers. [M]. Dalian: Dalian maritime university publishing company, 2006.6

Role And Situating of Practical Training of Deck Students on Training Ships in Practice of Gdynia Maritime University

Bogumil Laczynski[1]

Abstract

According to STCW Convention requirements and Polish Maritime Administration regulations seatime necessary to obtain watch officer license should be minimum 12 months. Gdynia Maritime University within 5 years of study on Navigation Department arranging in summary 4,5 months of sea practice on board 2 training ships "Dar Mlodziezy" and "Horyzont II". Detailed programs of period of board training will be shown with connection with whole education period of study in Gdynia Maritime University. System of assessments of individual students practiceship called: "OS / AB training", "Radar training", "Shiphandling training" as well as contain of Record Book of outstanding period of 7,5 months of training on merchant fleet vessels will be shown in paper. Actual system of education in Poland and Gdynia Maritime University and necessary changes of system due to Bologna Agreement requirements will be presented.

Introduction

Over the generations, the education of professional officers has undergone many evolutions. Today's maritime universities, academies and faculties using advances methods of teaching, modern simulators and other sophisticated equipment have to not forget that practical training play invaluable role in officers education. Training ships and on-board practice give students and cadets an opportunity to practice their skills under control of experienced teacher and seafarers.

On AGA-7 of IAMU in Dalian last year was established a new International Working Group named "On-board training" what confirmed importance of training ships in modern seafarers education.

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My papers and presentation is my contribution to that initiative and I believe it gives a chance to exchange of experience between IAMU Members.

Plan of presentation:

1. Short presentation of Gdynia Maritime University
2. Actual structure of education on Faculty of Navigation
3. Contents of on-board training
4. Expected changes in field of on-board training in future
5. Conclusions

Short Presentation of Gdynia Maritime University

The oldest Polish Maritime School was established in 1920 just after receiving of Independence after over hundred years of occupation of Russia and Germany. From 1920 till 1930 our Maritime School was located in small town Tczew on Vistula River, 50 km SE of Gdansk / Gdynia. Polish government bought in 1921 first training vessel "Lvov" (ex "Nest" build in Birkenhead in England in 1868) for the price of 247.000 USD.

In 1930 training vessel "Lvov" was replaced by "Dar Pomorza" (build in 1909 in Hamburg, bought for money collected by people from northern part of Poland – Pomorze). This is why the name in Polish means "Gift of Pomeranian".

In the same year 1930 State Maritime School was removed to special new building campus in Gdynia where we are placed up to these days. In period 1939 – 1945 our State Maritime School was removed to Great Britain (near Southampton) and after II World War in autumn 1945 the School returned to Gdynia and till 1968 was acting as post – secondary technical education college. Our training vessel "Dar Pomorza" was relocated in 1945 from Sweden where was interned during the II World War.

From 1968 school received an position of Higher Education School and name Gdynia Maritime Academy. From 5th of December 2001 Academy was restructuring into Gdynia Maritime University according to Parliamentary Act.

The history of University all the time is strictly connected with training vessels "Dar Pomorza" (actual floating museum) and replaced her in 1982 "Dar Młodzieży" ("Gift of Youth") [Fig.1 and 2].

From 50thies parallel to tall ships Gdynia Maritime University owned few non-sailing training vessels [Fig.3]. The newest one "Horyzont II" is in operation from 2000 [Fig.4 and 5].

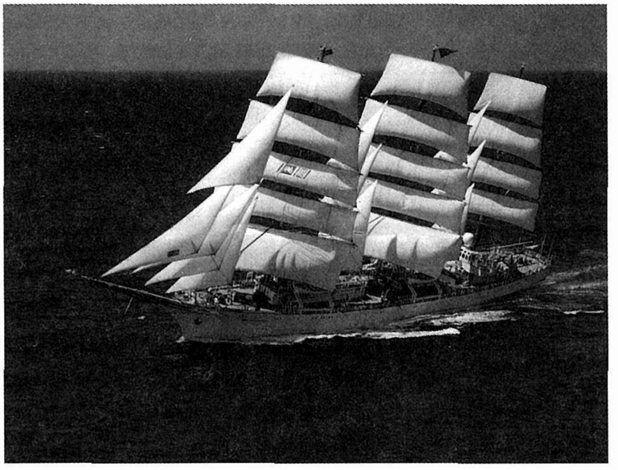

Figure 1. Sailing training ship of Gdynia Maritime University — "Dar Mlodziezy"

Owner	Gdynia Maritime University Home port Gdynia, Poland
Call sign	SQLZ
Class of ship	KM1F
Length overall	108.815 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
Empty ship weight	2086.2 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
Speed under the sails	The fastest day's run: 264,7 Nm - means 11.29 knots The fastest watch's run: 56.1 Nm - means 14.2 knots; temporary speed 16.5 knots
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 plus up to 4 teachers Trainees 120
Fresh water	347 t
Engine fuel (gas oil)	219 t

Figure 2. Details of sailing training ship – "Dar Młodzieży"

Name of the ship	Years of operations	L [m] B [m] D [m]	HP [kw] V [kn]	Comments Cadets capacity
"Turlejski"	1954 – 1985	59,23 9,05 5,70	1100,00 10,00	Ex – fishing trawler 34 cadets
"Horyzont"	1963 – 1999	33,00 6,70 3,40	428,00 10,50	Ex – fishing trawler 26 cadets each
"Zenit"	1965 – 1999			
"A. Garnuszewski"	1974 – 1989	121,90 17,03 7,80	5500,00 12,00	Build for training purposes 120 cadets
"Horyzont II"	2000 –	56,34 11,35 5,33	1280,00 12,00	Build for training purposes 43 cadets

Figure 3. Non-sailing training vessels of Gdynia Maritime University

Figure 4. Research training ship of Gdynia Maritime University – "Horyzont II"

Owner	Gdynia Maritime University Home port Gdynia, Poland
Class of ship	KM Research / Training Ship [1] L2 AUT
Length overall	56.34 m
Beam	11.36 m
Height to the upper deck	6.29 m
Height of the mast from the water line	21,75 m
Draft	3.90 m; 5.33 m including the keel
Total tonnage	1321
Net tonnage	396
Deadweight Tonnage	288
Main Engine	Type 8 S 20 UD-H.Cegielski – Szuler Power 1280 kW Nominal rotational speed: 1000 rpm
Main Generator	Type: D 2840 LE-DEMP/MA – 3 units Output: 301 kW (each one) – 376 kVA
Auxiliary Generator	Type: D 2866 TE-DEMP/MAN – 1 unit Output: 158 kW
Adjustable Pitch Propeller:	CP 65 WARTSILA, D = 2.1 m
Thrusters	Type: STT 10 LK Schottel Output: 125 kW
Speed	12 knots
Number of persons	57 (including 16 permanent crew members)
Fresh water	60 t
Engine fuel (gas oil)	265,6 t

Figure 5. Details of research training ship – "Horyzont II"

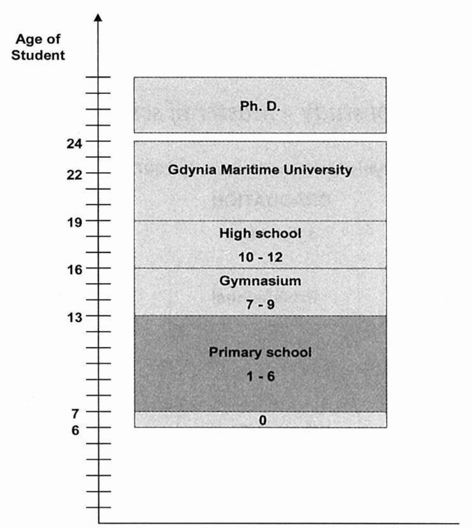

Figure 6. Actual education structure in Poland

NAVIGATION FACULTY

PLAN OF STUDY
DEPARTMENT: **SEA TRANSPORT**

GDYNIA MARITIME ACADEMY
MASTER OF SCIENCE DEGREE

Nº	SUBJECT	SUM	HOURS – AT ACADEMY L	AT ACADEMY E	AT ACADEMY Lab	ON BOARD TRAINING AND STATIONARY COURSES "0"	YEAR I	YEAR II	YEAR III	YEAR IV	YEAR V
	ENGLISH LANGUAGE	414	-	414	-						
2	PHYSICAL TRAINING	174	-	174	-						
3	ECONOMICS	48	32	16	-						
4	PERSONEL MANAGEMENT, ORGANIZATION AND TRAINING	36	18	18	-						
5	HUMANITIES	40	20	20	-						
6	SEA TRANSPORT ECONOMICS	64	32	-	32						
7	MATHEMATICS	256	128	128	-						
8	PHYSICS	96	48	48	48						
9	CHEMISTRY	64	32	-	32						
10	INFORMATICS	96	32	-	64						
11	ELEMENTS OF ELECTRONICS	48	32	-	16						
12	ELEMENTS OF AUTOMATIZATION	64	32	-	32						
13	ELEMENTS OF MACHINERY CONSTRUCTION	48	16	16	16						
14	SHIP'S ELECTROTECHNICS	48	16	-	32						
15	NAVIGATION	439	160	-	214		20	30		15	
16	CELESTIAL - NAVIGATION	145	50	-	50			30		15	
17	COLREG & WATCHKEEPING	120	58	-	42		5			15	
18	ELECTRONIC NAVIGATIONAL AIDS	333	132	-	156			30		15	
19	METEOROLOGY AND OCEANOGRAPHY	159	73	-	41		5	25		15	
20	SHIP'S CONSTRUCTION & STABILITY	271	126	-	110			20		15	
21	CARGO HANDLING AND STOWAGE	169	98	-	56					15	
22	SHIP'S MANAGEMENT	101	48	-	38					15	
23	MARITIME LAW	108	108	-	-						
24	SHIP MANOEUVRING AND HANDLING	156	52	-	46						58
25	LIVE SAVING, SEARCH AND RESCUE	58	16	-	42	20 ITR		30			
26	COMMUNICATION	148	68	-	80						
27	SHIP POWER PLANTS	32	32	-	-						
28	POLLUTION PREVENTION OF THE MARINE ENVIRONMENT	32	32	-	-						
29	LABOUR LEGISLATION	32	16	-	-	16					
30	SEAMANSHIP	94	37	-	21	16	20				
31	DIPLOMA SEMINAR	36	-	14	22						
32	MEDICAL TRAINING	33	-	-	-	12					21
33	FIRE PREVENTION AND FIREFIGHTING TRAINING	54	-	-	-	18					36
	TOTAL	4514	1544	848	1190	82	50	165	-	120	115
			3582			532					

TIME - TABLE OF STUDY — NUMBER OF HOURS IN THE WEEK

Nº	SUBJECT	SEMESTER I 16 WEEKS			SEMESTER II 16 WEEKS			SEMESTER III 16 WEEKS			SEMESTER IV 9 WEEKS				SEMESTER V 16 WEEKS			SEMESTER VI 14 + 2 WEEKS			SEMESTER VII & VIII WEEKS 5	5	SEMESTER IX 12+4 WEEKS			SEMESTER X 10 WEEKS		
		L	E	Lab	L	E	Lab	L	E	Lab	L	E	Lab	Lab	L	E	Lab	L	E	Lab	Lab	Lab	L	E	Lab	L	E	Lab
	ENGLISH LANGUAGE		4			4			4			4				4			4					3			3	
2	PHYSICAL TRAINING		2			2			2			2				2			2									
3	ECONOMICS	2	1																									
4	PERSONEL MANAGEMENT, ORGANIZATION AND TRAINING										2	2																
5	HUMANITIES																									2	2	
6	SEA TRANSPORT ECONOMICS														2	-	2											
7	MATHEMATICS	4	4		2	2		2	2																			
8	PHYSICS	1	-	2	2	-	1																					
9	CHEMISTRY	1	-	1	1	-	1																					
10	INFORMATICS				2	-	2			2																		
11	ELEMENTS OF ELECTRONICS				2	-	1																					
12	ELEMENTS OF AUTOMATIZATION														2	-	2											
13	ELEMENTS OF MACHINERY CONSTRUCTION				1	1	1																					
14	SHIP'S ELECTROTECHNICS	1	-	2																								
15	NAVIGATION	1	-	1	1	-	2	1	-	2	2	-	2	30	2	-	2	2	-	2	1	2	2	-	3	1	-	2
16	CELESTIAL - NAVIGATION							2	-	2	2	-	2	30							1	2						
17	COLREG & WATCHKEEPING	1	-	1											2	-	1				1	2				1	-	1
18	ELECTRONIC NAVIGATIONAL AIDS				1	-	1	3	-	2	2	-	2	30				2	-	1	1	2	1	-	3	1	-	4
19	METEOROLOGY AND OCEANOGRAPHY				2	-	1	2	-	1	1	-	1	25							1	2						
20	SHIP'S CONSTRUCTION & STABILITY							2	-	2	2	-	2	20	3	-	2	2	-	2	1	2						
21	CARGO HANDLING AND STOWAGE														2	-	1	3	-	2	1	2	2	-	1			
22	SHIP'S MANAGEMENT																	2	-	2	1	2				2	-	1
23	MARITIME LAW														2			2					4					
24	SHIP MANOEUVRING AND HANDLING																	2	-	1			2	-	1			2
25	LIVE SAVING, SEARCH AND RESCUE														1	-	2											1
26	COMMUNICATION	1	-	1														2	-	2			2	-	3			
27	SHIP POWER PLANTS							2																				
28	POLLUTION PREVENTION OF THE MARINE ENVIRONMENT														2	-	-											
29	LABOUR LEGISLATION	1	-	-																								
30	SEAMANSHIP	1	-	-							1	-	1										1	-	1			
31	DIPLOMA SEMINAR																		1						1			1
32	MEDICAL TRAINING																											
33	FIRE PREVENTION AND FIREFIGHTING TRAINING																											
	TOTAL	14	11	8	14	9	10	14	8	11	12	8	10	135	18	6	12	17	7	12	8	16	14	3	13	7	5	12
	Nº OF HOURS IN THE WEEK	33			33			33			30				36			36					30			24		
	Nº OF EXAMS	2			4			3			3 + MT				4			3					5			3		
	Nº OF CREDITS	10			7			7			6				7			8					4			6		

Nº	OTHER OBLIGATORY TRAINING	SUM	SEMESTER I	SEMESTER II	SEMESTER III	SEMESTER IV
1	MILITARY TRAINING	400	X	X	X	X

Figure 7. Plan of study – Master of science Sea transport

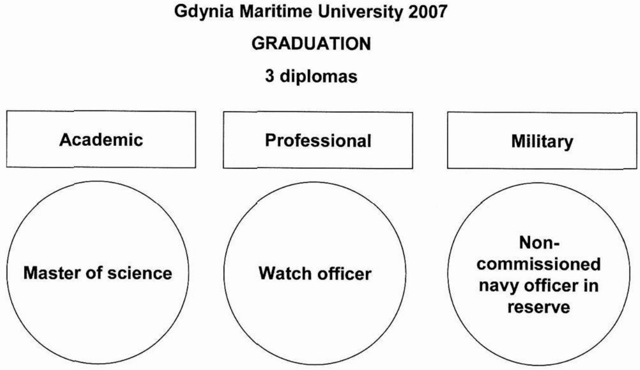

Figure 8. Certificates of graduated deck students of Master of Science course.

The students of our University also undergo apprenticeship on board merchant's vessels in order to require professional qualifications necessary to perform their prospective officer function. On 01 September 2007 there are 4 faculties, 20 specialties and total number of 7500 students.

ACTUAL STRUCTURE OF EDUCATION IN POLAND

From beginning of 90thies after democratic changes in Poland a new national system of education was established based on European standards and Polish educational traditions which replace soviet system throw on in Poland. Actual structure of education in Poland and position of Gdynia Maritime University in whole system is presented in figure 6. All candidates should pass final exams in high schools and results of above presented in percentage on official personal certificate are the base of qualification to any of University / faculty.

Gdynia Maritime University keeps a limit of 150 places for initial year of education on navigational faculty. About 150 cadets on 1st semester only apr.100 students graduated. All hours of study are distributed at it shown on picture [Fig.7].

All graduated navigator receive 3 diplomas [Fig.8]:

- **Master of Sciences** after completing all topics and preparing special diploma work which subject is individually known for every student in VI semester. Full period of study – 5 years,10 semesters. First group of subject (1-14) is minimum required by Polish Ministry of Higher Education for Master of Science course. Second group all subject (15-33) should be compare with STCW Convention requirements.
- **Non-commissioned navy officer in reserve**. Military training contains 400 hours, practically one day a week in 4 first semesters.
- **Watch officer license.**

ON BOARD TRAINING PERIOD

According to minimal STCW requirements all cadets of faculty of navigation should spend 12 months on-board training and merchant fleet vessels. Existed in the past Polish standard model of education required 18 months of sea period was received lowest officer license. Due to lower STCW requirement Polish Maritime Administration minimized obligatory period of sea practice in 1990 to give Polish cadets equal chances on international labor market. Maritime Administration very strictly checked every day of sea practice confirmed in student seamen book.

Ambition of GMU is to guarantee required sea period during 5 years of study.

ELEMENTARY AND SPECIALISTIC COURSES					ON BOARD TRAINING					
Nº	NAME OF THE COURSE	Nº OF HOURS	YEAR	REMARKS	Nº	YEAR	DURATION	PLACE	TYPE of PRACTICE
1	PERSONAL SURVIVAL TECHNIQUES	32	0		1	0	0.5 month	TRAINING VESSEL/"DAR MŁODZIEŻY"	RATING
2	ELEMENTARY FIRST AID	12	0	included in MEDICAL TRAINING	2	I	1 month	TRAINING VESSEL/"DAR MŁODZIEŻY"	RATING
3	FIRE PREVENTION AND FIRE FIGHTING	18	0	included in FIRE PREVENTION AND FIRE FIGHTING TRAINING	3	II	2 month	"DAR MŁODZIEŻY"	NAVIGATION
4	PERSONAL SAFETY AND SOCIAL RESPONSIBILITES	23	0		4	III	0.5 month	TRAINING VESSEL	RADAR - NAVIGATION
5	PROFICIENCY IN SURVIVAL CRAFT AND RESCUE BOATS OTHER THAN FAST RESCUE BOATS	30	II		5	IV	7.5 month	MERCHANT SHIP'S	SHIP'S OPERATING
6	GMDSS	116	III i V	included in COMMUNICATION	6	V	0.5 month	TRAINING VESSEL	MANOEUVRING
7	RADAR OBSERVER	126	III i V	included in ELECTRONIC NAVIGATIONAL AIDS	7				
8	ARPA	50	V	included in ELECTRONIC NAVIGATIONAL AIDS	8				
9	MEDICAL FIRST AID	21	V	included in MEDICAL TRAINING	9				
10	ADVANCED FIRE FIGHTING	36	V	included in FIRE PREVENTION AND FIRE FIGHTING TRAINING	10				
					TOTAL		12 MONTHS		

Figure 9. Plan of on-board training and curses during study.

Practically every student after completing of 10th semester is able to present to Maritime Administration Office 12 months of on-board training and practically can start with officer carrier after University's graduation. University offered 4,5 month on training ships and minimum 7,5 month on merchant fleet vessels. [Fig. 9]

Few years ago Faculty of Navigation had to cancel first period of on-board training – 2 weeks just before starting of first semester. In this period cadets completing 4 obligatory courses staying in campus without embarking on one of training vessel. During first and second semester what is the most difficult for new cadets about 20-30% have problem to pass academic basic subjects (mathematics, physics and chemistry). Natural academic selection eliminate dozens of cadets and cost of initial on-board training, seamen books, required courses etc. were decreasing rapidly. [Fig. 10]

First on-board training about 1 month is in summer after completing 2 first semesters.

Second period of on-board training is placed after IV semester of study. Long 2 month voyage after completing most of academic and professional subject with assist of few professors there is practical confirmation of knowledge of seafarers.

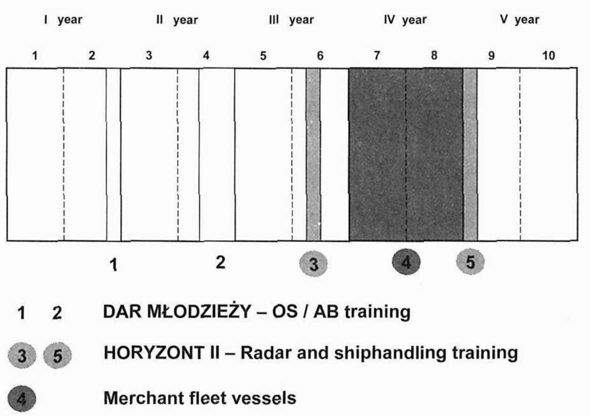

Figure 10. Schedule of on-board practices during studies

Third period of on-board training there is 2 weeks training on board training ship "Horyzont II". This is professional radar/bridge practice. Student of navigational faculty are able after 2,5 month of training to receive O/S (ordinary seaman) license in Maritime Administration Office. What give them advantage to find cadet position on merchant fleet vessels with obligations and salary of O/S. Many shipowners have no cadets positions on Minimal Safe Manning Document and O/S position help to locate cadets on board.

Forth period of training beginning in June and finish in October next year – there is practically 15 consecutive months. This is period for boarding for one/two or sometimes 3 different ship to cumulate total period up to 8-8 months (student study calculate all written in seamen books periods/days to be sure that in summary is minimum 11,5 months knowing that on 5 year of education University training guarantee one more

5. MANOEUVRABILITY ON-BOARD TRAINING

Period of on-board training:	**semester IX**
The place of on-board training:	**training vessel Horyzont II**
Duration of on-board training:	**2 weeks**

A. General program – 112 hours (14 days × 8 hours)

1. Complex watchkeeping and port watchkeeping as it is described in 'On Board Training Record Book For Deck Cadets' under supervision of watch officers.

The subject of exercise

	Manoeuvring – (58 hours)
1.	**Individual manoeuvring:** Preparing a vessel to manoeuvring.
2.	Familiarising and checking ship's manoeuvring information.
3.	Reporting to Port Captain, VTS station, etc.
4.	Berthing and mooring.
5.	Unmooring and unberhing.
6.	Leadership in manoeuvring on fore and aft.
	Assisting in exercise – 54 hours.
1.	**Individual watchkeeping procedures.** Watchkeeping / Preparation to watch / Take over the watch.
2.	Leading the vessel in trajectory using every available navigational equipment.
3.	Approaching to anchorage.
4.	Dropping the anchor and heave up the anchor.
5.	Change the watches.

1. Mooring and unoomring proceed during the daytime. Exercises are lead by each trainee in turn after checking manoeuvring theory. Trainees are obligated to use English commands during the manoeuvring.
2. Trainees drop anchors and heave up by themselves under the supervision of watch officers.

Figure 11. Example of general program of fifth on-board training

fifth on board period called "maneuvering training" in 2 weeks periods in groups of 43 cadets (max. capacity of training ship "Horyzont") [Fig. 11].

Everyone from 5 periods of on-board training has special program as well as training record book (for merchant fleet vessels). On Board Training Record Book includes sea training tasks for deck cadets. During this training cadets gains professional skills and experience necessary in the work as a watchkeeping officer. On board training skills gained according to the program included in the Training Record Book fulfill the minimum requirements for certification as an officer on charge of navigational watch. During sea training the cadets learns to combine theoretical knowledge form Maritime University and practice. It allows the future watchkeeping officer to learn the job in modern and automated seagoing ships. Sea training properly integrated with theoretical education is necessary for an officer of a contemporary ship. Practical training should be compared under supervision of the master, chief officer and designated supervising officers. Properly filled Training Record Book is evidence that the trainee has achieved professional skills and experience required in the standards of competence according to the Code A of Convention STCW 78/95. That is why the Training Record Book should be precisely filled up. The Training Record Book will be submitted to the Polish Maritime Administration, where the trainee applies for the watchkeeping officer's certificate [Fig 12].

Additionally Gdynia Maritime University required 8 sets of additional records exactly checked by selected professors of professional subject:

- Navigation
- Celestial and Satellite Navigation

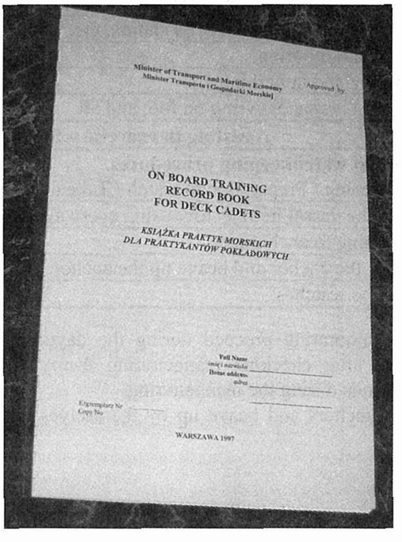

Figure 12. On board training record book

- Colreg
- Meteorology
- Bridge / deck equipment
- Ship construction and stability
- Cargo handling
- Shipmanagement

Student received marks as a acceptance and confirmation of passing required topics, subject, reported from every type of vessels. Before on-board period professor informed student and gave written instructions about contents of report and their expectation.

Expected Changes in Gdynia on-Board Training System

We all in Gdynia Maritime University are very satisfy with actual existing system of on-board training 4 month on training ship and 8 month on merchant fleet. Polish Maritime Administration understands above as optimal standards also in 2010.

Unfortunately due to Bologna Agreement which makes obligatory of 3 phases of higher education Gdynia Maritime University is pressed by Ministry of Higher Education to change actual 5 years Master of Science course for 2 steps: 3,5 years Bachelor of Science and 1,5 years Master of Science course. The 3rd remain course doctor of science course [Fig. 13].

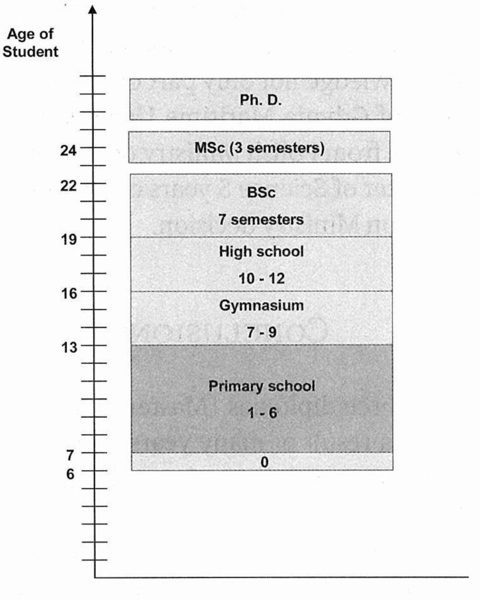

Figure 13. Education structure after implementation of Bologna Agreement.

The new prepared detailed program of first step unfortunately gives no chance to cumulate all necessary knowledge on in future officer on management level and obligatory 12 months on sea practice what is realized in actual Master of Science 5 years schools [Fig. 14]

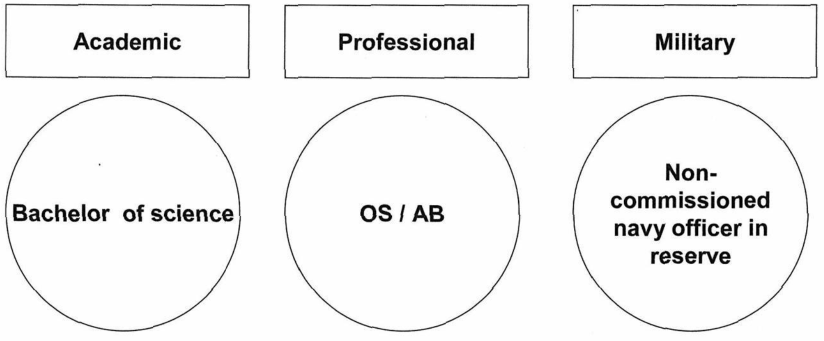

Figure 14 . Certificates of graduated deck students of Bachelor of Science course after implementation of Bologna Agreement.

Young officers graduated as 'final product" of Gdynia Maritime University should have full knowledge of navigation, shipbuilding, ship stability and other subjects. It is not realistic to divide above subjects in two separate courses for Bachelor of Science (7 semesters) and Master of Science (3 semesters). Proposition of finish the first course on operational level only and the second course on management level is completely not realistic in maritime sector. Nobody agree in Europe and Poland to divide for example medical studies for two different courses. Graduated doctor of medicine should have professional completely knowledge not only part of them.

President and all staff of Gdynia Maritime University are still permanently and desperately acting to receive from Polish Ministry of Higher Education acceptation for keeping one integrated Master of Science 5 years course, but as a State budget University we are fully contingent on Ministry decision.

Conclusions

1. Existing system of three diplomas (Master of Science, Watch officer, non-...) and 5 years study period is a result of many years of experience of Gdynia Maritime University teachers as well as practiced captains and ship owners.
2. Distribution of time on-board training and rest of study is optimal [Fig. 15].
3. Existing system allowed young officers developed professional carrier without 1,5 year brake for the second stage of academic education. This period of Master of Science study cuts the links with employer and regress practical skills.

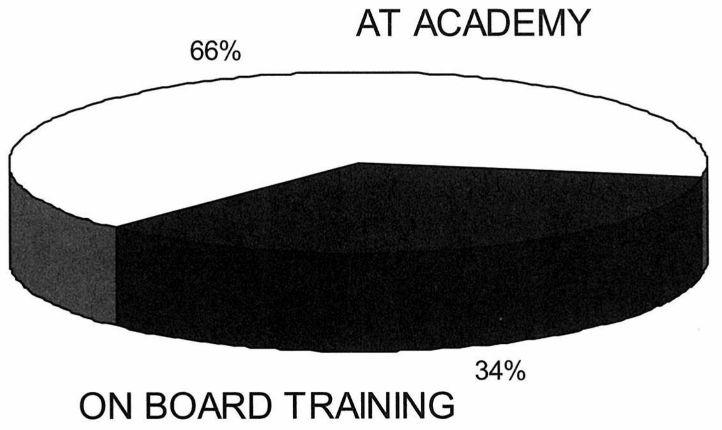

Figure 15. Distribution of on-board and at academy periods in weeks on Master of Science course on Deck department

4. Graduated officer form Gdynia Maritime University has a privilege to not participate in course preparing for Chief Officer examine in Polish Maritime Administration. Other officers without academic background have to take part in 15 weeks Chief officer special course.

Safety Culture, the Cure for Human Error: A Critique

Ehab Etman & Ashraf Halawa[1]

Abstract

Since the initial adoption of maritime safety standards, the focus was always on the ship's design and equipment; nevertheless, many studies have revealed later that human factor and human error are the main reasons contributing to marine accidents.

By the mid 1980's the International Maritime Organization (IMO) gave attention to the role of human factor in the maritime accidents. IMO have adopted the concept of implanting the safety culture in shipping industry.

The most significant instruments which were introduced to create safety culture are the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW 78/95) convention and the International Safety Management (ISM) code.

After five years of implementing the two instruments, important questions which raise themselves now are: have ISM Code and STCW convention achieved their initial objectives related to the improvement of human performance in ship operations. Moreover, is safety culture rooted in the shipping industry?

Keywords: Maritime safety, human factor, human error, marine accidents, safety culture, ISM Code, STCW convention, human performance.

1. Introduction

The Sinking of SS 'Titanic' on 1912 was the initial incentive for the international maritime community to set up safety standards in order to reduce accidents at sea, and that resulted in the adoption of SOLAS convention and later led to the establishment of IMO.

Initially, the main focus was on enhancing the technology of ship design and operation, as well as introducing regulatory system on international basis to ensure safety

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at sea and preservation of the marine environment, over and above, the adherence of ships crew and operators to such regulations.

However, there was a lake of attention to the human/system interface, the so called human factor, and the role of the human in maritime accidents. Factors such as sophistication of modern ships, multinational crew, the lack of proper competency, education and training system and many other resulted in the increase of the number of maritime accidents as a result of human errors, which has established the need for improving the performance of human element, by studying the causes of human error and how to overcome it.

Salvendy (1997) has defined Human factor as a discipline regarding human abilities and limitations in relation to the design of systems, organizations, tools etc. Important parameters are safety, efficiency and comfort.

Human error is defined as a result of observable behavior originated from psychological processes on different levels such as, perception, attention, memory, thinking, problem solving, decision making, evaluated against some performance standards, initiated by an event in a situation where it was possible to act in another way considered to be right (Senders & Moray , 1991).

2. THE FACTORS EFFECTS THE ROLE OF HUMAN IN SHIPPING

The human role is vital in the shipping industry; ships require well trained and motivated crew in order to operate safely and efficiently. Recognizing that most of the accidents are preventable and normally occur following unsafe action or failure to correct procedure, seafarers need to be provided with the appropriate tools and be properly trained to perform their duties safely and efficiently. In other words the quality of output mainly depends on the quality of input.

According to Squire (2006), the personal output of the seafarer is dependent of seven needs:

2.1. Competence: the seafarer's level of competence will depend not only on good and effective education and training and realistic competencies, it also on the ability to absorb knowledge and to understand the subject and his own skill and proficiency.

2.2. Attitude: the seafarer's attitude towards education and training will be given by his mental ability, intelligence, personality, character and sensitivity. Self-awareness and self-evaluation are the key drivers.

2.3. Motivation: motivation is driven by good communication, direction, teamwork, empowerment and character building in order to provide the seafarer with a sense of leadership, interoperability and adaptability.

2.4. Happy and healthy life style: a happy and healthy life style through the encouragement of a balanced diet, good hygiene, exercise, rest and recreation, together with acceptable standard of habitability and regular medical screening, including drug and alcohol testing, will ensure that the seafarer has the energy, physical fitness, physical strength, stamina and a sense of wellbeing to enable him to do the job.

2.5. Safe and secure working environment: good ergonomics, safe working practice, the provision of protective equipments, together with the proper physical security will lead to an improved safety culture and greater security awareness.

2.6. Self-actualization: personal ethics, conscience, cultural integration and leadership, together with proper supervision and adequate remuneration can generate a sense of pride and purpose, identity, conviction, trust, expectation, realization, belonging, loyalty, esteem, fellowship and personal security.

2.7. Moral values: Moral values are equally important; an awareness of the various religious beliefs, together with one's personal faith and self-discipline are drivers towards cultural awareness.

It's the role of maritime administrations to ensure that many of the above mentioned needs are satisfied, such as the establishment of good maritime education and training (MET) system, living conditions onboard, the working environment, working and rest hours, and most of all, verifying that the ship is complying with all the national and international regulations related to safety, environmental protection and seafarer's rights.

On the other hand, ships-owners are responsible for providing safe and secure working condition, decent working and living conditions, and reasonable terms of employment among other needs. Subsequently, it's the duty of seafarers themselves to use all the available tools to satisfy their needs.

3. The Role of Human Factor in Maritime Accidents

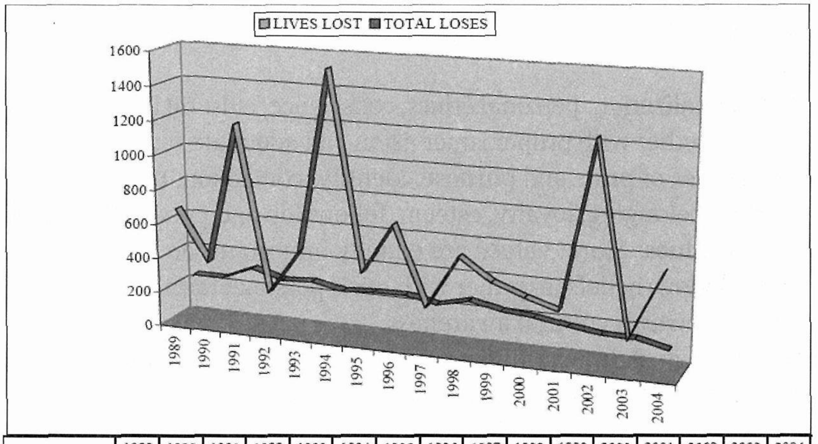
Accidents are unplanned and unintentional events that result in harm or loss to personnel, property, production, or nearly anything that has some value. Consequently, these losses increase the operating costs.

The IMO's Code for Investigation of Marine Casualties and Incidents defines marine accidents as, an occurrence or event being caused by, or in connection with, the operation of a ship by which the ship or any person is imperiled, or as a result of which serious damage to the ship or structure or the environment might be caused.

Talley (2002) has classified the main causes for maritime accidents as follow:

3.1. Flag of convenience

3.2. Doubts about the vessel safety enforcement performance of classification societies
3.3. Shirking crew size
3.4. Vessel maintenance
3.5. The aging of world fleet of dry cargo vessels
3.6. Insufficient fire protection and instability of ferry vessels
3.7. Human factor



	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
LIVES LOST	688	389	1204	246	504	1552	419	710	257	566	439	373	317	1274	197	589
TOTAL LOSES	244	244	321	266	278	240	254	257	219	263	220	206	173	148	144	101

Figure (1): Statistics on total loses of ships of 100 GT and above and losses of lives as a consequence to the total losses
(source: IMO causality statistics and investigations, very serious and serious casualties for the year 2003)

It seems to be common knowledge that a majority of accidents are actually caused by human factors or human error. Recently, an analysis of 187 instances of groundings and collisions carried out by IMO's Sub- Committee on Flag State Implementation (FSI) indicates that in 150 cases 80 per cent the human element was a contributory factor (E.Mitropoulos, 2006); the analysis indicates also that there are fewer accidents are caused by technical failure.

According to O'Neil (2000), the shipping industry cannot go on this way, with over 1000 deaths from accidents among seafarers every year. The authors believe that perhaps the causes of 100 percent of marine accidents are related to the influence human factor, taking into considerations the human factor aspects also from other parties than the seafarers.

Nevertheless, when considering maritime safety it is necessary to address both the human element and the technical solutions, taking into consideration that human error may be due to an error in the equipment design, ship design, the lack of proper maintenance on board or the way the ship's management is operating. Many aspects of ship design that have a direct impact on human performance, such as ship motions, accessibility, lighting and noise levels and basic habitability.

According to UK P&I club, human error costs the maritime industry $541 million a year. From their own analysis of 6091 major claims (over $100,000) spanning a period of 15 years, the Club has established that these claims have cost their members $2.6 billions, 62% of which is attributable to human error.

A number of studies were conducted in the recent years in order to study the role of human factor in marine accidents, in particular, why people do mistakes? Of course not all authors and researches agreed on every cause, but there was a great deal of harmony on the results of why people do mistakes in the maritime industry.

The UK P&I club stress that latent failures frequently stem from decisions higher up and such failures can be hidden in one or more of 11 categories: Procedures, Hardware, Design, Maintenance Management, Error Enforcing Conditions, Housekeeping, and Incompatible goals, Communication, Organization, Training and Defenses.

Probably, there are many lessons to be learned from the experience of other industries, to prevent the marine industry learning the same lessons the hard way. Most of analysis of human error has been aimed at improving understanding, and its remedial value has not been fully exploited.

The American Bureau of Shipping (ABS) acquired 150 accident reports from the web site of the Australian Transportation Safety Bureau (ATSB), attempting to codify the causal factors of each accident. Based on that review figure (2) presents the database over the period 1992 to 2001, which suggests that human error was primarily responsible for approximately 85% of maritime accidents.

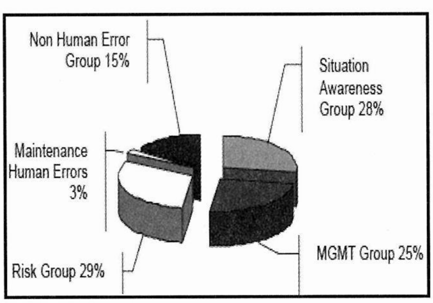


Figure (2): Accident Causation by Qualitative Groupings for ATSB Data (Source: ABS Review and analysis of accidents Databases: 1991–2002 Data)

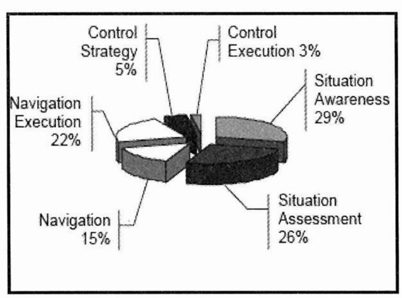


Figure (3): Top-Level breakdown of near root causes for human error induced accidents (Source: ABS Review and analysis of accidents Databases: 1991–2002 Data)

Figure (3) presents accident data for accidents and incidents cited as being primarily caused by human error. Shown in the figure is the top-level breakdown of near root causes for the human error category. The figure shows that the situation awareness and situation assessment are the primary area of human error, with over 50% of human errors falling into this category.

Numerous other causes of marine accidents were identified and categorized into human, environmental, including job, task, equipment, organization and management. The common human causes of accidents include: stress, isolation, fatigue, carelessness, operator error, calculated risk, improper loading, lack of training, cultural differences, lack of communication, lack of motivation, error in judgement, lack of knowledge and physical impairment.

4. The human factor in the work of IMO

By the mid-1980s, the international maritime community became anxious about the number of major maritime accidents continued to occur despite the IMO's stringent technical standards. Studies revealed that the human element was present in a vast majority of maritime casualties. Accordingly, IMO gave attention to the human element of daily ship operation and ship management.

In 1991, Maritime Safety Committee (MSC) / Marine Environment Protection Committee (MEPC) working group was established on the role of the human element in maritime casualties and since then several Assembly resolutions have present "the human element vision, principles and goals for the Organization" (resolution A.850 (20) updated by A.947 (23)) and requested the IMO Committees to focus their attention on "shifting emphasis onto people" (A.900 (21)).

The working group continues to meet annually. In 2006 the working group approved a checklist for considering human element issues by IMO bodies; strengthening of human element input to the work of IMO; framework for IMO consideration of ergonomics and work environment; and the Organization's strategy to address the human element, which includes a related action plan.

In addition to the key human element regulations include the STCW Convention and the ISM Code, IMO has also developed guidelines for the investigation of human factors in marine casualties and incidents, included in the IMO Code for the Investigation of Marine Casualties and Incidents, and comprehensive guidance on fatigue mitigation and management has been published.

The STCW Convention requires that all seafarers to be properly qualified for the position that they hold on board. Meanwhile, MSC agreed that a comprehensive review of the STCW Convention and STCW Code is needed, in order to ensure that the convention meets the new challenges facing the shipping industry including, the rapid technological advances today and in the future.

The ISM code was developed to provide a framework for the proper development, implementation and assessment of safety and pollution prevention management. Additionally, the ISM Code requires that ship-owners define the responsibility, authority and level of competence required of each crew member. Moreover, the ISM Code, is an instrument that encourages the cultivation of a safety culture in the maritime industry by setting international standards for the safe management and operation of ships and for pollution prevention

Meanwhile, MSC/MEPC working group is studying the impact and effectiveness of the ISM Code, based on the data collected, the report concludes that where the ISM Code had been embraced as a positive step toward efficiency through a safety culture, tangible positive benefits were evident; and ISM Code compliance could be made easier through a reduction in the administrative process (Sekimizu, 2006).

5. Safety Culture in Shipping

Kuo (1998) define safety as a perceived quality that determines to what extent the management, engineering and operation of the system is free of danger to life, property and the environment. In the other hand, Oxford dictionary defines safety as the freedom from danger. Moreover, safety can be defined as the freedom from unacceptable risks/personal harms, additionally, safety can also be defined as, measures and practices undertaken to prevent and minimize the risk of loss of life, injury and damage to property and environment.

Culture is a way of life; the customs, beliefs and attitudes that people in a particular group or organisation share. Perhaps, culture is behind the reason why certain group of people or nationality behave in a similar manner, or prefer particular type of food and certain way of life, for instance, occasionally it's possible to guess somebody's nationality from his body moves the so called body language.

A safety culture means that safe and proper methods of shipping and doing business in the maritime industry are not only economical, but a way of life. Moreover, safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's safety management (O'Neil, 2002).

In addition, safety culture can be defined as a subset of the organizational culture, organisational culture is the product of multiple interactions between people (Psychological), jobs (Behavioural) and the organisation (Situational). It therefore becomes evident that an effective safety culture requires the active collaboration between management and the workforce.

Individual seafarer must believe that safety is important; it is not possible to create a strong safety culture if people do not believe that safety is everyone concern. Safety culture often involves changing the way people think, it's important that the management behave in ways which demonstrate 'Safety Comes First' example is the most effective way of creating a strong Safety Culture.

The goal of everybody must be making the working condition safe. Bearing in mind that, safety is not a problem which can be solved and then put aside. It is permanent feature of how everyone on board works and lives. O'Neil (2002) has emphasized that the crew members on board a ship will observe and be sensitive as to whether the company not only complies legally with all the appropriate safety and environmental requirements, but also the manner in which compliance is approached.

Creating a good company culture goes beyond compliance with regulations. It goes well beyond looking for the last dollar in profits. It requires a company vision of keeping the goals of each individual at a higher priority than the sole pursuit of profits (Chawla, 2004). There are perhaps three components to introduce genuine safety culture, commitment from top, measuring the scale of the problem, and finally changing the behavior.

IMO have realized the importance of promoting safety culture concept in shipping, despite the significant differences of IMO member States, particularly in their abilities to make the necessary institutional change as well as developing their human resources. IMO instruments and standards will be effective only, if the safety oriented attitude is established. Among the instruments and standards adopted by IMO, STCW convention and ISM code.

The ISM Code were designed to influence the process aboard ships and within shipping companies and contribute to the mental attitude necessary for the promotion of safety culture in shipping. According to IMO resolution A.788 (19), the application of the ISM Code should support and encourage the development of a safety culture in shipping. Success factors for the development of safety culture are, inter alia, commitment, values and beliefs.

6. An overview on the impact of introducing safety culture concept in shipping

Its nearly five years since the date of the full implementation of STCW convention and ISM code in 2002, perhaps it's time to review and assess the impact of those two instruments in establishing the safety culture in daily routine work onboard ships, in order to establish realistic and valid safety management standards, taking into consideration the nature of humans as well as the factors influence the role of human in shipping and the potential incompatible goals between safety and productivity.

Two questions raise themselves now:

- Have ISM Code and STCW convention achieved their initial objectives related to the improvement of human performance in ship operations?

- Has safety culture rooted in the shipping industry?

Many shipping statistics show some positive and negative signs, which appear in the annual shipping causality statistics of different causes. In some cases, difficulty in coping with international conventions and instruments were the main reason behind the failure of implementing genuine safety management system in some shipping companies, probably because of the huge administrative work which have be done by the tiny crew.

It has been recognized that there have been marked improvements in the casualty records and that fewer ships and fewer lives are being lost at sea than was the case a decade ago. The records also show that there has been a concurrent decline in the amount of pollution entering the marine environment from vessels transiting the oceans (O'Neil, 2002).

Madsen (2000) believes that the present trend of increased mobility of crewmembers and reduced contact between the shore-based organization and the seafarers makes it more demanding to build a genuine safety culture. The whole industry is engaged in a fight for talent, showing that experienced and competent crew is in strong demand.

In 2006 The Norwegian classification society (DNV) has performed a survey among 4,000 seafarers based on a questionnaire imitated from the aviation industry by the Danish Maritime Institute, University of Texas, Risø National Laboratory and DNV. The survey shows that:

- 50 per cent of the seafarers confirm that they break safety procedures frequently.
- The top 25 shipping companies have an accident frequency of only 15 per cent compared to the bottom 25 companies.
- The average ship operator has a potential of 70 per cent reduction in accident frequency measured against the best performers.

Concurrently, the DNV has verified 300 training providers globally as part of a quality improvement project, and revealed that more than 50 per cent under-perform according to best practices regarding facilities, course content and instructor qualifications. This demonstrates that lack of relevant qualifications represent a serious safety risk in shipping.

According to the chief executive of DNV, International requirements for qualifications and training can only make shipping safer if all parties perform in line with the intentions. Our findings show that there is a gap between documented and actual qualifications, for instance when it comes to basic safety skills, and a need for much more focus on building a safety culture (Madsen, 2006).

Figure (4) and figure (5) presents the average monthly total loss of ships due to accidents for three years prior to the full implementation of both STCW convention and ISM code, and three years after their implementation. The authors see no significant change or drop in the number of totally lost ships.

Table (1). *Reported total loses by month 1997-1999 for merchant ships of 500 GT and over*

Month	No. of ships	1997 1000 gt	1000 dwt	No. of ships	1998 1000 gt	1000 dwt	No. of ships	1999 1000 gt	1000 dwt
January	12	96	167	9	49	79	6	73	109
February	8	105	191	8	40	67	2	44	56
March	10	88	141	1	1	2	8	16	14
April	8	18	20	6	39	54	3	19	38
May	4	35	9	5	26	31			
June	6	61	94	6	49	75			
July	3	42	77	4	30	48			
August	6	15	22	6	87	79			
September	6	72	120	4	48	58			
October	7	48	64	15	60	92			
November	13	94	93	7	43	70			
December	5	87	158	9	47	73			
Total	88	761	1157	80	519	726	19	151	217
Monthly Average	**7**	**63**	**96**	**7**	**43**	**61**	**5**	**38**	**54**

Table (2). *Reported total loses by month 2003-2005 for merchant ships of 500 GT and over*

Month	No. of ships	2003 1000 gt	1000 dwt	No. of ships	2004 1000 gt	1000 dwt	No. of ships	2005 1000 gt	1000 dwt
January	12	103.6	146.3	8	26.3	38.5	8	25.4	20.5
February	13	37.7	50.9	12	90.7	134.6	10	52.8	68.1
March	3	4.3	7.4	3	13.5	20.7	4	34.7	54.6
April	7	45.9	52	4	13.8	19.5	8	27.1	33.4
May	9	65.2	113	5	52.2	31.4	3	17	22.4
June	12	53.7	86	5	16.7	19.7	6	34.2	54.4
July	6	59.5	103.2	11	45.4	64.1			
August	4	23.4	31.6	3	22.4	34.4			
September	7	67.1	102.1	6	20.1	21.8			
October	6	31.5	50.2	3	23.9	27.4			
November	4	23.1	35.9	9	39	55.9			
December	8	24.6	26.8	5	54.2	94.9			
Total	91	539.7	806.4	74	418.1	562.9	39	191.3	253.3
Monthly Average	**8**	**45**	**67.1**	**6**	**34.8**	**46.9**	**7**	**31.9**	**42.2**

They hoped to raise the safety culture through the use of lengthy procedures and checklists, which did not bode well with those who were supposed to use them. Some companies then changed their strategy by first soliciting feedback and participation from those using the manuals and then writing concise, user friendly procedures and improved transparency between the vessel and the office removed the blame culture (Sivasundram, 2006).

Probably one reason behind the failure in establishing genuine safety management in many companies was the production of large volumes of manuals, which clouded or failed to address key issues.

Conclusions

Perhaps the idea of building the safety culture in shipping through the enforcement of rules and regulations may not persuade the individuals to comply with and adhere to, seeing that, the individual's attitude to the rules that really determines the culture, do they comply because they want to, or because they have to.

The authors believe that safety culture involves moving beyond compliance to external rules to culture of self regulation; "want to" attitude can be effective in achieving the objectives of establishing safety culture in shipping.

Probably, IMO's member States are required to review and amend their safety management, maritime education and training, as well as their manning legislation to ensure the effective and practical implementation of genuine safety management system onboard ships. IMO is required to establish more effective instruments to assist the member States in doing so.

References

1. Chawla, P. (2004). Building the company culture. The International Maritime Human Element Bulletin (ALERT), 5, 3.
2. International Convention on Standards of Training, Certification and Watchkeeping for seafarers, 1978, as amended in 1995 and 1997 (STCW Convention), IMO, (2001).
3. International Maritime Organization. (1995, November 23). Resolution A 788 (19): Guidelines on Implementation of the International Safety Management (ISM) Code by Administration. London: Author.
4. International Safety Management Code (ISM Code), IMO, (2002).
5. Just waiting to happen...the work of the UK P&I Club. (2003, October). The International Maritime Human Element Bulletin (ALERT), 1, 3-5.
6. Klarin, M. & Kitarovic, J. (2006). Human factor in raising standards of safety at sea. In Proceedings of IAAST, 7th international conference: The human element in safety and survival at sea. Sibenik: Adriamare maritime training center.

7. Kuo, C. (1998). Managing ship safety, London: LLP reference publishing.
8. Madsen, H. (2000). Towards safety culture. DNV Classification news, 2
9. Retrieved 10 December 2006 from the World Wide Web:
10. http://www.dnv.com/publications/classification_news/no_2_2000/index.asp
11. Madsen, H. (2006). Poor safety training a hidden safety risk. DNV Classification news, 3
12. Retrieved 20 November 2006 from the World Wide Web:
13. http://www.dnv.com/publications/classification_news/3_2006/Poorsafetytrainingahiddensafetyrisk.asp
14. O'Neil, W. (2002). IMO- safer shipping demands a safety culture. Speech given at the world maritime day 2002.
15. Retrieved 20 November 2006 from the World Wide Web:
16. http://www.imo.org/includes/blastDataOnly.asp/data_id%3D5674/Message.pdf
17. Salvendy, G. (1997). Handbook of human factors and ergonomics. New York: John Wiley & Sons, Inc.
18. Sekimizu, K. (2006). The Human Element in the work of the IMO. The International Maritime Human Element Bulletin (ALERT), 12, 7.
19. Senders, J.W. & Moray, N.P. (1991). Human error: cause, prediction, and reduction. New Jersey: Lawrence Erlbaum Associates.
20. Sivasundram, M. (2006). Towards safer ship operations and the economic viability of a company. The International Maritime Human Element Bulletin (ALERT), 12, 3.
21. Squire, D. (2006). The human element in shipping. In Proceedings of IAAST, 7th international conference: The human element in safety and survival at sea. Sibenik: Adriamare maritime training center.
22. Talley, W. (Eds.). (2002). Maritime safety and accident analysis: The handbook of maritime economics and business. London: LLP reference publishing.
23. Technical Report SAHF. (2003). ABS review and analysis of accidents database: 1991 – 2002.

New Perspectives for Enhancing Educational and Research Activities on Maritime Security Problems at N.Y.Vaptsarov Naval Academy

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The Black Sea region underwent considerable changes during the last decade. Concisely, nature of the process is an emergence of a dynamic maritime security environment. Many directions of the changes can be defined.

The first one is the increased number of countries which exercise sovereign rights on the sea territories. This fact is accompanied by growing economic imbalance.

As a result of many factors, a number of "hot spots" appeared in the Black Sea region and its vicinity.

The most significant trend of the new security environment is the shift of military efforts focus from high scale military conflicts to the area of crisis prevention.

As a result, centralized maritime security systems in the Black Sea region, which were dominated by the Navies, have been replaced by multi component models. An inevitable aftermath of this process is a capability gap in the network organized Maritime Crisis Management System (MCMS). The problems in the system have been aggravated by the lack of common Maritime Crisis Management (MCM) education, training, and Command and Control procedures.

The questions we are to answer in order to overcome the problems we met are addressed to the MCMS and are presented by the following logical sequence: "What has happened and changed?", "Where are the roots of the problems hidden?", "What is going to be in the future?", and finally - "What should be done for the purpose not only to get over the recent problems, but also to adapt the system to possible future condition of functioning?"

The paper presents a brief answer to the questions, which is a result of a research done in the Bulgarian Naval Academy "N. J. Vaptsarov". The research was performed by a team of specialists and is focused both on maritime security problems and the possible ways to enhance educational and research activities in this area.

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The research takes under consideration predominantly the situation in Bulgaria and the opinion expressed by the authors does not present the Bulgarian institutions' formal position.

I. The Change of the Maritime Security Environment

The study of the security environment requires making a clear distinction between the types of impact that can affect the maritime security. Traditionally, these impacts are associated with the terms "risks" and "threats", and some publications include "challenges" as such. Considering the fact that in the existing literature one may come across different interpretations of these terms on this subject, and also that they are frequently used synonymously, defining them becomes methodologically important for this study. As a result of the analysis conducted for the purposes of this study, the terms "challenge", "risk", and "threat" are taken to mean as follows:

A **challenge** is a state of the environment that is directly or indirectly orientated against the presence of the governmental institutions, the nongovernmental organsiations, and/or the juristic and natural persons in the national maritime spaces (NMS), whereas the adverse effect on their interests is hard to identify and is characterised by a high degree of indefiniteness.

A **risk** is a state of the environment orientated against the presence of the governmental institutions, the nongovernmental organsiations, and/or the juristic and natural persons in NMS, whereas it is possible for adverse effects on their interests to occur for an indefinite period.

A **threat** is a state of the environment orientated against the presence of the governmental institutions, the nongovernmental organsiations, and/or the juristic and natural persons in NMS, whereas it is highly possible for adverse effects on their interests to occur.

Currently, there are different approaches that offer methodologies for analysing security in a region [7,8]. What all of them have in common is that the negative impacts on security are treated as traditional and new. This approach is adopted as a framework of the analysis.

The **traditional challenges, risks, and threats** are related to the territorial, ethnic, economic, and social issues and contradictions among the states in the region. They are related to tangible manifestations of global and the regional factors, whose influence is reinforced by economic difficulties and inadequate doctrinal and statutory support for the protection of national interests.

Perhaps the most significant negative impact on security in the region is the possibility of using military force against one of the countries in the Black Sea region.

The new challenges, risks, and threats that are related to or originate from the sea, have been defined in different national and international documents, and also in political analyses and assessments of security in the Mediterranean and the Black Sea published by Harvard University [4] and similar think-tanks from Bulgaria, Romania, and the Ukraine. The following issues are the most significant for the specific conditions of the sea: upsurge of transnational organised crime; the resurgence of one of its specific form – piracy; intensification of the danger from different types of terrorism; upsurge of contraband and drug trafficking; uncontrolled proliferation of weapons and military technologies, including WMD components; efflorescence of poaching and predatory plundering of the sea resources; refugee problems; threats to information security, aggravation of environmental problems; technogenic risks, related to industrial accidents and disasters. The majority of the new risks and threats are of a transnational nature and strongly affect the international security.

In modern times, ***piracy and maritime terrorism*** are among the most dangerous international maritime crimes.

One of the basic problems related to preventing these negative impacts is associated with their identity in international law. Despite the expeditious measures undertaken in this respect after 11 September 2001, up to December 2002 the international legal framework treating maritime transport security matters was voluntary and almost non-existent. Up to present day, only piracy and armed robberies against ships have been defined by UN [10].

The term "**piracy**" as a legal category has gained additional content over the last few years. There are attempts to confer the same status as piracy to some acts of terrorism, which will provide legal grounds to prosecute and prevent acts of terrorism at sea.

Nowadays, piracy is still a frequent event in many regions of the world. It is practised by well-organised transnational structures. According to IMB experts, the main targets for modern-day piracy are bulk carriers and tankers [5].

The regions with high concentration of acts of piracy coincide with the regions of increased terrorist activities. Terrorist forces conduct piratical attacks to fund their main activity. Furthermore, there is a fusion of personnel from criminal to terrorist lines.

Prates also co-operate closely with other criminal groups, particularly in the field of the illegal trade in narcotics, weapons, and human beings.

In the Black Sea, there have been no cases of classic piracy or armed depredation in recent years. This can be explained with the enclosed nature of the Black Sea. On the other hand, being a sea state, the Republic of Bulgaria has repeatedly been faced with the problems of piracy in the World Ocean. The list of incidents with vessels flying the Bulgarian flag, or a foreign one, but with Bulgarian nationals among the crew, is long enough.

In the context of maritime security, ***maritime terrorism*** is inseparable from piracy, in the sense of the *Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation* and the *Protocol for the Suppression of Unlawful Acts against the Safety of Fixed Platforms Located on the Continental Shelf*'.

Nevertheless that the international community has not given a thorough and exhaustive definition of the term *terrorism* [11], the terrorism is considered to be a peculiar type of warfare and requires counteraction adequate to the laws of warfare. [2].

The terrorist threats in the Black Sea region have a global dimension and a regional one.

The *global dimension* was insignificant until 11 September 2001. After that, when the USA launched the antiterrorism campaign, it increased dramatically. This is determined by the proximity to regions that are potential sources of threats, and by the fact that most of the nations in the region are participating in the antiterrorism coalition.

The *regional dimension of terrorist threats* has several sources: the existence of unsettled conflicts and potentially dangerous crisis regions; the isolated manifestations of religious extremism; the aggressive separatist aspirations; the economic instability; and etc.

A significant number of terrorist orrganisations operate in the region. According to the US Department of State, there are seven of them and they are classified as regional. Three of them operate on the territory of Chechnya, two in Turkey and two in Greece [9].

Bulgarian active participation in the antiterrorism coalition poses significant risks for our national security [11].

A considerable problem for the security of the region is ***the illegal trade in weapons, dual-use technologies, and WMD components***. This criminal activity is facilitated by the huge arsenals hoarded in the time of the Cold War.

The trafficking in different types of narcotics in the Mediterranean and the Black Sea is in the process of dynamic changes, characterised by increased consumption, changing channels, increased manufacture of synthetic drugs, and elaboration of criminal networks.

Over the last decade, drug consumption has been increasing at an alarming rate in the entire region. The specific geographic location of the region makes it a crossroad of multi-directional drug channels.

The maritime channels in the Black Sea are of a particular interest. The majority of them start from the Russian or the Georgian coasts and reach the ports of Romania, Bulgaria, and the Ukraine. Some seaborne trafficking is also conducted through the Strait of Bosphorus [1].

Contraband (primarily of different excisable commodities) has its own centuries-old traditions in the waters of the Black Sea. The contraband in the Republic of Bulgaria calls for paying particular attention to the contraband of cigarettes, alcohol, and petroleum products, with an emphasis on the maritime aspects of this criminal activity. The situation became even more complicated in the last few years, when started so called fictitious re-export.

Serious challenges, risks, and threats to security can be generated by ***the trafficking in human beings and illegal migration*** from and across the Black Sea region. The main problems that provoke these illegal activities, such as demographic boom, regional conflicts, poverty, etc., cannot be solved quickly, which means that these negative effects cannot be easily eliminated despite the efforts on a national and international level.

The pollution of the marine environment and environmental disasters at sea are another potential negative effect on the security in the region. The most serious environmental catastrophes at sea have been caused by spilling large amounts of oil in result of navigational accidents (the Exxon Valdez), engineering reasons (the Erika, the Prestige), or terrorist acts (the Limburg). Also, a grave danger for the marine environment is the deliberate or accidental release of nuclear, radiological, or chemical waste on the sea bottom.

The specific negative effect on the security in the region are the ***cybernetic threats*** (the threats to information security) against the systems for management of shipping. The reasons to pay particular attention to cybernetic threats are determined by humanity's entrance into the third period of its civilised development and the possibility for accidental or deliberate intrusion into management systems [11].

In recapitulation the following CONCLUSION can be drawn: the emergence of a dynamic maritime security environment in the Black Sea region is a direct result of the dynamic influence of the complex processes in South-Eastern Europe, the Caucasus, Central Asia, and the Middle East, which are considered to be some of the most volatile and unpredictable parts of the world. The significance of the region is determined by the fact that it is both a source of new challenges, risks, and threats itself, and, at the same time, due to its geostrategic location, a natural border for the new threats associated with terrorism.

II. The reaction of the Bulgarian Maritime Crisis Management System to the Changes in the Maritime Security Environment

In order to adapt the security system to the dynamic security environment, the Bulgarian MCMS has undergone major changes, whereby two basic trends can be outlined.

Firstly, the replacement of the centralized model of the system with a network organization should be noticed. The leading motive is the necessity of strengthening the civilian control over the work of the state subjects and the national maritime spaces (NMS). The implemented approach foresees the achievement of a relatively high level of demilitarisation of the control in the NMS through delegation of authority to organisations from the structure of other ministries except for the Ministry of Defence. The approach embodies the idea of achieving synergy in the joint efforts of the MCMS's components.

As far as the indicated trend relates to a great extent to the structural aspects of the Bulgarian MCMS, the next change rather applies to the functional purpose of the system and can generally be summarized as a shift of focus of the MCMS's efforts from a reaction to concrete situations to preventive action. The direct effect of that trend is the increased importance of the surveillance in the NMS.

Both trends are closely connected and practically indistinguishable. In result, functional dimensions of the responsibilities in the sphere of maritime security appeared, being addressed either to pre-existing or newly established actors. Inevitably, this redistribution of responsibilities in the maritime security system caused a vacuum of the capabilities within the functional dimensions. As far as a part of the actors increased their relative autonomy within the system and/or expanded their sphere of responsibility, while others were newly established, what the two processes had in common was that in both cases the new legal rights and obligations were not upholstered with the required capabilities. The process of restructuring coincided, and, to a large extends, caused a growth of the factors threatening maritime security. Because of this, the optimization of the maritime security system was done in response to concrete challenges and incidents and, logically, to a situational approach.

The systemic aspect of the situation in place can be defined as **dehierarchisation of the maritime security system, in result of which a situationally-dominated, spontaneous self-organization took place among the components on the coherence line.**

The practical dimensions of the self-organization were interagency statutes and agreements drawn up in response both to specific obligations to the EU and international agreements and to specific incidents. Although this approach provided the stability in purpose of the maritime security system, it should be noted that, under the conditions of transition and on the basis of the interagency agreements, executive bodies, including interagency ones, came into being and received substantial legal rights on the basis of the obligations that were assigned to them. Practically, conditions for establishing sub-systems within the maritime security system were created. As far as the difference between a system and sub-system can be defined through the scale of observation, it should be noted that all the system's properties can be observed on the subsystem level as well.

Assuming that all components of the national maritime security system have their own statutes, management bodies, spheres of responsibility, executive units, legal rights, and budgeting, it can be maintained that they are differentiated subsystems. In this context, it is interesting to note the "*drive for self-reproduction*" that is typical of the systems of the class organizations. Its typical manifestations are both the aspiration to expand the borders of the system and the ambition of retaining structures and functional models even after their purpose has been exhausted. These two trends are one of the generators of intersystem conflicts. The negative consequences of these conflicts are aggravated in the conditions of resource scarcity or by an approach related to allocation of resources by the suprasystem and based on the principle "*you counteract... - you receive...*".

It should be noted that, due to a number of factors, the situation described hold god for the national MCMS. This fact resulted in the following aftermaths: duplication of structures and disintegration of efforts, lack of coordination in the course of exercising control and especially in rendering critical services, lack of uniform management procedures, lack of uniform understanding for the problems on the part of the managing staff, absence of unified requirements to the training of personnel and the equipment and support provided to them. In result of all this, the different institutions, with their scanty resources and extremely insufficient personnel, work on their own and with no coordination, or co-operate incidentally. Practise has shown that they fail to be a reliable instrument for protecting maritime sovereignty due to the lack of the needed transparency among them, while there is even rivalry at times. The new type of threats to national security cast a shadow of doubt on their effectiveness in a complicated crisis situation.

This translates into a situation where a long-term strategy for countering the challenges, risks, and threats to maritime security is yet to be developed and implemented. Creating such a strategy is further impeded by the absence of integrated processes and procedures for decision-making on a national and an international level in order to respond in the event of crises in the maritime spaces.

It is self-evident that building up and efficient and effective MCMS is only possible on the basis of a thorough academic analysis of the problematic areas, realized in close co-operation between all the organizations that perform activities in the maritime spaces. The leading role in this process should be assigned to *N. Y. Vatpsarov* Naval Academy as a well-established and licensed centre for training maritime personnel. In addition, the Naval Academy will provide connections with all the Bulgarian MCMS's components.

III. What is the Security Environment Going to be in the Future?

The possible "picture" of the world is presented by the CIA report published in 2000. According to the report, known as the "apocalyptic" [3], the world will face with by 2015:

- **global terrorism** – the international terror groups and organized crime, are anticipated to make a stand against the specialized government services, including the use of WMD as means of exerting pressure. The terror groups and the organized crime are expected to unite.

- **mass migration and population growth** – hosts of refugees are expected to move from Latin America and South-Eastern Asia to North America and From Northern Africa, the Middle East, and Central and South-Eastern Europe to Western Europe. By 2015, the population of the world will be 7,2 milliard people. In Africa, the population will decrease due to AIDS and malnutrition. Russia and Eastern Europe will also see a drop in population. Ageing of the population will emerge in Western Europe, the USA, and Japan.

- **famine, shortage of water and energy** – in 2015, more than a half of the population of the world will live in shortage of water;

- **ethnic conflicts** – instead of the wars typical of the 20th century, regional conflicts that are harder to predict and more difficult to manage are expected;

- **diseases** – although the rapid development of medicine, it is expected that bacteria will become resistant to antibiotics, viruses will mutate, and mass migration will be conducive to the spread of lethal infections, tuberculosis, malaria, hepatitis, and AIDS.

Although the objectivity of the report was questioned at first and it was dubbed to be "apocalyptic", the events that followed proved its validity. The report illustrates a familiar picture regarding the real situation in the Mediterranean and the Black Sea.

In result of the analysis performed, we defined **a possible security environment in the Black Sea region.**

In the early 21st century the likelihood for using military force against one of the countries in the Black Sea region is minimal. However, a danger of using military force in the region can result from failure to resolve the separatist conflicts in the region.

The most significant role among new challenges, risks, and threats in the region will be played by the ***terrorism***.

Regarding the problems of maritime security in relation to terrorist acts against targets at sea, the following can be expected: terrorist attacks with conventional weapons or WMD; using a merchant ship as a ramming device or as a mean of transportation [6, 11].

The factors that are most likely to attract the attention of international terrorism to the Black Sea are:

- the possibility to interact with the structures of the organised crime;
- the fact that the region is an important crossroad in the illegal trafficking in narcotics;
- the possibility to create terrorist cells on the basis of existing Islamist organisations;

- the favourable conditions for infiltration by members of terrorist structures, building up sleeper cells and using them to penetrate the European states.

The terrorism threat in the Black sea region also will have its concrete negative economic consequence.The routes of some of transcontinental projects related to transport, communications, and energy carriers go by (are designed to go across) unstable regions.

The illegal trade in weapons, dual-use technologies, and WMD components in the region could be stimulated by some nonstate actors, such as the movements of

HAMAS and Hezbollah and could be directed to Syria, Iran, Libya. Although they are carrying out transfers of conventional weaponry only, there are serious grounds to believe that they are making efforts to acquire WMD and the means of delivering them to the target.

In terms of ***the trafficking in different types of narcotics***, the analysis performed gives grounds to conclude that the two tendencies, referring to the diversification of the routes and their shift to the north, will continue to develop. These conditions make the maritime route across the Black Sea (and, potentially, up the Danube) particularly attractive for traffickers, as it grants them direct access to the EU states.

The ***contraband*** of cigarettes, alcohol, and petroleum products will continue to be a challenge. The number of typical cases of contraband, performed by fishing boats in the high seas, is expected to decrease in contrast to the number of cases of fictitious re-export.

The trafficking in human beings and illegal migration from and across the Black Sea region is going to be a serious challenge. The institutional measures that are being taken in Bulgaria to suppress this process will redirect the wave of migrants to our maritime borders.

The risks of ***pollution of the marine environment and environmental disasters at sea*** will increase, because of the expected intensification of tanker shipping in the Black Sea after the completion of the project Novorossiysk – Bourgas – Alexandroupoli.

IV. What Should be Done for the Purpose to Get over the Recent Problems, and to Adapt the MCMS to Possible Future Conditions of Functioning?

The maritime security environment is presented by the following conclusions:

1. The dynamic security environments in the Black Sea region has resulted in the appearance of a new set of challenges, risks, and threats to the maritime security.
2. The traditional challenges, risks, and threats to the maritime security have decreased in intensity but they remain still valid.
3. There is little room for optimism regarding successful resolution of the regional maritime security problems in the following decades.

On this background, the Bulgarian MCMS suffers an intersystem conflict, driven by the MCMS components' will to expand their structure and to keep their status quo.

The intersystem conflict in the MCMS logically lead to the question: can any steps be taken to circumvent problems? In practise, the answer is positive.

The first option is to solve the problems by a "forceful" intervention on the part of the suprasystem. Such an approach presupposes a sound academic argumentation for the restructuring of the system. Despite the rational value of this option, it would be difficult to implement, because it is expected to meet stiff resistance from the MCMS's components whose interests are put at stake by the realisation of the system. This difficulties are likely to manifest by lobbying, which, combined with the inherently high degree of subjectivism typical of decision-making in conditions of critical functioning of systems, restructuring processes often being like this, can lead to an abrupt drop in the functional parameters of the MDMS, and even to making a situational decision, inadequate in the long run.

The second approach counts on the idea to form up a collective decision, shared by all the actors of the system, for the necessity of and the way to restructuring the organisation by means of academic communication. Obviously, this option relies on the altruism of the components' management bodies and their inclination to undertake actions in protection of the common interests, which may be incongruent with their personal interests. Such an approach is more optimistic than realistic. Nevertheless, the idea involving a collective decision made by means of academic communications should be developed further.

The third approach practically utilises this option, but realises through the secondary connections among the components of the maritime security system. The underlying idea involves surmounting the potential antagonism in the interests of the actors of the system by artificially interconnecting them on the basis of uniform understanding of security matters and the concomitant uniform approach in addressing them. This can be achieved by **gradually renewing the personnel of the system**, while developing the human resources at a centre for training highly qualified specialists. Obviously, it is necessary to involve young researchers in their capacity of future managers of the MCMS's components. Considering the necessity for a gradual transformation of the system, this requirement should be developed further into the necessity for the training environment for the young specialists to be constantly acting, based on academic communication, and a collective forum of the MCMS's components. Such an approach would ensure continuity in the organisation.

A proper approach to organise and run activities related to the possibility to enhance the mechanisms for MCN in the Black Sea region consists of recommendations for:

1. The goals of the undertaking.
2. The composition of the participants in the undertaking and its general design.
3. The system of objectives for achieving the goals and a general methodology.

Before setting out to formulate such recommendations, the problem with the format of such an undertaking needs to be solved. Due to many reasons, it should be accepted that the undertaking will be realised in the form of an **international initiative (project)** for enhancing the interagency and international mechanisms for MCM in the Black Sea region.

The first problem that any scientific activity should solve is setting the goals. The overall goal of the initiative is **to create the prerequisites for ensuring security at**

sea in the long term and in any conditions of the environment. The leitmotif in the goal is realising adaptiveness in the functioning of the MCMS. While the key word is "adaptiveness", the goal should be broken down in terms of the time dimensions of the adaptation processes.

Classically, a system carries out its function on the basis of continuously adapting to the conditions in which it does so. Three functional dimensions can be observed in the process of adaptation: short-term; long-term; and evolutionary adaptiveness. Since the maritime security system generally has adaptive function regarding the society, the goals of the undertaking should be analysed in this context.

Short-term adaptiveness takes place in response to particular situations. It is direct and situationally-dominated process. This is why this aspect of the adaptation is primarily associated with the functional aspect of systems. Therefore, and also considering the current status MCMS, the first set of tasks to be solved should be functionally directed as follows:

1. Developing methodology and a centre for training the components of the MCMS.

2. Generating standard procedures and mechanisms for MCMS's components to interact in the process of carrying out their function.

Since short-term adaptation is vital for the system as a whole, its goals should include a set of measures aiming at creating the necessary conditions for adapting in the long term. This necessitates the introduction of another short-term goal, generally formulated as:

3. Creating conditions for the realization of the long-term goals of the undertaking.

The next levels of adaptiveness are associated with the functioning of the MCMS in the long run, and are aiming at maintaining its ability to carry out its function while changes are occurring. These conditions should be analyzed on the basis of the content of the changes that bring about a new situation of functioning. In broad terms, three cases are possible:

1. The changes in the conditions of functioning occur in result of different combination of familiar risk factors for maritime security, as well as changes in the scale of their manifestation. As regards the intersystem aspect, sources of such changes are the planned transformation of the system, the refocusing of efforts, the incidence of a "moderate" intersystem conflict, i.e. such changes that, without threatening the integrity of the MCMS, go beyond the possibilities offered by the short-term adaptive processes and appear to be their logical continuation on the basis of summarized experience.

2. The changes in the conditions of functioning occur in result of an abrupt escalation of familiar negative factors in the logical sequence of "challenges – risks - threats", the appearance of new factors and/or unforeseen combination of them. The intersystem "generators" of such changes are the result of abrupt structural modifications,

including the disintegration of the system, acute shortage of resources, depletion of the goal of functioning, and/or a sudden transition to a new goal. That is, the changes that occurred, even if predictable, bring up the question of the system's survival.

3. The changes in the condition of functioning occur in result of unpredictable factors and are always accompanied with disintegration processes within the system, both in result of physical disadvantage and a bitter intersystem conflict.

A common thing in the content of the first two cases of a change in the conditions of functioning is their relative predictability. On this basis, they are associated with the so-called long-term adaptiveness.

The third case is characterized by a high level of unpredictability of the condition of functioning and corresponds with the processes of the so-called evolutionary adaptiveness.

As regards the necessity for a long-term adaptiveness of the MCMS, it is met by two sets of tasks. The first one, like the short-term adaptiveness goals, addresses functional aspects. The second group corresponds with the necessity for structural changes of the system. The two task sets should be presented separately.

As regards long-term adaptiveness, the functionally-directed goals are:

1. Dissemination of the functional MCMS's model from a national to a regional level.

2. Developing scenarios for potential conditions of the security system's functioning and the corresponding functional models.

Realizing these two sets of tasks should be supported by developing and implementing adequate structural models. Long-term adaptiveness in structural aspect should include:

3. Optimizing the structure in order to support the goals of functioning and their realization strategies.

Considering the iteractive character of the process of designing system architecture, the goal of the undertaking to create the prerequisites for the realization of the long-term goals of the initiative should be specified, formulated in the context of the short-term adaptiveness:

1. Analysis of the functioning of the system and the status of the environment and development of recommendations for optimizing the strategy and technology of purpose.

2. Analysis of the functioning of the system and the status of the environment and development of recommendations for optimizing the structure of the system

Since it was pointed out that the changes in the conditions of the functioning of the system can result from unpredictable factors, the necessity to create conditions for the realization of the long-term goals should be developed further.

The practical dimensions of the likelihood for unforeseen situations of functioning to occur boil down to impossibility to develop functional models of the system in advance. In fact, the only possible approach is to provide the structure of the MCMS with a set of features that would contribute to the process of adaptation in an unforeseen situation. On this basis, the necessity to create conditions for the realization of the long-term goals should be developed in the following aspect:

3. Creating conditions for continuous adaptation of the system to the widening content of the term "security".

Regardless of its conceptual formulation, this goal has specific dimensions, which can be detailed in the following aspects:

- establishing and maintaining an environment for academic communication, where the MCMS's components participate voluntarily and on equal footing;
- establishing and maintaining a centre for research in the sphere of MCM;
- creating and maintaining system for training a potential of personnel.

These three functional aspects are a strong argument in support of the statement that the tasks related to the continuous adaptation of the system to the widening content of the term "security" can be solved by **establishing and maintaining a Centre of Excellence** (CoE) dedicated to the matters of maritime crisis management.

Since a large number of goals were formulated, they have to be systematised.

The main goal of the undertaking should be focused on the possibility for long-term adaptiveness of the MCMS while contributing to circumventing the sources of intersystem conflict. In this line, t**he main goal of the process should be focused on the possibility to establish and maintain a CoE dedicated to maritime crisis management**.

Taking into account the fundamental role of the processes of short-term adaptiveness, the main goal should be supported by the following objectives:

1. Developing a methodology and a centre for training the MCMS's components .
2. Generating standard procedures and mechanisms for interoperability.
3. Analyzing the functioning of the system and the status of the environment and developing recommendations for optimizing the MCMS's structure and strategy.

Although they are directly related to the long-term adaptation of the security system, the following objectives should also be input in the undertaking.

4. Developing scenarios for potential conditions of the functioning of the MCMS and the corresponding functional models.
5. Harmonization of the national functional model with the existing regional models.

Methodology is closely related to the objectives for achieving the goals. Chronologically the first group of issues to be solved involves an analysis of the conditions of the MCMS functioning. In this context, the following tasks can be defined:

1. Analysis of the environment where the MCMS functions.
2. Analysis of the challenges, risks, and threats to maritime security.

In result, a real picture of the security situation should be obtained. This includes:

- rights and responsibilities of the MCMS, as well as their statutory foundation;
- a general description of the environment where the MCMS functions;
- a description of the challenges, risks, and threats to the MCMS, including their sources, possibility for escalation, frequency and scale of their occurrence, potential consequences, as well as trends in their development. The legal grounds that allow and oblige the maritime security system to counter these factors should be revealed here.

The results of the analysis presented in the first part of this paper are a good starting point for the first and second tasks.

Furthermore, the analysis of the conditions of functioning of the MCMS inevitably includes a set of tasks studying the functional suitability of the system concerning the goals set for it. The following task should be defined:

3. Analysis of the capacity of the MCMS for adequate accomplishment of its goals.

In result of solving this task, the following should be expected:

- clarification of the goals, the functional model, and the structure of the MCMS;
- clarification of the statutory foundations of the MCMS;
- discovering the functional aspects of the activities of the MCMS and its composition and the organisation of the components engaged in these aspects;
- analysis of the capacity of the MCMS to counter the challenges, risks, and threats;
- formulating recommendations for functional and structural optimisation of the MCMS;

The above results from solving the first three research tasks are a suitable basis for developing the next four functional aspects:

- tasks related to solving specific issues discovered in the analysis of the conditions of functioning of the MCMS;
- tasks related to prognosticating the future conditions of functioning of the MCMS and developing recommendations for the optimization of the system.

The next tasks are:

4. Developing procedures and mechanisms for interaction for the MCMS's components.

5. Developing a methodology and a centre for training for the MCMS's components.

In result of solving these tasks, the following should be expected:

- developing functional models of response of the system in standard situations;
- developing standard procedures for planning the response of the system in the conditions of a maritime crisis;

- developing standard procedures for interaction of the components, both under normal conditions and in case of a crisis;
- developing a methodology and procedures for training the MCMS's compo-nents;
- developing a centre for training the components of the MCMS;
- developing a structural model of the system in support of its functioning.

The classic approach to response in a problem situation consists in analysing the problem and answering the question whether this is a familiar situation and, if so, whether there is model for solving the issues that has already worked. The following task is formulated:

6. Comparative analysis of existing models for the MCM Systems and studying their applicability to the problem areas defined.

In result of solving this task, the following should be expected:

- studying the experience in the sphere of MCM and systematising the existing models;
- to discover theses, ideas, and models from the theory and practise of development and functioning of MCMS, applicable in the conditions of the undertaking.

The academic approach requires that, before a developed model is implemented into practise, its applicability should be verified by conducting a number of experiments. This verification should be done on the basis of properly developed scenarios, modelling the conditions of functioning of the MCMS. The following task should be defined:

7. Developing scenarios for the conditions of functioning of the MCMS.

The results of solving this task should be found in two aspects:

- developing scenarios for the conditions of functioning of the MCMS and the respective generic models of response;
- discovering the trends for changes of the conditions of functioning of the MCMS.

The first group of results directly corresponds with the necessity to test the results from the research and the theoretical works. This allows the formulation of the next task:

8. Validation of the system models developed in artificial conditions

In result of this task, the system models should be tested by means of the scenarios developed. The classic option for such a test is a computer-assisted exercise with the participation of the components of the MCMS. This task corresponds with the necessity to develop a methodology and a centre for training the components of the MCMS.

The second functional aspect of the results of scenario development is also of in-terest: discovering trends for changes of the conditions of functioning of the MCMS. This result corresponds with the idea for developing and implementing mechanisms for adaptation of the MCMS in a long-term perspective. The following task should be formulated:

9. Developing recommendations for structural changes aimed at optimising the MCMS in the long run.

In result of solving this task, the following should be expected:

- discovering trends in the development of the conditions in the security environment;
- developing a system of scenarios for the maritime security environment;
- developing flexible functional models of the MCMS;
- formulating recommendations for optimising the structure of the MCMS in order to enable it to adapt to the prognosticated conditions of functioning.

Since the process of adaptation occurs continuously, the results of the undertaking should be an open system, subject to further development. Also, the main goal, involving the possibility to establish and maintain a CoE on the matters of MCM, should be considered here. On this basis, the following task should be formulated:

10. Establishing a permanent Centre for analysing the conditions of functioning of the MCMS and for generating recommendations for optimising its functioning.

The expected result of solving this task should be the establishment of a forum about maritime security matters, which should be permanent, should unite all the components, and should be an environment for exchange of academic argumentation. This approach also meets the requirement for establishing a centre for preparing young specialists.

Since solving this task requires the use of the results of all the other tasks, it can be considered that it finalises the undertaking to enhance the interagency and international mechanisms for maritime crisis management in the Black Sea region.

When the system of tasks is supplemented with the academic methods of solving them, the methodology for achieving the goals of the research is formulated.

As a unique centre for naval science and marine technology the "N. J. Vaptsarov" Naval Academy is ready to take the challenge and to lead an initiative aimed to enhance interagency and international mechanisms for maritime crisis management. Research and development activities are an integral part of the Academy's life.

The Naval Academy's team unites the efforts of the best specialists in the Republic of Bulgaria in the sphere of maritime crisis management and security, including scientists and maritime transportation specialists. This team is determined to turn the Academy into a think-tank, which formulates modern maritime security policy and develops MCM theory and practice.

References

1. Drug trafficking and drug abuse, IMO, L., 1994.
2. Full Alert An Arsenal of Ideas for the War Against Terrorism, (www.rand.org), 11.01.2007.

3. Global Trends 2015: A Dialogue About the Future With Nongovernment Experts, (www.cia.gov), 15.01.2007.
4. Harvard University, Black sea security program, (www.harvard-bssp.org), 15.01.2007.
5. I C C International Marititme Bureau (IMB), (www.iccwbo.org/ccs/menu imb bureau. asp), 15.01.2007.
6. Kubiak, K., Possible Ways of Conducting Terrorist Attacks Against Maritime Trade and Shipping, Security and Stability in the Black Sea Area, the V[TH] International Scientific Session, National Defence University "Carol I" Publishing House, Bucharest, 2005, pp.55-61.
7. New security risks, inter-agency co-operation. security sector and defense transformation; NATO, EU and the new risks: a Southeast Europe perspective, International security conference, Center for the study of Democracy, Oct. 29-30, Sofia, 2004, pp.28-31.
8. Rumer, E., J. Simons, Toward a Euro-Atlantic Strategy for the Black Sea Region, Black Sea Region- New Frontiers, New Partnerships, Romanian Journal of International and Regional Studies, Volume II, EURISC Foundation – Romanian Institute of International Studies, Bucharest, 1-2/2006, pp.115-144.
9. The World Factbook, CIA, USA, (www.cia.gov), 15.01.2007.
10. United Nations Convention on Law of the Sea (UNCLOS), 1982.
11. VassIlev, V., ISPS Code and Identification of the Risks and Threats to the Bulgarian Ports and the Civil Ships, Sailing in the Black Sea, The Academic, World Network of Maritime Institutes, 2003, №3, pp.38-46.12.

Maritime Security Education and Training: Establishing a Learning Community and Framework for Program Goals and Outcomes

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Abstract

In the years since the attacks of September 11, 2001, the international maritime community has embraced the need to introduce and adopt security measures to protect vital shipping, facility and port assets from terrorist attacks. These measures have been embodied in the International Ship and Port Facility Security Code (ISPS) of 2002. However, the upcoming review of the Standards of Training, Certification and Watchkeeping (STCW) 78, with its emphasis on maritime safety has led some to suggest this may present a unique opportunity to enfold the ISPS security standards into STCW as well. At the same time, subsequent maritime natural disasters – specifically the 2004 Asian Tsunami and Hurricane Katrina – have led others to suggest that our conceptualization of maritime security should be expanded beyond the prevention and deterrence of maritime terrorist attacks. For these and other reasons, a review of how we define and conceptualize maritime security may be a useful exercise. At the same time, as maritime security – in any and all of its conceptions – will become more and more embedded in the training and education of the IAMU member institutions, beginning a discussion of the common elements of maritime security training and education may be of benefit as well.

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1. Introduction

The upcoming review of STCW 78 presents a unique opportunity for the international maritime community – through the IAMU member universities – to shape the next set of standards for the decades to come. It has been suggested that this may also present a unique opportunity to discuss the inclusion of security standards – as embodied in ISPS – into STCW as well.

This, however, presents an interesting set of questions. STCW was developed to ensure maritime *safety* by setting a minimum agreed upon set of standards, while ISPS was designed to enhance maritime *security*. This raises the first question – what, if any, is the difference between maritime safety and maritime security?

Second, even if we achieve a mutually agreed upon definition of security, how do we devise a security curriculum so that IAMU universities may begin to share best practices in their training, as they currently do for safety within STCW? While ISPS could be said to suggest learning objectives, no definitive list of outcomes has been established. Is maritime security achieved only by meeting the ISPS requirements? Or does it extend to include other objectives such as, for example, critical thinking and threat/risk identification and analysis?

The goal of this paper is, therefore, to present more clearly the two sets of questions:

- How should the international maritime education community define maritime security? How, specifically, does maritime security differ from maritime safety? What are the components of maritime security?
- What might be the minimum learning objectives maritime security training and education programs?

2. Safety and Security: Conceptual Similarities and Differences

There are many definitions of both safety and security, and distinguishing between the two concepts may, in the final analysis, be little more than an academic exercise. Some define safety and security somewhat synonymously, with each being a component of the other. For example, one dictionary defines safety as "protection from or nonexposure to the risk of harm or injury" and security as "the state or feeling of being safe and protected" (Encarta). Yet another source defines safety as "the condition of being safe from undergoing or causing hurt, injury, or loss" and security as the quality or state of being secure...freedom from danger... safety" (Merriam-Webster).

However, some see safety and security as more distinct (although not unrelated) concepts. Safety is a state of being protected against physical, social, political, damage or any other kind of harm. To put it another way, safety is *doors open* to allow free access for escape or rescue in a dangerous or unsafe situation. Security, on the other hand, is *doors closed* to prevent access to those who might wish to do us harm. While security is related to safety, the difference between the two is the added emphasis security places on being protected from dangers that originate from the outside. Security takes into consideration the actions of malicious agents who attempt to cause deliberate destruction. In summary, security can be considered protection from active malicious agents. Safety, on the other hand, can be considered protection from accident, maritime casualties, inadvertent harm and destruction, and the like.

This latter conceptualization, allowing for some distinction between safety and security, is reflected in the global maritime realm. The International Convention for the Safety of Life at Sea (SOLAS), as its name implies, deals with safety. STCW is essentially also a safety convention, dealing with ship construction and human element standards, and is meant primarily to ensure the safe passage and operation of vessels, and to prevent accidents at sea. STCW can be thought of as the operationalization or guarantee that SOLAS objectives are met in the training and certification of officers and ratings. On the other hand, ISPS, despite the fact that it is an amendment to SOLAS, is meant to ensure maritime security.

In the final analysis, it may be useful to work with a conception that encompasses elements of both safety and security. Surely the goal of every vessel, port, facility and maritime asset is to be both safe and secure, and we can imagine many events that could challenge both safety and security. The value of being both safe and secure is especially important as we turn to the debate within the academic community and elsewhere over the proper conceptualization of security.

3. Maritime Security: A Conceptual Framework

There is disagreement over how much our conceptualization of security should encompass: In the United States, for example, many define maritime security narrowly as protection against terrorist attack; others (even within the United States) adopt an "all hazards" approach, incorporating maritime piracy, stowaways, tsunamis, earthquakes and hurricanes under the security definition. It has been suggested that these differences of opinion can be grouped into at least three different perspectives: strict constructionalism, middle-of-the-road moderation, and radical reconstructionalism (Bellavita 2006). To this can be added a fourth category: humanitarianism.

3.1. Strict Constructionalism

Strict constructionalists would argue that maritime security should focus solely on preventing and responding to terrorist attacks, with the primary emphasis being on prevention. In this interpretation, the primary emphasis of the maritime industry should be on ISPS implementation, plus possibly involvement in other regional and multilateral initiatives such as the US Container Security Initiative, as appropriate. Prevention is the primary emphasis of the terrorism-only security advocates.

While the International Maritime Organization does not explicitly define security, a constructivist definition can be inferred from its website discussion of ISPS implementation (IMO):

Ship and port facility security is a risk management activity. As with all risk management efforts, the most effective course of action is to eliminate the source of the threat ..., which in this case is *those that would commit acts of terrorism or otherwise threaten the security of ships or of the port facilities* ... (my emphasis).

In the constructivist perspective, the role of the maritime industry is to ensure it has done everything possible to prevent a terrorist attack on, or using, key critical components of the maritime infrastructure, including individual ships and port facilities.

3.2. Middle-of-the-Road Moderation

Moderates agree that maritime security should include prevention of, and response to, terrorist attacks, but it should also include other – more frequent and widespread – threats to maritime security such as maritime piracy and, increasingly, natural disasters such as hurricanes, earthquakes, and tsunamis.

Moderates argue that the costs (human and economic) to the maritime industry from piracy and natural disasters are actually greater (or at least occur more frequently) than those that have been incurred from maritime terrorist attacks. The data bear this out: A recent study of terrorist attacks between 1999 and 2003 showed that maritime assets represented only one percent of all terrorist targets during this time (Aegis 2003).

3.2.1. Maritime Piracy

While maritime piracy is by no means a new phenomenon, by the early 1990s the number of pirate attacks had reached a point where the international maritime community decided action was required. In 1996 the International Maritime Organization (IMO) of the United Nations was charged with maintaining details of reported attacks and issuing official reports on a monthly, quarterly and annual basis. The IMO began producing annual reports in 1998, and monthly reports in mid-2000. Since then it has documented over 4,200 attacks through 2006. In 2006 there were 240 recorded pirate attacks around the world, translating to one attack roughly every thirty six hours.

With many pirate attacks known to be unreported, calculating the amount of financial damage caused can be very difficult; however, the International Maritime Bureau estimates that maritime piracy costs transport vessels between \$13 and \$15 billion a year in losses in the waters between the Pacific and Indian Ocean alone (Ryan 2006). Earlier economic estimates had placed the annual global figure at approximately \$16 billion (Dillon 2000). Costs stem not only from stolen cargo and goods (and, in some cases, from the theft of the ship itself) but also from delays in port while the attack is reported and investigated, and from increased insurance rates as well.

The human costs of maritime piracy can be significant: In 2006, fifteen sailors were killed in pirate attacks, 188 were taken hostage, and 77 were kidnapped and held for ransom. Since 1995, over 350 sailors are reported to have lost their lives in pirate attacks worldwide (IMO); this has translated to roughly thirty sailors each year. While the 240 attacks reported in 2006 are the lowest number of attacks reported since 1998, and the fifteen deaths in 2006 represent the lowest level of casualties since 2002, seventeen sailors have lost their lives in pirate attacks in the first two months of 2007 alone (IMO).

3.2.2. Natural Disasters

Moderates would argue that natural disasters should be included within the scope of maritime security, and offer primarily two reasons. First, as maritime facilities have begun to plan for effective response to terrorist attacks, they have found that much of what would need to be done overlaps with response to natural disasters. Terrorist attacks and natural disasters can both damage infrastructure in similar ways; both can create social, psychological and economic disruptions to the flow of goods and services. Consequently, more and more facilities were working with disaster response teams and planners in the creation and testing of their mandatory security plans. Second, as serious as maritime terrorism is, the reality is that natural disasters have also caused significant damage and disruption to maritime assets, and far more economic costs than maritime terrorist attacks have done to date. A few examples follow:

The Loma Prieta Earthquake struck the San Francisco Bay region on October 17, 1989. The magnitude 7.1 earthquake left sixty-three dead and more than 13,000 injured. A section of the San Francisco-Oakland Bay Bridge collapsed, as did a portion of a major highway. Over 28,000 homes and businesses were either damaged or destroyed. All told, the estimated damage was reported at more than \$6.5 billion (Dames and Moore 1999). There was extensive damage at the Port of Oakland, the fourth busiest containerport in the United States and (along with two other containerports in California) responsible for approximately 50% of the total container volume in the

United States (Port of Oakland). Damage included deformed rail lines, tilted container cranes, and cracked wharf piles. Despite the reported damage, most of the port facilities were able to remain in operation immediately following the earthquake, although indirect losses from traffic delays and delays in the transportation of goods due to the collapse of the Bay Bridge and Nimitz freeway exceeded several billion dollars (Dames and Moore 1999).

The 1995 Hanshin earthquake, while by no means one of the largest recorded earthquakes in history, had some of the most far-reaching maritime impacts in modern times. It completely devastated the Japanese port of Kobe, which at the time handled 25% of all Asian trade going to Europe and North America, and accounted for 17.8% of Japan's exports and 14.5% of its imports. 30% of the maritime transportation network in Japan at the time was concentrated there. (Coulter 2002). The port complex itself, constructed on two artificial islands made of relatively loose fill, suffered widespread liquefaction and settlement, and was incapacitated for two months (Louie 1996).

The 2004 Indian Ocean earthquake and subsequent tsunami were among the worst natural disasters in recorded history. Over 225,000 people lost their lives and economic losses were put at approximately $10 billion. In the maritime realm, preliminary estimates indicated that 66% of the fishing fleet and industrial infrastructure in the regions affected by the tsunami were destroyed by wave surges. Shipping was disrupted as well, particularly in the Strait of Malacca where the depth of the seabed was changed in numerous places. Navigational buoys and old shipwrecks were also disturbed, creating temporary hazards to navigation.

The 2005 hurricane season was one of the deadliest and most costly for the United States. Over 1,800 people lost their lives in Hurricane Katrina and the floods in the immediate aftermath, making it the second most deadly hurricane in US history. Economically, the storm caused over $81 billion in damage, making it the costliest hurricane to strike the United States. Maritime losses were significant. Port Fourchon, Louisiana, a key energy hub took a direct hit, leading to the loss of half a billion dollars a day. Similarly, the Louisiana Offshore Oil Port, responsible for the import of 11% of all US oil consumption, was temporarily unavailable. Additionally, twenty offshore oil platforms were missing, sunk, or set adrift. A few weeks later, as Hurricane Rita struck an area responsible for 30% of the total refining capacity of the United States; fully half of the Gulf's oil production was shut down. The storm caused $11.3 billion in damage and was directly responsible for seven deaths.

3.2.3. MIDDLE-OF-THE-ROAD MODERATION: SUMMARY REMARKS

Without emphasizing one set of threats over another, the logic of the moderate approach is that preparation for one set of threats prepares the maritime domain for other threats as well. Being prepared for a terrorist attack on a port facility in terms of response, recovery, and continuation of operation is not significantly different, moderates would argue, from responding to a hurricane or earthquake. Moderates focus on response and recovery preparedness, possibly even more than prevention, since the more likely severe threats are due to non-predictable natural events. In addition to implementing procedures to prevent maritime terrorist attacks, the maritime industry should undertake plans, policies and procedures to assist in recovery from natural and human-induced disasters.

Moderates argue that it is important to keep an "all hazards" approach in mind at all times – critics argue that an overemphasis on terrorism can actually reduce overall readiness; they offer the inadequate US response to Hurricane Katrina as an example (Bellavita 2006), claiming that the US Department of Homeland Security was so focused on terrorism that it diverted too many resources from the Federal Emergency Management Agency (FEMA).

3.3. Radical Reconstructionalism

Radical reconstructionalists would argue that maritime security should be about more than preventing terrorist attacks or responding to natural disasters. Rather, they would pay more attention to the underlying social and economic conditions that might lead to actions that threaten maritime security. Radical reconstructionalists would focus their attention on the root causes of man-made disasters such as famine, war and civil unrest, severe social disruption, and the like; which may lead, for example, to increases in maritime piracy and attacks on maritime assets, human smuggling and stowaways.

Radical reconstructionalists would argue that we can increase maritime security by dealing with the *root causes* of maritime threats. If the causes of maritime threats are reduced or eliminated, then, they argue, the maritime realm would become more secure. This would include reducing more than just the obvious threats. For example, while all would acknowledge that the Asian tsunami had a significant maritime dimension, few would argue that we have any ability to reduce or eliminate tsunamis. This said, environmental evidence suggests that the impact of the tsunami may have been considerably lessened if the coral reefs had not been so severely degraded and had been able better to perform their natural barrier function. Indeed, areas with healthy coral reef structures suffered considerably less damage with fewer fatalities (Illegal Destruction 2005). Knowledge about these kinds of cause-and-effect relationships can improve security in the future. Looking at maritime piracy and terrorism, maritime security professionals should dedicate their efforts to understanding whey these events occur, in addition to preventing these attacks.

3.4. Humanitarianism

Humanitarians would argue that not only should the maritime industry take an all-hazards approach to direct threats to maritime assets, it should also focus on the role the maritime industry can play in security threats that do not necessarily directly (or only indirectly) affect the maritime realm:

Emphasis on Maritime Assets as Target/ Victim of Attack/Disaster	**Emphasis on Maritime Assets as Support/ Assistance in Attack/Disaster**
Strict Constructionalism Middle-of-the-Road Moderation Radical Reconstructionalism	Humanitarianism

Humanitarians focus on the important role the maritime industry plays in famine response, evacuations from natural disasters or conflict arenas, and relief efforts in general for natural and human-induced disasters. Should a terrorist attack occur where the maritime industry could play a useful response role in evacuations or deliveries of necessary goods and services, humanitarians would argue that maritime assets should be offered for response and recovery. Indeed, after the 9/11 attack on the World Trade Center, up to one million people were evacuated from Lower Manhattan by water in a spontaneous response of privately and publicly owned watercraft (Greeley 2002).

Looking at the natural events discussed in the section detailing the middle-of-the-road moderation approach to maritime security, humanitarians would argue that the maritime industry has a role to play in these events (and indeed has played a role), even when there has been no significant impact on, or destruction of, maritime assets. For example, immediately following the Loma Prieta earthquake, ferry service between San Francisco and Oakland, which had ended decades before, was restored. Crowley Maritime (a private corporation), largely acting alone, provided the ferry capability as an emergency response service within three hours of the event, due to the collapse of a section of the San Francisco-Oakland Bay Bridge. The service was offered free of charge for a day and a half, with substantially reduced, state-subsidized fares implemented after that (Hansen and Weinstein 1991).

More generally, while response immediately following any natural disaster is usually provided by the fastest means possible – typically air – longer-term sustained relief efforts are conducted almost entirely by sea. This has led to new fields of endeavor: specifically humanitarian logistics and relief chain management. In each, a great deal of emphasis is placed on the role of the global maritime community as a vital component in any sustained emergency response.

3.5. Conceptualizing Maritime Security: Summary

The goal is not necessarily to provide an either/or discussion of maritime security, or to suggest that one conceptualization is somehow superior to another, or that maritime educators and professionals must lock themselves into a single notion of maritime security. Rather, the goal is to provide a sense of the richness of the ways in which maritime security can be conceptualized so as to provide a basis for discussion among maritime education and training professionals. Depending on the nature of the security threat, different countries (and different ports, regions and states within countries) may well find they need to define security differently. Not all countries face – or feel they face – threats from terrorism; not all countries experience hurricanes or earthquakes; nor are all countries afflicted with widespread humanitarian disasters requiring external relief.

4. Teaching Security: A Suggested Framework

A March 2007 conference on undergraduate curriculum development sponsored by the US Homeland Security and Defense Education Consortium reached a consensus on ten curricular outcomes for security professionals ("Undergraduate Homeland Security" 2007). Since, according to ISPS, ensuring maritime security – no matter how it is defined – can be viewed essentially as a *risk function*, it is useful to group these learning outcomes into their risk constituents. As has been noted in prior research, risk may be viewed as comprising two parts: risk assessment and risk management (Nincic 2006). While many of the goals and objectives listed below can be viewed as components of *both* risk assessment and risk management, they are grouped by their primary emphasis (it should be noted that the conference outcomes have been slightly modified, where appropriate, for the maritime security environment).

4.1. Risk Assessment

Risk assessment is essentially the determination of risk prior to an event occurring. Students, therefore, should learn how to anticipate and prepare for a wide range of threats before they happen. Key skills that should be learned include:

4.1.1. The ability to identify, assess, and prioritize threats, risks, and vulnerabilities

Students should be able to determine what threats exist to their ship, port, region, and the like, understanding that threats will vary from ship to ship, port to port, and region to region. Some may find that natural disasters are the most critical threat they face; others will find that terrorism is more likely. Most will find that they face multiple threats; in these cases, the ability to prioritize the threats – rank them from most to least likely – is vital.

4.1.2. THE ABILITY TO DEVELOP, INTERPRET, AND ASSESS MARITIME SECURITY PLANS

Once threats have been determined, students should be able to develop, assess and work with viable security plans prepared for each threat, or range of threats. While there may be some overlap (or even considerable overlap) in responding to an earthquake versus, say, a large-scale detonation of a bomb within a port facility, it is important to remember "one size fits all" security plans are unlikely to be of great utility in an actual crisis situation.

4.1.3. THE ABILITY TO ASSESS COMMUNITY NEEDS AND RESOURCES IN THE CONTEXT OF MARITIME THREATS, RISKS AND VULNERABILITIES

Maritime threats are rarely limited to a specific maritime asset. It is important to remember that ports are often parts of greater communities; a threat to a port, should it occur, is highly likely to affect the surrounding community as well. This is as true of a terrorist attack as it is of a natural disaster. Therefore, successful disaster planning and preparation must effectively engage the local population as well.

4.1.4. AN UNDERSTANDING OF PUBLIC, PRIVATE, AND NON-PROFIT INSTITUTIONAL ROLES AND RESPONSIBILITIES OF MARITIME SECURITY

Following from the point above, the "community" is generally made up of public, private and non-profit (or NGO) entities (it should be noted that many of the latter may be international organizations as well). Each will have different priorities in disaster/threat response, and each will have different value and organizational structures. While an understanding of the points of difference and dissent is important, what is even more important is the ability to turn these differences into strengths in a crisis situation. Because these are often entities that do not normally work closely together on a routine basis, the planning process is essential in bringing these stakeholders together prior to a crisis event.

4.1.5. THE ABILITY TO IDENTIFY AND COORDINATE RESOURCES TO COMBAT THREATS, MINIMIZE RISKS, AND REDUCE VULNERABILITIES

Once community needs have been determined within the context of maritime threat/disaster planning, the community should be viewed as a resource and partner in the planning process. The community is a source of valuable resources and is very often the first responder, should a crisis occur. Students should learn how to work with the local population in planning and coordination, burden-sharing and training.

4.2. Risk Management

Should a maritime security event/disaster occur, students should be prepared to manage the event successfully. Successful management involves the minimization of human casualties and the mitigation of psychological, social and economic disruption at all levels. This will involve, at a minimum:

4.2.1. The ability to communicate within government, across government levels, and to all sectors

As has been seen from the US responses to 9/11 and to Hurricane Katrina, one of the most common and deadly errors made in disaster response is the lack of effective communications. Communication networks are often found to be incompatible; chains of command are not effectively determined; decision-making authority is not appropriately delegated; cell phones do not work. Minimizing and eliminating problems of communication is vital in any disaster response.

4.2.2. Ability to understand principles of managing people, financial obligations, and projects

Disaster response and security preparedness often becomes yet one more competing item in maritime facility budgets. Ports cannot count on having unlimited funds made available to them should a crisis occur and should plan accordingly. This will be especially true after the immediate response is complete and the immediate crisis has passed. Responders will eventually become accountable for the funds they have spent; the ability to minimize financial dissipation, while obviously not the immediate concern while lives are at risk, will eventually become a matter of consequence. Similarly, in a crisis situation, multiple stakeholders will be present; the ability to manage people who are not part of one's day-to-day work environment is an essential skill.

4.2.3. Ability to understand and work within the environment of social, economic, legal, ethical, technological, and political interdependencies of maritime security

While many of these considerations may not (as above) be of immediate importance in disaster response while lives are still at stake, they will – as many events have shown – become important soon afterwards. While effective planning can help mitigate some of the pitfalls in this regard, a more general framework of understanding is essential. In crisis situations, decision makers must respond without significant time for refection; the more embedded these interdependencies are, the less likely it is that fundamental errors of judgment will be made.

4.2.4. Ability to work effectively within, and understand the dilemmas of, collaborative networks

Collaborative networks are formed by disparate entities (maritime firms, facilities, ports, emergency responders, NGOs, etc) in response to common problems. While an understanding of these networks is essential to the crisis planning process, knowing how to work with them in a crisis situation can make the difference between an effectively managed – and mismanaged – response. Routine practice, planning and training can minimize likely errors, but students should be educated and trained to understand that the vital learning outcome is how these various stakeholders work together *while the crisis is occurring*. Learning how to anticipate problems and manage dilemmas before they become acute is a critical security management skill.

4.2.5. Ability to collect and analyze data and information

While this would seem to be – and is – also a key component of the planning process, learning how to acquire essential information in a crisis situation is of the utmost importance. Students should learn what information they will need as a crisis unfolds, how to ask for that information, and how to assess its reliability. There will be much "fog" and confusion in a terrorist attack, or natural disaster, or response to a humanitarian crisis, and much incorrect information. Successful response to these situations requires an awareness of the information and data pitfalls that can occur.

5. Conclusion: The Utility of Communities of Learning/Communities of Practice

The goal of this paper has not been to provide the "correct" answers to the questions it has posed regarding the definition of maritime security, its constituent components, or its relationship to safety or STCW. Nor has it been to arrive at a definitive list of curricular goals and outcomes for maritime security students and practitioners. Rather, the goal has been only to provide one possible framework for addressing these questions by presenting various possible definitions and conceptions of security, and by suggesting one possible set of goals and outcomes, based on existing best practices. It is hoped that this paper may be a starting point for discussion within the IAMU so that member institutions can begin to work together to: 1) devise a mutually agreed upon understanding of the range of components of maritime security, 2) establish goals and outcomes for our respective educational and training programs, and 3) share our best practices towards meeting these ends.

Cooperation of this nature can be achieved through what are increasingly known as *communities of learning* or *communities of practice*, "groups of people who share a concern, a set of problems, or passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Braziel 2006). Different from formal organizations with official meetings only a few times each year, members in learning/practice communities work together frequently and informally, interacting with one another through *personal networks* – "smaller, frequently overlapping groups comprising people who know, have worked with, and trust each other" (Braziel 2006). The interaction can be either in person or, more often, online through e-mail, chats, "webinars," moderated electronic forums and the like, to discuss issues of mutual concern

These communities exist not out of mandates but out of voluntary cooperation among interested individuals with a mutual desire to seek, share and create both a deeper understanding of our common problems, and cooperative solutions to these problems. The IAMU already provides an excellent forum for the global community of maritime educators to discuss and share best practices in many important fields and endeavors. IAMU members with an interest in maritime security research, education and training are already the natural leaders in these fields, and should strive to deepen their cooperation through multiple avenues to set the agenda for the maritime security field in the years to come.

Sources

1. (2003). Aegis Research and Intelligence Database (2003).
2. (2007). Encarta Online Dictionary. Encarta.com.
3. (2005). "Illegal Destruction of Coral Reefs Worsened Impact of Tsunami". www.pysorg.com.
4. (2007). "Maritime: Facts and Figures". Port of Oakland. www.portofoakland.com.
5. (2007). Merriam-Webster Online Dictionary. Merriam-Webster.com.
6. (March 20-21, 2007). "Undergraduate Homeland Security Curriculum Development Conference." Sponsored by the Homeland Security/Defense Education Consortium (HSDEC) and Virginia Commonwealth University.
7. Bellavita, Christopher (2006). "Changing Homeland Security: What Should Homeland Security Leaders Be Talking About?" Homeland Security Affairs, Volume II, Issue 2.

8. Braziel, Rick (2006). "Impact of Homeland Security Communities of Learning: Developing a Strategy for Training and Collaboration." US Naval Post Graduate School. www.nps.edu.
9. Coulter, Daniel Y. (2002). "Globalization of Maritime Commerce: The Rise of Hub Ports," in Sam J. Tangredi, ed., Globalization and Maritime Power, Washington DC: National Defense University Press.
10. Dames and Moore's Earthquake Engineering Group (1999). "The Loma Prieta Earthquake: Impact on Lifeline Systems." Disaster Recovery Journal Vol. 3, No. 2.
11. Dillon, Dana Robert (2000). "Piracy in Asia: A Growing Barrier to Maritime Trade." Heritage Foundation Backgrounder #1379. www.heritage.org.
12. Greeley, Andrew (6 September 2002). "Media Ignored Calm Amid the 9/11 Chaos." Chicago Sun-Times.
13. Hanson, Mark and Sharon Weinstein (December 1991). "East Bay Ferry Service and the Loma Prieta Earthquake." Studies on the Loma Prieta Earthquake, No. 5.
14. Louie, John (2006). "Earthquake Effects." http://www.seismo.unr.edu/ftp/pub/louie/ home/home.html.
15. Nincic, Donna (2006). "The Utility of Risk Assessment Tools in Maritime Security Analysis," in Wang Zuwen, ed., Proceedings of Globalization and MET. Dalian, China: Dalian Maritime University Press. (With Bruce Clark).
16. Ryan, Margaret (2 February 2006). "Captain counts the cost of piracy." BBC News. www.bbc.co.uk.

Academic Spin-offs with the Aspects of Academic Entrepreneurship in Maritime Universities

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Abstract

Transfer of technology and knowledge from academic institutions to social environment can take place through various channels; such as disseminations, publications, education, interaction, co-operation, licensing and the establishment of new business entities based on academic technology and knowledge, so called academic spin-offs. When we focus on the maritime universities, we can see that the academic entrepreneurship and the process of academic spin-offs also can become a key issue for these entities. Gaining competencies in the process of academic spin-offs by accelerating entrepreneurship in maritime universities can provide the linkages between maritime academic centers and maritime industrial sectors and can be a barrier for core rigidities in maritime education and industry.

By the view of point, in this study it is aimed to understand the process of spin-off firms in maritime universities with the encountered problems and their possible effects in maritime industry.

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1.INTRODUCTION

For a sustainable marine future, marine research should achieve three main goals in the future: increase the knowledge of the marine world, explain the economic, social and political stakes which the ocean represents, bring scientific and technical expertise to policy-makers in ocean related activities and enhance technological competitiveness of maritime industry. Thus we can say that technnological developments and knowledge become key concepts.

As the technological innovation is a rising evolutionary process for the maritime industry, the maritime researches and their results which are the driven components for the innovation process, are being important phenomenon . The originators of researches and innovations are mostly the research centers such as universities, academies and institutions. Accordingly, innovation policies of government support the universities and research centers to commercialize their research results. The acceptance of commercialization as an academic task constitutes the triple helix concept that originates from the processes of transferring academic technology into application through the linkages between university, government and industry (Etzkowitz & Leydesdorf, 1997; Rasmussen & Borch, 2004). So academic technology transfer of the maritime research results can be important for the sustainable maritime industry.

Academic technology transfer can be referred as the process of transferring laboratory discoveries out of the academic institutions to the other entities for development and commercialization. Transfer of technology and knowledge from academic institutions to social environment can take place through various channels; such as disseminations, publications, education, interaction, co-operation, licensing and the establishment of new business entities based on academic technology and knowledge, so called academic spin-offs. However licensing, meeting, patents, publications and spinning out ventures are not only introduced as mechanisms of technology transfer but also presented as the kinds of academic entrepreneurial activities (Rogers *et al.*, 2001; Antonelli & Consiglio, 2001). Accordingly, academic spin-offs can also be identified as the only one type of the academic entrepreneurship.

Moderating entrepreneurial activities and academic spin-off process in the same entity may lead conflicts and problems. There are several challenges related to the formation of spin-off companies such as applied research vs. basic research, publications vs. patents, individual working vs. group working. Internal conflicts can also arise amongst the academic members in the weak entrepreneurial environment. This may cause additional problems for the growth potential of academic spin-offs (Rassmussen & Borch, 2004; Degroof & Roberts, 2003). The congruent points between the academic structure and entrepreneurship directly influence the creation of academic spin-offs.

This study orients to the formation of academic spin-offs through the perspective of academic entrepreneurship in maritime universities or academies. In the next section of the study, the maritime educational concept is in research centers are taken and then academic spin-offs literature is reviewed; the third part is about the effects of academic entrepreneurship and challenges on academic spin-offs. After that a case study is given for the academic maritime spin-offs and finally some concluding remarks are presented.

2. Maritime Academic Researches

Research in maritime policy and management is concerned with solving problems in the maritime industry and advancing knowledge that is industry specific. Thus to have a greater contribution and to achieve greater recognition outside industry boundaries, there is potential for research outcomes to inform theory outside the maritime realm. Furthermore technology is one of the factors driving the globalisation of economies, and maritime work processes have an important role in this picture. From the perspective of maritime technologies, three issues should be emphasized. These are shipbuilding, maritime transport and undersea exploration and explotiation (Roseta, 1998)

Shipbuilding has kept important technical competence. Technological research is necessary to improve tools to conceive and produce ships using particularly new materials and information technologies, to develop techniques for new ships. *Maritime transport* has been accelerated steadily and provides the development of specific technologies to improve multimodal transport (sea, road, rail), to develop high-speed sea connections between harbours for passengers and freight traffic, to introduce new techniques for traffic control and management to provide new services for shipping and to modernise harbour logistics. *Undersea exploration and exploitation* of hydrocarbon and mineral resources require the development of appropriate technologies. The possibility of exploiting deep-sea off-shore oil and gas fields represents a real technological challenge which has to be met (Roseta, 1998)

The technological programmes that are these three major issues which have great importance for the competitiveness of maritime industries and its economy and which should be at the core of technological programmes, one must acknowledge the fact that other areas call for technical progress and breakthroughs (Veenstra, 2002)

As there is an increasing interdependence between marine science and technology, scientific reseach opens new opportunities for the technological developments and maritime services that bring together different perspectives. The fundamental research is originated from the academic research centers, the academic spin-offs become an important entities to convert the fundamental research to applied research, stated in Figure 1 (Caron et al., 2004).

Nowadays, the maritime industry faces numerous challenges with respect to technological innovation. Marine scientific research will be driven in the future as in the past both by curiosity and by the needs of society. Marine science and technology will bring new knowledge to the maritime industry from its exploitation in a sustainable manner.

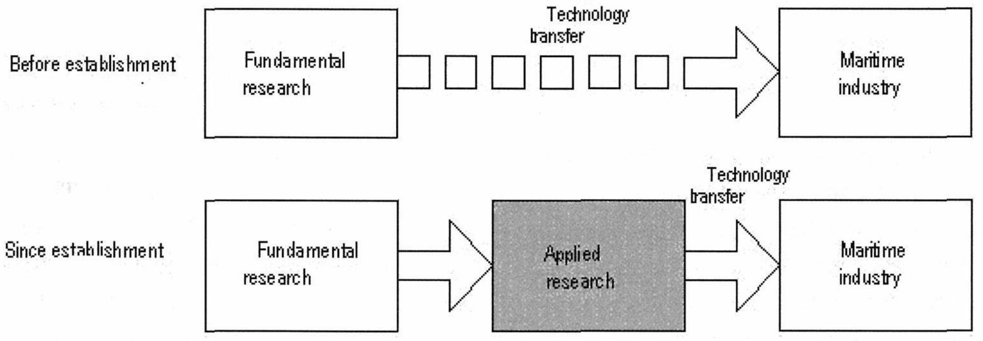

Figure 1. Applied research as a bridge between fundamental research and maritine industry

From the point of view academic spin-offs will be an effective mechanism to solve the challenges of maritime linkages between the technology and industry by: the mobilisation of scientific and technological competence, the constitution of research networks associating academic laboratories, national institutes and private companies, the building and peration of large common research infrastructure (Roseta, 1998). Thus understanding academic spin-off concept and applying to the maritime universities or academic research centers will provide more dynamic maritime sector.

3. Academic Spin-offs

Generally, spin-off is taken as a process that involves the division of an existing company into two, usually a bigger one (parent company), and a smaller one (the spin-off) through sharing the human resources, assets and intangibles.

Elfring and Foss (2000) identify the spin-off as the individual or the team who uses the competencies of parent organization to begin a new business. A spin-off can also be evaluated as a process of transfer of technology with the entrepreneurial activities from the parent organization (Dahlstrand, 1997).

Roberts and Malone (1996) identifies four principal entities which can be seen in the spin-off process:

- The *technology originator,* the person or organization that brings the technology from basic research through the stages of the innovation-development process to the point at which the technology can begin.

- The *parent organization* in which the R&D is conducted by the technology originator.
- The *entrepreneur* (or the entrepreneurial team) who takes the technology created by the originator and attempts to create a new business venture centred on the technology.
- *the venture investor*, who often represents a venture capital organization that provides funding for the new company in return for partial equity ownership in the new company.

According to Carayannis et al. (1998), two factors are often seen in spin-off firms:

- The entrepreneur who usually leaves the parent organization.
- A technology which is also transferred from the parent organization as a base of the new entity.

Furthermore, types of spin-off can vary due to their parent organizations. Spin-offs can be classified according to which organizations they are spun-off and which entities the entrepreneurs come from (Perez, Sanchez, 2002). One of the major originators of new firms is higher education institutions, namely, university or academic spin-offs.

Academic spin-off is a mechanism of transferring the technological knowledge or the know-how from academia to marketplace (Mansfield, 1991; Consiglio & Antonelli, 2001). Pirnay et al. (2003) conclude that academic spin-offs are the new entities which utilize commercially the research results and the technology of academic organizations.

Consiglio and Simoni (1998) identify two agents for the academic spin-offs. One of the agents is the characteristics of the academics of the research group and the second one is the way of the exploitation of the research results. The introduced agents support a commercial stage from laboratory (Consiglio & Antonelli, 2001) and provide knowledge flow dynamics between the academic institutions and industry (Rappert, 1999).

The effective use of knowledge production that takes place in universities and other research organisations requires the performance of a transformation process that includes the application of new scientific concepts. Furthermore the different scope and purposes of academic institutions and industrial organizations make this transformation process a complex matter. Thus there is also a need for translator between academic and industrial contexts (Chiesa & Piccaluga, 1998). Academic spin-offs appear to be well positioned for this task as they can match the knowledge of research organizations and the needs of market (Fontes, 2005).

Thereby the creation of academic spin–off firms are effected from many factors such as the economic climate, demand and market conditions, existence of knowledge base, business culture and business environment (Bálazs, 1996; Antonelli & Consiglio, 2001). The market orientation of academics is a critical factor as innovative determinants come from the demand-side. So the academic spin-offs should be more dynamic in network before and after their formation to produce a circulation of market orientation and technical capabilities (Perez, Sanchez, 2003). This circulation requires the people and the technological map of the region to be evaluated as a type of local network. From the regional economy perspective, it is identified that the academic spin-offs evolve under financial pressures and in response to changing market conditions, based on both academic knowledge and local knowledge.

Stankiewiez (1994) classifies the academic spin-offs with three modes. One of the modes is consultancy and R&D contracting for technology transfer and competence shortages; the second is product oriented mode that have well-improved product concept; the third of them is technology asset oriented mode which is relevant of the development of technologies.

The academic spin-offs are also categorized by Thornburn(1997) as;

- Direct research spin-off companies which are originated by commercializing intellectual properties through protecting the rights of the individuals, from the research institutions to the new firm.
- Technology Transfer Companies that are created for exploiting commercially the university's tacit knowledge and know-how.
- The Direct Spin-off Companies that are established by university staff or students who have no formal intellectual property licensing or similar linkages between the universities.

4. Academic Entrepreneurship in Academic Spin-off Concept

The formation of the academic spin-off is not an instantaneous phenomenon; it is a process, which constitutes the transformation of knowledge and technology into application. The creation of academic spin-off is a long way from the technology development to the exploitation of technology. The pathways of the academic spin-off process require the involvement of different approaches of the academic members during different stages of the spin-off process. The exploitation of technology benefits from entrepreneurial activities for utilization of the opportunities of market place. When the technology exploitation time comes, the research group of the development stage turns into an entrepreneurial team (Balazs, 1996). So the entrepreneurialism of the academic behavior becomes a key point for the creation of spin-offs.

Entrepreneurship is a process by which individuals create opportunities without regard to resources they currently control (Stevenson & Jarillo, 1990). Academic entrepreneurship can be taken as a behavior of modifying patterns of research in academic structure. Tyson et al. (1994) state that academic entrepreneurship is a knowledge-base activity which is consisted of taking risk, technology and being a bridge between the knowledge and industry. Louis et al. (1989) introduce the five types of academic entrepreneurship as

- engaging in large scale of science that can be externally funded.
- supplementing income
- gaining industry support for university research
- obtaining patents or generating trade secrets
- commercialization

Accordingly, the academic spin-off concept coincides with entrepreneurialism. When Freeman's (1986) conceptualisation of entrepreneurship is examined, the academic entrepreneurship and academic spin-off concepts come together. He claims that the formation of the new establishments is generally the outputs of the other organizations and the academic spin-off is one of the genetic interpretations of the organizational entrepreneurship. By the context, the entrepreneurial alertness is an important behaviour for sustaining the enterprising mindset and culture for emergency of new ventures.

Drucker (1985), states that innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or service. He also emphasises that innovation is capable of being presented as a discipline, capable of being learned and capable of being practised. That's why the transformation of an invention to a product can be taken as a three-phase entrepreneurial and innovative process. The first phase is the origination phase which includes genesis of the spin-offs and identification of the opportunity. This is followed by concept-testing phase that the opportunity is tested with a technical, intellectual and business point of view. Then the third phase, start-up support phase, starts (Degroof & Roberts, 2004). As a result of the integration of entrepreneurship and innovation concepts during the phases, the academic spin-off process is driven by the mission of capitalization of knowledge which is directly related to management of innovation through the academic culture (Etzkowitz, 1998; Ndonzuau *et al.*, 2001).

While executing the all phases of innovation, the management skills of the academics get importance (Balazs, 1996). Management of innovation requires the entrepreneurial qualities of drive, creativity, vision and ambition. (Consoglio & Antonell, 2001). Based on this, it can be claimed that if the conflicts that are encountered at the generation of the new ideas are overcome, the entrepreneur mindset can be spread to the other stages of the academic spin-off. As a result, scientists of the academic entities will be transformed to academic entrepreneurs who can manage the innovation during the spin-off phases through the academic concept.

Once the innovative activities and academic spin-off process are presented in the same organization, moderating these activities may lead conflicts and problems. When the core abilities in management of innovation are analysed, the congruent points of its concepts with the academic structure are experienced mostly at the origination phase

(Ndonzuau *et al.*, 2001). Generating new business ideas includes having the ability to create some aspects of the technology or the scientific knowledge in-house. Origination of innovative ideas provides to make the correct internal identification and assessment of the new opportunities which constitute the backbone of the academic spin-off process. Roberts (1991) suggests that the early choices during the initial phase impact the subsequent growth potential of the spin-off ventures. It is important to pay attention to the early phase of the academic spin-offs as the venture development is path dependent (Degroof & Roberts, 2004).

Furthermore the academics become the key individuals as they are the determinants of the organizational behaviour. The successful academic spin-off activities require the presence of the motivated academic entrepreneurs who have team building and management skills in addition to the traditional tasks of being an academic (Consoglio & Antonelli, 2001). But understanding the corporate organizational realities within the academic structure requires two opposite approaches in the same medium, namely, the scientific conception and the economic conception (Ndonzuau *et al.*, 2001). It is difficult to find the persons who carry these two concepts at the same time. We have to know why the scientific and economic conceptions are opposite to each other to avoid the barriers for the infancy of academic spin-offs.

Generally the scientific conception includes the basic research instead of applied research because the main goal of this conception is the enhancement of the human knowledge. Furthermore the academics of scientific conception transfer the research results and the knowledge mostly by publications (Callon, 1994; Etzkowitz, 1998). Publications are very important for academicians to get status in the academic structure. But from the perspective of academic spin-off process, the publication of a research result is not an effective way of knowledge transfer. Because a publication can cause lost of the originality of the new scientific knowledge. Nevertheless the legal issues such as patents can not be under control in the public domain. So the commitment of the academics to the publications can be presented as one of the conflicts between the scientific and economic framework (Ndonzuau *et al.*, 2001).

The other barrier for the formation of new academic spin-offs is the attitude of the academics to the money. While the economic conception uses scientific knowledge to make assets such as money, the scientific conception uses money to produce new scientific knowledge (MacMillan *et al., 2000).* So universities or other academic structures are not interested in the potential of the commercialization of the research results. Therefore new ideas that can be a trigger for an academic spin-off, aren't emphasized within the academic structure.

It is also important to identify the market-oriented results. Generally the scientists in the academic entities are often pictured as isolated from the realities of the business world. A perspective that is far away from the real world, sets a barrier to the realization of an market opportunity for the creation of successful academic spin-offs. The business idea characteristics should be in touch with the realities of the market potentials (Grandi & Grimaldi, 2000).

As the conflicts arise due to the non-entrepreneurial mindset, entrepreneurship should be made compatible with the academic structure by overcoming the conflicts. The dualisms of the scientific conception and economic conception -patents vs. publication, basic search vs. applied search, scientists vs. businessmen-, should also be accepted in the academic structure (Etzkowitz, 1998). As the academic spin-off process is an element of the triple helix concept, the supports of the government, the industry and the academy make the academic structure and entrepreneurialism coincided. Therefore the governments, universities and the industry carry out sustainable policies.

The governments can motivate the academic spin-off process by relaxing anti-trust regulations, developing co-operative research centres, and protecting the intellectual property (Bozeman, 2000). Industry develops well functioning financial markets. The local industry can provide suppliers, partners and buyers for the new academic spin-offs (Djokovic & Souitaris, 2004; Looy *et al., 2003;* Porter, 1990). In the academic institutions, the policies are generally made on focusing to the organizational culture. Many universities establish Technology Transfer Office and work with technology incubators and technology parks. To integrate the academic entrepreneurship and academic structure, universities also offer entrepreneurial courses, organise network events to create linkages between scientific, economic and technological fields and develop procedures for the spin-off formation (Birley, 2002; Mustar, 1997).

5. A Case Study: EMATAK – the Spinno Project of the Estonian Maritime Academy

The aim of EMATAK - the Spinno Project of the Estonian Maritime Academy is the development of co-operation between Estonian Maritime Academy and Estonian maritime enterprises and organisation of the knowledge transfer to the outside of the Academy. It also offers competitive training, research and development and innovative services at the international level to the Estonian maritime enterprises for their sustainable development.

The goal of the Estonian Maritime Academy as an internationally recognised professional higher education institution is provide quality maritime education, supervise and co-ordinate the maritime training and R&D activities and organise applied marine research.The objective of EMA research and development activity (R&D) is the promotion of the required co-operation between the Academy, public sector and enterprise for the sustainable development of the Estonian maritime enterprises and public sector, the arrangement of knowledge transfer and finding the solutions to the environmental issues of the Baltic Sea region bordering with Estonia. According to the R&D strategy, a favourable environment for the commercialisation of R&D activities is going to be created; knowledge transfer and business related training for the lecturing staff and the students is going to be carried out; the lecturers and students are consulted on the identification and testing of ideas, finding co-operation partners and sources of financing; the competence, provided services and intellectual property of the Academy will be introduced to the marine enterprises and joint research is carried out in the field of knowledge and technology transfer both with Estonian higher education institutions, R&D institutions and foreign partners.

The Centre was formally created in the Academy in December 2003 with a main objective to carry out tasks prescribed by the R&D strategy. Academy finances the Centre by means of its net assets earned by contractual work and paid Refresher Training service to the personnel of marine enterprises. The implementation of the set of tasks, established by the R&D strategy as a whole, is a time and resource consuming process.

The Centre creates a favourable and motivating environment for the lecturers and the students to carry out R&D activities and co- operate with enterprise. Raising the awareness of the members on commercialising the R&D results and co-operation opportunities with marine enterprise are another aim of the centre. The other activities are

- development of the support services, required for encouraging the knowledge transfer. Their application would considerably contribute to the increase in the volume of research contracts and projects, creating the preliminary conditions for the development of the spin-off enterprise;
- active introduction of the Academy competence, provided services, co-operation opportunities and its intellectual property by distributing the information materials and arranging partnership activities, creating an objective image of the opportunities to provide the required and useful services for the enterprise by means of Academy aid
- development of knowledge and technology transfer related co-operation, exchange of experience with Estonian R&D institutions and professional higher education institutions and foreign partners with marine enterprises.

In the course of the realisation of Spinno project the volume of enterprise oriented projects and contracts will increase in a sufficient scope to transform EMATAK into a self-sufficient enterprise in its activities (www.ematak.emara.ee).

6. CONCLUSION

Maritime research centers and maritime academies are the backbone of maritime industry. To have a sustainable maritime environment, the linkages between the maritime academies and industry should become a strategic issue for the national and international maritime policies. The academic spin-offs can be one of the most productive ways of linking the maritime technology to maritime social system. To understand the dynamics and organizational characteristics of academic spin-offs would accelerate the maritime industry developments from the academic institutions. Thus further researches are suggested on the concept of spin-off firms in maritime education.

REFERENCES

1. Antonelli G., Consiglio, S. (2001), " The development process of academic spin-off " Via De Sanctis, Polifunzionale II
2. Bálazs, K. (1996), " Academic Entrepreneurs and Their Role in 'Knowledge' Transfer" Science Policy Research Unit Mantell Building, University of Sussex
3. Birley, S. (2002), "Universities, Academics and Spinout Companies: Lessons from Imperial" International Journal of Entreprenuership Education, Vol. 1, No. 1, pp.1-21.
4. Bozeman, B. (2000), "Technology Transfer and Public Policy: A Review of Research and Theory" Research Policy, Vol. 29, No. 4-5, pp.627-655.
5. Callon, M., (1994), "Is Science a Public Good?" Science, Technology and Human Values, Vol. 19, pp.395-424.
6. Carayannis, E.G., Rogers, E. M., Kurihara, K., Allbritton, M. M. (1998), "High Technology Spin-Offs from Government R&D Laborities And Research Universities" Technovation, Vol. 18, No. 1, pp.1-11.
7. Caron A., Fortin J., Simard P. (2004), "The Case of Maritime Innovation", Canada Economic Development, Partner in Innovation
8. Chiesa, V., Piccaluga, A., (1998), "Transforming Rather Transferring Scientific and Technological Knowledge – Contribution of Academic 'Spin-out Companies': The Italian Way", (In: Oakey, R., During, W. (Eds), New Technology Based-Firms in the 1990s), Paul Chapman, London, p.15.
9. Consiglio S., Simoni M. (2000), "Metodologia e risultati della sperimentazione" Working paper Comitato, Tecnico del Progetto "La ricerca crea impresa" di Sviluppo, Italy.
10. Dahlstrand, A. (1997), "Growth and Inventiveness in Technology-Based Spin-off Firms" Research Policy, Vol. 26, No. 5, pp.331-344.
11. Degroof, J. J., Roberts, E. B. (2004), "Overcoming Weak Entrepreneurial Infrastructures For Academic Spin-off Ventures" MIT Industrial Performance Center Working Paper Series 04-005, Massachusetts Institute of Technology.

12. Djokovic, D., Souitaris, V. (2004), "Spinouts from Academic Institutions: A literature Review with Suggestions for Further Research"
13. Drucker, P , (1985), "Innovation and Entrepreneurship" HarperBusiness, New York
14. Elfring, T., Foss, N. (1997), "Corporate Renewal Through Internal Venturing and Spin-offs: Perspectives from Organizational Economics" IVS/CPS Working Paper 97-7, Department of Industrial Economics, Copenhagen Business School.
15. Etzkowitz, H. (1998), "The Norms of Entrepreneurial Science: Cognitive Effects of The New University-Industry Linkages" Research Policy, Vol. 27, pp.823-833.
16. Etzkowitz, H. , Leydesdorf, L. (1997), "Introduction to Special Issue on Science Policy Dimensions of Triple Helix of University-Industry-Government Relations" Science and Public Policy, Vol.24 , No. 1, pp.2-5.
17. Fontes, M. (2005), "The Process of Transformation of Scientific and Technological Knowledge into economic value conducted by biotechnology spin-offs" Technovation, Vol. 25, pp. 339-347.
18. Freeman, J. (1986), "Entrepreneurs as Organizational Products. Semiconductor Firms and Venture Capital Firms" (in: G. Libecop-Ed., Advances in The Study of Entrepreneurship, Innovation and Economic Growth. A research Annual Of Entrepreneurship and Innovation, The Impact Of Venture Capital On The Development Of New Enterprise,), Vol. 1, pp.33-52, Greenwich, C.T: JAI Press.
19. Grandi, W., Grimaldi, M. (2003), "Exploring the Network Characteristics of New Venture Founding Teams" Small Business Economics, Vol. 21, pp.329-341.
20. Looy, B. V., Debackere, K., Andries, P. (2003), "Policies to Stimulate regional Innovation Capabilities via University-Industry Collaboration; An Analysis and An Assessment" R&D Management, Vol. 33, No.2, pp.209-229.
21. Louis, K. S., Blumenthal, D., et al. (1989), "Entrepreneurs in Academy: An Exploration of Behaviours Among Life Scientists" Administritive Science Quarterly, Vol. 43, pp.110-131.
22. MacMillan, G, S., Narin, F., Deds, D. L. (2000), "An analysis of the critical role of public science in innovation. The case of biotechnology" Research Policy, Vol. 29, No. 1, pp.1-8.
23. Mansfield, E. (1995), "Acedemic Research Underlying Industrial Innovation, Sources, Characteristics and Financing" The Review of Economics and Statistics, Vol. 77,No.1, pp.55-65.
24. Mustar, P. (1997), "Spin-off Enterprises. How French Academies Create High-Tech Companies. The Conditions for Success or Failure" Science and Public Policy, Vol. 24, No. 1, pp.37-43.
25. Ndonzuau, F. N., Pirnay, F., Surlemont, B. (2002), "A stage model of Academic Spin-off Creation" Technovation, Vol.22, pp.281-289.
26. Perez P. M., Sanchez A. M (2003), "The Development of University Spin-offs: Early Dynamics of Technology Transfer and Networking" Technovation, Vol. 23, pp.823-831.

27. Pirnay, F., Surlemont, B., Nlemvo, F. (2003), "Toward A Typology Of University Spin-offs" Small Business Economics, Vol. 21, pp.355-369.
28. Porter, M. E. (1990), "The Competitive Advantage of Nations", Free press, London
29. Rappert, B., Webster, A., Charles, D. (1999), "Making Sense of Diversity and Reluctance: Academic-Industrial Relations and Intellectual Property" Research Policy, Vol. 28, No. 7, pp.873-890.
30. Rasmussen, E., Borch, O. J. (2004), "University Resources Facilating Strategic Entrepreneurship" Paper for the Second bi-annual European Summer University,
31. University of Twente
32. Roberts, E. (1991), Entreprenuers in High Technology:Lessons From MIT and Beyond., New York, Oxford University Press,
33. Roberts, E. B., Malone, D. E., (1996), "Policies And Structures For Spinning Out New Companies From Research And Development Organizations" R & D Management, Vol. 26, No. 1, pp.17-48.
34. Rogers, E.M., Takegami, S., Yin, J. (2001), "Lessons Learned About Technology Transfer" Technovation, Vol. 21, pp.253-261.
35. Roseta, Pedro. (1998), "Future Challenges in European Maritime Science and Technology", Committee of Science and Technology, Parliamentary Assembly
36. Siegel, D. S., (2004), "Analyzing the Effectiveness of University Technology Transfer: Implications for Entrepreneurship Education", Working Papers in Economic, Number 0426.
37. Stankiewicz, R. (1994), "Spin-off Companies From Universities" Science and Public Policy, Vol.21, No. 2, pp.79-87.
38. Stevenson, H. H., Jarillo, J. C. (1990), "A Paradigm of Entrepreneurship: Entrepreneurial Management" Strategic Management Journal, Vol. 18, No. 7, pp.509-533.
39. Thornburn, L. (2000), "Government Policies to Encourage Creation of Spin-off Firms from Academic Institutions" Paper Presented at APEC Symposium on Intellectual Property Rights.
40. Veenstra, W. Albert. (2002), "Nautical Education in a Changing World: The Case of The Netherlands" Marine Policy, 26, pp.133-141
41. http://www.ematak.emara.ee, 23. May.2007, 14.30 local hour.

Impact of Globalisation and Integration Processes on the Development of the EU Seaports

Adam Przybyłowski[1]

Abstract

The EU seaports are under a very strong influence of the globalisation and integration processes. Vertically integrating transport chains make them vulnerable to rapidly changing contemporary environment. As a response to those global challenges, the European Commission elaborated the Green Paper on a Future Maritime Policy of the EU. The holistic approach is to ensure better future also for ports in the EU. The obsolete seaport administration and management systems as well as port policy objectives and requirements, based principally on the concept of exclusively port-oriented management forms, do not comply any more with the new logistic management challenges and growing competitive transport environment. The seaport administrations are forced to adjust and get much more global and transport chain oriented. The paper examines some substantial reasons of the ongoing changes in the international trade and transport and also analyses the possible strategies for survival of the EU seaports.

1. Introduction

In 2005, one of the Polish Gdynia Port container terminals has been taken over by Hutchison Port Holdings Group (HPH). HPH handled that year 51,8 mln TEU on 251 quays in 43 ports. This global operator has shares on the terminals in 21 countries all over the world: in Asia, Africa, both Americas and Europe. In Europe, they are present in Belgium, Germany, Spain, the Netherlands and Great Britain.

The above example reflects the ongoing globalisation and integration processes that influence the international transport, affecting directly the world maritime transport and seaports, as well. Some nowadays existing traditional seaport administration and management systems as well as port policy objectives and requirements based princi-

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pally on the concept of exclusively port-oriented management forms, do not comply any more with the new logistic management challenges and growing competitive transport environment. The traditional concepts and models of national seaport policy are being steadily evolved, getting much more global and transport chain oriented.

Each European port must find its own strategy, depending on its particular situation, to survive in such a dynamic environment in order to remain competitive. In particular, they have to make plans in a climate of market uncertainty, confront the growing power of the shipping lines, justify expensive public investments, satisfy environmental issues and manage effectively under various regulatory changes.

2. Global Factors Influencing the Development of the EU Seaports

European ports, like all ports in the world, are being confronted by forces of change and uncertainty that are reducing their abilities to control their own destinies. Since several years, other actors in the transportation industry (the shipping lines in particular) are shaping port development. More than ever before, as intermediate points in transport chains, linking shipping with road and rail modes, ports are vulnerable to developments on both land and water. These developments have brought about uncertainty and change that has made port planning extremely difficult. Inter-port competition has been heightened in unanticipated ways (Slack 2001).

EU seaports' development is influenced by many factors (see fig. 1). Especially, the globalisation and integration processes affect the evolution of their management systems and models.

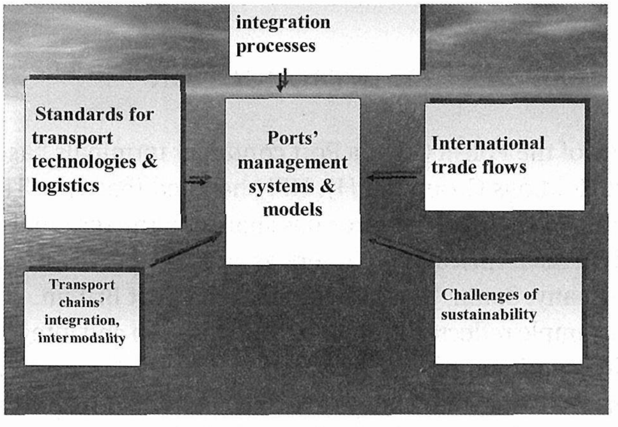

Fig. 1. Factors influencing the development of seaports

Source: Grzelakowski & Przybylowski 2006, p. 3.

The ongoing growth of the world economy in terms of GDP and industrial output accelerates the growth of the international trade and as a consequence boosts the increase of the world seaborne trade (UNCTAD 2005). According to WTO calculations, it accounts for more than 80 % of the world total trade in tonnage terms. The growth rates of the seaborne trade were especially high in the recent twenty years of the 20.th century. In 2004 it reached 6,76 billion tones 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 in deadweight tons (dwt) up to ca 900 million that represents 4.5% increase. The rapid increase of the world seaborne trade boosts the development of the maritime transport. As a result, it accounts nowadays ca. 90 % of the world transport in ton-miles. As a consequence the total throughput of the world sea ports has been growing considerably, reaching (according to the provisional data) more than 14 billion tones (loaded and unloaded) (Grzelakowski & Przybylowski 2006).

Shipping, being the most important mode of transport in terms of volume, gets an important support from the EU. In fact, the common transport policy favours the development of environmental friendly modes of transport in compliance with the idea of sustainable development (Lisbon and Goeteborg Strategy). The EU, through a set of political actions, legal and financial instruments, promotes intermodal transport (Marco Polo Program) and creation of motorways of the seas, for instance.

Furthermore, as a result of its geography, its history and the effects of globalisation, maritime transport will continue to be the most important transport mode in developing EU trade for the foreseeable future (Maritime transport 2006). The Green Paper on a Future Maritime Policy for the European Union intends to launch a broad debate on the development of an overall maritime policy which combines an integrated, cross-sector analysis with effective policy co-ordination and common action. According to the Commission, such a policy should combine the competitiveness and employment objectives of the Lisbon agenda with improving the health of the marine environment.

The Green Paper puts forward five concrete areas for discussion (EC Commission 2006):

- sustainable maritime development,
- quality of life in coastal regions,
- ocean management tools,
- maritime governance,
- European maritime heritage and identity.

Seaports feature prominently in the Green Paper and are identified as 'multifunctional areas, being key-elements in the logistics chain as well as business locations, but equally providing residential space and tourist facilities'. The Green Paper further acknowledges that the growth in trade and shipping is dependent on having adequate port capacity and recognises that this need is under competition from environmental objectives.

The Green Paper proposes that Member States would implement a system of spatial planning for maritime activities on the waters under their jurisdiction or control. This would create greater legal certainty for investment decisions. The proposal is based on the Thematic Strategy for the Marine Environment the Commission published last year which introduced eco-system based spatial planning. It also builds on the principle of Integrated Coastal Zone Management (ICZM).

The coastline of the European Union is many thousands of kilometres in length and contains well over 600 individual ports. These handle around 90% of EU external trade and more than 35% of trade between EU countries. This involves handling 3.5 billion tonnes of goods and 350 million passengers being transported on millions of ship journeys each year (www.emsa.europa.eu/end, 25.02.2007).

The ongoing process of cargo flows concentration benefits to the biggest EU ports, mostly in the northern part of the continent. The table 1 displays the total volume (in tonnes) of goods handled in all the major maritime ports of the EU. A big part of the increase over the years can be attributed to the increase of import of oil and oil products (http://epp.eurostat.cec.eu.int 2006).

Table 1. *Transshipment in EU countries (million t)*

	2004	2005
EU (25 countries)	3505	:
EU (15 countries)	3305	:
Belgium	188	:
Bulgaria	23	:
Czech Republic	-	:
Denmark	100	:
Germany (including ex-GDR from 1991)	272	:
Estonia	45	:
Ireland	48	:
Greece	158	:
Spain	373	:
France	334	:
Italy	485	:
Cyprus	7	:
Latvia	55	:
Lithuania	26	:
Luxembourg (Grand-Duché)	-	:
Hungary	-	:
Malta	4	:
Netherlands	441	:
Austria	-	:
Poland	52	:

Portugal	59	:
Slovenia	12	:
Slovakia	-	:
Finland	107	:
Sweden	167	:
United Kingdom	573	:
Croatia	41	:
Iceland	5	:
Norway	198	:
Switzerland	-	:

Source: Sea transport of goods, http://epp.eurostat.ec.europa.eu/portal/, 10.03.2007.

Containerisation that has given shipping lines greater freedom to serve markets from a wider choice of ports, thanks to so-called transferability (Fleming et al. 1994), deepened the globalisation process. Ports have no longer control over inland markets and can not be sure of the trade even in their own local areas. They have to invest huge sums of money in superstructure and infrastructure to participate in the container industry. However, it is not a guarantee to take profits from this business as some of them, despite having a container terminal, may be bypassed because of the reasons linked to the whole transportation chain, like hinterland connections.

The shipping lines, being the most important players in the logistics chains, 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 southern entirely new pivot ports, such as Gioia Tauro and Algeciras, bypassing direct services with northern reputed ports 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 top 20 container terminals only three EU ports are named, i.e. Rotterdam, Hamburg and Antwerp, ranked 7, 9, 11 respectively (see table 2). However, the percentage change of container throughput in the EU container terminals is above the world average level.

Table 2. *Top 20 container terminals and their throughput, 2004-2002 (millions of TEUs and percentage change)*

Port	Millions of TEUs			Percentage change	
W Ul Ł	2004	2003	2002	2004/2003	2003/2002
Hong Kong (China)	21.93	20.82	19.14	5.33	8.78
Singapore	20.60	18.41	16.94	11.90	8.68

Shanghai	14.57	11.37	8.81	28.14	29.06
Shcnzhen	13.65	10.70	7.61	27.57	40.60
Busan	11.43	10.37	9.45	10.22	9.74
Kaoshiung	9.71	8.81	8.49	10.22	3.77
Rotterdam	8.30	7.10	6.52	16.90	8.90
Los Angeles	7.32	6.61	6.11	10.74	8.18
Hamburg	7.03	6.14	5.37	14.50	14.34
Dubai	6.43	5.15	4.19	24.85	22.91
Antwerp	6.06	5.44	4.78	11.40	13.81
Long Beach	5.78	4.66	4.52	24.03	3.10
Port Klang	5.24	4.80	4.50	9.17	6.67
Quingdao	5.14	4.24	3.41	21.23	24.34
New York	4.40	4.04	3.75	8.91	7.73
Tanjung Pelepas	4.02	3.50	2.67	14.86	31.09
Ningbo	4.00	2.77	0.00	44.40	n.ii.
Tianjin	3.81	3.01	0.00	26.58	n.a.
Laem Chabang	3.62	3.18	2.66	13.84	19.55
Tokyo	3.58	3.28	2.71	9.15	21.03
Total top 20	166.62	144.40	121.63	15.39	18.72

Source: Containerisation International, March 2005, p. 77.

In the maritime transport sector the changes concern not only the growing volume of commodity flows and the structure, but also ships' size, specialisation, containerisation and transport chain organisation.

The growing ships' size involve huge capital expenditures in ports. They refer to extensive dredging, much more dockside and handling capacity, for example. However, such an anticipation may be a risky undertaking, as there is an uncertainty over the ultimate vessels' size.

As far as the organization of the 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 (see table 3). The main result of the capital integration and other forms of cooperation is enhancing the 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 transport of goods by sea costs have been decreasing and the effectiveness of the international combined transport chains is steadily growing. This process is still going on, despite huge unavoidable ports investments (Grzelakowski & Przybylowski 2006).

Table 3. *Emerging Port/Terminal Groupings in European Ports*

HUTCHISON	P&O	PSA	GATE
Felixstowe	Southampton	Genoa	Hamburg
Thamesport	Tilbury	Venice	Bremen
Rotterdam	Larne	Rome	G. Tauro
Trieste	Naples		La Spezia
	Cagliari		Lisbon

Source: Slack 2001, p. 14.

Major shipping lines formed strategic alliances because of the pressures of globalisation requiring to be present in all the major markets of the world. As a result, formerly separate services of members are being integrated and create new service configurations that ports are unable to predict the outcome (see table 4).

Table 4. *Shipping Alliances, 1999*

Alliance	**Grand**	**New World**	**United**	**SeaLand/Maersk**
Members	H-L,MISC, NYK,	APL, HMM, MOL	CY, DSR, Hanjin,	SeaLand, Maersk
	OOCL, P&ON		UASC	
# ships	79	75	61	199
#TEUs	299,224	289,399	190,235	483,000

Source: Slack B., 2001, p. 4.

Meanwhile, ports operations become more capital intensive, labour saving and space consuming. Due to liberalization of the EU transport markets the seaports are under the huge competitive pressure put mainly by 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 lowering of the operational handling costs. Only the biggest terminals and port handling operators can meet those 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 a huge public money and the 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 a transport chain and the evolution of their model of administration and management, in particular. The EU ports should consider specific approaches depending on the environment they are operating in to face the ongoing challenges.

3. Survival Strategies for Ports in the EU Countries

The EU port authorities, confronted with the abovementioned processes, must adopt efficient survival strategies in order to resist global and integration pressures. Slack mentions two possible reactions: keeping pace with market demands or pursuing customer-driven strategies. Porter and Robinson works suggest providing superior value-delivery to targeted customers at a cost that provides acceptable profit levels.

The first strategy consists on carrying out expensive investments in superstructure and infrastructure in order to keep pace with shipping lines expenses on larger vessels. The second one is a response to concrete demands coming from shipping line clients. Certainly, investing huge money is 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.). A port authority may be not only a port operator but also a land developer. Sites that have no more 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).

The majority of the major EU ports systems were created a long time ago, based mainly on the inside port-oriented factors connected with the land ownership. This criterion was decisive for the establishment of the port management systems. Consequently, the EU seaports management systems vary from the public models - landlord (autonomous ones) through municipal models to private systems The administrative function is taken over by maritime authorities (security, terrorism prevention, protection of the environment).

It is obvious that those models dominating in most of the EU ports do not comply any more with the contemporary requirements of the logistics transport operators. The biggest EU ports, like Rotterdam, Hamburg and Antwerp, acting not long ago as a typical municipal ports, under the growing pressure of the globalisation and logistic integration of the supply chains, are going more towards the autonomous models. The typical local dimension of the port management system which to a great extent hampered the adjustment process, was partly abandoned. Nevertheless, such a step is not sufficient to meet the criteria set by the global trade and transport sectors (Grzelakowski & Przybylowski 2006).

As mentioned above, the next one is to be a full integration of those entities into the transport chains is necessary. Such a process has already started. It is performed by horizontal and vertical forms of integration. The first one is caused by the ongoing process of privatisation of the ports terminals, mainly container ones. The global container operators, like HPH, take over container terminals becoming their owners in the world scale. The reason of 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 (Grzelakowski 2004).

The vertical integration is based on capital concentration among the ports terminal companies and other logistic transport operators such as global container alliances (Maersk). Till now, the ports behaved passively being 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 to be unable to resist the enormous global challenges. However, since the mid 90. some European seaports are getting much more pro-active on the global transport market. The simplest form is the EU biggest container terminal operators (Eurogate) set together with the strongest railway companies container railway services which 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 binds huge area of the hinterland and the main initiative is overtaken by the container terminals. The wider concept, based on stronger position of container terminal operator in land transport relations is aimed at strengthening its position in relation to the container transport operator (container alliances). Nevertheless, the port container operators are partly overtaken by still stronger maritime transport operators. In fact, the 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.

Containerisation has reduced the economic impact of ports on cities, because ships crews are smaller than they used to be, spend little time in port and dock labour considerably diminished. As local economic benefits (employment) are declining, it is no longer justified to invest huge public money in the port area. The European Commission wants to minimise subsides in accordance with proper competition policy and a restrictions on public state aid.

The increased competitiveness of the European ports can be achieved by establishing port clusters either via their port authorities or via municipal governments. The port cluster 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 the 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. The sustainable composition will be reached if all stakeholders having different goals are taken into account (Musso E. 2006). It is not an easy task, as ports authorities may be often in conflict with legislation, environmentalists and the general public while trying to accommodate their sites to growing economic needs (f. ex. access to water depths requiring a frequent dredging).

There is a need for more partnership solutions as regards port management, 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 be also a horizontal integration and port networking and combining competition and cooperation (fig. 2).

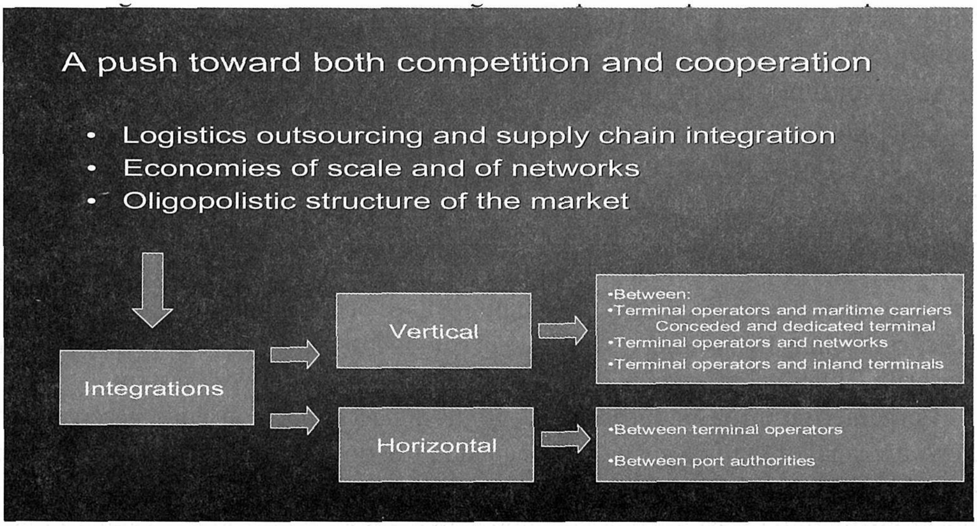

Fig. 2 Vertical and horizontal integration – ports competition and cooperation

Source: www.enricomusso.it/VigoSlides3.ppt, 14.02.2006.

So the EU ports, acting as a real global players, need to be much more efficient in micro and macroeconomic terms. They should become an integral part of the vertically integrating logistic transport chain. The simplest form of performing these strategy is the development on their areas the distribution and logistics centres, for example. They need to enforce much more integrated, 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. Such kind of seaport reorientation can not be efficiently carried out without a transformation of their administration and management systems, i.e. going towards more partnership solutions, for instance.

4. Conclusion

The position of EU ports in the context of modern, global and integrating logistical chains has considerably weakened. They have been put 'at mercy' of the shipping alliances dominating world trade not only on water, but also on land. Moreover, the process of deregulation in the common transport policy in the EU enables shaping equity mergers and alliances on land. For instance, the rationalisation of rail services raises the potential of differential access to ports. Most EU port authorities play only a secondary role in the global game.

The EU supports the development of maritime transport and seaports. The latest Green Paper on Future Maritime Policy is a step towards a holistic approach which could benefit to European ports. However, it is unlikely that there will be a harmonisation of port policy soon. It is not clear yet whether the EU wants to support bigger ports or rather help the regional and local ones in their development.

The traditional port management models decrease the competitive position of many of the EU ports. Thus, there is a need for novel organisation solutions in order to enhance their competitiveness. Some of the European seaports try to adapt to the new widely observed internal and external challenges and conditions. The appraisal of their position is possible through capital integrated transport chain oriented models of management. Actually, the efficient seaport policy needs to take into account such strategies as vertical and horizontal integration, port networking and port clustering.

Some of the European ports 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. However, this would require more partnership solutions, going far beyond the port area. Ports could also allocate births to a single user in exchange for along-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 economic benefits of port operations, like in Port of Rotterdam. The horizontal port alliances seem to be a good solution for survival, as well. A group of northern European ports already gather together to solve common problems. However, this process is quite a challenge because of the differences concerning port management models and systems. Finally, the ports' position in relation to global carriers can be upgraded thanks to the privatisation processes and emergence of grouping of terminal owner/operators.

References

1. Containerisation International, March 2005.
2. EMSA, Monitoring of Port State Control, http://www.emsa.europa.eu/end, 25.02.2007.
3. Fleming, D.K and Hayuth, Y. (1994) 'Spatial Characteristics of Transportation Hubs: centrality and intermediacy'. Journal of Transport Geography 2.
4. Grzelakowski A. S. (2004), Impact of containerasation development in maritime transport on shipping and ports, Namiary na Morze i Handel (Kontenery).
5. 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.
6. Grzelakowski A. S., Przybylowski A. (2006), The seaport policy and port management systems in the EU countries – do they comply with contemporary global challenges?, Maritime Transport, Barcelona.
7. Hong-Seung-ROH (2004), A conceptual model of port clusters and related assemblage, IAME IZMIR proceedings, vol. II.
8. Maritime transport, http://europa.eu.int/comm/transport/maritime/index_en.htm, 20.02.2006.
9. Maritime green paper proposes spatial planning for legal certainty port investments; http://www.espo.be/pages/ezine.
10. Musso E., la nueva dimension de los puertos en el siglo XXI, http://enricomusso.it/VigoSlides3.ppt, 14.02.2006.
11. Notteboom T. E. (2005), Port regionalisation: towards a new phase in port development, Maritime Policy & Management, vol. 32, no. 3.
12. Pando J. & al. (2005), Marketing management at the world's major ports, Maritime Policy & Management.
13. Review of Maritime Transport 2005. UNCTAD/RMT/2005. New York and Geneva.
14. Sea transport of goods (million t), http://epp.eurostat.cec.eu.int/portal/page, 10.03.2007.
15. Slack B. (2001), Globalisation in Maritime Transportation: competition, uncertainty and implications for port development strategy, Fondazione Eni Enrico Mattei.
16. Slack, B. (1993) 'Pawns in the Game: ports in a global transport system'. Growth and Change 24.
17. The Green Paper: Towards a Future Maritime Policy for the Union, a European Vision for the Oceans and Seas, Commission of the European Communities, Brussels COM (2006)275 (final), 07.06.2006.

Globalization, Maritime Education, and Student Exchange Programs

Graham Benton[1]

Abstract

As maritime universities across the world recognize the profound impact the forces of globalization have made on maritime industries, they've taken measures to educate students on issues of global interconnectedness. One way to further develop cross-cultural understanding and economic interdependence is to improve student exchange opportunities between maritime universities: while most institutions have student exchange programs in place, there are many impediments to their efficient functioning including complex and ambiguous financial contracts, the evaluation and transferal of academic credit, academic calendar alignments, STCW requirements, and additional administrative and governmental obstacles. The exchange of students between maritime institutions should be more efficacious, and via the institutional frame and authority of the IAMU, provisions can be made to streamline the process. Not only should student exchanges between maritime universities be encourage and cultivated, but the methods by which these programs are implemented should also be standardized.

1. Introduction.

Last October, the IAMU Presidents'/Rectors' Forum issued "The Dalian Statement" (2006) which asserted, in part, that "globalization has been progressing rapidly in the international shipping arena" and therefore "passing on maritime skills and knowledge to the following generations needs to be achieved on a global scale." Furthermore, a collective objective of maritime education around the world, this group maintains, should be to "prepare and develop standardized undergraduate curricula and an International Certification System for Competency" (The Dalian Statement 2006). For some time now, maritime universities have been attuned to the social, cultural, and political forces of globalization, and organizations such as IAMU work to disseminate

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ideas within a global arena. Maritime education now incorporates theories and practices of globalization into various courses, and students may also visit foreign ports of call during sea training periods which help to develop a multicultural perspective. One way to further develop cross-cultural understanding and to work toward the aims outlined in The Dalian Statement is to increase and strengthen student exchange opportunities between maritime universities. If students have the opportunity of studying abroad at different institutions, their knowledge of the world, and their position within it as future maritime industry professionals would be vastly improved.

Given the multilingual, multi-ethnic, multinational makeup of the majority of crews in the maritime industry, and given the obvious internationalist nature of maritime security, oceanic politics, and maritime environmental policies, it has become imperative that maritime education do what it can to reduce the communicative complications that may arise in such working conditions due to cultural difference. I have written elsewhere that problems in cross-cultural communication have significant and far-reaching implications regarding safety, security, and economic production, and a means by which to circumvent such problems is to "embed a knowledge of cultural difference in the classroom -- to make the study of the cultures of globalization a core component of the maritime curriculum (Benton 2005 p. 349). If we agree that this is a worthwhile and valuable goal then we must recognize that enabling our students to spend a semester or a year at another maritime institution is one way to reach this objective. According to The Institute for the International Education of Students, in the first large-scale survey to explore the long-term impact of study abroad on a student's personal, professional, and academic life, it was found that "study abroad positively and unequivocally influences the career-path, worldview, and self-confidence of students (Dwyer and Peters 2004). Besides improving students' confidence and enhancing their interest in academic study, "when questioned about intercultural development, 98 percent of respondents said that study abroad helped them to better understand their own cultural values and biases, and 82 percent replied that study abroad contributed to their developing a more sophisticated way of looking at the world" (Dwyer and Peters, 2004). Moreover, the researchers add, "it is significant to note that these intercultural benefits are not fleeting but continue to impact participants' lives long after their time abroad. Almost all of the respondents (94 percent) reported that the experience continues to influence interactions with people from other cultures" (Dwyer and Peters 2004).

Maritime education and training is committed to the practice of "experiential learning" – to gain knowledge via hands-on practice through the use of simulators, training ships, and other technologies and pedagogical methodologies. If we are truly committed to transnational cooperation, then developing and enhancing student exchange opportunities must be seen as another powerful example of "experiential learning." Indeed, participating in a study abroad program may exemplify the highest order of experiential learning in that a student's entire consciousness is engaged every day by working and socializing in a foreign country at a foreign university: the very act of "studying abroad" itself constitutes a personal, geographical and intellectually transformative experience.

2. Problematic Issues in Student Exchange Program Implementation.

Despite the obvious value of student exchanges and study abroad programs, they are often difficult to implement for a number of reasons. Many of these difficulties stem from the complex negotiations that need take place between two independent academic institutions (difficulties of a universal nature); and other problems surface because of the unique and specialized nature of maritime education itself (difficulties of a specific nature). Before proceeding it should be noted that this essay is concerned primarily with international educational opportunities for non-matriculating students and specifically bilateral exchange programs wherein two institutions agree, usually through a Memorandum of Understanding or other formalized contract, to exchange an equal number of students for an equal amount of time. While other study abroad opportunities exist – including full matriculation at a foreign institution – these often have very different admission structures and strategies. Even within the category of the bilateral student exchange program, however, there are often confusing or ill-defined procedures, in part because agreements and memorandum of understanding between two institutions are so ambiguous that they provide little information regarding procedure. This ambiguity is deliberate because it allows the two maritime universities entering into a student exchange to map out their own expectations and requirements, but this also places excessive administrative burdens on an institution every time it seeks to broaden its study abroad opportunities, or when new regulations or requirements are mandated from federal or university-level governing bodies.

2.1. Student Fees: Bilateral vs. Unilateral Exchanges.

Financial relationships between students, their maritime universities, and their nations are complex, individualized, and cannot easily be adjusted for international partnerships. Generally, in a bilateral one-to-one exchange, a student from one maritime university wishing to study at another would pay his or her student fees, including room and board, to the home institution, not to the host school. Or, the student pays tuition to the home institution but room and board fees to the host institution. In other situations, a student may have to pay international student fees to the host institution while also paying fees to his or her own institution. If a university has an exchange agreement with several or even dozens of other universities, and if each of these agreements has a different financial structure, then accounting practices become extremely knotty.

The issue is compounded, however, when two universities cannot exchange an equal number of students for an equal length of time. Oftentimes, a school will wish to send two, three, or four of its own students abroad to a specific maritime university which in turn can send only one of its own back: the financial inequity of such a unilateral exchange becomes a concern. Maritime universities across the world have widely divergent student populations and enrollment figures. If we wish, say, for 2% of the undergraduate student body to study abroad for a semester or a year, and given that entering and exiting students generally don't participate, at a four-year institution that leaves just 2nd and 3rd year students available. At Cal Maritime -- a relatively small school – this amounts to less than ten students. We currently have student exchange relationships with thirteen other maritime academies and thus our supply cannot meet demand. Furthermore, in cases where student education is heavily subsidized by the nation's government (and especially in institutions with impacted enrollment) admitting international students unilaterally without charging student fees is a difficult practice to condone in fiscally-stringent times. It must also be acknowledged that each student often utilizes several different financial resources to pay for education: personal or family savings, government scholarship, government loan, private loans, individual scholarships, etc., and each revenue stream has stipulations as to how the money may be spent – some of which prevent the student from attending classes in an institution different from that which the money was assigned. Yet to deny these students the opportunity to study abroad arguably amounts to economic discrimination.

2.2. Academic Calendar Incompatibilities.

Periods of study from one maritime institution to another do not line up neatly, thus creating problems with curriculum and enrollment management. For example, most U.S. maritime universities run on a two-semester academic calendar from September to December and January to April; Dalian Maritime University's academic calendar runs September to January and March to July; The Australia Maritime College's semesters run from February to June and July to November. A student wishing to study abroad for only one term would have to begin after the semester has started or leave before it has finished in order not to adversely affect attendance for the next term at the home institution. A student wishing to study for a year may also discover scheduling conflicts with sea time on a training ship. Missing days or weeks of coursework (especially if it falls at the end of a term) has wave-like detrimental repercussions: missing course work and/or exams can lead to lack of course credit or STCW certification, which in turn may delay graduation. Foreign students wishing to register for courses late or withdraw early at their host institution also place burdens on individual faculty who may not be able to accommodate such flexibility in their curriculum plans. And obviously, many courses are designed for incremental skill-set acquisition with final exams used as assessment tools: to miss the beginning or end – especially if the foreign student must also grapple with a new language and new culture – makes mastery of a given subject nearly impossible.

2.3. TRANSFER OF ACADEMIC CREDIT.

Differences in curriculum, unit measurement, accrediting bodies, and grading protocol make it troublesome for students to receive credit for courses they have taken at different institutions. Bracketing for a moment the issue of STCW requirements, all institutions are accredited in the county in which they reside, and regulatory bodies often prohibit (or at least make it very difficult) to transfer credit from one differently-accredited body to another. Also, units of study are measured differently: is a three-unit course in maritime engineering in America equivalent to the same in Asia? Furthermore, student evaluations are frequently recorded in different scales: most prevalent in the United States is a 4.0 scale, but a 5.0 scale is used in Russia, with some European and South American universities using a 6.0 scale, a 10.0 scale, or a 20.0 scale, and others using The European Credit Transfer System. Who then, ultimately decides credit and course grade equivalency? Generally, in order for a course to be transferred, it must be equivalent in three areas: course content, course level, and unit value. In reaching equivalencies, it may even be necessary to separate and/or combine elements from different courses given by the host institution. These are issues that face any university that offers an international study abroad program. Larger institutions, however, also have resources to assist students in integrating their coursework overseas into their home campus degree programs. The Office of International Programs of the California State University system, for example, evaluates, translates, and reports on student work done at the host institution. This office also evaluates courses taken abroad and with deliberate consideration and analysis determines the equivalent course at the student's home campus. This process requires the examination of student transcripts, academic advisement forms, campus catalogs, course syllabi, etc. (Office of International Programs 2007). No such office exists within the maritime university community to authorize such determinations.

2.4. MET AND STUDENT EXCHANGE.

The aforementioned issues of credit transfer are exacerbated by the particular characteristics of maritime training. The '95 STCW Convention carefully identifies and categorizes a number of components necessary for the acquisition of a license, but it doesn't explicitly delineate *how* those components should be integrated into a curriculum. Thus, maritime universities may comply with the ends of STCW regulations but do so by very different means, with different components covered in different courses, in different sequences, with different unit measurements. To take just one marine program for example, in his study of marine engineering curricula Boris Butman found that "in spite of the substantial efforts of the IMO and the maritime community aimed at developing standardized curriculum for training ship officers, the educational programs in different institutions vary quite substantially. Undergraduate marine engineering programs offered in various countries differ in their duration, content, onboard training, [and] specific requirements" (2005 p. 19). Furthermore, the distribution of time among the various portions of a program and the list of academic courses varies quite substantially from country to country, and even among different schools from the same country" (2005 p. 19). Without venturing to assess the strengths or weaknesses of one curriculum over another, it is evident that the non-standardization of maritime curricula from school to school presents additional challenges to the student wishing to transfer academic credit back to his home institution.

Likewise, sea training is another unique aspect of maritime education which opens up additional opportunities for student exchanges. If students are unable or unwilling to spend a year or a semester abroad, perhaps more programs could be developed which make use of a host institution's training ship. Such an exchange is not unfeasible, but is subject to all of the issues already raised, with additional concerns regarding space availability, seamless integration into shipboard duties, ports of call and foreign visa complexities, and additional financial expenditures.

2.5. ADDITIONAL STUDENT EXCHANGE ISSUES.

An effective International Exchange Program faces many administrative challenges, and there exist several other complexities that are related to, but expand beyond, the potential problems articulated above.

First, language barriers hinder cross-cultural communication: students who do not have a strong command of the language used in course work at the host university are severely challenged. Even if students wish to develop and increase their language skills (a noble pursuit which should not be dissuaded) the possible damage done to their grade point average, especially as this may impact academic standings and even career aspirations, may discourage them from applying. Students who are less than fluent in a foreign language often feel marginalized and disenfranchised by fellow students, instructors, and administrators.

Second, federal government-level paperwork regarding immigration and visa acquisition adds an additional level of bureaucracy to student exchange programs. It is ironic that the very threats to global stability which make interaction between the world's students so important also result in so many reviews and document requests.

In the United States, for example, post 9-11 legislature requires all student exchanges to be processed through the Department of Homeland Security, (DHS) via the Student and Exchange Visitor Information System (SEVIS) which then enables the submission of designation applications to the Department of State (DoS). Only once the student has been cleared by these agencies will he or she be granted a visa. The time needed for this to occur can take months, thus a student exchange process must be planned well in advance.

Finally, the very nature of an exchange program requires input and approval from many different university departments, offices, and bureaucratic entities. A successful exchange of just one student demands participation from an Admissions Department (does the incoming exchange student have the appropriate intellectual skills?); the Housing Coordinator (is there a dormitory room available for the incoming student? Does the student require special living arrangements because of cultural or religious beliefs? Likewise, are there dietary restrictions that might present problems?) Also involved are Records Departments and enrollment management personnel, specific Academic Departments and academic advisors (what classes does the incoming student wish to take? What courses is she or he qualified to take? What if those classes are full or unavailable? Who is to advise these students?) And, for students planning to study abroad, who will advise them from their home university on classes to take? What if their current advisor has no knowledge of the host university curriculum? Will they be assured of housing upon their return? There are numerous other questions: is there specialized mentoring or an orientation that is needed or desired? Are there health insurance requirements? Who is to pay for these? Is there legal assistance available for the exchange student should the need arise?

Not only, then, are several – perhaps dozens – of departments, agencies, and individuals required to process even one student's single semester exchange, but these entities must be carefully choreographed and calibrated to work quickly: if one step of the process is delayed – confirmation of available housing, for example – then months of work on behalf of others (not to mention extreme disappointment on the part of the student), may be for naught.

The amount of work, therefore, needed to process exchanges is daunting, and universities strapped for human and economic resources may be understandably reluctant to pursue and expand such programs. The rewards of a student exchange program are great, however, and to simply narrow or limit the international opportunities available in maritime education and training is counterproductive in the age of globalization. Some proposals in the following section suggest how the process may be made more efficient, and how the International Association of Maritime Universities may help in this endeavor.

3. Student Exchange Program Proposals and Recommendations.

The exchange of students between maritime institutions should be more efficacious, and via the institutional frame and authority of the IAMU, provisions can be made to streamline the process. Not only should student exchanges between maritime universities be cultivated, but the methods by which these programs are implemented should also be standardized (thus fulfilling one of the objectives of The Dalian Statement).

First, each university should identify a chief international student exchange officer, or at least a designee specifically for maritime university exchanges. The larger institutions may have entire staff and resources devoted to international study, but at smaller institutions, it is not always easy to identify the appropriate personnel. One is left wading through pages of web-based material, often with poor language-translation software, or one is left to peruse university catalogs hoping to alight on the right contact person. Certainly, most institutions have several people and/or distinct entities that engage with international issues related to education, but student exchange programs are housed differently in different institutions. Some schools have a dedicated Office of Student Exchanges; others umbrella these programs within an International Education office, still others house them with admissions, or student affairs, or even individual academic departments.

This chief international officer then would work with those important intramural affiliated departments mentioned in the previous section (admissions, records, academic affairs, housing, etc.) *and* with other intercollegiate maritime university international officers to both increase study abroad opportunities across the IAMU and to make the process more efficient. Possible charges to this international student exchange working group may be to:

- Compile data on all IAMU member institutions that currently have Memoranda of Understanding with fellow IAMU member institutions with provisions for student exchange.
- Analyze the consistency of the language and requirements of those memoranda and seek strategies to standardize, as much as possible, the exchanges. This should not be construed as an attempt to wrest autonomy away from each individual academic institution, but rather as a means by which we can move toward a more globalized and uniform curricula.
- Seek to expand (with proper institutional input and approval, of course) the number of maritime universities willing to participate in student exchanges. These new exchange programs could be modeled on the revised and standardized programs aforementioned. As of this writing, there are 45 member institutions. It not so very hard to imagine a day when a student at any given IAMU

institution would have the opportunity to study at any other IAMU member institution.

I would also suggest that should this working group get formed, additional energy be directed toward developing a document – a separate catalog under the aegis of the IAMU, perhaps, or a subset of the catalog of each participating member institution, that clearly sets out the following in regards to student exchange:

- A list of courses (including the language with which it is taught and the appropriate pre-requisites) within each department or area of study that may be taken at the host institution, with a clear understanding that these courses can be transferred back to the home university for credit.
- A grade equivalency matrix for all participating universities.
- Additional guidelines if necessary on course-load restrictions or obligations, academic advisement forms, language requirement forms, etc.

This group would work with all the assorted parties on their respective individual campuses to resolve issues of financial expenditure and academic affairs, and this group could also work together online, to share ideas and disseminate information with which to usher in a new era of maritime education collaboration.

4. Conclusion

In the words of the IAMU Honorary Chair Yohei Sasakawa, "globalization has been accompanied by the rapid internationalization and multi-nationalization of maritime activities and problems," and "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...There is an urgent need to ensure not only a high level of education, but also a uniform curriculum for all students" (Development for a New World Maritime Community 2006). Facilitating student exchanges between maritime universities is a step toward this goal: the rewards in developing an interlocking, systematized structure are enormous; the risks in not doing so are grave.

References.

1. Benton, G. (2005). Multicultural Crews and the culture of globalization. *Proceedings of the International Association of Maritime Universities: Sixth Annual General Assembly and Conference.* . Detlef Nielsen, Editor. WIT Press, Southampton, UK.
2. Butman, B. (2005). Study in standardizing marine engineering curriculum. Project Report. *Proceedings of the International Association of Maritime Universities: Sixth*

Annual General Assembly and Conference. Detlef Nielsen, Editor. WIT Press, Southampton, UK.

3. Dwyer, M. & Peters, C. (2004). The benefits of study abroad. *Transitions Abroad Magazine.* Available from http://www.transitionsabroad.com/publications/magazine/0403/benefits_study_abroad. [cited from 15 June 2007].
4. "The Dalian Statement" (2006). The First IAMU Presidents'/Rectors' Forum. International Association of Maritime Universities. Available from: http://www.iamu-edu.org/generalassembly/aga7/dalianstatement.php. [cited 18 June 2007].
5. Office of International Programs, California State University (2007). Academic arrangements. Available from: http://www.gateway.calstate.edu/csuienet/Participants.cfm?ID=10 [Cited 15 June 2007].
6. Sasakawa. Y. (2006). "Development for a new world maritime community." Speech delivered at the 7th General Assembly of the International Association of Maritime Universities, Dalian, People's Republic of China. Available from: http://www.iamu-edu.org/generalassembly/aga7/sasakawa.php. [cited 17 June 2007].

The Maritime Security Regulations: do they go far enough?

F. A. Anstey[1]

Abstract

The Diplomatic Conference on Maritime Security held in London in December 2002 adopted the International Ship and Port Facility Security Code for the purpose of detecting and deterring security threats to the maritime transportation sector. However by failing to institute a broader application, the maritime community has been lulled into a false sense of security. The International Maritime Organization insists that risk assessment is an essential and integral process for ships and facilities when developing requisite security plans but it has not used the same criteria when identifying applicable ships for inclusion within the Code. Although terrorist attacks are frequently directed at oil related infrastructure and personnel, the apparent lobbying efforts of the oil industry have resulted in the exemption of assets, such as the Floating Production Storage and Offloading vessel, and most Mobile Offshore Drilling Units, from the mandatory application of the ISPS Code. The potential consequences of an attack on these high value assets are significant loss of life, appalling environmental damage, and economic disruption through supply shortages and volatile oil price fluctuations. Fishing vessels too have been excluded. Thousands of deep-sea trawlers of significant tonnage, ply international waters, have multinational crews, and visit ports worldwide, but are not included in the security regulations and therefore remain off the radar screen of international security inspectors. At best they pose a risk of contaminating ISPS certified ships and port facilities, at worst they can be used to cause a major security incident. Similarly large ocean-going yachts have been exempted from the ISPS Code, creating security risks and indeed have been used for eco-terrorism activities. High-risk government vessels, attractive to terrorist organizations are also exempt from the security regulations. A variety of application measures are being used by some contracting governments, with national security regulations applying to an array of smaller type vessels, and with some including domestic-trade vessels. Most countries have ignored home-trade passenger ferries, which may carry hundreds of passengers

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and vehicles, and create an obvious target for terrorist organizations. Additional risk is incurred because contracting governments have not used standardized criteria for conducting background security checks for port facility and vessel personnel. This paper has conducted a literature review, and an analysis of pertinent statistics and security regulations to examine the risks associated with these insufficient measures.

1. Introduction

The ISPS Code identifies the mandatory security requirements to be enforced by contracting governments and other affected parties. The application section of the Code is central to this security regime as it identifies the ships and consequently the port facilities to which the Code applies. It requires passenger vessels, certain cargo ships and mobile offshore drilling units (MODUs) that are on international voyages, to conform. The IMO has used the guidance in Part B, the amendments to the SOLAS Convention and the issuance of circulars to clarify many of the requirements of this international security framework. A stated ISPS Code objective (IMO 2003a) is, "to ensure confidence that adequate and proportionate maritime security measures are in place." The arbitrary selection of vessels and associated port facilities does not totally meet this objective. A review of the included and excluded categories of vessels reveals a number of short-comings, not easily fixed through national security regulations. This fact, combined with the inadequate, unregulated personnel identification system for seafarers and port facility workers, has resulted in a piecemeal global security regime with weaknesses that may ultimately defeat the intent of the Code.

2. Vessel size

Vessel tonnage is one criterion used to determine cargo vessels that are required to comply. It is an arbitrary determinant, of 500 gross tonnage and upwards, and is not directly linked to maritime security considerations. In reality, and as indicated by the Code, the implementation of a security regime must be based on a security risk assessment. The security regulations, by applying this arbitrary cut off has exempted smaller sized vessels, which due to the nature of their work or the nature of their passage may indeed pose a risk that exceeds that of larger vessels. Secretary-General Mitropoulos (2005) of the IMO, in an address to a seminar on maritime security stated that "the threat of a small craft might even be greater than that posed by SOLAS ships" and he further admitted that such an incident "could have a major disruptive effect on human life, the environment and local, regional and even international trade".

Several countries have moved to address the potential threat of non-SOLAS ships. The port of Singapore, having 3000 small vessels that operate in and around its harbour, has implemented a number of security measures. They include the requirements to carry a low-cost transponder, to complete a ship security self-assessment, and to abide by a Harbour Craft Security Code (Yew 2005). Other countries, in national security legislation, have used a smaller gross tonnage as the arbitrary cut off for applicable ships. The United States has included foreign cargo vessels and self-propelled U.S. cargo vessels, greater than 100 grt, in its Maritime Transportation Security Regulations (MTSR). Transport Canada (2007) has defined 'non-SOLAS ships' as those engaged on a voyage from a port in one country to a port in another country and in excess of 100 grt, and identified them for inclusion in the Canadian MTSR.

These examples are not suggested to be the ideal models for determining the appropriate size of vessels for inclusion, but they do indicate that the arbitrary tonnage requirement, as mandated by the ISPS Code does not address all security concerns. The IMO (2004b) identified 22,500 vessels requiring ISPS compliance, but according to the Institute of Shipping Economics and Logistics (ISL 2002) the total merchant fleet comprised of about 90,000 vessels of 100 grt and over. The Code, through Part B, does suggest that vessels less than Convention size may be subject to controls imposed by port states, but as this section is designated non-mandatory, adherence is envisioned to be sporadic at best.

The IMO (2003a), through SOLAS, now requires that certain vessels be fitted with an Automatic Identification System (AIS). From a security perspective this will enable other vessels and port states equipped with AIS receivers to determine, in part, the identity of those vessels. The regulations also require that certain ships be outfitted with a ship security alert system (SSAS) to enable them to alert a competent authority, when they are the subject of a security incident, in order that a response may be initiated. Respectively, these regulations apply to vessels of 300 grt and 500 grt and upwards and therefore vessels of a smaller size are not required to be outfitted. When analysing the infamous attacks on the USS Cole and the VLCC Limburg, or the hundreds of piracy attacks that occur annually, it becomes apparent that small vessels are often the threat and without including AIS requirements for these vessels, all such ships may be viewed with suspicion. Additionally, it is not always large vessels that are subjected to security incidents, particularly in areas where piracy is prevalent, and smaller vessels may also benefit from the mandatory carriage of SSAS.

3. International Voyages

The ISPS security measures apply to certain vessels on an international voyage, defined by SOLAS as a voyage from one contracting country to a port outside that country. This suggests that the risk of a security incident can only be caused to, or through vessels coming from that other country. The 'international voyage' definition (IMO 2004c) also precludes vessels navigating solely on the Great Lakes and St. Lawrence River, even though such voyages commonly involve passage between the United States and Canada. These two countries, recognizing the risks associated with this exclusion have included these voyages within their national security regulations. The United States (USCG 2003) has also expanded the list of applicable ships to accommodate those domestic vessels considered to be of higher risk, such as those carrying more than 150 passengers, and vessels or barges carrying certain dangerous cargoes.

It is difficult to determine the extent of the risk caused by the exclusion of domestic trade vessels. However on the ISPS Code implementation date, IMO (2004b) calculated that 22,500 vessels were required to be compliant. According to world fleet statistics as cited by the Japan International Transport Institute (JITI 2005) the global merchant fleet of vessels of 500 grt and over totalled in excess 45,500 vessels. Therefore it may be inferred that there were just as many vessels of this size that were engaged on domestic voyages, and to which the Code did not apply. The IMO also noted that 9000 port facilities, servicing ISPS certified vessels, were required to conform to the Code. The significant number of domestic vessels suggests that there are also a large number of facilities not requiring compliance even if the ship or facility is a high risk asset, because it does not service vessels that are on international voyages.

Some jurisdictions have realized the risks associated with using only the international voyage as a determinant for their security regulations. The European Parliament (2004), while following the ISPS model for initial implementation, phased in other applicable vessels in years following. By 2005 the regulations applied to Class A domestic passenger ships and in 2007 they affected certain other vessels operating domestically. The EU regulations mandated that countries within the European Union conduct a security risk assessment to determine precisely which vessels would be covered, and this process is envisioned to suffice if all countries apply a rigorous and consistent risk assessment model. Additionally, as the regulations have expanded the categories of vessels requiring certification they also require port facilities servicing those vessels to comply with the security regulations.

It is interesting to note that terrorist attacks have commonly been carried out against domestic transportation systems. High profile examples, including the use of American aircrafts in the attacks of 9/11; the targets of domestic commuter trains in Madrid in 2004; and the attacks on the London bus and subway systems in 2005, all point towards the risk to domestic transportation. These events suggest that the maritime community has also incurred an elevated risk because it has not mandated consistent global security procedures for domestic trade vessels and associated port facilities.

4. Passenger Ships

Passenger vessels are at risk as evidenced by the notorious terrorist attack on the Achille Lauro and the high-profile pirate attack on the Seabourn Spirit (BBC 2005). The cruise ship industry is of particular interest and statistics (ISL 2002) indicate that the number and size of vessels within this industry continues to grow. A major security incident has the potential to cause significant loss of life, the destruction of the vessel and port facility, and the economic crippling of an industry. As the size of theses vessels increases, and with their capability to carry more crew and passengers, the attractiveness as a target also increases.

However, in addition to the cruise ship industry there are other vessels that carry passengers including cargo and Ro-Ro passenger ships, and ferry vessels. The Code has recognized the inherent risk and for that reason has not used vessel size as a determinant. Rather for security purposes it encompasses vessels carrying more than 12 passengers while on an international voyage. However domestic ferries are not covered by the Code and do not have the resultant security plans and procedures. Unfortunately, as evidenced by attacks in Manila on the Superferry 14 in 2004 killing 116 people, and on the Dona Romona in 2005 killing two, such vessels are not immune from the aggression of terrorist organizations (Martin 2005).

In Canada, BC Ferries (2007) has a fleet of 36 vessels servicing 47 ports of call. The largest is 560 feet in length, capable of carrying 2100 passengers and 470 vehicles. In 2005/06 the fleet carried in excess of 8.5 million vehicles and 21.7 million passengers on over 186,000 sailings. As the voyages conducted by these vessels are not international, the vessels are not required to comply with the international security regulations, even though a major security incident on one of these vessels would not be viewed as any less significant. Globally, statistics indicate that there are about 3800 vessels, excluding cruise ships, categorized as passenger vessels (ISL 2002). A major security incident on this type vessel whether domestic or international would have major implications.

5. FISHING VESSELS

As wth SOLAS the security Code does not embrace fishing vessels. Statistics gathered by the Institute of Shipping Economics and Statistics (ISL 2002) establishes the global fishing fleet of vessels over 100 grt, at over 23,000. Globally, it is estimated that there are 15 million people working aboard fishing vessels. While these statistics do not give a breakdown of size, category or type of trade, there are a sizable number of such vessels and individuals engaged in the deep-sea and international trade. For example in 2005 the Pacific Island Region, which requires foreign fishing vessel registration, 1100 such vessels were registered (Martin 2005).

Fishing vessels frequently conduct foreign port visits for cargo discharge, replenishment, repairs, and relaxation. The fact that these vessels are not covered by the ISPS Code is cause for concern. In New Zealand, the Director of Maritime Safety (Kilvington 2004) noted that some fishing vessels carry far larger crews than cargo vessels, and he stated that New Zealand border control agencies have increasing become aware of irregularities pertaining to fishing vessels. Consequentially this jurisdiction may advocate an amendment to the ISPS Code to incorporate 'international' fishing vessels for application.

A common concern even with ISPS compliant vessels surrounds adequate and reliable crew identification. The Seafarer Identification Document (SID) is one solution considered by port states to alleviate this concern. The intent of the SID is to facilitate the movement of seafarers when joining and leaving ship or going ashore. The use of recognized identification and the additional controls placed upon ISPS vessels by the port state and by port facilities has ensured some degree of control over the movement of seafarers. However such controls are not as prevalent within the fishing industry. Too frequently such vessels will berth at facilities which are not ISPS compliant, and that are not required to monitor the movement of persons to and from the vessel. The extent and quality of checks carried out regarding crew identification and even crew numbers is widely acknowledged to be very poor and therefore has caused some observers to describe this industry as the potential Trojan Horse of maritime security (Martin 2005).

Fishing vessels are also exempt from the AIS carriage requirements. Additionally the Long Range Information and Tracking (LRIT) regulations, which come into effect January 1st, 2008, will not apply to fishing vessels. This regulation requires applicable vessels to be outfitted with a LRIT system that enables SOLAS governments to receive information about ships navigating within a distance of hundreds and even thousands of nautical miles off their coast. As fishing vessels are exempt from the carriage of LRIT and AIS it will make it difficult to monitor their movements as compared to vessels that are so equipped.

The new security measures (IMO 2003a) necessitated amendments to the SOLAS Convention including the requirement for ships to prominently display their unique IMO number. The regulations specify color, size and location of these permanent markings. Additionally SOLAS vessels are now required to carry a Continuous Synopsis Record (CSR). This document is intended to provide an onboard record of the vessel's history as of July 1st, 2004. It is kept onboard and is subject to inspection by port state control officers. The intent of both the IMO number display and the CSR are to combat the use of 'ghost ships' that have been used to stymie various international regulations. Port state control officers will now have additional tools to ensure that vessels no longer misrepresent themselves. Unfortunately, as fishing vessels are excluded from the SOLAS Convention they are not required to display such identification or carry the CSR and their ability to more easily circumvent various regulations will continue.

The exemption of fishing vessels also provides complications for many ports and port facilities. During a visit by such vessels, facilities will have to ensure that there is no violation of the port facility security plan or 'contamination' of other interfacing vessels. The fishing vessel has no ship security plan to violate, but the actions of the crew could cause a security breach, threat, or incident that could have severe repercussions for that facility.

Research by Martin (2005 cited ICONS 2005) pertaining to the fishing industry, determined that many crew members work under conditions of extreme hardship. It also found that, globally, they were not well organized and often not covered by international labour and safety standards. Quite frequently crews were found to be poorly paid and from poor, undeveloped parts of the world. Conditions onboard fishing vessels were found to be 'fertile grounds for resentment and dissent' and in the broader context of maritime security and when viewed in conjunction with other problems as previously identified, the exclusion of fishing vessels from the security regulations should be viewed with concern.

6. Yachts

A number of similar concerns are raised due to the fact that pleasure craft are also exempt from the security regulations. The fact that there are an incalculable number of such vessels, often having the ability to berth at small and even undisclosed locations, and with some frequently on international voyages, is disconcerting. These vessels are not required to be equipped with AIS or LRIT and do not display IMO numbers or make use of the CSR. By definition such vessels are normally used for pleasure and as such frequently travel without the use of passage plan, with sudden changes of destination, and without following many regulations that merchant vessels are required to follow.

Some eco-terrorism groups have been accused of thwarting international regulations by declaring vessels used in their operations as 'yachts' and therefore exempt from many regulations. The R/V Farley Mowat originally built as a Norwegian fisheries research and enforcement vessel was registered under the Canadian flag as a pleasure craft and therefore not required to carry safety, security or manning certificates. The vessel, of significant size at 677 grt and engaged in international travel, was accused of harassing several Japanese fishing vessels engaged in the whale fishery (Baron 2007). This scenario could easily be played out by other terrorist organizations with more sinister results.

7. Government vessels

Warships, naval auxiliaries, and ships owned or operated by governments for non-commercial use are specifically exempt from the requirements of the ISPS Code. The high profile attack on the USS Cole in Yemen in 2000 underscores the risks to such vessels. For many such vessels, particularly warships it is expected that they will institute measures that meet or exceed the Code. However the category of ships 'operated by governments for non-commercial use' could include many vessels that would not have comparable security measures.

Another problem is that exempted vessels may not have appropriate security procedures in place when interfacing with port facilities or other vessels. ISPS compliant facilities will have procedures for the acceptance of ship stores bunkers and cargo, and for access control measures. Compliant vessels will have similar procedures which dovetail with the port facility procedures. Anecdotal evidence, gathered during marine security training courses, suggests that exempted vessels are often unaware of such procedures, due to the lack of knowledge of the security regulations and therefore do not readily conform to facility procedures creating at best complications for such facilities and at worst causing security breeches which must be reported to the appropriate authorities.

The blanket exemption of such vessels from the security regulations appears to be a matter of convenience for contracting governments that causes complications for others that are required to adhere to those regulations.

8. Oil industry maritime assets

The ISPS Code, in Part A, does give some degree of comfort that high value oil industry assets will be protected, as it includes the mobile offshore drilling unit (MODU) in the definition of ship and specifically states that the Code is to apply. However SOLAS Chapter XI-2 states that by definition the MODU is to be so designated for the purpose of maritime security only if it is mechanically self-propelled and not on location. Most MODUs are not self-propelled and instead require the use of support vessels to tow them from location to location. The purpose and design of a MODU is for oil exploration and this entails that it spend most of its time on location. Additionally while engaged in exploration the MODU would see a full complement of workers and use a range of dangerous goods necessary for its work. It is therefore envisioned that at any given time the global MODU fleet, numbering 920 in 2006, would not be required to implement the ISPS Code even though these assets represent high value, have a large complement of employees and do present an attractive target (IUMI 2006).

The oil industry also uses floating production, storage, and offloading units (FPSOs), and floating storage units (FSUs) in the process of bringing hydrocarbons from field to market. Again these assets are of high value, have a large crew complement, and indeed resemble large vessels. Through MSC/Circ. 1097/1111, the IMO (2003b/2004a) has decided that neither of these is to be classed as ships for the purpose of ISPS Code application. The only concern expressed through the circulars is that ISPS compliant vessels interfacing with a FPSO/FSU would be considered 'contaminated' because the installation was not required to be compliant. There is no direct security concern iterated for the FPSO/FSU.

To put this matter in perspective it is interesting to look to the east coast of Canada for an example of the possible ramifications of following only the mandatory requirements of the ISPS Code. Canada accounts for about 10% of the United States crude oil needs and is second only to Saudi Arabia in estimated oil reserves. In 2006, the offshore oilfields of eastern Canada produced over 110 million barrels of oil, representing 13% of the total Canadian crude production (Rowat 2006). This product was recovered using the Hibernia Platform, the SeaRose FPSO, and the Terra Nova FPSO. In total the construction cost of these assets is about eight billion dollars, their total combined crew complement is over 400 persons, and total crude oil storage capacity is 2.2 million barrels of crude oil. A number of MODUs continue to be used to delineate the oil fields. Several shuttle tankers transport the crude to a transhipment terminal in Canada, while others transport direct to market in the United States. Canadian flag offshore supply vessels service all three installations. In this scenario, the ISPS Code would only be mandatory to the tankers that travel to the United States. All other assets would be outside the purview of these regulations and therefore security procedures would not be required. An attack on such assets could result in significant loss of life, have catastrophic environmental impact, and cause a serious disruption in oil supply and create havoc in world oil and financial markets.

The scenario as previously iterated is of a significant security concern and as expected the Canadian government has instituted national security provisions for these oil fields. Likewise the United States has mandated security requirements for the outer continental shelf to cover assets such as MODUs and fixed and floating assets not covered by the Code. However the fact that the ISPS Code, the primary maritime security document, does not apply to these assets, and the fact that such high value assets require that applicable jurisdictions mandate security requirements, undermines the

Code objective of "detecting security threats and taking preventative measures against security measures" that affect the maritime industry (IMO 2003a). Other jurisdictions may not be as vigilant when instituting domestic security measures.

Security procedures, plans and measures are to be based on risk assessment, and the ISPS Code espouses as one of its objectives the importance of ensuring confidence that adequate and proportionate maritime security measures are in place. However the fact that these high value assets, belonging to an industry that have evidenced terrorist attacks, such as the foiled attack on a major oil production facility in Saudi Arabia (Gardner 2006) and the attack on the VLCC Limburg, are not covered by the Code does not portray a seamless, effective security regime.

The oil industry in general is a target of interest for terrorist groups. Osama bin Laden, the world's most notorious terrorist has stated that the oil industry is the 'umbilical cord' of the western world. The fact that certain assets are not covered by the Code provides a gap in the security measures and one security analyst has stated that "Al Qaeda is very, very good at identifying gaps" (Murphy 2003).

9. Identification Documentation

The ISPS Code was developed primarily for the protection of ships and port facilities. A cornerstone of both the ship and the port facility security plan is the procedure for access control. The complexity of the shipping industry necessitates frequent movement of persons to and from the ship and facility and therefore each of these entities is required to establish procedures for appropriate identification as part of these mandated access control measures.

Without the comfort of a recognized system of identification documentation, port states have been concerned with the movement of seafarers during port visits. There has been considerable discussion surrounding the requirements for appropriate seafarer's identification documentation (SID) in order to ensure that individuals have been appropriately vetted and that the resultant documentation is issued. The International Labour Organization (2003) has, through its Seafarers' Identity Documents Convention, created a system for the issuance of a recognized SID. This convention outlines procedures for the issuance of the document, for the protection of national databases, and it also outlines the content and form requirements.

The revised convention, in effect as of February 2005, leaves much work to be done to ensure worldwide acceptance. Although there are still problems associated with seafarer identification, there does at least appear to be a willingness to address these issues. One of the concerns with the convention is that it does not direct governments to do a risk assessment on individuals who apply for such documentation, but rather it focuses only on confirmation that the person has reliable and verifiable documentation. Some countries, such as Canada and the United States, recognizing this concern now require significant background checks for those applying for this documentation to determine if the individual poses a security risk to the maritime industry.

In contrast, there has been no concerted effort to promote a global system for identification documentation for port facility workers. A survey conducted by the International Chamber of Shipping and reported by IMO (2006), raised significant concerns related to port facilities. Some facilities had PFSOs that were conspicuous by their absence, others remained unresponsive to calls for help by vessels at the facility, and there were instances of even officials refusing to show identification, or to wear a visitor's pass. The idea of port workers having applicable security clearance and resultant identification at such ports appears not to be even on the radar. The survey concluded that these shortfalls jeopardized the broad effort of maritime security and that it increased the burden of ships and crews.

Some countries however have determined that port facility workers, by having access to sensitive areas, may pose a risk to ships and other marine assets. The United States uses the Transportation Worker Identification Credential (TWIC) as identification for all such personnel requiring access to secure areas. Individuals that require unescorted access must pass a security threat assessment as conducted by the Transportation Security Administration (TSA 2006), before receiving clearance and subsequent identification. Similarly, Canada has the Marine Transportation Security Clearance Program (MTSCP), which does similar risk assessment but on a limited number of workers (TC 2006). Many other countries have no such program.

The global tendency to emphasize the need for seafarer identification while ignoring the need for similar identification for port and port facility workers appears to defeat the purpose of the security regulations. It suggests that although the ISPS Code places equal importance on enforcing preventative measures against security incidents affecting ships and port facilities, in reality it is the ship that is left vulnerable. The varying national standards, as illustrated, for both ship and port facility identification do not produce a reliable identification system that is consistently based on risk assessment and therefore provides further gaps in the global security arrangement.

10. Summary

This paper has identified a number of areas of concern with regards to maritime security. There is a need to expand the application of the ISPS Code to other vessels and to the domestic trade. Exactly how these vessels should be included is difficult to say. However, as illustrated the categories of vessels reviewed each pose security challenges. Smaller vessels often stay in one geographic area and one study (JITI 2005) has suggested the registration of non-SOLAS vessels on a regional basis. Areas with higher risk of security incidents, including important international straits, will require more stringent measures.

Large passenger vessels whether on domestic or international travel are attractive targets for terrorist organizations and should be included in the Code. The FPSOs and other oil industry assets are conspicuous by their absence from mandatory inclusion in the Code. Whether MODUs are on location or self-propelled is immaterial. Risk assessment demands that such assets also be included.

Government classed vessels should require security measures possibly under a different authority but mirroring the requirements of the Code. More concern must be shown for the yachts and fishing vessels that move about almost as if unseen. The risks, as identified, need to be addressed. Both types of vessel should be considered for carriage of the AIS or similar transponder device. The inclusion within the Code of the categories of vessels discussed will also entail the certification of more port facilities.

A recognized system of identification documentation for both seafarers and port facility personnel is requisite. The vessels discussed are in themselves not the danger. The danger lies with the people that move through our ports and on our vessels. This issue is paramount for maritime security.

The development and implementation of the ISPS Code was primarily a result of the events of 9/11. It was a quick response by the IMO to perceived maritime security threats. This implementation, although not without short-comings, has required the global community to grapple with the issue of maritime security. The ISPS Code insists that security officers maintain the continued effectiveness of the security plan through audits, amendments and response to any identified deficiencies. This is advice that the IMO itself should follow for improving the International Ship and Port Facility Security Code.

REFERENCES

1. Baron, E., 2007. Eco-activist claims harassment in ship status fracas. Canwest News Service. [online]. Available from:
2. http://www.canada.com/topics/news/national/story.html?id=89efaf16-b353-4297-ba60-dd2a7c326f84&k=23675 [Accessed 28 June 2007].
3. BBC News, 2005. Cruise ship repels Somali pirates. BBC News. [online].
4. Available from: http://news.bbc.co.uk/2/hi/africa/4409662.stm
5. [Accessed 28 June 2007].
6. BC Ferries, 2007. About BC Ferries [online]. Available from: http://www.bcferries.com/
7. [Accessed 27 June 2007].
8. European Parliament, 2004. Regulation (EC) No 725/2004 of the European Parliament: on enhancing ship and port facility security. Official journal of the European Union. [online]. Available from: http://www.mcga.gov.uk/c4mca/ec_no_725_2004.pdf

9. [Accessed 26 June 2007].
10. Gardner, F., 2006. Saudis 'foil oil facility attack' BBC News. [online]. Available from: http://news.bbc.co.uk [Accessed 27 June 2007].
11. Institute of Shipping Economics and Logistics (ISL), 2002. Shipping statistics yearbook 2002.
12. Bremen: ISL.
13. International Labour Organization (ILO), 2003. Seafarers' Identity Documents Convention (Revised). http://www.ilo.org/ilolex/cgi-lex/convde.pl?C185
14. International Maritime Organization, 2003a. ISPS Code. London: Halstan.
15. International Maritime Organization, 2003b. MSC/Circ. 1097: Guidance relating to the implementation of SOLAS chapterXI-2 and the ISPS Code. London: IMO.
16. International Maritime Organization, 2004a. MSC/Circ. 1111: Guidance relating to the implementation of SOLAS chapterXI-2 and the ISPS Code. London: IMO.
17. International Maritime Organization, 2004b. ISPS Code status update 05. [online]. London, IMO. Available from: http:www.imo.org/Newsroom [Accessed 26 June 2007].
18. International Maritime Organization, 2004c. SOLAS consolidated edition 2004. London: IMO.
19. International Maritime Organization, 2006. MSC 81/5/15: Measures to enhance maritime security. London: IMO.
20. International Union of Marine Insurance (IUMI), 2006. Report on world merchant fleet. [online]. Zurich, IUMI. Available from: http://iumi.svv.ch/ [accessed 26 June 2007].
21. Japan International Transport Institute (JITI), 2005. A study on maritime security measures for non-SOLAS vessels. Tokyo: JITI.
22. Kilvington, R., 2004. The ISPS Code and beyond. [online]. The Maritime Law Association, Australia. Available from:
23. http://esvc000873.wic005u.server-web.com/docs/11%20Russell%20Kilvington.pdf
24. [Accessed 27 June 2007].
25. Martin, T., 2005. Report on foreign fishing vessel security in the pacific island region. Suva: Secretariat of the Pacific Community.
26. Mitropoulos, E., 2005. Opening address to the seminar on maritime security measures for non-SOLAS vessels [online]. London, IMO. Available from: http://www.imo.org/Newsroom/
27. [Accessed 26 June 2007].
28. Murphy, K. 2003. Oil industry is an obvious terrorist target say experts. Daily Times. [online]. Available from: http://www.dailytimes.com.pk/default.asp?page=story_19-4-2003_pg4_22
29. [Accessed 27 June 2007]
30. Rowat, M.R., 2006. Boom times: Canada's crude petroleum industry. Ottawa: Ministry of Industry.

31. Transport Canada (TC), 2006. Marine transportation security regulations. [online] Ottawa, Government of Canada. Available from: http://www.tc.gc.ca/acts-regulations
32. [Accessed 25 June 2007]
33. Transportation Security Administration (TSA), 2006. TWIC Final Rule Guidance. Washington: DHS.
34. United States Coast Guard (USCG), 2003. Code of federal regulations. Washington: DHS.
35. Yew, L.T., 2005. Maritime security measures for non-SOLAS vessels. Seminar on maritime security measures for non-SOLAS vessels, 10 May 2005 London.

Training of Maritime Specialists Based on the Concept of Sustainable Development

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The term "Sustainable development" was first introduced into general usage at the UN Conference on Environment and Development (Rio-de-Janeiro 3 – 14 July 1992) as an alternative to former nature-ruining course previously pursued by the Mankind. The principle issue was the transiting of our civilization to the strategy of development which should ensure the survival and further sustainable development of human society. But this requires maintaining of the environment in good order and the preservation of cultural, spiritual and informational resources.

It is absolutely evident that the successful solution of various problems on the way of transition on the course of sustainable development in the frameworks of different industries, state, regions and in the world at large depends first of all on the people, their knowledge, preparedness, motivation and attitude to the above concept. In this connection a prominent place in the national concepts of transition to the sustainable development many countries occupy the issue of educational systems with the purpose of informing the population, training of the specialists in the concerned sphere.

The basis for the above transformation in the educational establishments of different levels is the principal provisions of the international documents adopted at the intergovernmental forums. The UN General Assembly, at its 57th Session (2002), proclaimed a Decade of Education for Sustainable Development (DESD) (2005 - 2014) and designed UNESCO as lead agency for its promotion.

It is evident in the view of all above, that the graduates of maritime educational establishments should join the shipping industry not only professionally competent but also well informed about the purposes and principles of the mankind sustainable development, the place and role of the marine transport operations at sea. In the Odesa National Maritime Academy, engaged in training specialists for the employment on board the ships of the National Fleet and foreign companies, these issues are the matters of high priority in the courses of all professional disciplines.

At the end of last century the world community was imposed with the vital question: What is it necessary to do to prevent the universal catastrophe on the Earth? Scientists of

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different countries, having studied the course of world system of mankind development, have come to distressing conclusions: the growth of the Earth population, accompanied with industrialization and increase of foodstuff demand, alongside with environmental pollution, in the nearest future will reach a certain limiting value, exceeding which will start abrupt diminution of the number of people on the planet, followed by loss of mankind. Altogether with this the concrete reason of the global catastrophe may be different – starvation due to lack of foodstuff, death caused by epidemic, loss of people at wars for resources possession and holding, etc. In other words, the growing pressure of the civilization on the biosphere has reached the border of its adaptative possibilities, on the other side of which lies irreversible degradation. Also, while biological species, inhabiting the Earth, adjust their vital functions in different ways, people adjust the environment to their needs, exposing it to inevitable exhaustion and destruction. From the standpoint of the above, it becomes clear that one of the central directions of the future stable society formation has to be the globally-scaled organization of economical activity, which will not destruct the biosphere, but, on the contrary, preserve it, thus being ecologically permissible. People of the Earth have to transform all the spheres of their vital activities in such a way, as to diminish the pressure on the environment significantly. It is a very complicated task requiring development of new approaches, modern management model, based upon the principles of ecological longevity and reliability. At the International UNO Conference on Environment and Development (Rio de Janeiro, July 3-14, 1992), providing participation of 179 countries' representatives, the concept of sustainable development was proposed, laid down in the form of 27 principles in the final document – the Declaration. Within the latter, in particular, it is stated that for mankind survival and sustainable development environmental protection must become an unalienable part of development process. Of course, all this also refers to maritime transport activities, which serves 80% of international goods transportations. Though maritime transport is one of the least environmental-polluting types of transport, the volumes of shipment of oil and mineral oils are constantly growing, and, consequently, increase the danger of sea vessel-source pollution.

In this connection the role of IMO rule-making activity on implementation the principles of sustainable development in the world maritime industry is becoming more and more important – by means of development, approval and control over putting into practice international agreements and normative documents on safety of shipping and environment protection from pollution. And now work in this direction is one of IMO priorities, which is testified by, in particular, the statement of IMO Secretary-General Mr. E. Mitropoulos in «IMO News» Journal [1]. Expressing his opinion on the way shipping must react on modern society demands, he states that «The earth and its resources do not belong to us and are not ours to squander without thought for the future. Not before time, global society is coming to accept this and, as it does, shipping has to ensure that its activities are sustainable. Sustainability in this context is normally understood to mean that any negative impact an activity may have on the environment must be reduced to the point where it is clearly outweighed by the positive benefits that the activity brings». It is also symbolic that the topic of the World Day of the Sea in 2007, which is planned to be celebrated in Brazil, will be «IMO`s response to current environmental challenges».

Undoubtedly, the many-sided and fruitful IMO work on advancement ideas and principles of sustainable development in one of the first-rate and most important industries of world economy must receive constant support from the side of maritime administrations, enterprises, institutions and organizations of those countries fulfilling transporting operations at sea. It is also obvious that the successfulness of development of different tasks on the way of transition to sustainable development within the limits of separate fields, states, regions and in world scale depends in the first place upon people – their awareness, preparedness, motivation, attitude. That is, finally upon the level of knowledge and education of all strata of population in matters of sustainable development of civilization, which has no alternatives.

Integration of sustainable development in the system of education at all levels;

Assistance to development of education as the base of sustainable society;

Improvement of international cooperation for development of innovatory policy, programs and practice of education for sustainable development.

It is considered that for the specialists, involved in the sphere of education, the input into realization of the Decade can be: inclusion of the ideas of sustainable development in educational disciplines and courses, elaboration of separate courses of education for sustainable development, preparation of educational guidelines in this area, retraining of staff according to the concept of sustainable development.

The essential contribution into international coordination of actions in the sphere of education for sustainable development was done at the 54th conference «Environment for Europe» (Kyiv, May 21 – 23, 2003), gathered at the initiative of European Economic Commission of UNO. The ministers of environment of 55 countries of regions of Europe, North America and Central Asia signed the Statement of enlightenment with the aims of sustainable development achievement.

The Statement read about the decision, adopted by the ministers, to develop regional strategy in the sphere of sustainable development to 2005, that is for the beginning of the Decade. The ministers also summoned the states to «integrate the sustainable development within the systems of education of all levels, starting from pre-school and up to higher, including informal education, education in non-governmental sector, with the aim of education becoming the key factor of changes». The project of regional strategy of European Economic Commission of UNO in the sphere of education for sustainable development was elaborated earlier during the preparatory stage of the conference and later submitted as an annex to the Statement of ministers under the title «Basic elements of EEC UNO strategy on enlightenment in the interests of sustainable development». This project has become the case for further work over the document under the patronage of the Committee on ecological policy of UNO and with participation of different interested organizations and parties of society. In October 2004 at the 11th session of this Committee new provisions of the strategy, which fulfillment start was estimated for March 2005, were considered.

This strategy was developed with consideration of experience, accumulated at the region and at global level. Its base was formed with the help of more than 40 documents, among those known documents of Bologna process. It is planned that for 2010 every country must take the decision of adaptation of its legislation, policy and institutional mechanisms with consideration of needs of education in the interests of sustainable development.

In February 2005 at mutual meeting of the highest level the strategy of the Decade of education in the interests of sustainable development of EEC UNO was approved.

Finally, in August 2005 in Paris at the 72th session of Executive Council of UNESCO the «Project of international plan of measures and activities within the limits of the Decade of education in the interests of sustainable development of UNO (2005 – 2014)», which was drawn on the base of profound consultations with national governments, organizations of civil society, scientific enterprises, experts and specialists, was considered and approved. The plan of measures and activities is a strategic document, and main attention in it is drawn to revelation of the aims, which the governments are bound to achieve within the limits of their participation in the Decade of education in the interests of sustainable development. It is stated, in particular, that at the national level such aim is the «creation of possibilities for elaboration and popularization of the concept of sustainable development and transition to such development within the limits of all forms of education, enlightening activities and staff training». The partners of UNESCO in realization of the plan at local, national and regional levels will be governmental sector, civil society and private sector. The main role in realization of national plans within the limits of the Decade is given to ministries and institutions of education and science.

Thus, nowadays there exist basic documents at European and international levels, making it possible for countries to work aiming at reorganization of their educational systems in the interests of sustainable development.

The main components of education in the interests of sustainable development, as defined by UNESCO are: education (training), training and retraining of staff, elaboration of skills, definition of systems of values, informing and enlightenment of the population regarding understanding sustainability, upgrading the quality of life and diminution of risks. Among the main directions of education elaboration for sustainable development an important part is taken by re-orientation of existing education at all levels for solving matters of sustainable development. It is recommended to re-orient curricula at the direction of social, ecologic, economic knowledge, perspectives and formation of skills and values, needed for sustainable development. Re-evaluation and revision of education – form school and up to university – supposes that it will include as much principles, knowledge, opinions and values, connected with provision of sustainability in three spheres: the environment, the society and the economy, as it is possible. In UNESCO documents it is stated that education for sustainable development is interdisciplinary. None of educational discipline can embrace all the aspects of such education, but all of them can make their input in it. There is no universal model of education in the interests of sustainable development that is why every country needs to define its priority tasks and actions in this field.

World leaders in the sphere of education in the interests of sustainable development are Great Britain, Sweden, Australia, the Netherlands, Norway, Russia. In these countries they have not only adopted the necessary official documents and fulfill their realization in the system of education, but also hold serious scientific research at the given problem. In Ukraine there are also certain achievements in this direction. There has been elaborated the Concept of sustainable development of the country, which after the approval by the Supreme Council in the status of the law will become the base for the development of the corresponding strategy. In December 2001 the Collegium of the Ministry of education and science of Ukraine approved the Concept of ecologic education in Ukraine, in which, in particular, it is stated that one of the main tasks of ecologic education is the «development of personal responsibility for the condition of the environment at local, regional, national and international levels, the ability to forecast personal activities and other people and collectives actions» [2]. The conditions of the Concept realization presuppose formation of ecologic culture of specialists and inclusion of the section on environmental protection and rational usage of nature into diploma thesis of graduates of higher technical educational institutions.

In this connection it seems expedient to note that at ONMA, which trains specialists for work on board vessels of national fleet and foreign companies, the matters of environmental protection from pollution, practical usage of international documents and standards, acting in this sphere, conscientious and responsible attitude of future ship officers towards these responsibilities occupy priority part of the programs of special disciplines. Alongside with this, as a rule they are interconnected with the matters of provision of shipping safety, which makes training of ship officers at this base corresponding to the spirit and the principles of the concept of sustainable development of world society.

Really, sustainable development and general safety of mankind are interrelated: this was pointed out by UNO Secretary-General C. Annan in 1999 in his report of UNO work [3]. He stated that «equitable and sustainable development is one of the necessary conditions of safety provision, but provision of minimum safety standards, in its turn, is one of the preconditions of development. The strive to solve one task in isolation from another does not have much sense». Later this matter was repeatedly considered at different conferences, in materials of scientific institutions, publications. As the summarized total of their results it may be considered that sustainable development, that is preservation of human culture and biosphere, is impossible without provision of their mutual safety. It is obvious that sustainable development of world maritime transport, in the interests of all mankind, has to be fulfilled with minimum negative influence upon the environment, which can be achieved only with the high level of ships operation safety.

Starting from these prerequisites, acting on international and national documents with the aim of concentration in one place and systematization of knowledge on safety and environmental protection during the operations at sea, effective fulfillment of the requirements of STCW Convention and Code regarding maritime specialists' professional knowledge, development of scientific elaborations, by the Scientific Council of ONMA it was decided to create in the year 2003 the department «Safety and security at sea». Nowadays the chair has elaborated a number of educational disciplines which totally cover all main aspects of safety shipping provision and prevention of maritime and air environmental pollution while ships' operation. (see fig. 1)

These disciplines, including lectures, practice and seminar studies are provided with the necessary educational and methodical materials which are taught at the senior courses of the academy faculties in order graduates start their carrier not only professionally trained, but also enriched with knowledge regarding aims and principles of sustainable development of humanity, places and roles of maritime transport in their practical realization, necessity and possibilities of environmental prevention in process of transport operations at sea.

Big attention is paid to foster cadets' careful attitude towards people, nature, culture values, cultivation of the elements of ecological culture and culture of safety. The cycle of interrelated disciplines is oriented on achieving these aims, the statement of which is fulfilled in accordance with principle « from general to particular» and «from simple to complicated». It is considered to be necessary to give the students the characteristics of ecological, economical and social part of sustainable development, the interrelation with safety as in theoretical plane, as so to apply to conditions of industrial activity of marine transport. In particular, regarding the role of «human» element in provision of safety at sea, on the base of minimization of risks for people, property and negative influence on environment.

The methodical maintenance of educational process at the department is constantly improved by the way of working abstract lecture, educational and practical allowance, experiment-graphical and other materials are based on various information, getting from native and foreign sources, the results implementing by scientific-research of elaboration. In addition to lecture materials and for individual study by cadets of separate questions, the department has prepared and published a number of books on safety and environmental protection, in particular, «The lessons of the sea», «Management

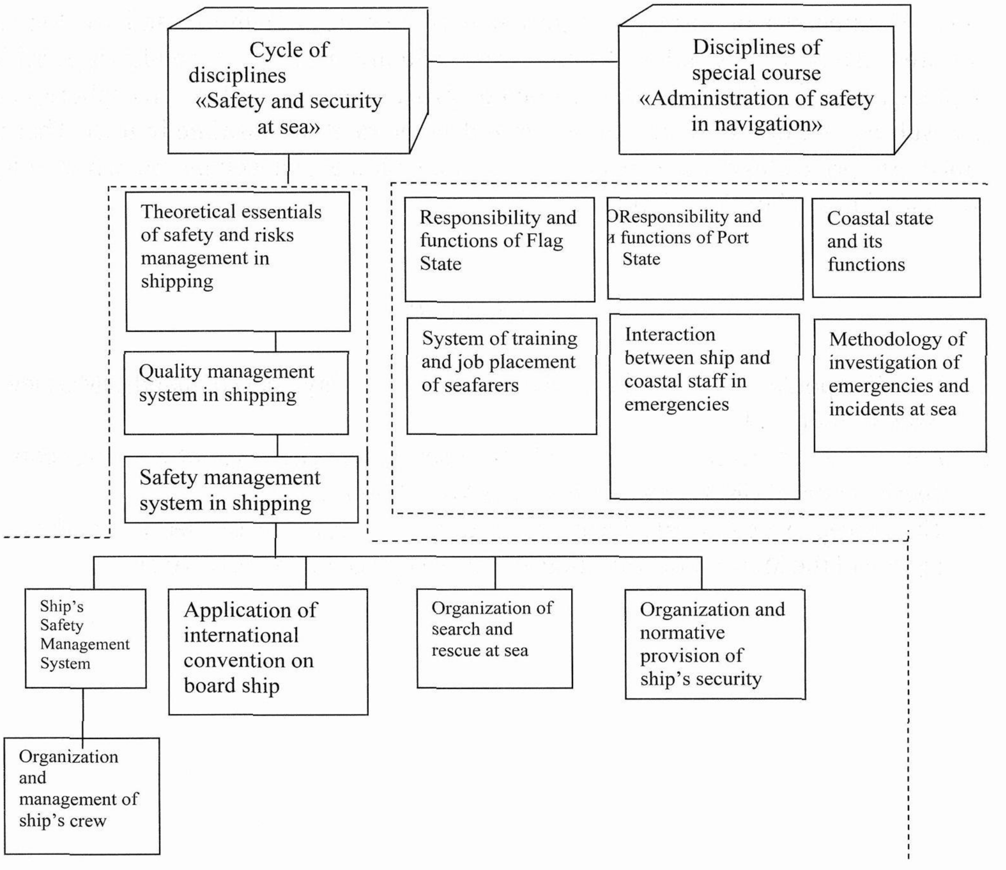

Figure 1. Structural-functional scheme of educational disciplines of Safety and Security at Sea Chair of ONMA

of crews», «Application of international conventions on board vessel», «Ship safety management system», «IMO and ILO maritime conventions, codes and recommendations», «Risks in shipping » and a number of others. Naturally, that all doesn't mean, that created on the chair of safety and security on sea is structure-functional scheme of cycle safety of navigation is in full of measure fit with modern aims and problems of training for the future ships officers, including interest settled development. Still many things have to be done and collective of department is working about this, following the principle of UNESCO: «Teach and study for the sake of sustainable future». Obviously, a big attention should be paid to education of academy graduates «ecological cultural» transport production, which should be taken as the unity of ways activities, national and spiritual valuable repelling the state of maritime interaction of association and nature. The purpose of this is to show the necessity of ecological evaluation of all decision making in process of ships operation and ensuring of safety natural environment. Maintenance of norm and requirements «the safety of culture» and «ecological culture» on board ships and on the enterprises of maritime transport makes it possible to present like dirigible balance development, providing preservation of biosphere, and also subsequent existence and progressive development of maritime branch. That is replying to principles of the Convention of sustainable stable development of humanity, was stated in Declaration of Rio 92.

Literature

1. E.E.Mitropoulos. Time for shipping to respond to society's new demands. IMO News, issue 4, 2006, p.4
2. Annan C.A. Prevention of wars and distresses: global challenge of growing scope : Yearly report of UNO work of 1999. New York, 2000, p. 17.
3. The concept of ecological education in Ukraine. Approved by the decision of the Collegium of the Ministry of education and science of Ukraine 20.12.2001.

The ISM Code versus the STCW Convention MET – challenges convene?

Jan Horck[1]

Abstract

The ISM Code and the STCW 95 Convention can without doubt be considered some of the most important IMO instruments that contributes to "safe, secure and efficient shipping on clean oceans".

The two instruments are fundamental in the sense that they have a perceptible link to quality assurance (QA). Maritime Administrations (MarAd.), shipping departments, maritime education and training (MET) institutions, shipping companies and ports etc. ascertain public assurance of efficient and safe ship-operation by opening their doors allowing an external audit.

It has been realized that national administrations are given less room for individual interpretations on vital issues in IMO instruments. This is an important step towards harmonization of standards and commercial activities within shipping. With an operational guarantee, e.g. an *international* QA award, the question remains if the ISM Code is an instrument that has got its deserved backup from relevant training of those made to use the Code.

Indirectly, the port state control function is made to assure that the MET institutions do their job i.e. that the end-products from the MET institutions know how to use knowledge and show professional skills; a ship seaworthy and safely manned.

Today, it is time to ask oneself if the STCW 95 really pass on relevant and needed knowledge and skill to seafarers and assures the shipowners (hereinafter owner) that the ship will not be detained due to their employee's substandard education. What subjects in the curricula should be, or has been, rewritten in order to make the ISM Code a real success and useful to the industry? Is it proven that ship *casualties* are reduced with the introduction of the ISM Code? Have ship *detentions* and *deficiencies* onboard been reduced because of improved knowledge and skills among ratings and officers? Does cargo arrive intact and on time?

This paper is aiming at vital safety issues that still are not adequately addressed in the STCW 95 but important in order to make the ISM Code successful.

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The industry is expecting a dialogue with MET, and also that MET not only follows the easiest flow of the stream by no more than fulfilling required minimum knowledge and skills demanded by the lawmakers. Hence, the MET is required to play a more proactive role in the shaping of maritime education.

The views expressed in this paper are those of the author only and do not represent in anyway that of World Maritime University (WMU).

1. Introduction

Five years have passed since the application of the ISM Code for all cargo ships > 500 grt. The Revised STCW 74 (STCW 95) entered into force ten years ago. By now, with ships being ISM certified there should be a well wished safety culture implemented among all seafarers and all owners. With STCW 95 a pragmatic worldwide harmonised MET programme should be achieved. Are these statements/shoulds reasonable? Is this even a possible accomplishment? Did the industry with IMO and other organisations make shipping what it ought to be with the ISM Code and STCW 95?

In more than 2000 years the industry has tried to make the consignees happy. In just about 60 years, since IMO/IMCO started, the industry has improved ship standards, crew conditions and minimized illegal discharges, groundings and collisions etc. The questions are forwarded bearing in mind that these efforts ultimately should lead to a happy consignee.

This paper will not give a full answer to these questions but merely identify what the MET has to do to help the ISM Code to be the tool needed for *quality shipping*. *Quality shipping* is in itself a disputable expression. The word quality has become a buzzword. Why not just express a wish to have a successful transport effort i.e. cargo arriving on time (JIT) and intact; a happy consignee or consignor, with GOOD shipping. Good is a well known word. The owners still have a lot to do to be able to say to their customers: *Trust me*. The reason for me saying this is that as long as we agree that there is no process better than training and teaching to change and strengthen the human beings regarding motivation, dedication, attitude, knowledge and skill etc. we simply have to dedicate ourselves to teaching and training. Everybody should be trained, not only the middle management but also the top managers. If training is properly done it will be an eye opener to better safety standards; less pollution, less accidents and incidents, happier crew and cargo being transported in style.

Again, the crucial question is: Do the STCW teach and train becoming Masters, officers and ratings to be able to perform according to ISM Code requirements?

2. What §'s in the ISM Code Require STCW Action?

With the implementation of the ISM Code follows an extensive change in safety management and QA. What is all this about?

The Code has an objective to provide for safe practises in ship operation and continuously improve safety management skills. A number of functional requirements can be identified in the Safety Management System (SMS). Two of them are: 1) procedures for reporting accidents and 2) procedures for reporting to emergencies. These two functions represent two very important elements to improve safety. Logically, with the fast technical development of today each individual has to have a continuous training programme in the agenda. To have a safe ship it requires an understanding of: 1) proper maintenance and 2) regular supervision or inspections. The two functions represent an additional two issues that very much concern the owners and that give the MET additional responsibility.

To be able to move cargo it arriving intact and on time to the unloading port normally requires very good knowledge in:

1) Loading and unloading procedures
2) Lashing of cargo to the ship and lashing of cargo in containers
3) Ship's stability
4) Cargo care during the voyage
5) Properties and behaviour of different cargoes.

Above represents subjects that describe the essence of being in shipping. If these issues are not understood those who are set to master these issues should be seen as a big disgrace to the industry. The P&I Clubs can tell how much they pay in compensation for cargo damages; the amounts are enormous. For many years about 30% of all compensations are due to cargo being badly treated in ports and during transport. The International Union of Marine Insurance (IUMI) reports a raising evolution in paid claims in a macro perspective (Seltmann, 2006). This is understood, if not directly then indirectly in the ISM Code, to be far from good. Knowledge in cargo care gives benefits to the consignees, the owners' reputation, profoundly to safety and pollution prevention and ultimately to you as a consumer.

In order to professionally master a ship and to look after its cargo risk identification is needed. The risk is evident i.e. to learn to recognise risk and prepare for emergencies and exercise good safety management skills are very important in modern shipping. Insurers have voiced concern at the risks. The number of reported incidents involving tankers has increased with 64% in 2006. The fire-explosion category represents a substantial increase. The cargo is not travelling comfortably. INTERTANKO has established a human element in shipping committee to find out how to combat this problem.

The SMS contains instructions and procedures to ensure safety and environment protection. To instruct is a MET concern. Are such instructions really part of the curricula of today's worldwide MET?

It is now six years since de Bievre (2001) reported, after the meeting of the International Maritime Universities (IAMU) in Kobe (AGA2), that the MET institutions often are said to be too remote for the real world. It is 27 years since the first Rector of WMU, Sölve Arvedson[2], at an international STCW meeting in Malmö November 1980, spoke about the need of bridging the gaps between the ships and the MET institutions. Still in 2007 these appeals are relevant.

The ISM Code, §3.3, demand resources and support to enable the designated person (DP) to do the job he/she is assigned to. Training is needed for the DP to optimise resources available and to be able to manage the SMS. §6.3, §6.4 and §6.5 require familiarisation, understanding and training; a direct link to MET activities and obligations.

These two regulatory cornerstones are IMO's drive to focus on the human element because at the end of the day these activities very much are reliant on people. The ISM Code should offer a pathway to genuine uniformity of operating practices and place more emphasis on training. All IMO instruments should have a section on how users of the instruments (codes, conventions, regulations etc.) can be educated in the respective instrument. The format for such education could be a wider use of IMO model courses. The IMDG Code has an appeal to training of people involved in handling dangerous goods; § 1.3. The industry needs more of this type of training suggestions in concurrent IMO instruments and the ISM Code requirements will be met.

2. MET INSTITUTIONS AND GOVERNMENTS HAVE TO CREATE A MARITIME SAFETY CULTURE?

What MET can do is to create a safety culture and change seafarers' attitude to be quality minded and take care of cargo and property in the interest of ship- and cargo owners. Implant a teamwork spirit where everybody onboard should realise that they are in the same boat with the same objective – i.e. to have a happy consignee. MET institutions will not be able to survive with an ivory tower mentality; neither to be dogmatic but to be pragmatic and proactive.

If MET, by itself, do not change attitude it might loose the public funding that they today are very dependent on. The MET rescue might come when shipping companies start to realise that an investment in seafarers' training becomes an urgent issue because of the ISM Code. With this realisation might follow an industry own operated MET where the MarAds merely have a supervisory role not taking an active role in

2 It was during this STCW meeting that the Secretary General of IMO Mr C.P. Srivastava asked the delegates if they wished to have an institution where the IMO instruments better could be promulgated to increase safety at sea and pollution prevention. A voting resulted in an omnibus support which later became WMU. Sölve Arvedson passed away late December 2006; remembered in a world forgetting.

what happens between the four walls of the classroom. This solution would not be very encouraging for MET institutions.

To get some evidence if crew has improved in knowledge and skills, since the introduction of the ISM Code, one could study the annual reports from the different MOU areas. Assuming that the MOU deficiency categories "SOLAS related operational deficiencies" and "ISM deficiencies" can represent crew quality the following can be noted limiting the study to the Paris MOU:

SOLAS related operational deficiencies

2002 report: from 2000 – 2002 ... a steady increase (20%).

2005 report: from 2002 - 2005 ... steadily increased (24%).

In table 1 the ratio of deficiencies to inspections is shown. Ratio is a better comparing tool than % because the number of inspections per year varies.

Table 1. *Ratio of deficiencies.*

	Ratio of deficiencies to inspections x 100					
Year	2000	2001	2002	2003	2004	2005
SOLAS related operational deficiencies	6,20	6,80	6,85	14,11	11,62	9,85
ISM related deficiencies	5,00	6,60	16,24	17,43	13,75	13,80

With intervals the different secretariats have campaigns on certain controls and this could be misleading when interpreting the figures. The jump from 2002-2003 (SOLAS) and 2001-2003 (ISM) is explained by this. ISM inspections have been improved, operational controls, and PSC inspectors have been trained and become more experienced. Detentions have decreased. SOLAS related items have become more complicated. Any deficiency could be registered as an ISM deficiency; a matter of an inspector's subjective decision. Although, the conclusion could be that the disappointments are explained by an increase of *minor* deficiencies. Though, any deficiency is an indication of negligence. Taking a helicopter view of the situation the industry and the authorities cannot be happy with this development. The MET must talk about the ideas of PSC and ship operation practices not to give the ship any negative ISM notifications.

Because of lack of confidence in standards of competency it prompts owners to develop their own standards. Teekay and NYK (both tanker operators) have established their own competency levels certified by DNV. If this continues where will the link be between STCW and ISM? Also governments need to take an interest in shipping.

To match the ISM the STCW should seriously consider and pay attention to below subjects (a-g):

a) Computer literacy

One serious concern is seafarers understanding of computers. The reason for such additional knowledge is seafarers' work and leisure time in an isolated environment. Onboard, resources are limited and communication is costly (Patraiko, 2001). IT training should be emphasised in the curricula. With the ISM Code comes higher responsibility where computer literacy is necessary. Many ISM Code objectives are controlled electronically. Therefore, continuous education and training is needed to maintain skills in the operation of computer hardware and software. Computer systems are used to manage the SMS system. With the need and demand of *quality assurance* come the requirements to keep operational and managerial records in order to be able to verify that you do what you say that you do. Auditors need to see these verifications in order to revalidate a given QA award.

The inability to effectively use computer-based applications will contribute to commercial losses. It should therefore be in owners' interest to assure that the crew has knowledge in information technology (IT) and electronic data exchange (EDI). With the fast development of EDI/IT in shipping retraining programmes are needed. Retraining could be done at a MET institution or, with some doubt, onboard ships. Certainly it would be an additional welcomed work for MET. The income should be used to upgrade MET equipment and to give participating MET teachers an added income or incentive to an already low MET salary.

IT may not be written into the STCW but it is there in practice. If it is the MET's role and government's role to support owners and seafarers then training should be delivered. A more extensive training, than normally given today, should be cared for.

A growing problem onboard is the increase of e-mails arriving to the ships computer. Masters need to be trained on how to select what is important in a world exaggerating dissemination. In practice it is shown that the Master does not need all information sent to the ship. Instead of looking after his SMS, time is spent on reading inappropriate e-mails. Dragging it to it's extreme such flow of information hampers the safety onboard. We have an e-mail paradox that needs to be tackled before the industry will encounter e-mail accidents.

Give, in particular the officers, additional theoretical knowledge in functions of the computer because it will assist the OOW in solving various problems in cargo handling, navigation and ships manoeuvring etc. Give elderly officers the same training because they might be reluctant to seek advice from a junior officer or a person from another culture than himself. The complexity in electronic based equipment should be understood not to be an easy understanding.

b) Duties of Designated Persons (DP), surveyors and Auditors

The MET should be proactive and contribute more in the training of auditors and DP duties. Even if it is not prescribed but indirectly a necessity in the ISM all graduates from a MET institution should have a genuine education in how to meet an audit team. Seafarers need to be trained on how to answer interviews and how to support the audit-team. Auditing in the maritime industry is a fairly new activity that requires special training. It should not be the Class Societies training program training its own auditors. It should, in the name of harmonization, be the training program set by the

International Register of Certified Auditors (IRCA). Class Societies should do surveys. Auditing is not surveying. The ISM philosophy is based on checking objectives against the company's documented procedures and nothing else.

In order to make the ISM Code more effective also flag state surveyors and port state inspectors should come to school. They should come to the MET institution to get *a teacher mind*. A successful implementation of flag state surveys and port state controls (PSC) requires the performers to be corrective and not have a dictatorial attitude to what is wrong and what is correct. The surveyor/inspector/officer/controller should tell the ships crew what could be a better practice or procedure and then *kindly* have the crew to implement this. Explain the practical, safety, environmental, economical and last the regulatory requirements and other benefits of doing it as the crew just has been told. This is *quality* shipping! An oil major's vetting examination is different in the sense that it is a process that offers a clearance if the ship is accepted or not accepted to carry out a specific transport according to a shipper's requirement/standard.

c) Lecturers' standard

MET should urge owners to allow MET teachers with intervals to work onboard ships to keep their officer of the watch (OOW) licence. Normally, a typical teacher at a MET institution has seafaring experience. This typical teacher also has lost his licence because he/she has not been to sea with intervals as required to keep a valid licence. An efficient teacher needs to keep up to date with development in the industry. The best way to do this is to observe and take active part in modern industry practises. An excellent example of such practice can be seen within Chinese MET. The EU CIPMET project showed a remarkable number of teachers still having a valid OOW license. This policy should be introduced and be a worldwide MET teacher requirement. It is far from the situation in EU MET. Teachers: Sign on! Owners: open navigation-bridges and engine-rooms for teachers and you will get value for your training budget and less worries to risk your ships to be detained because of crew substandard education. Governments should allocate funds to MET to be used to subscribe to maritime journals, magazines etc. This is also a way for teachers to update themselves.

There is a need for a MET teacher's' competency standard. Knowledge and skills are passed on beyond conception making one wonder if the endproduct from the MET institutions worldwide possibly could be of the same standard. Train the trainer programmes are meant to harmonise the MET. The WMU MET-course aims to foster teachers to adapt a harmonised approach to teaching and training.

Consistency with verifications is a must in future safety and environment thinking in shipping and also in MET. Performance-related benchmarks would help to reach the quality we all wish. MET managers (rectors, presidents etc.) should hurry to obtain an ISO 9000 series recognition in order to assure themselves and owners that what is delivered in MET is up to standard.

A study of the Kongsberg's Ship Simulator Reference no 1/07 is used to see who have invested in simulators and when during the period 2000-2006 (Kongsberg has only been taken as an example to get a tendency on the issue). The study aims to see if MET has done training efforts after the implementation of the ISM Code.

Table 2. *Ships bridge simulators.*

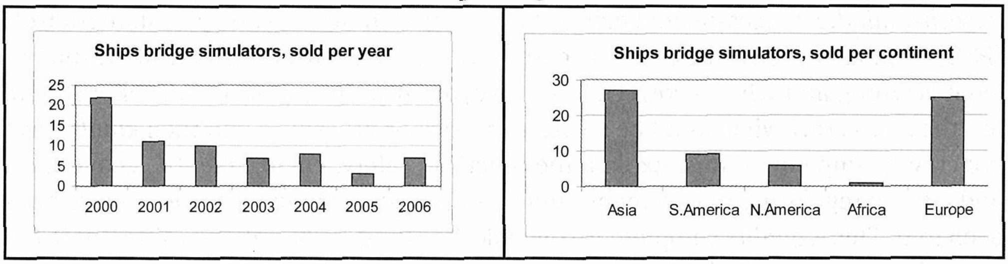


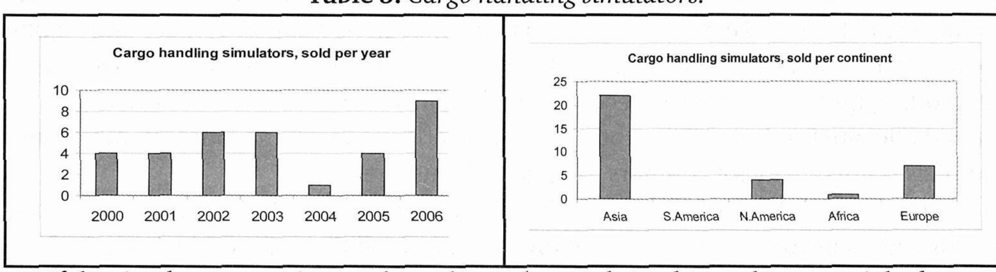
Table 2 shows the purchase of Ship Handling Simulators, i.e. not upgrades and specialised simulators, the following is noted:

Many simulators, sold in 2006, have landed in Asia. In 2000 Asian MET institutions bought 45% of the simulators sold by Kongsberg. Asia and Europe dominate the market.

Table 3 shows that the number of sold Cargo handling simulators in 2006 mainly went to Asia (6/9). Every year, in the period, MET institutions in Asia have bought most cargo handling simulators. Asia clearly dominates the market.

If the figures in table 3 can be considered significant for a total purchasing of ship's bridge and cargo handling simulators in the world then Asian MET is very well equipped. Logically, this has a positive impact on the education as such.

Table 3. *Cargo handling simulators.*



If the simulator operating teachers also understand simulator advantages it looks good for the future. It should guarantee improved safety? The willingness to change and adapt is apparently there. Lack of training equipment inhibits progress (Muirhead, 1998; Horck, 2006).

The income from e.g. mandatory upgrading courses, short courses, professional development courses etc. should be used to upgrade and modernise existing education facilities including the library. Former MET students should not be puzzled, at an ISM inspection, by not being familiar with onboard equipment.

d) Training in the English language and communication in general

The training and also the assessment procedure for application of Standard Marine Communication Phrases must be taken seriously into the MET curricula. Without proper communication skills safety is on stake. Not enough words can underline the necessity for such competence among seafarers all categories.

Alert dedicated its issue no. 14, May 2007, completely on effective communication. With "Can shipping people communicate?" (Horck, 2004) and "Communication skills are vital to safe ship operations" (Horck, 2005) and other similar articles flourish in the maritime press, Different authors, have alerted the industry on a challenge that has become a problem. Recent two accidents attest this statement. Communication constraints have been the major reason for the grounding of the Singapore flagged MS Crimson Mars on 1 May 2007 (Communication problems ..., 2007) and the sinking of MS Queen of the North on 22 March 2006 (Dysfunctional relations ..., 2007).

That the issue is a problem is clear from the *Tanker Management and Self-assessment, a best practise guide for ship operators* (TMSA). In Element 3 it is written "... ability to communicate in a common language ..." (OCIMF, 2004, p.12). To safely evacuate a ship in distress is impossible "if no common means of communication has been established" (Short, 2006, p.2). MET has to assure better communication competency and ISM must better control communication skills. The requirement to control crews communication ability is expressed in the ISM Code § 6.7.

3. What Can the Owners Do to Meet the ISM?

With the ISM Code the owners have been assigned additional responsibility. To burden them also to take care of the MET is absolutely absurd. The governments must also take their responsibility if they wish to have a maritime industry in the country.

Owners should, free of charge, assist in the classrooms and pass on the latest in the industry. It should be in the owners' own interest because they are the one to use the MET endproduct. Owners should take a genuine interest in institution activities. Cooperate and be active in MET board meetings.

Return to use cargo ships that are servicing as a platform for schooling. The owners have to be more cooperative and allow students to do on-the-job training in a sandwich type of programme. The German owner Hapag Lloyd has recently taken up the old idea of having a cargo ship equipped with cabins for apprentices/cadets (German owner..., 2006; Horck, 2006). Other owners must do the same in order to get the crew that they can trust handling their ships.

An alternative for countries that wish to have a strong merchant is to have a training ship dedicated to education. Sweden will have such a ship available for 15 students in the autumn 2007; MS Atlantic Cartier (Klart med..., 2007).

It is a company's management role to built up and support the safety attitude onboard. But it is not enough to tell, it also has to be *shown* by senior officers and officials. Sagen (2002, p.12) wrote that "it should be contagious like a disease". It then becomes the MET commitment to assure that graduants have this attitude and that officers set a good example onboard.

The owners should increase crew motivation, invest in human beings and realise that no machine can replace the human being. The bad image that the maritime industry has been marked with has to be washed away. A way to do this is to accept a recruitment of an adequate number of ordinary unexceptional people to serve onboard (Mottram, 2000). A strive for decentralization gives the crew an opportunity to run the ship on own best-cost consciousness and own high safety level. Let them show their ability to use their qualifications and experience. Not only the transportation revenue will increase and operational costs decrease but safety will be an every person's heartfelt concern.

4. To Bridge the Gaps

To link the gap between ship and shore is being increasingly important, figure 1. Not only for the ship's increasing demand for operational communication but also because of crew's need for social communication.

Bridge the gap between ships and MET institutions

The Swedish owner Wallenius Wilhelmsen has decided to install a broadband service based on the C-band VSAT Sealink System to meet this ambition (Swedes settle ..., 2007).

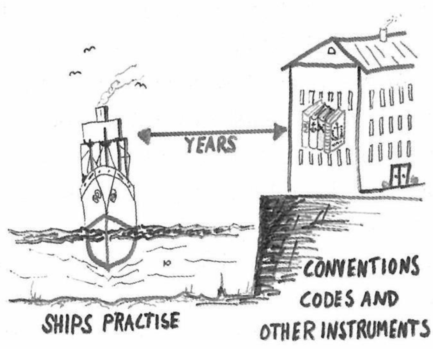


Figure 1. Bridge the gap (Arvedson, 1980)

To *bridge the gaps* (Arvedson, 1980) means, not only between players ashore but foremost between ships and MET institutions. Seafarers must get information faster. Not only rules and regulations but also findings from casualty investigations, P&I Club reports etc. must be passed on to the actors that wish to do their duties well. One has to be transparent so we can learn from each other. To *bridge the gaps* means to allow staff to be systematically updated not only through mandatory and supplementary courses but a general update on findings in the industry. It is the owner's responsibility to make room for refreshing and updating staff/crew (Horck, 2001).

Another bridge, important to build, is a closer link between the MET and the MarAd. If MET does not receive the IMO instruments the message will not be passed on to the seafarers; an ISM problem will follow.

5. What Can Be Done in the Future to Harmonise the STCW and the ISM?

IMO is undertaking a review of the ISM Code and the STCW Convention where possible shortcomings might be addressed. Probably, these are long term projects. The industry needs immediate solutions. A quick way out is a proactive MET.

Let us assume that the STCW 95 is clear in its objective to cover what the ISM Code requires. But what should be covered in future maritime training to be in step with today's quick evolution in the industry? Seven years ago Mottram (2000) suggested the following improvements: 1) communication, 2) teamwork and 3) training systems. These topics are still relevant. I would like to add the importance of taking MET to a 4) better worldwide MET harmonisation and 5) introduce the subject *cultural sensitivity* into the curricula.

a) Training again

A positive environment protection *attitude* should be intensified among all seafarers. This would not only be a step in widening the scope for MET students but also an introduction to safeguard the future of STCW 95.

Mottram (ibid.) summarises from the EU MASSOP study that the shipping companies realise as a 2nd important factor in ship management to have more staff training on familiarisation. This is not a surprise because additional responsibilities have been laid on owners to make sure everything is in compliance. The important question is if the owners should take care of this training on their own cost and with own resources rather than turn to MET professionals. To conduct familiarization training is an excellent opportunity for MET to shoulder. It would give the already low paid teachers an opportunity to earn a bit extra. Ship-targeted computer softwares are made and giving crew, in advance, a possibility to be familiarized with the ship they are going to sign on. In three dimensions it is possible to locate safety equipment and an interactive can check if the operator can handle it. The control of such training is a MET mission; no doubt.

Of course, training at the workplace is conceptualised by interactive e-communication or distance learning. It is a method that will make continuous professional development feasible in a very cost-effective way. In 2003 Videotel launched a training package for ship safety officers. The course includes an assessment element that also covers ISM Code responsibilities. It is a both practical and cost-effective alternative to produce a safety officer. Since the Videotel programme was launched students in excess of 1500 have taken up the portfolio not including the number of seafarers that have followed the course from videos provided to the ships. Perhaps the days of the charismatic teacher have become less important? No, never!

b) Cultural diversity and attitude

What MET has to do in order to make the ISM successful is to make the students realise that safety is a matter of teamwork. To be successful when practising teamwork it is paramount that the members can talk to each other in a language understood by all. In addition it is also essential that there are no cultural barriers for full understanding of messages and orders. Courses must be conducted to learn the students about the existence of such obstacles. Studies have been carried out on the pros and cons of mixed crews and conclusions are both negative and positive (Horck, 2005, 2006). In the future, lack of cultural awareness and the negative and afraid liking attitude to diversity perhaps will be a problem, if not already a problem, also in the owner's boardrooms, surveyors' inspectors' and controllers' contact with crew and within MET institutions. Workforce mobility has become fundamental in shipping. To manage, a company with many different cultures is complex. In addition seafarers usually cannot choose their fellow workers i.e. it will be more difficult to manage people onboard than ashore. Apparently, multicultural awareness training is required to be able to manage this challenge.

When onboard teamwork is practised a MET emphasis must be on subjects like behaviourism, fatigue and cultural understandings. Owners cannot afford to have delays and misunderstandings because crew do not understand each other. Failure of crew to follow correct procedures and to speak with a professional language is becoming major factors for accidents. The MS Bow Mariner accident is a good example of this.

From now on, MET institutions must emphasise their efforts to change becoming seafarers' mentality to safety. Teaching is to change people's behaviour and attitude to certain phenomena linked to the knowledge and skill they need according to mandatory and national MET requirements. Teachers, and of course rectors, should not be afraid of doing so. Contrary, show what good seamanship is by your own good example and most important: be proactive!

MET should foster students self-motivation to acquire knowledge and skill and include subjects like professional work ethics, teamwork and leadership. All are subjects that in one way or another will have an impact on *quality shipping*.

The Maritime and Coastguard Agency (MCA) recently issued a booklet named *Leading for Safety*. The booklet has a heading "Be sensitive to different cultures" (MCA, 2006, p.18). The mere fact that the subject appears is an added argument to urgently introduce cultural awareness in the MET curricula (Horck, 2006). The content should not be a surface introduction but to go in depth.

Crew fatigue is many times referred to as the reason for casualties. We cannot teach people to work without rest. What owners, MarAds and perhaps IMO can do is to review manning levels and the ISM Code would be easier to comply with.

c) Technology

Training is without any doubt a proactive approach to safety. If looking to the future, changes will be necessary as ships are differently built and designed.

The question is if training is catching up with the change in technology. There are indications that high technology is a contributing factor to casualties. Crew get sort of hypnotised by all the fancy equipment onboard; gadgets. We also know that a little knowledge is dangerous. Therefore, training must embrace also abnormal situations. The ability of understanding equipment limitations and awareness of distraction factors must be more considered as important issues in future MET. It is imperative that an emphasis is placed on the man-machine interface remembering that everything should be user friendly.

If noting is done it will take safety to the back seat and the OOW will continue to be more focused on the instrumentation than looking out of the windows. For instance, if the overburden of understanding radar screen markers is not reduced the world will soon experience icon or sign accidents.

MET needs better safety-training facilities for crew's regular safety training and better update on the handling and maintenance of safety equipments carried onboard. It has been shown that there is less time during service to do update training. It is too hazardous to perform on a ship in service. An example of this is the launching and home taking of a free fall lifeboat. It is too a dangerous exercise to do onboard. Let MET do it with their training facilities! Practical training is the only way to learn to react properly. People solve problems by knowledge, experience and behaviour. The experience should be obtained through realistic exercises. Real exercises (contrary to simulations) can be risky. Therefore, it is important that the instructors are properly trained to instruct in risky environments and with real equipment.

To achieve good training is the financing of a *variety* of equipment needed at the MET institutions. Seafarers need to be trained on different e.g. lifesaving equipments. Techniques on how to operate different equipment needs to be taught and taught again. Crew has difficulties to be familiar with operation manuals, company manuals and equipment manuals. The language in these manuals should also be improved to better and faster understanding. Like in the QA manuals the language should be talkative to the reader, not cryptic and certainly not commanding. An improvement on these issues will reflect on a better ISM.

IMO should develop new mandatory training requirements because of all the new and more complicated equipment that is installed on a modern ship. Professionals are in need of greater support to manage their work.

Use the human being and its brain instead of introducing a lot of gadgets to help/assist in handling a ship. The human should not be over exhibited with instrumentation. It is not that difficult to take a ship from port A to port B.

d) Cargo care

Insurers are very concerned about the still very high claims paid each year. One can blame the current boom in shipping but also a growing shortage of trained and experienced personnel (Total losses ...., 2007). To be trained on handling cargo must be a prime emphasis in the future. The reason for being in shipping is to move cargo. If this is done better ISM related issues automatically will be better.

Conclusion

To bridge the gap is still a very relevant issue in the shipping industry. Some caretaking MarAds and MET institutions have been bridging with success but a lot is still to be done. Sölve Arvedson was very foreseeing in his speech in 1980. The WMU academic programme is bridging gaps between shipping stakeholders and users of IMO instruments. WMU is also bridging cooperative relationships between people who have devoted themselves to shipping.

All training should be in everybody's interest. To have this important statement properly planted in everybody's mind. The cure is to cry out loud that it is a matter of having the right training *attitude* and hope that it enters in the companies' management culture.

From this paper one can see that several years ago many different writers have made their views known on the core issue of this paper. The hot discussion is if any of these foresights have resulted in any regulatory changes by MarAds and IMO in order to be ahead of developments in the industry. Readings from reputable maritime journals, casualty investigations etc. indicate the opposite. Some deficiencies are repeated year after year. If so, MET should be proactive and on own initiative educate to meet future needs of the industry. MET should not wait for the lawmakers to tell them what to do.

Other IMO instruments contributing to safer shipping and cleaner oceans should be thoroughly discussed in parallel with STCW subjects in order to have the latter properly implemented. STCW 95 is directly dependent on the capacity of the MET institutions to extend their courses to industry requirements as well as students' requirements above the minimum requirements according to STCW 95. This statement cannot be emphasised enough.

If governments adopted the IMO resolution A. 890 (21) that sets out guidelines on *Principles of Safe Manning* as mandatory and owners management demonstrated more commitment to safety it would improve PSC statistics.

References

1. Arvedson, S. (1980). The interpretation of the 1978 STCW Convention and its relation with other conventions and codes. Paper presented at the IMO/SIDA Seminar, The global implementation of global maritime training standards. 3-7 November, Malmö.
2. Communication problems led to Crimson Mars grounding, (2007, 26 March). Lloyd's List, p. 14.
3. de Bievre, A. (2001, 17 October). Maritime Universities take globalisation in their stride. BIMCO News, p. 4.
4. Dysfunctional relations behind sunken ferry (2007, 24 January). Scandinavian Shipping Gazette Newsletter. Retrieved on 30 May 2007 from: http://www.shipgaz.com/news/archive/index.php.
5. German owner launches "special" training ship (2006, October). Telegraph, 39 (10), p. 15.
6. Horck, J. (2001). The future STCW 95. Paper presented at the BIMCO Residential Seminar, The ISM Code and STCW 95 – making them work better, 3-5 September 2001, Copenhagen, Denmark.
7. Horck, J. (2004). Can shipping people communicate? A human factor aspect on multicultural communication and ethnic stereotyping in shipping. Alert, S. No. 25.
8. Horck J. (2005, October). Communication skills are vital to safe ship operations. The International Maritime Human Element Bulletin, (9), p. 3.
9. Horck, J. (2005a). Getting the best from multi-cultural manning. BIMCO Bulletin, 100 (4), pp. 28-36.
10. Horck, J. (2006). A mixed crew complement. A maritime safety challenge and its impact on maritime education and training. Licentiate dissertation series 206:3. Malmö: Malmö University, School of Teacher education.
11. Klart med svenskt skolfartyg [A Swedish schoolship available], (2007, January 12). Svensk Sjöfartstidning, 1, p. 5.
12. MCA, (2006, March). Leading for Safety; A practical guide for leaders in the Maritime Industry. Retrieved on 3 June 2006 from: http://www.mcga.gov.uk/c4mca/mcga-dqs-rap-human-element-leadership-handbook.htm.
13. Mottram, D. (2002). Manpower the lessons to be learned. BIMCO Review pp.84-87.
14. Muirhead, P. (1998). IT strategies in shipping – Can training keep pace? Paper presented at the 2nd International LSM IT strategies, 18 March 1998, Amsterdam, The Netherlands.
15. OCIMF, (2004). Tanker management and self assessment: a best practice guide for ship operators. London: Author.
16. Patraiko, D. (2001, March). Information Technology and the training needs of seafarers. Nautical Briefing, Supplement to Seaways.

17. Sagen, A. (2002). Safety, health and environment. Know How (2), 12.
18. Seltmann, A. (2006, 18 November). Recent hull & machinery claims. CEFOR Seminar on recent claim trends. Retrieved on 30 May 2007 from: http://www.cefor.no/statistics/statistics.htm.
19. Short, V. (2006, October). Maritime English valuing a common language. Nautical Briefing, Supplement to Seaways.
20. Swedes settle on VSAT systems (2007, March). Fairplay Solutions, (126), p. 8.
21. Total losses down but accidents increasing. (2007, May/Jun). the sea, (187), p. 1.

VTS Operators' Eye Movements

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Abstract

This study clarifies the characteristics of Vessel Traffic Services (VTS) Operators' eye movements during their regular tasks. Experimental studies are carried out at the Istanbul Strait VTS Head Center in TURKEY for the general aim of the authors as maximising integrated human reliability on board during the passage of congested waterways.

The safe passing through the Istanbul Strait is a critical issue not only for VTS Operators (VTS-Os) but also for Ship Masters, ship owners, major oil companies and so on for saving lives, keeping clean seas and also economic aspects.

The objective of this study is to define eye movements of VTS-Os who have a long-term experience as a Ship Master. For this purpose, Eye Mark Recorder (EMR) is utilized as physiological index to evaluate fixation points, fixation durations and changes in viewpoints of VTS-Os. Three experimental studies are carried out in different conditions of watch keeping times and sectors in the VTS area.

VTS-Os' eye movements were recorded by the EMR-8 that provided by Istanbul Technical University Maritime Faculty. In the analysing part, the visual field is categorized to determine the fixation points of VTS-Os and to understand of what is the mainly information and its significance for their decision-making. Then, the data was analysed by using "Frame by Frame" method. The results are also compared among the VTS Sectors.

The visual field of the operator consists of two computer screens, two monitors for displaying of cameras in the Istanbul Strait and cameras' control unit, VHF communication unit and paper work area. Computer screens of the VTS System can spread from one display to other and VTS-Os generally used the function of picture in picture on the display.

There are some sharing behaviours for the VTS-Os' fixation durations and some differences based on their individual characteristics. Generally, their eye movements have

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similar pattern for operating VTS System and for the information. However, the order of information changed among the fixation points, and the fixation durations changed based on the operating display as individual choosing. On the other hand, moving of viewpoints was over 60 deg/sec, so saccade of eye movements has significant ratio, because of quick eye movements through the categories.

Keywords: Human Element; VTS Operator; eye movements; fixation duration; viewpoints

1. INTRODUCTION

The most important source of getting information through the environment of human is the eyes. Almost 70% of the all information is got by the eyes. When considering the information inputting from external world, its quantity is too high for human being, so human selects the necessary information by using the five senses. As the result of that, the source of getting information and the style of using information are valuable for the mariners, especially to consider the supporting systems to the vessels for the safe passing of a narrow waterway; the main supporting tool is their information to provide to the ships. Vessel Traffic Services (VTS) and such kind of services are the main supporting systems as a shore side partner for the ships. In here, the investigating item is; how the VTS obtains this information, what is the way of VTS Operators (VTS-Os) to get, assess and use such various data, and so on? In this paper, authors aim to indicate VTS-Os' behaviours based on their eye movements through the answering such kind of questions for minimizing human error considering to ergonomic design during their task execution. While doing this, it is crucial to keep in mind that VTS-Os who involved in experimental studies have experience as a Ship Master and now they are not onboard but they are involved to bridge as a supporting part of the Captain/Pilot.

There are a few researches related to eye movements of mariners, but there is not any study to search of VTS-Os' eye movements before.

1.1. TURKISH STRAITS VESSEL TRAFFIC SERVICES (TSVTS)

Istanbul Strait is one of the difficult to manoeuvre narrow waterways in having of densest traffic. The average numbers passing through the Istanbul Strait is 48,456 yearly, 4,038 for monthly and 133 for daily. Additionally, the number of maritime accidents (daily average is 22.5 ships had accident) is in the high level (Kum et all. 2006). On the other hand, it is obvious the effect of the VTS that constructed in 2003 for the safe passage of ships from Black Sea to Aegean Sea by covering territorial waters of Turkey.

VTS covers the area of the Marmara Sea, Istanbul and Çanakkale Strait is called as the Turkish Straits VTS (TSVTS). The total length of this area is 164 nm. TSVTS is operated in 24 hours; there are two watching system as day shift and night shift. The shifts have two hours watches. There are; two VTS-Os (while one of them operates to the system, the other is standby), one Assistant Supervisor and one VTS Supervisor, VTS-S, (who is an appropriately qualified VTS-O carrying out supervisory duties on behalf of the Authority) in every watch. Additionally, some of the VTS-S (who engaged for daily administrative works other than interaction with the vessels), Data Input Operator (who engaged to input the vessels sailing plans to the system) and other staffs are involved day shifts.

The number of VTS-Os is 48 (including VTS-S) at the Istanbul VTS and 30 operators at the Çanakkale VTS. The 32 of VTS-Os at the Istanbul VTS have engaged actually for the system operation (who sit on console table and make communication with ships). All of the Turkish VTS-Os has sea experience (13.6 years in average) as a Ship Master (5.5 years in average). Their average age is 33 years and all of them have Bachelor's degree from a maritime faculty.

The experimental studies are carried out at the Istanbul VTS Center. Istanbul VTS has four sectors as shown in Fig. 1.

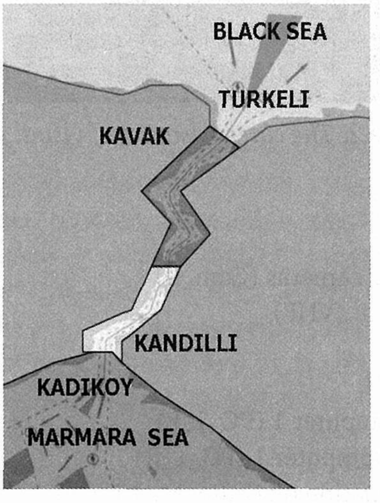


Figure 1. Istanbul VTS sectors

2. Experimental Study

2.1. Experimental Conditions

The eye mark recorder is a head mounted equipment, NAC EMR-8, for detecting subjects' eye movement and recording the fixation points with images superimposed on VTR (Video Tape Recorder) every 1/60 second. The EMR-8 is provided by Istanbul Technical University Maritime Faculty (ITUMF).

It is important to divide the categories to visual field for analysing by "Frame by Frame" method. That's why the whole area of VTS-O's visual field is divided mainly twelve categories as shown in Fig. 2. The visual field of VTS-Os consists of,

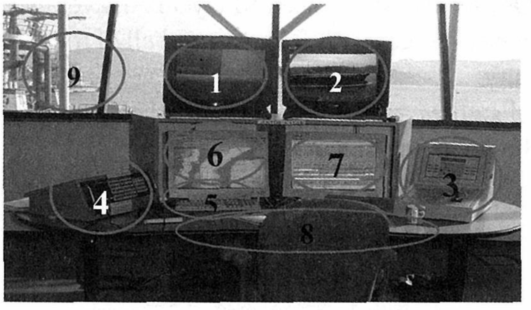


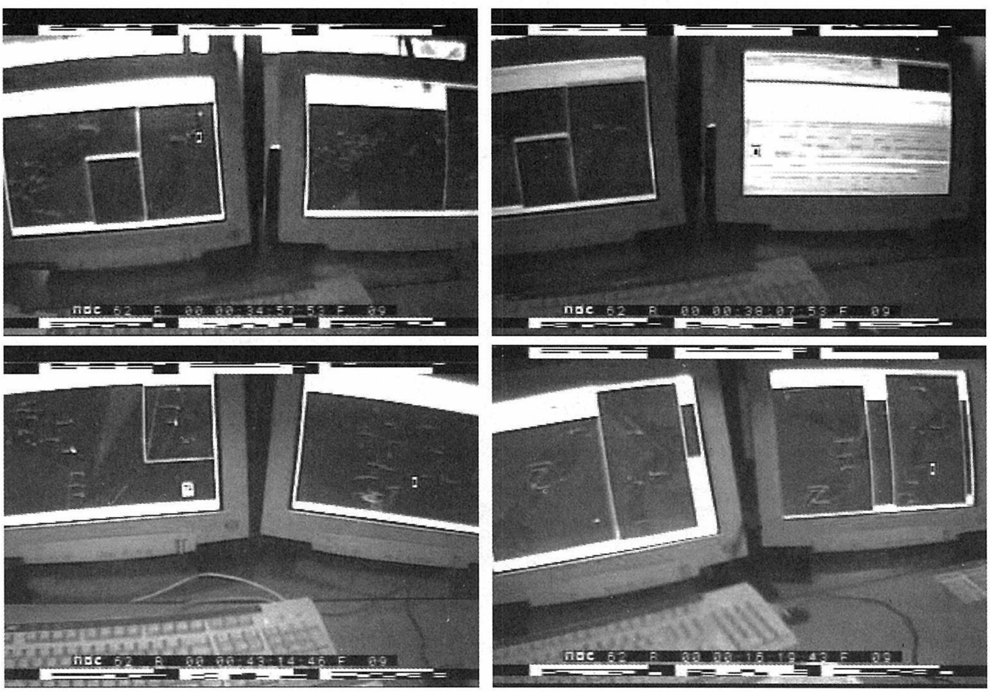
Figure 2. The categorisation of visual field

1. Camera 1 (Cam_1)
2. Camera 2 (Cam_2)
3. Control unit for the cameras (Cam_C)
4. Communication unit (VHF)
5. Keyboard
6. Computer 1 (PC_1)
   a. Left screen of computer 1 (PC_1_L)
   b. Right screen of computer 1 (PC_1_R)
   c. Menu and information on computer 1 (PC_1_M&I)
7. Computer 2 (PC_2)
   a. Left screen of computer 2 (PC_2_L)
   b. Right screen of computer 2 (PC_2_R)
   c. Menu and information on computer 2 (PC_2_M&I)
   d. Page of Ship Movement Information (SMI)
8. Paper works, PW, (notes, logbook etc.)
9. Other spaces (OS); it consists of fixations to environment either than other categories such as looking around, windows etc.

10. Others; means that eye blinks, saccade of eye movements and the shifting period of eye movements from one category to the others.
11. Other operators (OO); when VTS-O looks the near operator on his sides, it is categorised as other operators.
12. Supervisor (VTS-S); when operator communicates and looks the supervisor about one issue it is evaluated that he looks to supervisor.

Almost all operation mainly performed on the computers and their screens can spread from one display to other, also VTS-Os used the function of picture in picture on the display. That's why the screen of computers is divided categories for getting detail information about VTS-Os' eye movements. The photos in Fig.3 show that how VTS-Os use the display function and illustrate the situation of recording eye movements (the small white square indicates the fixation point at that time). Fig. 3 also shows the individual choosing of VTS-Os to operate the VTS system.

During the time of experiments, the flow of traffic in the Istanbul Strait was just one way, North to South (southbound), due to the operation that carried at the southern entrance of the Strait for underground railway system. Moreover, the environmental conditions in the Strait were fine; weather was partly cloudy, average wind force was 8



The order of photos from left upper part is; computer's display forVTS-O_1 and when he looked to Ship Movement Information page, the display of computers for VTS-O_2 and VTS-O_3.

Figure 3. Samples of the recording data and display of computers (PC_1 & PC_2)

knots and northerly, calm sea and normal level of current flow, and visibility was clear in 3 km.

For keeping the fresh knowledge of experiments, authors also fill "Event Record Form for Eye Mark Recorder" included profile information of operators, remarkable events and other useful information based on the time scale.

There are some restrictions to carry out such kind of experiments as;

- To provide a suitable instrument for recording eye movements (it is quite expensive),
- To take administrative permission,
- To be accepted by VTS-O as to be a subject,
- Time limitation for recording (after 20-30 minutes later the subjects do not feel convenient due to infrared light for tracking eye movements, it makes the paint) and analysing (the number of data is so high just for one minute),
- Restrictions for the analysing data (number of raw data, methodology and so on),
- Some environmental restrictions

2.2. PROFILE OF SUBJECTS (VTS-OS)

Totally, authors had three experimental studies at the Istanbul VTS Center. The characteristic of VTS-Os who involved in experiments is shown in Fig. 4. All of them have onboard experience as a Ships Master (5 years in average) and their total average sea experience is 12.7 years. Their average age is 37 years old and they have not any eye problem.

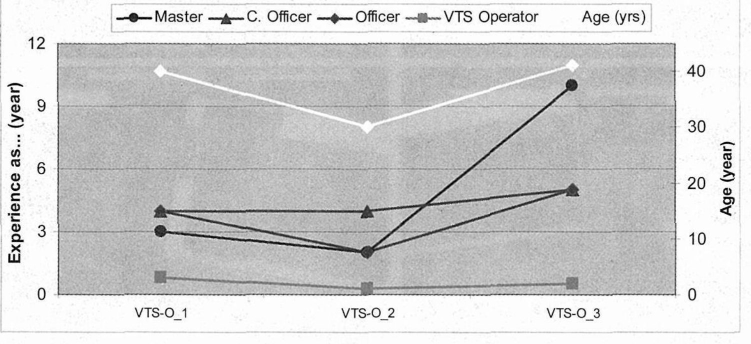


Figure 4. The profile of VTS-Os

2.2. Analysing Method (Frame by Frame)

Frame by Frame method is used to analyse the results of eye movements. The qualitative and quantitative assessments are made based on the result of Frame by Frame method. This method is most suitable, because it doesn't include head motions comparing to the software of eye tracking methodologies.

The raw data of EMR includes 18,000 data (every cell corresponds to one frame) for 5 minutes recording. The steps for the Frame by Frame method are summarised as follows;

1. Watching VTR for getting the general idea of eye movements,
2. Preparing the Microsoft Excel sheets for every subject; in this part when the time is indicated by row, columns indicate the categories that divided by researcher. In addition, the time series continue as indicated by VTR image for every frame. In Fig. 3, time indicated at the lower part as hour, minute, seconds and frame number. The relations between frame and second is "1 second = 60 fields = 30 frames". In Excel sheet, one cell corresponds to one frame and so the cell indicates 33 milliseconds.
3. Filling the category's cell; the researcher starts to watch VTR for playing frame by frame between the time interval of analysing part (starting frame and ending frame on VTR). While this watching, the point of eye tracking by "white square" is followed and its position is marked depend on the categories. In here, it is a good way to put "1" to each cell on the point of eye tracking with different colours of cell that corresponds to different categories.
4. Counting the cells, determining fixation points and durations; when putting the number "1" for viewpoints of VTS-Os, at the end it is counted how many cell or "1" putted in each category. This is the total frames and time for fixation duration. Later similar calculation made for determining the fixation points.

In this study, the fixation duration means that the subject looks at the same area more than 133 milliseconds (four frames). The fixation points mean that how many times subject looks at the categories (successive fixation to the category). And, the place of viewpoints means what the subject have looked at and not related to the duration. In this study authors don't consider the place of viewpoints because eye movements are so fast and they just focus their task, it means that the meaningless image and fixation on empty spaces are almost minimum level, and when they look at one area there should be some meaning for the operation and their decisions during the communication with ships.

The sampling data were chosen randomly as shown in Fig. 5. The first five minutes were neglected due to calibration and arrangements of EMR, subject needed the time to be used to instrument and feel free to return his ordinary task.

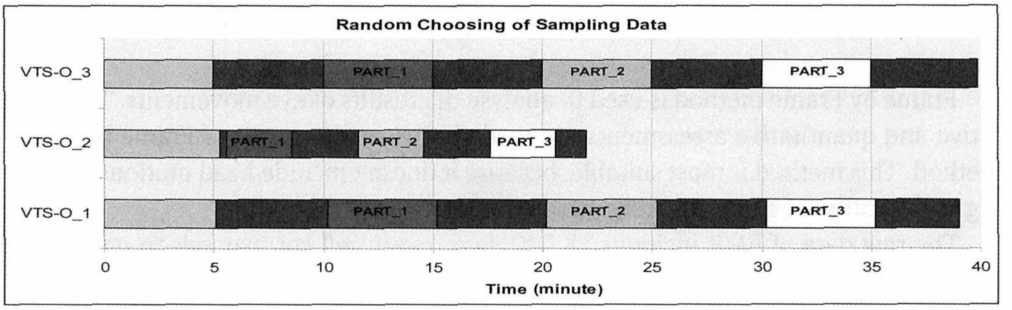


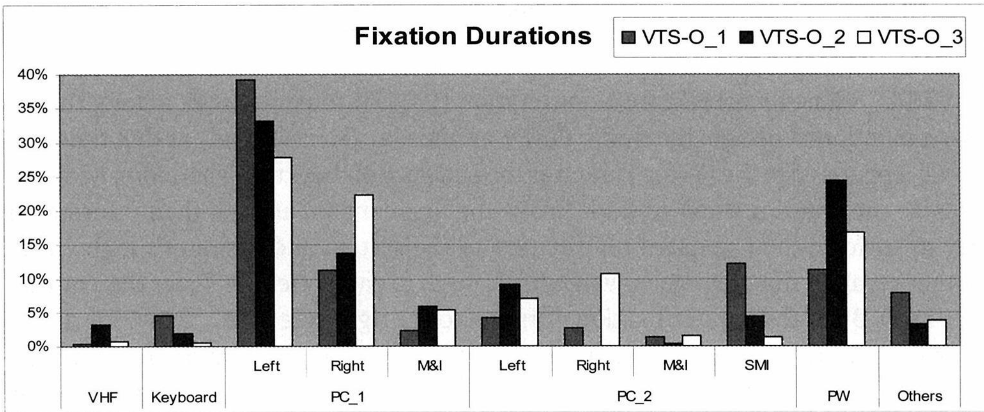
Figure 5. Random choosing of sampling data

3. Results and Considerations

3.1. Fixation Durations

During the first experiment (VTS-O_1) there were many times cutting off electricity. Normally, the generator supplies the power for the whole VTS system with just a little bit delays. The main parts of the VTS system (operators' console table) are supplied by UPSs until the generator steps in. VTS-Os immediately recognise to cut off electric power and automatically they give some reactions, especially if the generator steps in lately, because during that time they can just follow the screens and the lighting system of the operation room and/or VTS Centre don't work (except emergency lightings and exists). This knowledge is important because the EMR-8's electric supply gets from main source (city electricity) and eye-tracking window cannot be obtained. However, its camera is working so it can be obtained the area where VTS-O_1 fixates on. In the analysing part, the area of fixation points is decided based on the eye-tracking window according to Frame by Frame method. On the other hand, it can be estimated where the eye-tracking window should be, but authors don't do this, and these areas (when the eye-tracking window cannot be observed) are put as "Others" category for VTS-O_1. Then, the fixation duration to "Others" category comes higher than normal for this operator. When authors estimate the area of eye-tracking window based on the camera images, it is determined that the general behaviour of VTS-O_1 is the similar. Moreover, comparing to the other VTS-Os, the results have similarity and the same tendency for the general characteristics of operators (it means that all the below explanation is the same whether electricity cuts off or not). The difference of analysing with cutting off electricity is the ratio of fixation durations to PC_2_M&I increased and "Others" decreased for VTS-O_1.

The significance of the results of Frame by Frame method tested by ANOVA Two-Factor analysis. According to ANOVA analysis, there is no significant difference among the behaviours of VTS-Os based on the fixation durations to the categories as shown in Fig. 6. It is determined that the fixation durations to the categories are significantly different from each other. VTS-Os have the highest fixation durations to the left side of computer 1 (33.5% to PC_1_L), and the lowest fixation durations to the categories are cameras and camera control unit, supervisor, other operators and other spaces.



F value of VTS-Os is 0.005, p > 0.05; F value of the categories is 14.6, p < 0.01
Figure 6. Fixation durations to the categories among the operators

Table 1 shows the VTS-Os' choosing display items of computers. VTS-O_1 mainly divided the display of PC_1 in two parts, but he is also to add one small display as shown in Fig. 3. Because sometimes he needed to look the higher scale on PC_1 and sometimes he opened this small display and later closed again. This necessity can be explained as; the sector operated by VTS-O_1 (Sector Kandilli) covers the critical area of the Strait (from Vaniköy to Kanlıca) and the devil currents flows in this sector at the point of Kandilli. VTS-O_1 has the highest fixation duration to SMI by 75.6% in the total fixation durations.

Table 1. *The area displayed on the computer screens by VTS-Os*

	Computer 1		**Computer 2**	
	Left side	**Right side**	**Left side**	**Right side**
VTS-O_1 (Sector Kandilli)	Southern part of the sector (Haydarpasa to Bogazici Bridge)	Northern part of the sector (Bogazici Bridge to FSM Bridge)	It covers the southern anchor-age area in the Sector Kadıköy	Southern part of the Sector Kavak (FSM Bridge to Selvi-Tarabya Point)
VTS-O_2 (Sector Türkeli)	The area (Rumeli Light to northern limit of the sector by covering the anchorage area) covers to 2/3 of the screen	It is small part of the screen and covers the ap-proaching area to the Light (North entrance of the Strait)	The display of computer isn't divided. It is the largest viewpoint of the sector.	

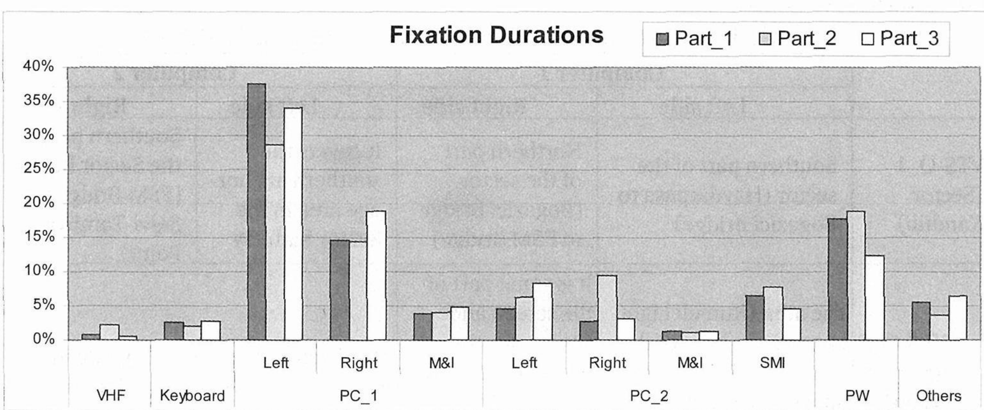
	Computer 1		Computer 2	
	Left side	Right side	Left side	Right side
VTS-O_3 (Sector Kavak)	North of the sector (Garipçe-Fil Point to Beykoz)	South of the sector (Beykoz to Kanlıca, FSM Bridge)	South of the Sector Turkeli Turkeli (Rumeli Light to Garipçe)	South of the sector (Beykoz to Kanlıca, FSM Bridge)

VTS-O_2 has the highest fixation duration (24.3%) to paper work among the others. As mentioned before, the traffic flow was one way (southbound) at that time, and VTS-O_2 operated to the Sector Türkeli as the entrance of the Strait. Therefore, he should organize the entering order of ships, make the first contact, and get their information, later to perform their updated information to the system and operator's logbook. As another result of that, his eye movements through to categories are faster than others'.

VTS-O_3 has the highest fixation duration to the right side of PC_ 2 by 79% among the operators. There is no significant difference among the parts based on the fixation durations to the categories as shown in Fig. 7. In addition, the fixation durations to the categories are significantly different from each other among the parts.

According to the average values of fixation durations as shown in Fig. 8, the order of VTS-Os fixations are; PC_1 (53.8%), PC_2 (19.0%), paper works (16.4%), others (5.2%) and keyboard (2.5%), and the other categories are equal to 1% or less than 1%. Fixation durations to the left side of the computers are higher than right side. This result is the similar for computer users as a common behaviour that the eye movements start to search from left part of the screen (Fukuda & Bubb 2003, Özçelik et all. 2006).

Fixation duration to PC_1 for the all operator is 74% among the computers, and it is 53.8% among the other categories. Moreover, the ratio between PC_2 and PC_1 is 0.35. It means that VTS-Os use one of the computers (PC_1) for understanding the general situation in the sector, and they divide the display in two screens. In addition, all opera-



F value of parts is 0.004, $p > 0.05$; F value of the categories is 53.08, $p < 0.01$

Figure 7. Fixation durations to the categories among the parts

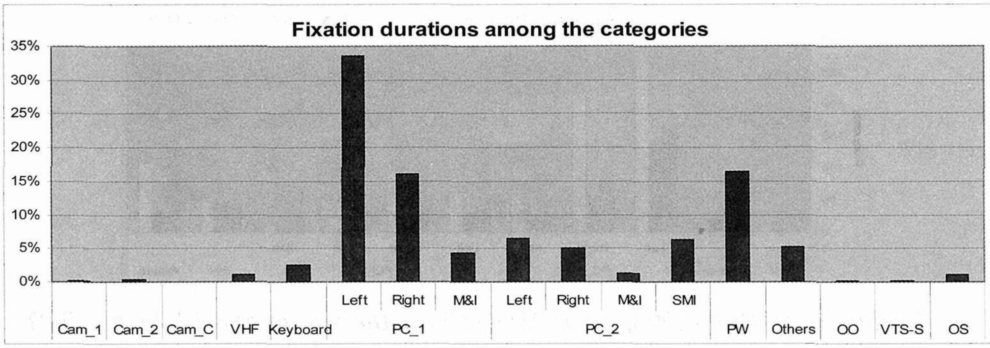
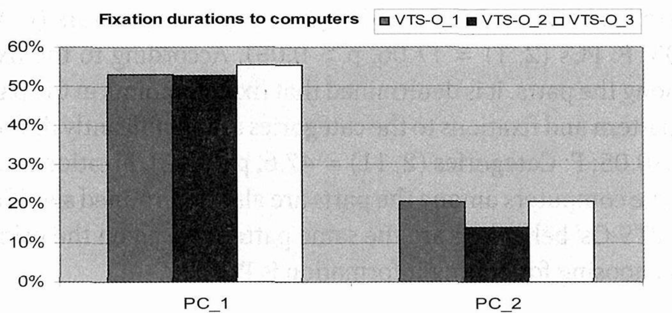


Figure 8. The percentages of the average fixation durations to the categories



F value of VTS-Os is 2.1, $p > 0.05$; F value of computers is 342.3, $p < 0.01$

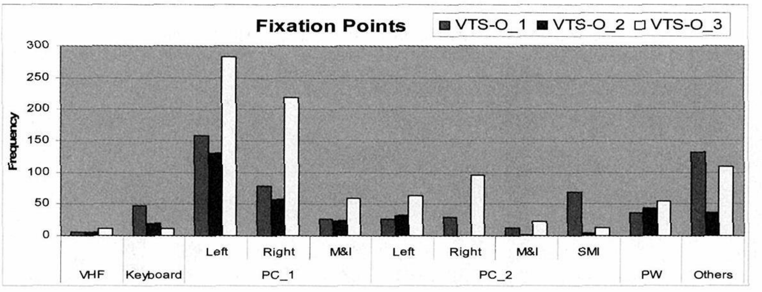
Figure 9. The percentage of fixation durations to computers among the operators

tors use the function of picture in picture. VTS-O_3 has the fast and most eye movements, then VTS-O_1 and VTS-O_2. All operators open the page of Ship Movement Information on PC_2. Fig. 9 shows that there is significantly difference between PC_1 and PC_2 and the fixation durations to the computers are significantly similar.

3.2. Fixation Points

VTS-Os' most fixation point is to PC_1 as shown in Fig. 10, and PC_1_Left has the most fixation points for all operator. The operators' behaviour on the fixation point is significantly similar and their fixation points to the categories significantly have different meaning.

VTS-O_1 and VTS-O_2 are the only operators to have fixation durations to the cameras; and VTS-O_3 has the only fixation durations to "Other Operator", and "Supervisor". VTS-O_3 has the highest fixation points to computers among the operators and parts. His ratio of fixation points to the PC_1 is 54.1% in the total fixation points to PC_1 among the operators, and that is 52.8% for PC_2.



F value of VTS-Os is 0.003, p > 0.05; F value of the categories is 12.76, p < 0.01
Figure 10. The frequency of fixation points to the categories among the operators

VTS-Os' fixation points to the computers are determined as insignificant and there isn't any difference between PC_1 and PC_2 among the operators (F: VTS-Os (2, 1) = 0.28, p > 0.05; F: PCs (2, 1) = 17.06, p > 0.05). According to the fixation points to categories among the parts, it is determined that fixation points in the parts significantly are the same pattern and fixations to the categories are significantly different (F: Parts (2, 11) = 0.01, p>0.05; F: Categories (2, 11) = 47.6, p<0.01). Fixation durations and fixation points to the computers among the parts are also determined significantly different. It means that VTS-Os' behaviour are the same pattern based on the using of computers, and their first choosing for getting information is PC_1.

4. CONCLUSION

Authors have another experiments at the Istanbul VTS Center simultaneously with this study, the assessment of mental workload of VTS-Os by utilising Heart Rate Monitor and questionnaire for determining the factors to cause mental workload and the level of VTS-Os' mental workload based on the NASA Task Load Index. When matching the result of VTS-Os' heart rate variability and eye movements it is determined that the ship specifications and position effect the VTS-Os' behaviours while executing task, especially the ships with long length in the critical area and sharp turning points. On the other hand, it is quite difficult to tracking eye position of the operators on the computer screen to understand what kinds of information looked, because of frequency difference between the recording camera of EMR and computers. When the authors make relatively comparison among the VTS-Os based on their fixation durations and fixation points for the main fixations in the visual field; the computers, paper work and others (because of the saccades among the categories) have the highest fixations. Table 2 shows this relative comparison and percentages of the fixation durations (horizontal texts of table) and fixation points (vertical texts of table) to the mainly areas where VTS-Os fixate on the visual field.

<table>
<tr><th rowspan="3" colspan="2"></th><th colspan="12">TIME DURATION (%)</th></tr>
<tr><th colspan="4">VTS-O_1</th><th colspan="4">VTS-O_2</th><th colspan="4">VTS-O_3</th></tr>
<tr><th colspan="2">Among the categories</th><th colspan="2">Among the operators</th><th colspan="2">Among the categories</th><th colspan="2">Among the operators</th><th colspan="2">Among the categories</th><th colspan="2">Among the operators</th></tr>
<tr><td rowspan="6">FREQUENCY (%)</td><td>Keyboard</td><td>HFP (7.3)</td><td>MFD (4.67)</td><td>Highest fixation point (61.0)</td><td>Highest fixation duration (73.40)</td><td>MFP (5.3)</td><td>LFD (1.95)</td><td>Middle fixation point (24.7)</td><td>Middle fixation duration (18.23)</td><td>LFP (1.1)</td><td>LFD (0.55)</td><td>Lowest fixation point (14.3)</td><td>Lowest fixation duration (8.37)</td></tr>
<tr><td>SMI</td><td>VHFP (10.6)</td><td>VHFD (12.13)</td><td>Highest fixation point (80.0)</td><td>Highest fixation duration (75.59)</td><td>LFP (1.1)</td><td>MFD (4.45)</td><td>Lowest fixation point (4.7)</td><td rowspan="2">Middle fixation duration; SMI (16.43) PW (34.44)</td><td>LFP (1.3)</td><td>MFD (6.29)</td><td>Middle fixation point (15.3)</td><td>Lowest fixation duration (7.98)</td></tr>
<tr><td>Paper Work</td><td>MFP (5.7)</td><td>VHFD (11.29)</td><td>Lowest fixation point (27.6)</td><td>Lowest fixation duration (26.97)</td><td>VHFP (12.0)</td><td>VHFD (24.32)</td><td>Middle fixation point (32.1)</td><td>MFP (5.6)</td><td>VHFD (16.85)</td><td>Highest fixation point (40.3)</td><td>Highest fixation duration (38.59)</td></tr>
<tr><td>Others</td><td>VHFP (20.5)</td><td>HFD (7.77)</td><td>Highest fixation point (47.5)</td><td>Highest fixation duration (58.57)</td><td>VHFP (10.1)</td><td>MFD (3.20)</td><td rowspan="3">Lowest fixation point; PC_1 (20.5) PC_2 (10.0)</td><td rowspan="3">Lowest fixation duration; Others (14.29) PC_1 (22.81) PC_2 (16.97)</td><td>VHFP (11.4)</td><td>MFD (3.76)</td><td>Middle fixation point (39.6)</td><td>Middle fixation duration (27.14)</td></tr>
<tr><td>PC_1</td><td>VHFP (40.8)</td><td>VHFD (52.88)</td><td rowspan="2">Middle fixation point; PC_1 (25.4) PC_2 (37.1)</td><td rowspan="2">Similar with VTS-O_3; PC_1 (38.53) PC_2 (42.18)</td><td>VHFP (59.4)</td><td>VHFD (52.81)</td><td>VHFP (57.9)</td><td>VHFD (55.32)</td><td rowspan="2">Highest fixation point; PC_1 (54.1) PC_2 (52.8)</td><td rowspan="2">Similar with VTS-O_1; PC_1 (38.65) PC_2 (40.85)</td></tr>
<tr><td>PC_2</td><td>VHFP (21.3)</td><td>VHFD (20.47)</td><td>VHFP (10.4)</td><td>VHFD (13.89)</td><td>VHFP (20.2)</td><td>VHFD (20.68)</td></tr>
</table>

Table 2. *Summary of VTS-Os' fixation durations and fixation points*

LFD: Low Fixation Duration	LFP: Low Fixation Point
MFD: Medium Fixation Duration	MFP: Medium Fixation Point
HFD: High Fixation Duration	HFP: High Fixation Point
VHFD: Very High Fixation Duration	VHFP: Very High Fixation Point

The main parts of the VTS consist of computer-based design. That's why when the operator used to use computer, it makes to fast operation on the computer and keyboard. It also effects to decrease VTS-Os' mental workload.

Finally, the affect of ergonomic design of the operator console table cannot be rejected to VTS-Os' behaviours. The fixation durations to the cameras are the lowest for all operators. If they want to look cameras, they should up their head. Moreover, the fixation points through the vertical line from one category to other are slightly less than horizontally. It clarifies that the vertical movements of eye movements are not chosen by the operators. On the other hand, the fixation durations to the left side of computers are higher than right side. The first choosing to display data is the left sides and it is convenient for the operators to shift eyes left to right on the horizontal line.

Acknowledgements

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References

1. Arthur, H. J. & Hancock, P.A. 2001, Navigation Training in Virtual Environments, *International Journal Of Cognitive Ergonomics,* vol. 5(4), pp. 387–400.
2. Fukuda R. & Bubb H. 2003, Eye tracking study on Web-use: Comparison between younger and elderly users in case of search task with electronic timetable service, *PsychNology Journal*, vol. 1(3), pp. 202–228.
3. Kum, S., Arslan, O. & Furusho, M. 2006, Analysing Navigators' Eye Movements by Utilizing Eye Mark Recorder on the Ship Handling Simulator, *The Journal of Japan Institute of Navigation*, vol. 115, pp. 147-152.
4. Kum, S., Fuchi, M. & Furusho, M. 2006, Analysing of Maritime Accidents by Approaching Method for Minimizing Human Error, Proceedings of IAMU AGA-7, *"Globalization and MET"*, Part 2, pp. 392-409.
5. Ma, MY., Nagao, T. & Kamaike, M. A Research of The attractiveness of visual Information in Railway Station, 2003, *The Journal of the Asian Design International Conference,* vol.1, pp. 127-136.
6. Özçelik, E., Kursun, E., & Çagiltay K. 2006, The Investigation of Universities' Web Pages by Eye Tracking Methodology (in Turkish), *"Conference of Akademik Bilisim 2006 and Bilgi Tek IV"*, Denizli, 9-11 February.
7. Unpublished Data of Turkish Ministry of Transport, Directorate General of Coastal Safety, http://www.coastalsafety.gov.tr/, http://www.dgcs.gov.tr/

Toward an International Rubric: A Compilation of STCW Competency Assessment Methodologies

Captain Cynthia Smith Robson[1]

By learning you will teach;
by teaching you will understand
Latin Proverb

Abstract

The International Maritime Organization Convention on the Standards of Training, Certification and Watchkeeping for Seafarers (IMO/STCW) addresses specific assessments with respect to ship officer certification. Although the IMO provides limited guidance on methodologies to be employed for assessment of mariner skills, it does not offer detail with respect to specific evaluation techniques.

The STCW Code establishes general performance standards for simulators used for training or assessment activities conducted to meet a requirement of the Convention. The Code also provides detailed guidance on the use of simulators for training and assessment of candidates for STCW certificates. Qualifications of trainers and assessors are also outlined. Other provisions such as simulator training objectives, training procedures, and assessment procedures are specified. The STCW assessments follow the educational hierarchy of knowledge, understanding, and proficiency.

This paper will detail the processes through which selected mariner proficiencies are assessed at the United States Merchant Marine Academy (USMMA). For example, historically, the Shiphandling / Seamanship course offered at the USMMA did not provide for evaluation of midshipmen through practical competency assessment of mariner skills. Moreover, simulation was not traditionally used in the facilitation process to demonstrate ship behavior. With the advent of IMO model courses and implementation of STCW competency assessment, the Shiphandling/Seamanship course offered to midshipmen at the USMMA was redesigned to employ practical demonstration, performance evaluation and assessment through the use of multi-task and full

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mission simulation. Practical assessments of mariner skills, to be successfully objective and quantitative, are now executed in the controlled environment the simulators provide. In conclusion, this paper will encourage discourse and promote international collaboration toward a standardization of the methodologies of mariner competency assessment.

1. INTRODUCTION

With the advent of STCW 95, mariner qualification was transferred from knowledge based to proficiency based examination. The Convention provides for several methods of testing, both written and practical. The latter method may involve the use of a simulator, a training ship or other merchant vessel. Strict standards governing the use of simulators in both mariner training and assessment are outlined in the Code. In chapter 1, guidelines are detailed regarding the performance standards of simulators, the qualifications of the instructors and assessors, and the procedures for simulator based training and assessment.

In chapter II of the STCW Convention, *Standards Regarding the Master and Deck Department,* Section A-II-1 provides mandatory minimum requirements for the certification of officers in charge of a navigational watch on ships of 500 gross tonnage or more. The included tables outline criteria for evaluating competence of these minimum standards according to three Functions: Navigation at the Operational Level (A-II/1); Navigation at the Management Level (A-II/2); and Navigation at the Support Level (A-II/4).

It is beyond the scope of this paper to enumerate all of the requisite standards of competence for persons in charge of a navigational watch. For each competence listed in the STCW Tables, methods for demonstrating competence and criteria for evaluating same are listed in exhaustive detail. Specific methodologies, however, are not provided. These are left to the discretion of the assessor, to be developed according to the parameters outlined.

For each competence, the Function defines a requisite Knowledge, Understanding, and Proficiency (KUP). It is interesting to consider the skill-sets detailed thus according to a taxonomy of educational objectives. Assessment of some competencies is basic, whereas others require much planning or database development when a simulator is employed. For the Function: *Navigation at the Operational Level*, more complex competencies will be detailed according to methodology and assessment criteria as evaluated at the United States Merchant Marine Academy. It is the hope of this author to open a dialogue between assessors for the purpose of working toward an international rubric, or standardized assessment of proficiency.

2. Performance Standards of Simulators

According to the STCW code, the use of a simulator is mandatory in only two cases: in training in RADAR and in Automatic Radar Plotting Aids (ARPA). Simulators are, however, identified frequently in the STCW code as an acceptable method or environment for demonstrating competence. Section A-I/12 of the STCW Code establishes specific performance standards for RADAR and ARPA, and general performance standards for simulators otherwise used for training or assessment activities conducted to meet a requirement of the Convention. Section B-I/12 of the STCW Code provides detailed guidance on the use of simulators for training and assessment of candidates for STCW certificates. [uscg.mil/STCW]

2.1. Use of Simulators for Training

Section A-I/12 Part 1 outlines general performance standards for simulators used for mandatory simulator based training. The unit must be capable of simulating the operation of the shipboard equipment concerned with a level of physical realism to include capabilities, limitations and possible errors of the equipment. The controlled operating environment the simulator provides must be also capable of producing a variety of conditions including but not limited to unusual situations, hazards, or emergencies relevant to the training objectives. The trainee must be able to interact with the equipment, the environment, and the instructor. The instructor must be able to control, monitor, and record exercises for effective debriefing. Peer debriefing is also encouraged.

2.2. Use of Simulators for Assessment

Section A-I/12 Part 1 outlines general performance standards for simulators used in assessment of mariner competence or demonstration of continued proficiency. In addition to the requirements outlined above, the simulator must have sufficient behavioral realism to allow a candidate to exhibit the skills appropriate to the assessment objectives. The assessor must be able to control, monitor, and record the exercises for the effective assessment performance of the candidates.

2.3. A Uniform Standard for Approved Simulators

When using simulators as a means to demonstrate competence (assessment) in competencies other than RADAR/ARPA, it is a mandatory requirement to use approved simulators. To be an approved simulator, the unit must meet performance standards as outlined above. The standard stipulates requirements for the performance of maritime simulators. The purpose of the standard is to ensure that the simulations provided by any maritime simulator include an appropriate level of physical and behavioral realism in accordance with recognized training/assessment objectives.

Det Norske Veritas has developed a uniform standard for certification of maritime simulators for STCW competency assessment. Application of this standard ensures consistency in simulation training, and verifies that the simulator center is operating according to established practices and specific requirements. Their standard can be applied to all simulator centers offering education and training with simulators to the maritime industry. The standard supports the requirements and objectives of the ISM code and the revised STCW-95 Convention. [dnv.com]

3. Qualifications of Instructors and Assessors

If conducting training using a simulator, the instructor must have received appropriate guidance and have gained practical operational experience on the particular type of simulator being used. If a person is conducting assessment involving the use of simulators, they must have gained practical assessment experience on the particular type of simulator under the supervision and to the satisfaction of an experienced assessor. These qualifications for appropriate guidance and operational experience are met through the completion of an approved "Train the Trainer" course wherein assessors are trained with respect to comprehensive and uniform training and assessment methodologies.

4. Procedures for Simulator Based Training and Assessment

Section A-I/12 Part 2 provides for other provisions such as simulator training objectives, training and assessment procedures. According to the Code, the aims and objectives of simulator based training must be defined within an overall training program and specific training objectives and tasks must be selected so as to relate as closely as possible to shipboard tasks and practices.

4.1. Simulator Based Training Procedures

Instructors must ensure that trainees are briefed and given sufficient planning and familiarization time and guidance with respect to the simulator and its equipment. The exercise must be appropriate to objectives and tasks and to the level of trainee experience. The exercise must be effectively monitored and supported by audio and visual observation, and the trainees must be effectively debriefed to ensure that objectives were met.

4.2. Simulator Based Assessment Procedures

Assessors must ensure that performance criteria are established clearly and are explicit to ensure reliability and uniformity of assessment and to optimize measurement and evaluation so that subjective judgments are kept to a minimum. As in training, the candidates must be adequately briefed and familiar with the equipment and the tasks and/or skills to be assessed. Further, they must have an understanding of the performance criteria by which their competency will be determined.

5. Knowledge, Understanding, and Proficiency

A taxonomy of educational objectives was proposed in 1956 by Benjamin Bloom, an educational psychologist at the University of Chicago. Commonly referenced as Bloom's Taxonomy, it is a classification of objectives and skills for students. The educational objectives are divided into three domains, but the cognitive domain is the most relevant to mariner competence. Skills in the cognitive domain constitute knowledge, comprehension, and application. These skill objectives follow closely the Knowledge, Understanding, and Proficiency (KUP) requisites of STCW assessment. (Anderson, et.al. 2001)

5.1. Knowledge

The knowledge level is the lowest of the cognitive levels and requires only that a student exhibit memory of previously learned materials through recollection of basic terminology, facts, and basic concepts. Testing of such knowledge is of the simplest level and is easily accomplished through written examination. For example, if a student were shown a photograph of an anchor windlass, they would be able to identify it as such.

5.2. Understanding

The understanding, or comprehension level involves a demonstrative understanding of facts and ideas, often through description or interpretation. For example, a student may be shown a picture of an anchor windlass and asked to describe its function and operation. Testing of knowledge at this level may also be in written or oral format but would be more essay than short answer.

5.3. PROFICIENCY

The highest of the skill objectives in STCW competency, demonstration of Proficiency entails an application or demonstration of acquired knowledge. For example, a student might be asked to demonstrate the function of an actual anchor windlass by dropping or weighing anchor. The best assessment at this cognitive level would be through practical examination.

6. FUNCTION: NAVIGATION AT THE OPERATIONAL LEVEL

"Function," as specified in the STCW Code, is defined as a group of tasks, duties and responsibilities necessary for ship operation, safety of life at sea, or protection of the marine environment. This term is important because the standards of competence set out in the chapters of the STCW Code are based on seven functional areas at three levels of responsibility: Support, Operational, and Management. In this analysis, the functional area, Navigation, is selectively detailed at the Operational Level. Please refer to the table at the end of this paper.

6.1 COMPETENCE: PLAN AND CONDUCT A PASSAGE AND DETERMINE POSITION

The KUPs (Knowledge, Understanding and Proficiency) for this competence range from celestial and terrestrial navigation, steering control systems, compass and gyro, meteorology to electronic navigation. The assessments range from the mundane (successful plot of a five star fix) to the complex (navigation). Two of the assessments from this competency have been selected for amplification.

6.1.1. ABILITY TO DETERMINE THE SHIP'S POSITION BY USE OF ELECTRONIC NAVIGATION AIDS

At USMMA, this competency is assessed by graded practical plotting examination during the Electronic Navigation course in the multi-task simulator, Navi-Trainer Professional 4000® manufactured by Transas. The student is assigned a scenario and allotted a one hour time limit to complete the exercise and accomplish a passing score of 70 or higher. For example, the student is given an initial position by Loran C TDs and required to plot same. Once underway, the GPS, echo sounder and radar may also be used to make good an intended track. If the vessel deviates from the intended track by more than a half mile, 30 points are deducted from the final score. After the run is completed, four additional questions (10 points each) are asked concerning the run. (Moskoff, 2007)

6.1.2. Echo Sounder: Ability to Operate the Equipment and Apply the Information Correctly

Demonstration of the use of an echo sounder is usually included as a part of a larger scenario rather than as a separate task. Although the competency is included in the Electronic Navigation course, it may also be evaluated during Bridge Watchstanding.

6.2. Competence: Maneuver the Ship

The KUPs for competency encompass a wide range of aspects of ship maneuvering and handling. The effects of wind, current, deadweight, draft, UKC (Under Keel Clearance), squat, shallow, shallow water, anchoring and mooring procedures are assessed, to name a few. Almost all of these assessments are accomplished in a simulator.

6.2.1. the Effects of Deadweight, Draft, Trim, Speed and Underkeel Clearance on Turning Circles and Stopping Distances

This competency assessment is accomplished using the PortSim® part-task simulator manufactured by SSPA. The students are given a series of practical exercises wherein they must determine whether factors such as draft, deadweight, shallow water, speed, etc have an effect on a vessel's maneuvering particulars, e.g., turning characteristics and stopping distance. As a final test, the student is assigned a ship model and required to stop in a designated channel by a given distance while remaining within the confines of the channel.

6.2.2. the Effects of Wind and Current on Shiphandling

This competency assessment is usually accomplished using the PortSim® part-task simulator. The students are given several exercises wherein they are required to successfully maneuver the vessel. (1) A post Panamax vessel must be maneuvered from a slipway in Rotterdam. This exercise is designed, among other learning objectives, to reinforce the concept that a ship will tend to back into the wind. (2) The student is required to successfully dock a vessel in Corpus Christi channel with a 1 knot ebb tide. The student is allowed to choose between a fixed pitch, right hand screw ship (post Panamax) and a controllable pitch right hand screw (1450 TEU container ship). The vessel chosen determines how the pier should be optimally approached. Finally, the student must successfully dock a twin screw ferry with wind and current.

6.2.3. Maneuvers and Procedures for the Rescue of Persons Overboard

This maneuver is best accomplished in the CAORF full mission simulator (NorControl) or the Navi-Trainer Professional 4000®. In these simulators, a person is reported overboard by the simulator operator (the victim is input on the database at the point of execution) and the student must maneuver to recover him within a specified time and distance using one of the practiced maneuvers. Wind, current, and visibility are also factors in this maneuver. This maneuver may also be accomplished on the PortSim® simulator.

6.2.4. Squat, Shallow Water and Similar Effects

This exercise is the most complex of the designated competencies in the Seamanship / Shiphandling course. If executed in the PortSim® simulator, the own ship is initially placed in the turning basin of the Corpus Christi channel outbound. In the course of the transit, the student will meet 10 ships inbound and must successfully meet a designated number to pass the competency. If executed in the Navi-Trainer Professional 4000®, the student is virtually on the bridge of a vessel inbound in the Houston Ship channel and must meet a vessel outbound as well as overtake another inbound. Bank effects, squat, and ship interaction are clearly demonstrated to adverse consequences if not held in check.

6.2.5. Proper Procedures for Anchoring and Mooring

This exercise is an example of a competency accomplished during the capstone course, Bridge Watchstanding. Meurn and Sandberg (2000) described well the use of a full mission simulator, such as CAORF, for competency assessment. It remains their belief that the use of experienced mariners, trained in simulator assessment through a course such as Train the Trainer, is the optimal method for minimizing loss of testing validity. Further, as this exercise exemplifies, they stressed the importance of accomplishing an assessment as a part of a complete scenario, rather than as an isolated proficiency. Anchoring and mooring procedures are accomplished as a two part exercise, each operation running about an hour in length. The tasks involved encompass passage planning, maneuvering, collision avoidance and navigation. The first hour, the ship is brought in to anchor inside the breakwater in Cristobel, Panama. The second hour (accomplished the following week), the ship anchor is weighed and the Canal transit is commenced. This is an example of an excellent exercise for evaluation of a number of additional competencies not listed in the chart below, such as following helm orders, steering on a range, interpreting an echo sounder and other instruments, handling traffic, to name a few.

7. CONCLUSION

The navigation simulator, whether part-task, multi-task, or full mission, remains the optimal venue for competency assessment. Well designed scenarios meet the STCW performance standards of behavioral realism within a controlled operating environment capable of producing a variety of conditions. Approved simulators are capable of simulating the operational capabilities of the shipboard equipment concerned to a level of physical realism appropriate to the assessment objectives and include the capabilities, limitations, and possible errors of such equipment (STCW section A-I/12). Approved simulator requirements, instructor/trainer requirements and competency methods are carefully outlined in the Code.

The STCW Code does not, however, detail assessment methodologies. Educational skill sets (to the level involved in competency assessment) are hierarchical and follow the knowledge, understanding and proficiency (KUP) objectives. Some competencies are very basic, i.e., those which are knowledge based, and so would have wide acceptance with respect to methodology. Consider, for example, competency assessment of helm orders. The proficiency (comprehension) level is highest and should therefore be carefully considered as a part of the evaluation process. These assessments necessarily involve detailed scenarios such as those examples provided. Such methodologies may vary widely between assessors.

Dr. Peter Muirhead (2006), of the World Maritime University, posed the question, "Is it realistic to expect marine simulators across the globe to be used uniformly by different assessors, against an agreed set of performance criteria, to measure seafarer competence?" The answer to his question is a resounding yes. May this paper be the genesis of a discourse between assessors toward such an international rubric.

APPENDIX I: DEFINITIONS

The following definitions are summarized from the STCW Code Section A-1/1 and are germane to the understanding of the discussion of the STCW Code and its Annex found in this paper:

"**Approved**" means approved by the Party in accordance with the regulations in the Annex. This term is used in connection with requirements for "approved training", "approved seagoing service", "approved training record bo ok", "approved simulator training" etc. In each case, there are requirements which must be met before a party can give its approval.

"**Function**" means a group of tasks, duties and responsibilities, as specified in the STCW Code, necessary for ship operation, safety of life at sea or protection of the marine environment. This term is important because the standards of competence set

FUNCTION: NAVIGATION AT THE OPERATIONAL LEVEL (excerpted examples)

COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	STCW METHODS OF DEMONSTRATING COMPETENCE	STCW CRITERIA FOR EVALUATING COMPETENCE	USMMA METHOD OF ASSESSMENT / WHERE ASSESSED
1. Plan and conduct a passage and determine position (cont'd).		Examination and assessment of evidence obtained from one or more of the following: (1) Approved in-service experience; (2) Approved training ship experience; (3) Approved simulator training, where appropriate; (4) Approved laboratory equipment training;	(continued) (2) The primary method of fixing the ship's position is the most appropriate to the prevailing circumstances and conditions; (3) The position is determined within the limits of acceptable instrument/system errors;	
	(g) Ability to determine the ship's position by use of electronic navigation aids.			Graded plotting exam in multi-task simulator. Electronic Navigation
	Echo sounders:			
	(h) Ability to operate the equipment and apply the information correctly.			Graded practical exam in CAORF simulator. Electronic Navigation
8. Maneuver the ship	Ship maneuvering and handling.			
	(a) The effects of deadweight, draught, trim, speed and under-keel clearance on turning circles and stopping distances.	Examination and assessment of evidence obtained from one or more of the following: (1) Approved in-service experience; (2) Approved training ship experience; (3) Approved simulator training, where appropriate; (4) Approved training on a manned scale ship model.	(1) Safe operating limits of ship propulsion, steering and power systems are not exceeded in normal maneuvers (2) Adjustments made to the ship's course and speed maintain safety of navigation.	Graded practical exam in part or multi-task simulator. Seamanship/Shiphandling
	(b) The effects of wind and current on ship handling.			Graded practical exam in part or multi-task simulator. Seamanship/Shiphandling
	(c) Maneuvers and procedures for the rescue of persons overboard.			Graded practical exam in part or multi-task simulator. Seamanship/Shiphandling
	(d) Squat, shallow water and similar effects.			Graded practical exam in part or multi-task simulator. Seamanship/Shiphandling
	(e) Proper procedures for anchoring and mooring.			Anchoring: Graded practical exam in CAORF simulator. Bridge Watchstanding
	(e) Proper procedures for anchoring and mooring.			Mooring: Graded sea project oral exam. 2nd sailing sea project

Table condensed from a compilation – original by CDR Paul Zerafa out in the chapters are based on seven functional areas at three levels of responsibility (which are broadly defined in section A-I/I of the STCW Code).

"**Standard of competence**" means the level of proficiency to be achieved for the proper performance of functions on board ship in accordance with the internationally agreed criteria as set forth in the Code and incorporating prescribed standards or levels of knowledge, understanding and demonstrated skill.

"**Management level**" means the level of responsibility associated with serving as master, chief mate, chief engineer officer or second engineer officer on board a seagoing ship, and ensuring that all functions within the designated area of responsibility are properly performed.

"**Operational level**" means the level of responsibility associated with: serving as officer in charge of a navigational watch on board a seagoing ship, and maintaining direct control over the performance of all functions within the designated area of responsibility in accordance with proper procedures and under the direction of an individual serving in the management level for that area of responsibility.

"**Support level**" means the level of responsibility associated with performing assigned tasks, duties or responsibilities on board a seagoing ship under the direction of an individual serving in the operational or management level.

"**Evaluation criteria**" are the entries appearing in column 4 of the "Specifications of Minimum Standards of Competence" tables in Part A and provide the means for an assessor to judge whether or not a candidate can perform the related tasks, duties and responsibilities.

References

1. Anderson, Lorin W. et al., ed. (2001): A Taxonomy for Learning, Teaching, and Assessing – A revision of Bloom's Educational Objectives, Addison Wesley Longman, Inc.
2. International Maritime Organization Convention on the Standards for Training, Competency and Watchkeeping of Seafarers of 7 July 1978 as amended. (London, 7 July 1995)
3. Meurn, R. and Sandberg, G., (2000): The Assessment of Watch Standing Skills Using a Bridge Simulator, Proceedings of the 11th International Navigation Simulator Lecturer's Conference (INSLC), Kalmar, Sweden.
4. Moskoff, D. (2007): unpublished Electronic Navigation Laboratory Exercises. United States Merchant Marine Academy.
5. Muirhead, Peter., (2006): STCW and Assessment of Competence by Simulator: Ten Years On – Why no Global Acceptance of the Practice? Proceedings of the 14th Annual International Navigation Simulator Lecturer's Conference (INSLC), Genoa, Italy.
6. Zerafa, P. (2001): STCW Control Documentation, United States Merchant Marine Academy.

Training Complex AIS for Training of the Ship Specialists

Koshevoy V.M.[1], *Kuprovsky V.I.*[2]

One of the important components for inculcation of steady practical skills to the ship specialists on a teaching level is the training preparation. Its efficiency, in turn, is determined by a condition and level of development of the training equipment, its capabilities on creation of integrated medium, with a high accuracy imitating real situation and permitting not only to decide practical problems, but also directly to observe and to fix the errors in a learning process. In the report the training complex AIS (Automatic Identification System), which operate on marine radio communication chair, is considered.

In the last decade in a world there was a considerable qualitative leap in development of information technologies (IT), communication engineering and telecommunications, infrastructure of communication and, as a consequent, market of communication services. Both conventional systems and types of communication, and in principle new equipment have received development: personal systems of a mobile satellite communications, system of a cellular communication, communications system on the basis of broadband technologies, IP - telephony etc.

The communication is the basis of construction and operation, the main component of management systems (MS) of any physical nature and any level of complexity (GMDSS, NAVTEX, AMVER, VTS etc.). As far as the communications system, engineering and the technology of communication is perfect, in many respects depends also condition of the management system, its capacity to execute the assigned functions with demanded efficiency. Quite often system frameworks of communication determine in the issue system frameworks of control. So, with development and intrusion of technologies, founded on application of wide-band signals, it was possible considerably to increase speed and reliability of delivery of the information in MS. The development of satellite systems of communication has allowed on the in essence new basis to organize delivery of the maritime safety information (MSI) and system of monitoring of ships. The development of systems of a cellular communication, their integration with mobile satellite systems of personal radio communication is opened the large outlooks in creation of a solid zone of cover. The development of radio-relay systems, fiber-optic

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links of communication has resulted in creation of the principal new infrastructure of terrestrial points and communications networks. The unification of capabilities of a communication engineering and computer technologies has allowed to receive a series of the new solutions, such as IP - telephony, off-wire subscriber lines, local area networks of a transmission of information etc.

The increase of intensity of the world navigation, creation of high-performance expensive ships, increase of their sizes and speeds is determined the paths of development of means of offshore navigation, which one, first of all, should provide the high safety of navigation. One of mainstreams in perfecting means of offshore navigation is connected to a broad intrusion of automatic systems, founded on complex using of communication, computer facilities and ship navigation systems within the framework of development of a direction of electronic navigation (E-navigation).

The appearance of global navigational satellite systems, including with a differential mode, systems of electronic cartography, development of systems of automatic digital radio communication have opened a perspective an intrusion of new navigational and information technologies for navigation and for increase of safety of navigation.

The main source of navigational data both for ships, and for shore services, is the radar. However under certain conditions it has a number of lacks:

- short range of detection, specially of small targets;
- delay in identification of manoeuvre of the target;
- strong influencing of a sea clutter and atmospheric phenomena;
- limitation in target detection behind impediments etc.

One of ways of their overcoming is usage of an Automatic Identification System (AIS). This system is a new mean for increase safety of navigation and quality of offshore navigation. However it at all does not substitute existing means of offshore navigation. Moreover, inept its usage can result it in pernicious consequences. In the Resolution IMO MSC 74 (69) is apart pointed out, that the watch officer always should mean, that on other ships AIS can be on any causes is switched - off. In this case such of ships become invisible if to rely only on AIS information. There is also number of problems with usage of the AIS information of marine pirates.

AIS is the equipment for automatic exchange by the most important navigation data between ships and coast centers with usage of a VHF of radio communication with a time division of channels (TDMA). It means, that all AIS stations work on one frequency, however each station transmits the information in a strictly retracted time period - so-called slot. The general synchronization of all stations implements by the GLONASS/GPS receiver

The automatic identification system is the combination of working AIS stations, established on ships, coast centers, navigational objects. The AIS stations interchange the data among themselves on two VHF channels with a time division of signals. The fault of the internal GLONASS/GPS receiver does not result in failure of AIS station. In this case the reserve way of synchronization of AIS station concerning other AIS stations (indirect synchronization UTC and synchronization by a method of "semaphore") envisaged. Except for two TDMA channels the AIS station simultaneously works on a DSC channel 70. The ship AIS station receives and processes the inquiries of a coast DSC station. The base AIS station can transmit on a DSC channel the data about AIS regions, request navigational data.

In each region the numbers of a VHF channels the administration sets. Outside of regions the AIS stations use the channels 87B (161,975 MHz) and 88B (162,025 MHz). AIS can work in frequency band 25 kHz, and also in frequency band 12,5 kHz on low power. The radius of action thus is reduced.

The frequency modulation with minimum frequency deviation FM/GMSK (Gaussian Minimum Shift Keying) is applied to transmission in TDMA channels. The given type of modulation is optimal from the point of view of reduction of held frequency band at a preset speed of data transfer of 9600 bits per second.

The ship equipment AIS is partitioned on two classes: the class A and class B. The equipment of the class A meets the requirements, shown to ships, for which the installation AIS is mandatory by the Rule 19 chapters V of the Convention SOLAS. All other convention ships (for example, pleasure yachts, the small fishing boats) can have the equipment AIS of the class B. Intervals of transmissions AIS of the class B is more, than for the class A. The AIS stations are set also on aircraft used at search and rescue operations, and on navigational objects. The listed types of stations relate to a mobile stations.

The fixed AIS stations are set on a coast and work, as a rule, in vessel traffic systems (VTS). For extension a cover zone will use stations of simplex repeaters.

The successful activity of a ship's AIS, implementation by it of all functions in many respects depends on a training level of staff: the knowledge of a system designated purpose, fundamentals of its operation, solved problems, skills, to enter and to correct values of performance parameters. Thus the special importance gains the factor of an error, as its detection directly on a workstation of the AIS operator is impossible, and the consequences can be very seriously. So, the errors in navigational data can result in incorrect perception of coordinates of a vessel, its course and speed. The errors or the inaccuracy in the voyage information can distort an anticipated arrival time, type of cargo. Errors or the inaccuracy of the static information result in an incorrect estimation of overall dimensions and draught of a vessel, its name and call sign etc. All transferred factors in the issue reduce safety of navigation and result in necessity of additional actions as on the ships, and on the coast stations.

In Odessa national maritime academy on the basis of GMDSS training center for the first time on Ukraine the training complex AIS is organized. Its structure is:

- ship equipment AIS MT-1 "Transas";
- ship equipment AIS KTM-201 "Izumi";

- electronic cartographical system - programmatic complex Navi Sailor 3000;
- electronic cartographical system - programmatic complex Fleet Manager IZB;
- program modules AISpos and AISer.

The basic problem solved with the help of a training complex AIS, is the training of highly qualified staff from a navigation personnel and radio officers of ships, capable to organize competent exploitation of the ship equipment AIS.

The main peculiarity of the built training complex is practical usage of two ship complete AIS, linked with completes of electronic cards (ECDIS), permitting operatively to register and to analyze errors of a different level, ensuring a capability of activity in an real air with the real navigational targets. The complex enables in real-time mode to observe the actions and errors of the student during input static, dynamic and voyage data. It is very important from the methodical point of view, since considerably increase visualization of training, and due to a feedback the capability of repeatability of assigned situation is provided.

The communication between workstations implements with a radio channel in a VHF band. A structure of one workstation is:

- ship transponder AIS of the "A" class in a structure of the mainframe, supply unit, an operator's terminal (MDT-2011) and GPS antenna;
- programmatic complex Fleet Manager IZB with the database of ships and programmatic modules AISpos and AISer.

The coupling of the AIS transponder with a programmatic complex is provided with the help of standard outports of the device and COM-ports of the computer.

The operator's terminal MDT-2011 conforms the requirements of the standard of IEC 61993-2, represents the minimum keyboard and indicator. It allows:

- to reflect MMSI, call signs, name and coordinates of interacting ships;
- to reflect mean and instantaneous heading, speed, angular rate of turn;
- to enter and to reflect the reports on safety;
- to enter the initial data and data of a voyage of the vessel;
- to reflect the characteristics of a positioning system (source of obtaining of coordinates, quantity of satellites, tag of availability of differential correction);
- to reflect the characteristics of the transceiver (channel, passband, radiated power);
- to establish a work channel;
- to reflect lists of the reports of the alarm system, inquiries from means of distant communication, system reports, list of the silence periods;
- to make of set-up;
- to give a sound signalling.

The programmatic complex Fleet Manager IZB is intended for:

- registration of ship positions both equipped AIS, and transmitted under the data of radar wiring;

- granting of the information about ships and their positions in a graphic form on an electronic card and as text;
- granting of the information about parameters of motion of ships (velocity vector, route);
- granting of help information from the database;
- granting of navigational data;
- solution of different measuring and information problems with usage of electronic cards.

The complex consists of a server and client part. In a structure of the server the database of ships operates under the control of a InterBase and set of the specialized programs executing an entry in the database the information of ships, which one goes on AIS, DSC, INMARSAT channels. Operator interacts with a system through a client workstation.

The information going from AIS is processed by the interface module AISpos. Apart from data processing AIS this program controls an amount of information, storable in the database of positions, and, if necessary, removes of the most aged report about a position. Before deleting of the aged reports, there is a backup copy of base of the data, which can be utilize in case of recovery of a system. The module reflects the reports on new ships in the database, about connection and disconnection with AIS in a real time, allows for total of the processed targets, including active, how much targets are lost, update rate of the database etc. The main window of the program represents the panel of bookmarks, with the help of which are possible to control a current condition and set-up of a system.

The interface module AISer represents the terminal of mobile station AIS and represents as hooked up transponders with the indicating MMSI, coordinates, number of the escorted targets, and observed targets with the indicating of their name, MMSI, class AIS, coordinates, accuracy of reading of coordinates, distance, bearing, course, speed. With the help of options of the main menu it is possible to form and to transmit commands to the inquiry of the information, safety report, telegram. Under condition of coupling it is possible to control main parameters and condition of the transceiver, static and voyage information, to inject a window of the alarming system and inquiries of a long-range communication. The relevant role in a structure of the interface module AISer is executed by an option "Diagnostic". With its help it is possible to set the dynamic programs of movement of a vessel, on which one the given module established, setting thus different coordinates, course, speed and series of additional parameters.

Doubtless advantage of a considered complex is the capability of joint utilization of program modules permitting to process AIS data, to control an amount of information storable in the database of positions, creation, dispatch and obtaining of the reports, creation of the programs of a simulation from external sensors etc.

However today navigational complex AIS-ECDIS with the equipment GMDSS functionally is not connected. At the same time their affiliation at a hardware level under the scheme GMDSS-AIS-ECDIS will allow considerably to increase an effectiveness and to simplify a procedure of organization of radio communication.

For implementation of such problem on chair of maritime radiocommunication the device of remote access (DRA) and programmatic complex permitting to control by the controller of a digital selective call (DSC) was designed. DRA allows to control the conforming controller from the personal computer, on which the programmatic envelope ECDIS is established. The hardware of the device represents the double-directional interface intended for transformation of formats of commands and the data of the DSC controller in semantic codes, sent in the PC through COM-port, and as for return operation of transformation of control commands of the PC in codes of controllers.

Such affiliation of radio communication systems and navigating will allow to execute a forming/reception of the information circulating in DSC channels, using the data cards of the AIS-ECDIS targets, and imaged in a current time scale on the navigational display. It will allow the operator, were in unified information space, with the help of context menus conforming to selected object, to form / receive indispensable formats of calls. The considerable part of the format of a call, including digital identifiers, coordinates, time will be imaged automatically, that will allow to avoid their manual input and considerably will speed up a procedure of preparation of a call.

The creation of a unified ship integrated system of radio communication and navigating on the basis of GMDSS-AIS-ECDIS will allow:

- to unify procedures of control of equipment of radio communication on the basis of unified information space, the fundamentals which one is made with a specialized programmatic complex ECDIS;
- to free the operator from necessity of interplay with two information subsystems - AIS and GMDSS;
- to simplify, considerably to speed up and to control a correctness of actions of the operator at problem solving of communication in a DSC system.

The experience of a exploitation of a training complex AIS, the tests equipment, combined working with the GMDSS equipment have allowed to determine reference directions of its modernization and development:

- to provide communication between workstations on a wiring channel without radiation in a air;
- to ensure transmission of the images reshaped within the framework of a system of electronic cards Fleet Manager IZB, on remote display devices;
- to supply coupling a system of imaging of the real information about ships with the DSC controller (GMDSS-AIS-ECDIS) for operating transmission of calls to address imaged objects.

The Literature

1. Шишкин А.В., Кошевой В.М., Купровский В.И., Ефимов С.Л. Глобальная морская система связи при бедствии и для обеспечения безопасности мореплавания: Учеб. Пособие. – М.:РосКонсульт, 2006. – 272 с., ил.
2. Рекомендация МСЭ-Р М.1371-1 «Технические характеристики универсальной судовой автоматической идентификационной системы (АИС), использующей множественный доступ с временным разделением в УКВ полосе частот морской подвижной службы». 2001.
3. Кошевой В.М., Шишкин А.В., Купровский В.И. Система и устройства автоматической идентификации судов/Учебное пособие. – Одесса: ОНМА, 2005. - 116 с., ил.

New Approach for Shiphandling Training in Simulators Using Small Scaled Simulator Ships as in "manned Model Training"

Knud Benedict, Matthias Kirchhoff, Karina Wieseler, Hinnik Wesselhoeft

Abstract

Full mission simulators have proven benefits for ship handling training in real time on fully equipped bridges throughout the last decades. In parallel the training in manned (or better "crewed") ship models has emerged where the trainee sits onboard the small scaled boats. The benefits of the scaled model training is that the time is also scaled and therefore the exercises with a model ration 1:25 need only one fifth of the time of exercises on a real training vessel or in a full mission simulator.

In order to take advantage of this time saving approach an investigation were made to model an existing simulator ship (container vessel of 2500 TEU) as a small scaled duplicate 1:25 in a Shiphandling simulator. The main parameters of the large model were changed according to the scale ratio as a basic setup for the small model. Series of simulations were made to adjust the manoeuvring characteristics for suitable similarity. For these procedures professional tools SIMOPT and SIMDAT were used for fast time simulation and for automatic assessment of the simulation results.

As test bed for this new approach a specific training area setup was used representing several parallel course manoeuvres passages and return manoeuvres similar to person over board manoeuvres at the Maritime Simulation Centre Warnemuende (MSCW) of Wismar University. This setup was successfully used during the investigations in an IAMU project on Shiphandling training with manned models on a lake and on board the big training vessel of Gdynia Maritime Academy in Poland.

As a result it turned out that some parts of the basic Shiphandling training exercises can be done more efficiently in less time than before. The results clearly indicate that the students' experiences made with the small scaled model could be transferred to the original scaled ship successfully.

1. Introduction and aim of this paper

1.1. Origin of the Idea -the IAMU Training Workshop in ILAWA and Experiences

Full mission simulators have proven benefits for ship handling training in real time on fully equipped bridges throughout the last decades. In parallel the training in manned (or better "crewed") ship models has emerged where the trainee sits onboard the small scaled boats. The benefits of the scaled model training is that the time is also scaled and therefore the exercises with a model ration 1:25 need only one fifth of the time of exercises on a real training vessel or in a full mission simulator. An IAMU research project "Analysis of effectiveness and efficiency of MET in Shiphandling" started in 2006 to compare and to analyse several training methods in small manned ship models, in Shiphandling simulator and on training ships in order to find out the benefits of the approaches.

Within this project a workshop for shiphandling training in 2006 was excellently organized by the Maritime University of Gdynia, Poland. Students from the 4 project partners Maritime Universities (apart from Gdynia they came from Wismar University, from Odesa National Maritime Academy and from Maine Maritime Academy). The Ship Handling Research and Training Centre at Ilawa, Poland was hosting the first part of the workshop with the manned models: This centre has been coaching masters and pilots for more than 20 years in manned models of different ship types. For the students' exercise in the workshop a LNG-Tanker ship model Figure 1 was used, which had to be steered through a buoyed waterway, specifically in a series of "Parallel Course Manoeuvre" and Williamson Turns at both ends to be seen in Figure 2 .

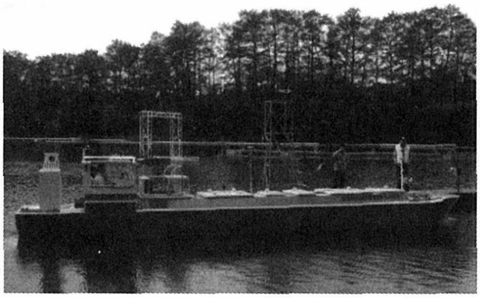

Figure 1: Student Karina Wieseler from Wismar University on the bridge of the LNG tanker model during berthing manoeuvre at Ilawa Training Centre

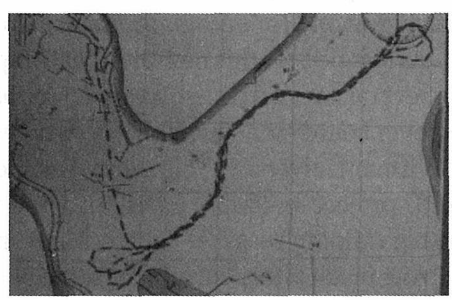

Figure 2: Track of the ship model (dotted green line) during "Parallel Course Manoeuvre" (Result of Student Nicole Schnell from Wismar University)

During this test it turned out that the training in the small manned models is faster than the training in full mission simulator and much faster than on the training vessel. Therefore the idea was born to transfer the advantage of smaller time consumption of the exercises with the small scaled ship models to simulator training facilities. The German team of the project came to the conclusion to model a small scaled simulator ship in the Shiphandling simulator of the MSCW and to make some tests on the suitability and efficiency which will be described in the following part of the paper.

1.2. Short Overview of MSCW / SHS As Test Bed for the New Training Approach

The Maritime Simulation Centre Warnemuende at Wismar University, Department of Maritime Studies in Rostock-Warnemuende accommodates six simulators embracing a common network and comprised of four ship-handling bridge systems with differing levels of equipment, a ship's engine system and a VTS simulation facility. The interaction of many of the simulators can be interfaced either mutually or to form a big scenario comprising all simulators (Benedict 2000).

The Ship handling Simulator (SHS) comprises four bridges: Bridge 1 consists of a fully integrated replica bridge assembly projector-based 360° visual display, Bridge 2 has a similar 257° visual display system which can be specifically used for manoeuvring a ship from bridge wing, the remaining two bridges 3 and 4 are used mainly as radar cabins, each being additionally equipped with 120° visual display screens. A lab with four stations for computer-based Instructorless Training (ILT) completes the setup for effective ship handling training.

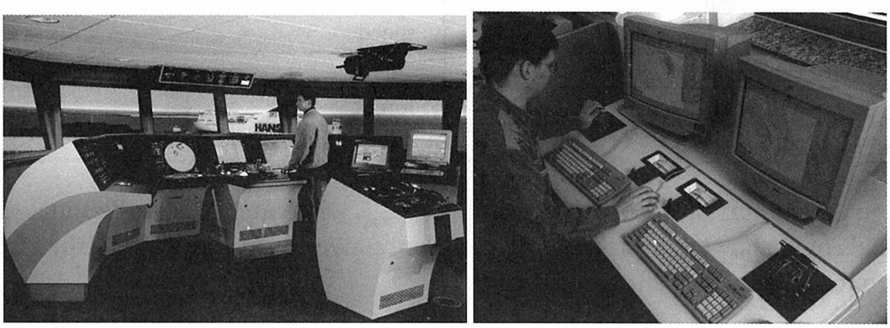

Figure 3: Full Mission Bridge Simulator with CV BALTIC (left) ad Instructorless Training Station for Shiphandling (right) at the MSCW of Wismar University

Specifically the Instructorless Training Stations should be used for the experiments with the small scale models because they are generally used to prepare for the training in the full mission simulators and excellently suitable.

2.TUNING OF A SMALL SCALED SHIP MODEL IN THE SHIP HANDLING SIMULATOR

2.1. SELECTION OF SHIP TYPE, VESSEL DATA AND CALCULATION OF THE MODEL SHIP PARAMETERS AND COEFFICIENTS

As sample ship a 2500 TEU container vessel Type BALTIC was selected from the ship handling simulator database. It is excellently modelled to the original full sized ship and often used in the training sessions as well as highly accepted by the master and pilot trainees. Her length is L_{OA}=220 m and the service speed about 20 kn.

The basis of the calculations is the geometrical similarity of the ship and the model-the aim is the similarity in manoeuvring behaviour. Froude's similarity laws (which is also the basis of regular ship model tests in reality) were used, examples:

a) Geometrical similarity:	
$L_s = l * L_m$ This results in e.g.	Index s: ship; Index m: scaled model l : scale factor (e.g. 24); L: length
$A_s = l^2 * A_m$ and	A: area
$V_s = l^3 * V_m$	V: volume
b) Kinematical similarity:	
$t_s = \sqrt{l} * t_m$ which results in e.g.	t: time
$v_s = \sqrt{l} * v_m$	v: speed
c) Dynamical similarity:	
$F_s = l^3 * F_m$	F: forces
$P_s = l^{3.5} * P_m$	P: power

The parameters of the original vessel (e.g. L_{OA}, wind attack areas, nominal speed, nominal engine power, displacement, etc.) were converted by these established formulas into the small scaled ship model data:

Parameter / Ship data	Original and Full Mission Simulator Ship	Small Scaled Simulator Ship
length over all [m]	217.5	9.06
beam [m]	32.2	1.34
draught [m]	11.0	0.46
rudder area [m^2]	45.0	0.08

displacement [t]	49 308	3.57
nominal power [kw]	16 440	0.24 (10)
nominal speed [kn]	18.9	3.9

The following equation of motion was used as math model for the ships dynamic:

$$X = m\left(\dot{u} - rv - x_G r^2\right)$$
$$Y = m\left(\dot{v} + ru + x_G \dot{r}\right)$$
$$N = I_z \dot{r} + m x_G\left(\dot{v} + ru\right)$$

The ships hull forces are normally represented by polynomials based on dimensionless parameters, for instance in the equation for transverse force Y and yaw moment N given as the sum of terms with linear components N_r, N_v, Y_r and Y_v and additional non-linear terms. Normally these dimensionless parameters could be used also for smaller ships and it was expected in the beginning to directly take them into account for the small scaled model. However, the ship database of the SHS was not prepared for such small power driven ships and accepted 10 kw as minimum power input of a simulator ship unfortunately. Therefore some extra work has to be done to adjust the ship model data to this power with the help of the SIMOPT software described below.

By means of a Clarke (e.g. 1983) estimation the hydrodynamic added masses and the coefficients of the equations of motion were estimated. To acquire the desired similarity in manoeuvring behaviour and the required track similarity these values (e.g. *Xup*- dimensionless hydrodynamic added mass in x-direction, N*uv*- hydrodynamic lift coefficient, etc.) were tuned to an acceptable coincidence. To compare the similarity of the tracks it is helpful to present the results divided by L_{pp} (length between perpendiculars).

2.2. Tuning of Model Using Fast Time Simulation and Assessment Modules

2.2.1. Fast Time Simulation Module SIMOPT

PC-based fast time simulation software was used for the tuning of the small scaled ship model which was developed at MSCW originally for the tuning of the regular simulator ship models (detailed description in Benedict et.al 2006). This software represents the same ships dynamic capabilities as the Ship Handling Simulator (SHS) system, except for some environmental impact as for instance shallow water, current or banking effects which are not considered for saving computation time. The programming was done in MATLAB and C++. The Advantage and Capabilities of this software is:

- The Math Model reveals same simulation results as SHS,

- It is remarkably faster than "SHS real time simulation " the ratio is up to 1/100,
- The steering of simulator vessels is done by specific manoeuvre-control settings / commands for standard procedures and individual manoeuvres.

The following figures show some examples of the SIMOPT interface:

If a ship file is loaded the ships main data are displayed (or can be entered for a new ship).. The hull coefficients are displayed in the centre. Manoeuvres can be selected from the right top menu. Several options can be chosen from the top menu (Figure 4) in order to calculate the hull data and other parameters based on methods published by Clarke1983, 1997 or Oltmann 2003.

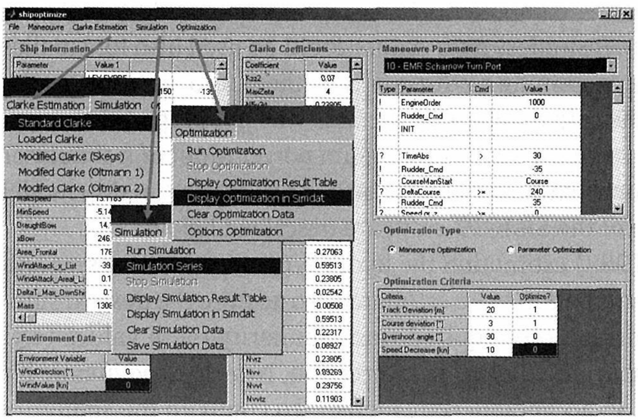

Figure 4: SIMOPT Interface Elements – Top Menus: Detailed Selection of Simulation and Analysis Elements from several menus; Manoeuvre Commands (top right) as well as Manoeuvre Optimisation criteria

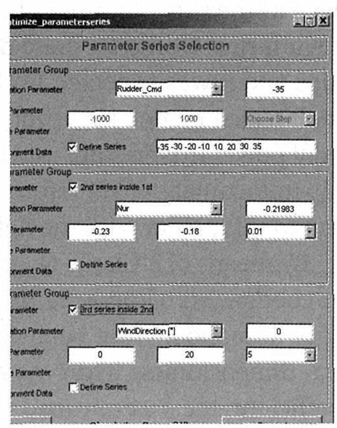

Figure 5: SIMOPT - Optimising Ship Model Parameters and Manoeuvres by Parameter-Series

Manoeuvres can be selected from the right top menu. Simulations can be done either as single run or as simulation series following the principle to be seen in interface Figure 5 for selection of up to 3 Parameter series to be simulated in parallel or sequential for:

- Simulation parameters, e.g. Manoeuvre series (here 8 rudder angles)
- Ship Parameters (L, B, T, or others)
- Hull / force parameters Clarke coefficient, e.g. N_{ur}
- Environmental data, e.g. wind force

The example in that figure represents a series of 8 rudder angle variations, 6 parameter changes of Hull yaw moment coefficient N_{ur} and 5 different wind force conditions – that means in total 8x6x5=240 simulation runs, given in the bottom line!

During the simulation run the monitoring of simulation process is clearly indicated e.g. by "coloured bars" in the respective windows at current manoeuvre element.

2.2.2. Simulation Analysis Module SIMDAT

The specific new "Offline assessment tool" SIMDAT was originally designed at the MSCW to supply the instructor with semiautomatic assessment of the recorded exercise data (BENEDICT et al. 2003). The tool allows for a detailed evaluation of the trainees results, e.g.:

- by analysing the plotted parameters or more complex data (e.g. the risk levels for collision avoidance situation) during the exercise or
- by comparing the ships track steered by the students with reference tracks.

The concept of data evaluation and assessment tool was to evaluate a variety of different manoeuvres and exercise elements with one common interface. During the evaluation all measurement data are analysed automatically according to selected criteria. Time- and limit- dependent violations are shown in the central window as well as penalty points according to an exercise specific algorithm are given. Apart from the evaluation of students training result the tools were used even in waterway investigation (Benedict et al. 2004).

For the purpose of simulator ships parameter tuning and optimisation of manoeuvres this SIMDAT tool was extended:

The Data for the manoeuvring characteristics can now be automatically retrieved for all manoeuvres used for simulator ships tuning

Enhanced Graphic tools are available for displaying various types of results

In the upper graphic of Figure 6 the complete track history of a simulation run is shown. A slider on the right hand side of the graphic allows for the timely and detailed analysis of periods during the simulation. The track can be presented in x/y co-ordinates or in geographical co-ordinates.

The lower graphic displays a number of ships data measured during the simulation. This includes Rudder angle, speed or course information of all ships. All graphics can be zoomed so that details of the exercise become visible and the graphical data shown on the surface can be saved and exported for further use.

Depending on the simulated manoeuvre types several special evaluation algorithms are used to produce the results for the manoeuvre as shown in resulting graphs and tables of the particular evaluation.

Additionally to the different graphical presentations specific overviews on the results are provided when series of manoeuvres have been simulated. This figure shows a comparison of simulation series results for turning circle with respect to Transfer, Advance, Diameter, Final Speed and Final ROT. It can be given in tables or in diagrams. Moreover the complete set of ships manoeuvring characteristics can be retrieved as a basis for the simulator ships manoeuvring documents. For the tuning of the scaled ship models the track data can be even related to the respective ships length to compare the scaled models results with the respective data of the same ships original data or data of the original sized simulator model.

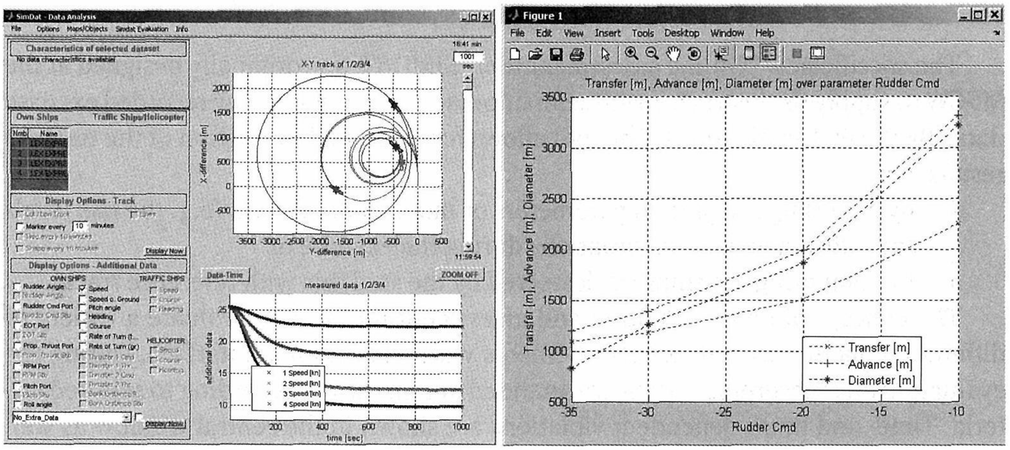

Figure 6: SIMDAT - Simulation result analysis in plots: Main interface and results for turning circle series varying rudder angles – Tracks and plots of time histories

2.2.3. PARAMETER – OPTIMISATION FOR SHIP MODEL FILES

The objective of the parameter optimisation process is to find suitable simulator ship model files which can be used in the simulator to represent the reference ships' dynamic. Starting from the ships main data, Basic Ship data files will be generated using simple methods (e.g. according to CLARKE 1983), to have a first estimation of the dynamic behaviour. By means of the SIMOPT program the fast time simulation produces various results of manoeuvring characteristics which are retrieved by SIMDAT and compared with the manoeuvring characteristics of the reference vessel. By changing the Model-Parameters the manoeuvring performance of Simulator Ship Model is adjusted. The final goal is to achieve a ship file with optimised model-parameters to be applicable for training & research in SHS. The biggest problem is that there are up to 200 parameters and the effects and tendencies of the changes are not very clear; some changes may even have effects which counteract the results of the others. Therefore it is very important to know about the parameters which have a clear impact on the manoeuvring characteristics. As an example for varying one of the Hull parameters here the variation of ships moment of inertia I_z is given; this parameter is expressed as kzz² in the database with

$$I_z = k_{zz}^2 \cdot m \cdot L^2$$

For the demonstration a Parameter-Series of turning circles with Hard Rudder to Starboard was simulated varying the value of k_{zz}^2 (which is initially 0.2) between 0.1 and 0.2 in steps of 0.01. The result in Figure 7 shows a clear effect on the advance of the turning circle whereas the diameter and the speed loss did not change.

The knowledge of those effects can be used to effectively tune simulator ships to have manoeuvring characteristics as the reference ships

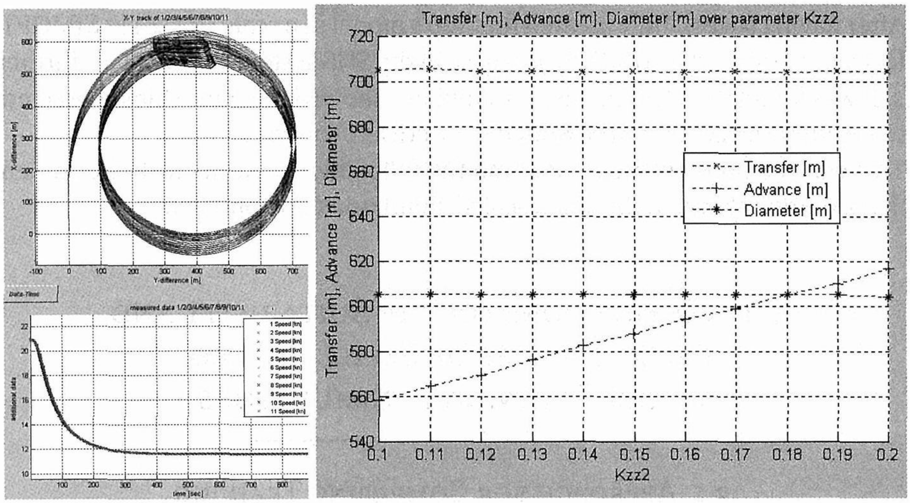

Figure 7: Model tuning - Parameter series for changing Moment of Inertia - Turning circle tracks and speed and extract of characteristic manoeuvring data

2.2.4. COMPARISON OF THE SHIP MODELS - RESULTS OF THE TUNING PROCESS

The result of the tuning process for the small scaled ship model is to be seen in Figure 8.

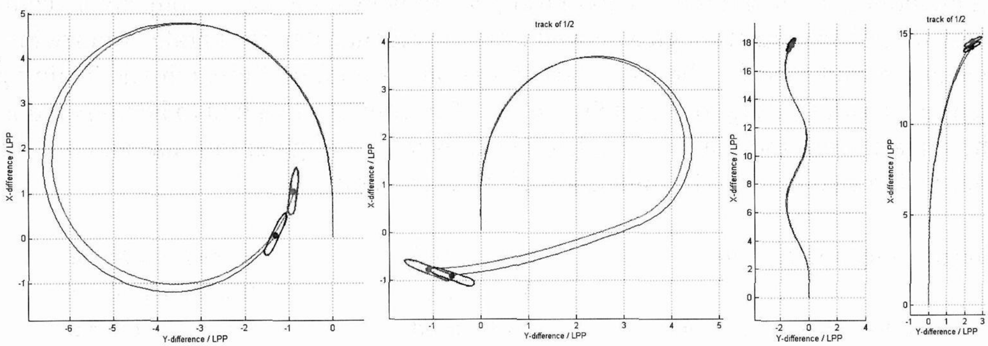

Figure 8: SIMDAT - Comparison of manoeuvring track results related to ship length Lpp for full sized ship (red) and the small scaled ship model (blue):
- Turning circle full rudder – left; Single Turn starboard - 2nd left;
- Zig-Zag test Port 10°(3rd left), coasting stop (centre); Crash-Stop Tests from full ahead to full astern (right)

The example tracks were taken from the SIMDAT software, which is used as a tool for manoeuvring data analysis and evaluation. The blue track describes the track of the small scaled model, the red track the motion of the original sized simulator ship model.

After having successfully created the ship's model in a scale of 1:24 in SIMOPT, the model was transferred to MMOCE database in the SHS system at MSCW for further test trials. It was found that the full mission simulator showed the same ships characteristics as the results as achieved by the SIMOPT / SIMDAT software.

This was the prerequisite to undergo the following test trails with the students to check for the suitability of the small scaled simulator ship approach.

3. Investigations on the Suitability and effectiveness of Small Scaled model Training in Simulators

3.1. Approach for Comparing Training Results and Trail Setup

3.1.1. Different Sea Areas and Experience levels in Groups of Trainees

In order to investigate whether the small scaled ship model is applicable for the shiphandling training three groups of test persons were built. Each group had to complete several voyages through a buoyed waterway identical to the Parallel Course Manoeuvre established for the workshop in the Ship Handling Research and Training Centre – Ilawa (see Figure 2 and Figure 12). This training area had to be prepared in the same scale as the ships, i.e. we had one area for the original ship size and one for the small scaled model. The dimension of the sea areas are:

- original ship model sea area:	north - south	7300m = 3.94 nm
	west - east	2230m = 1.20 nm
- small scaled ship model sea area:	north – south	300 m = 0.164 nm
	west - east	90 m = 0.0485 nm

Most of the trainees did the trips with the small scaled simulator ship model first and afterwards they used this experience gained to check their training skills on the large ship, others started with the full sized simulator ship.

The concept is to compare all these groups in order to find out whether they are able to transfer the skills they had gathered with the small scaled ship to manoeuvre the original sized vessel. Additionally the impact of the level of information to the trainees should be investigated: the test situations for the groups differ in the level of guidance and information they either got provided or had to be prepared by themselves.

- Group 1 - so-called beginners- they did not get any information or manoeuvring parameters of the ship model, they had to steer through this buoyed waterway without any preparation.
- Group 2 - so-called experienced users - they performed a Course-Change-Test for measuring the overswing angle y_0 and determined graphically the course change distance X_c by means of the track figures of turning circles. On the basis of these values they prepared themselves and planned the manoeuvre beforehand.
- Group 3 – so-called informed users – they got provided all necessary parameters on paper documents, they used existing Course-Change-Diagrams to plan their passage.

The following scheme shows the differences between the groups:

Data provided as guidance for the tests	**GROUP 1 Beginners**	**GROUP 2 Experienced users**	**GROUP 3 Informed users**
overswing angle y_0	-	performed Course-Change-Test to measure parameters individually	Provision of Course-Change-Diagram
course change distance X_c 7300m = 3.94 nm	-	determined graphically with tracks of turning circles for diff. course changes	Provision of Course-Change-Diagram

Each group has to pass the track four times at a preset speed of 2 kn, equivalent of Half Ahead of the original simulator ship model.

3.1.2. RESULTS FROM COURSE–CHANGE–TEST AS INFORMATION FOR THE TRAINEES

Results of a course change test are suitable information for voyage planning: This test was developed by Nomoto (see also Benedict 1987) to support ships in course changes e.g. in a given lane width. The following parameters are useful:

- course change distance X_c for wheel-over-point
- overswing-angle y_0 to apply for counter rudder action before having reached the final course

The following test procedures can be applied for the trails to acquire the necessary data:

The ship approaches to the test with constant speed and steady course. Then following actions will be taken:

- apply initial rudder angle d_I, e.g. $d_I = 10°$

- keep until a certain change of heading, e.g. $\Psi_C = 45°$; then apply counter rudder $d_C = 10°$ PT until rate of turn $= 0$
- rudder midships and steady course; - final course-change-angle is to measure e.g. $=31°$
- calculate over-swing-angle: $\Psi_0 = \Psi_F - \Psi_C = 56° - 45° = 11°$

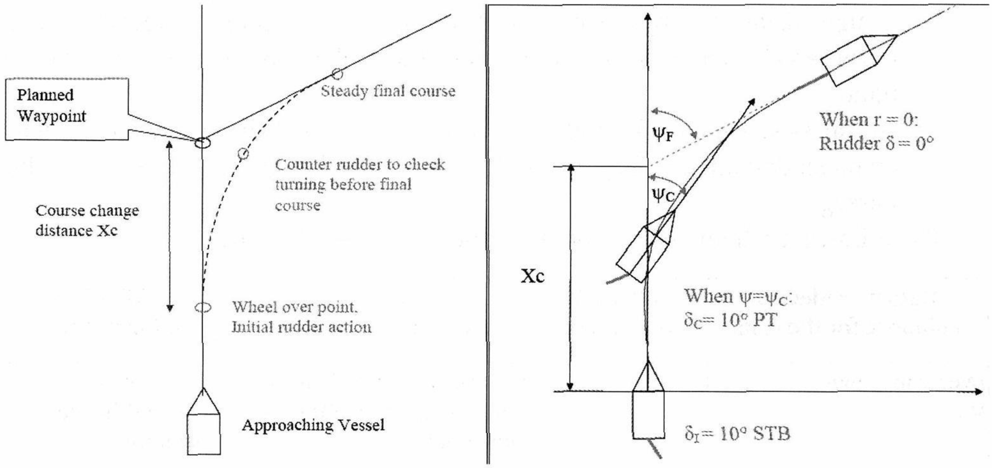

Figure 9: Standard course change manoeuvre and data for manoeuvre planning (left); Procedure of a Course Change Test, relevant parameters and actions (right)

This can be repeated for different course changes and/or rudder angles.

The course change distance X_c can be determined graphically by using the track figure of a certain turning circle (Figure 10). The planned course has to be applied as a tangent to the turning circle.

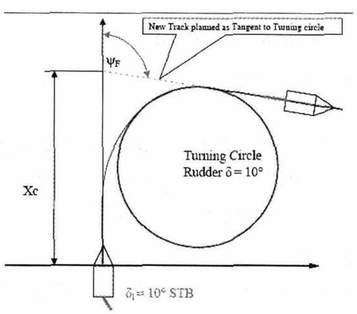

Figure 10: Simplified Estimation of XC from tangent to the related turning circle

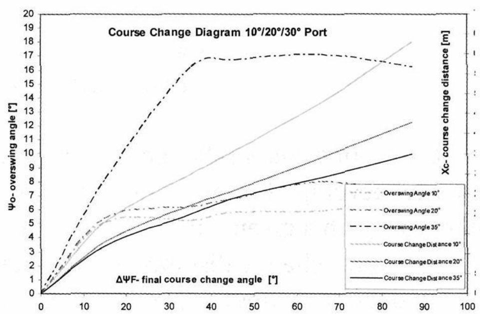

Figure 11: Course change diagram –Student Results of the trails with the small scaled ship model

The results of overswing-angley_0 and course change distance X_c will be plotted in a diagram versus final course change angle (Figure 11). This diagram can be used for voyage planning according to the planned final course change at a waypoint.

3.2. Results and Analysis of the Test Trials

While performing their voyage through the buoyed waterway the students' results of the different groups were being logged. Data recorded includes track, rate of turn, rudder angle, engine orders. By means of the SIMDAT software these logged sessions can be evaluated and analysed for research purpose. Figure 12 presents an overview of SIMDAT software interface and the track in the small sea area layout.

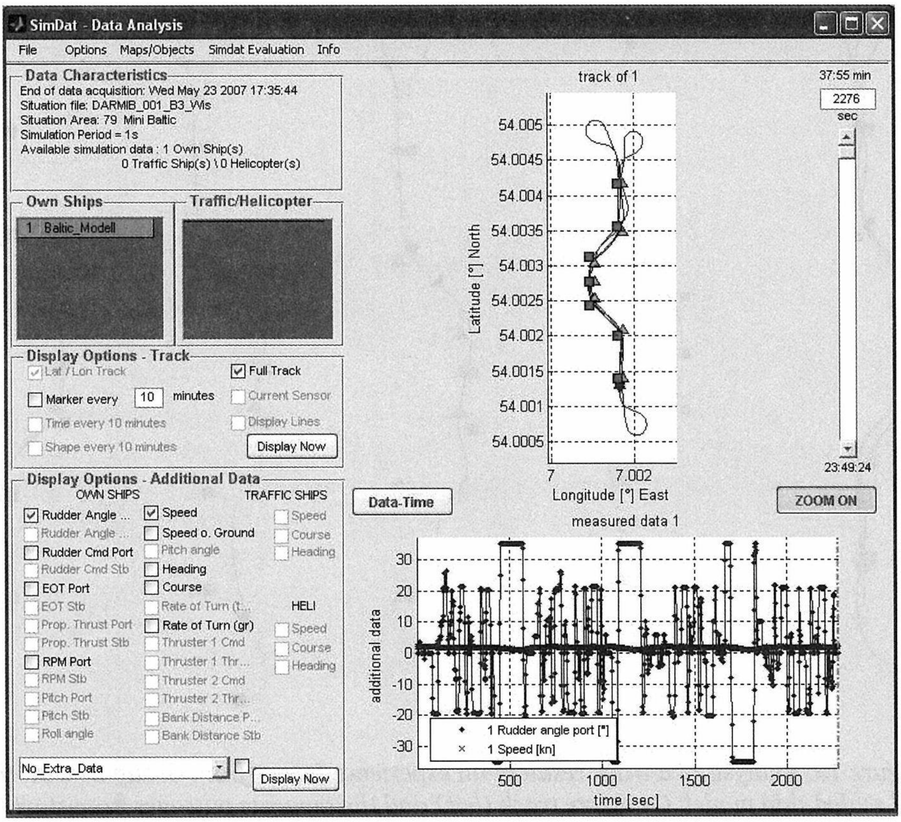

Figure 12: SIMDAT interface with data of a complete test run of a parallel course manoeuvre with the small scaled ship model – track with buoy system layout

The voyage with the ship model through the buoyed waterway takes 40 minutes on average. In contrast the same passage with the original sized ship takes nearly three hours.

According to the training effect an improvement of the trainees' performance can be seen during the course of the track (Figure 13): Particularly from the second to the fourth passage the test person seems to become acquainted with the manoeuvrability of the ship model. While performing the exercise the students had some problems in considering the overswing angle in case they had to change starboard and port theoretically on the way down from north to south.

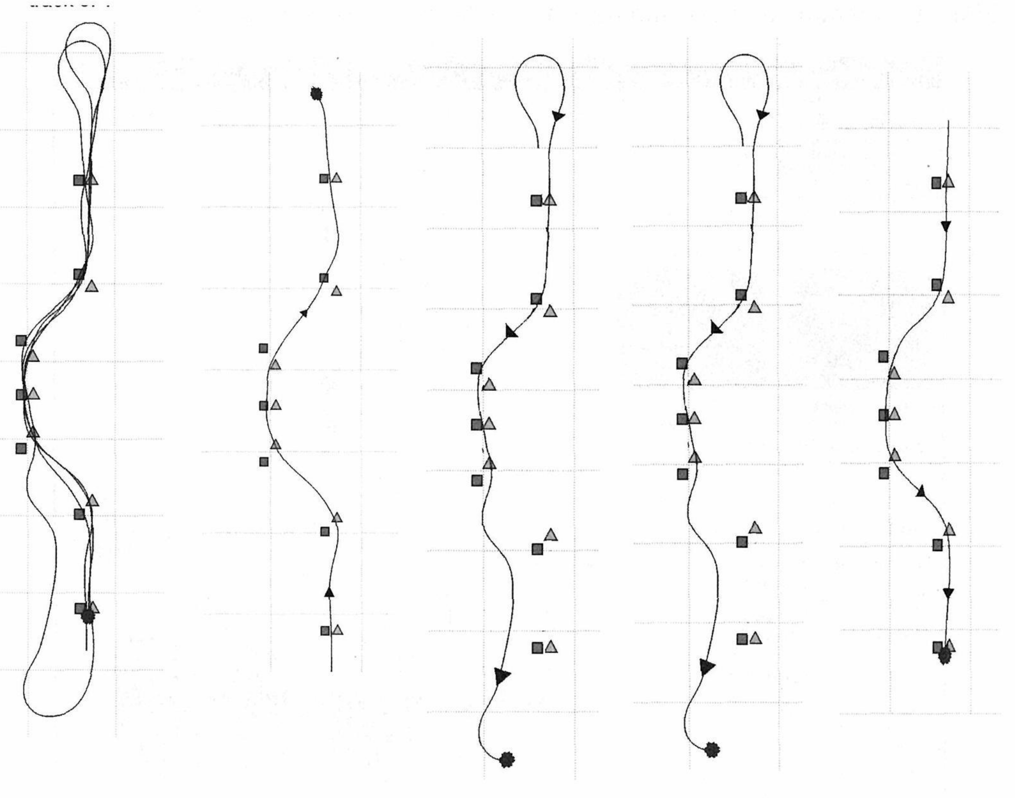

Figure 13: Analysis of a track result of an experienced user (from Group 2) with the small scaled ship model: Complete track (left) and the separate passages from start (2nd left) to the last passage (right)

Additional to the track figures the improvement can be seen also in the data figure of the rudder angle versus time (Figure 14). During the last passage the rudder commands and angles respectively reduced to a maximum value of 20°-25°, the first passage were steered only with hard rudder angles.

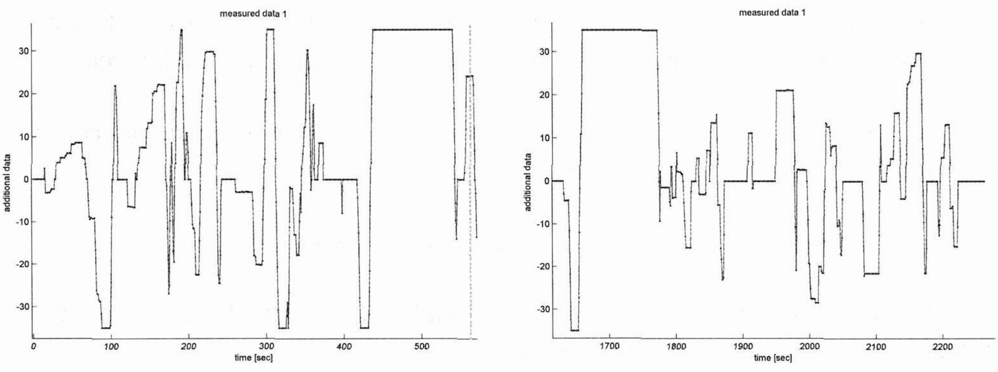

Figure 14: Analysis of a rudder angle plot of an Experienced user (from Group 2) with the small scaled ship model: 1st passage (left) and 4th passage (right)

After the training sessions with the small scaled ship model the same test persons manoeuvred the original sized ship. The person of the group of experienced users whose results are shown above performed now the track below in Figure 15:

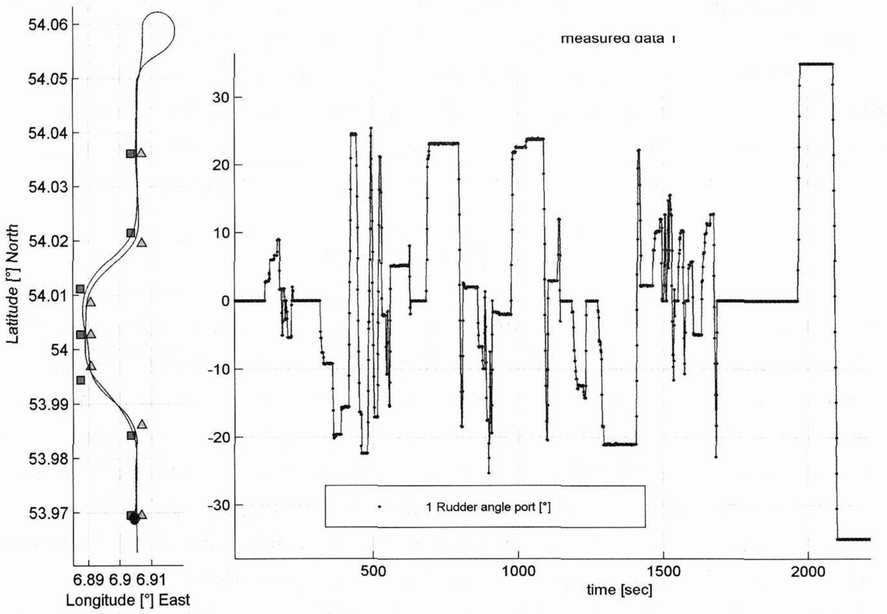

Figure 15: Analysis of test run of an Experienced user (from Group 2) with the original sized ship model: Complete track (left) and rudder angle plot of the first passage (right)

The voyage with the original sized model had to be reduced to half of the passages they had to do with the small scaled model, but even though this took 82 minutes.

There were approximately no deviation from the ideal course, The data figure displays also no higher rudder angles than 25° for steering through the buoyed waterway.

This result clearly indicates that the experiences made with the model could be transferred to the original scaled ship.

4. Findings and Conclusions

The investigation of the suitability of small scaled ship models for training in Simulators has led to the following conclusions:

It was possible to model a simulator ship with the same manoeuvring characteristic as a 2500 TEU container vessel in a smaller scale 1:24 successfully. Some extra efforts were necessary because the training area and the buoys had to be scaled, too.

Small scaled model ships could be used on very small bridges only because otherwise the ship might be smaller than the simulator bridge dimensions which imposes some problems with the visual perception; specifically suitable these small ships are on the ILT stations for basic training of manoeuvring aspects.

The most important advantage is the reduction of training time which was about five times less. Whereas for the small model four passages could be done in 40 min the duration for half of the program with 2 passages took 90 min for the original sized vessel model. The results clearly indicate that the students' experiences made with the small scaled model could be transferred to the original scaled ship. More detailed investigation will follow this short overview during students master thesis.

5. References

1. Benedict, K., et al. (2003). „Computer-based support for the evaluation of ship handling simulator exercise results", MARSIM - International Conference on Marine Simulation and Ship Manoeuvrability, Kanazawa, Japan, August 25th – 28th, 2003
2. Benedict, K.(2000) "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. Clarke, D. et al (1983) "The Application of Manoeuvring Criteria in Hull Design Using Linear Theory", Transactions of the RINA, London, pp. 45-68, 1983
4. Clarke, D., Horn, J.R. (1997) "Estimation of Hydrodynamic Derivatives" Proceedings of the 11th Ship Control Systems Symposium, Southampton, U. K., Vol. 3, pp. 275-289, 1997
5. Oltmann, P., "Identification of Hydrodynamic Damping Derivatives – a Pragmatic Approach", International Conference on Marine Simulation and Ship Manoeuvrability, Kanazawa, Japan, August 25th – 28th, 2003

6. Benedict, K. et al: (2006) "Combining Fast-Time Simulation and Automatic Assessment for Tuning of Simulator Ship Models." 14th International Navigation Simulator Lecturers Conference INSLC 14 of IMLA, Genoa (Italy), 3 – 7 July 2006
7. Benedict, K. Westphal, M. (1987) "Investigation in Course-Change-Test". IV. Congress of International Maritime Association of East Mediterranean ¬ Varna 1987 Proceedings Vol. 5 (No.173)

Safety Operation of Marine moving Objects

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The aim of present research is working out a conception of provision for assured safe manoeuvring of vessel at the expense of perfection of attendant activity of navigator and improvement of agreement of movement factors with hard and variable limitations, aimed at making algorithms appraising navigation situations, decision making on correction of set algorithm of control.

The decision of problems put forward the explanation of notions. So, maneuvering strategy requires set of possible actions for the achievement of the assigned task is understood as available recourses of security information, which operator is able to perform, it forms hypotheses to solve the problem. The tactics of manoeuvring foresees the decomposition of each hypotheses, that allows to follow from initial problem to elementary and make their typification.

For grounding of the ways of achievement of the above aims the analysis of the accidents on the basis of the material available in the Harbour Master office inspections of Ukraine and legal expert examinations was effected. As a result the ranging of human errors connected with the operator's actions was made [7]. As it follows from the Ukrainian ship accident rate during 1978 – 2002 the navigational accidents in the Ukrainian territorial waters make 79 % which twice exceeds the World average statistic data.

The performed analysis of the accident rate and the errors in the actions of the human operator (HO) shows that they are mostly the results of the insufficient agreement between the process character peculiarities and those at the actions of HO, as an element of the whole system as well as the factors of the movement with variable and constant limitations.

For the quantitative appraisal of the manoeuvring safety multi-factor criterion of agreement of psychophysiological characteristics of operator's activity with the process of manoeuvring movement factors is to be introduced. It includes in the least five movement factors and four characteristics of the operator's activity.

The movement factors are the speed the course, the manoeuvring trajectory configuration and position check up.

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From the point of view of operator's activity the errors arise in the process of receiving visual information, as it requires processing. This stage of malfunction is characterized by the loss of orientation, its share makes 31,8 % of all 173 cases analyzed. For their elimination it is necessary to process the information and present it to the operator in the form of procedure recommendations, which would be accepted as requiring one single action. If outer influences and certain variable limitations change, the operator is required to process the entering declarative information on the check up of the control process parameters for the correction of the planed trajectory. This stage results in the errors in the manoeuvring process control the share of it constitutes 23.1 % .

The delays in the operator's intellectual activity influence the speed and reliability of decision making and the check up of its realization. This stage leads to the errors in observing the rules of navigation, and their share is as big as 17.5 % of all the cases of accidents.

The safety of manoeuvring in the above cases was not provided due to the absence of the necessary data of the ship's manoeuvring characteristics as an object of the control and the corresponding data of the navigation technical aids current state for the monitoring the movement in the congested conditions of navigation grounding of ships in 46.8 % of 173 analyzed cases gives a sound evidence to that.

The insufficiency of information provision of the navigation process both inside the ship and from outside, the absence of the ways and methods of monitoring by the shore – based Aids to Navigation did not allow to prevent grounding of ships (47%) and contacts to coast line and clearing marks (17 %).

The information provision of the current parameters of the movement and the situation of the ship is also insufficient the absence of the methodology of the ship control preliminary planning, supporting systems for the decision making and the algorithms of the operator's actions in the manoeuvring control, which didn't allow to prevent collisions in 15 %, grounding in 47 % and contact accidents in 17 %.

This analysis made it possible to rank the operator's arrows in accordance with his psychophysiological characteristics: in 47 % of all cases the cause was the fault of the analyzer in 21 % as a result of malfunction while storing and processing the information; in 18 % faults in decision making and in 14 % motor mistakes caused by the low capacity to the work of the operator.

For the evaluation of the influence level of every particular characteristic on the process of the movement let us introduce the coefficients of ranking analyzers

$K_{\text{ржа}} = 0{,}47$, malfunction in storing and processing the information $K_{\text{ржп}} = 0{,}21$, the speed of the intellectual functions fulfillment $K_{\text{ржи}} = 0{,}18$ and the result of motor's faults $K_{\text{ржм}} = 0{,}14$.

The planned values of the movement factors are to be taken as the starting point, and the maximum assured results is achieved by the maximum possible approximation of the planned values of the parameters to the optimal values. Thus, the efficiency of the manoeuvring is determined by the predicted characteristics of the movement process and the ability of the operator to fulfill the prepared plan.

For the evaluation of the coordination let us introduce the three factors of movement and the operator's characteristics – local, generalized local and global ones.

Local Criteria of Coordination - show the degree of coordination of every characteristic of the operator with corresponding factors of movement. Their general number is 20. The denotation of the coefficients is given in Table 1.

In case of agreement of one factor of movement with one characteristic of the operator it acquires the value 0.2, if it is absent it equals 0..

Generalized Local Criteria of Coordination – informational analysis ($K_{\text{ан}}$), memory and thinking ($K_{\text{пам}}$), the speed and reliability of intellectual functions ($K_{\text{фун}}$) and anthropometry ($K_{\text{ант}}$) characterizes the degree of the agreement of every characteristic feature of the operator with all the factors of the movement. Everyone acquires the values [0;1]. In case of the agreement of one factor of movement with the corresponding feature $K_{\text{ан}}, K_{\text{пам}}, K_{\text{фун}}, K_{\text{ант}} = 0{,}2$, two factors – 0.4, three – 0.6, four – 0.8 in case of full coincidence 1.

Table 1. *Local coefficient of coordination*

Traffic factors	Analizators	Memory	Intellectual functions	Anthropometry
Speed	Кса	Ксп	Кси	Ксм
Course	Кка	Ккп	Кки	Ккм
Manoeuvre starting moment	Кма	Кмп	Кми	Кмм
Trajectory	Ктра	Ктрп	Ктри	Ктрм
Situation	Кпа	Кпп	Кпи	Кпм

Global Criterion of Coordination ($K_{\text{сог}} \in [0;1\ \text{отн.ед}]$) characterizes the degree of agreement of all the characteristics of the operator's activity with all, the factors of the ship movement, represented as separate coefficients.

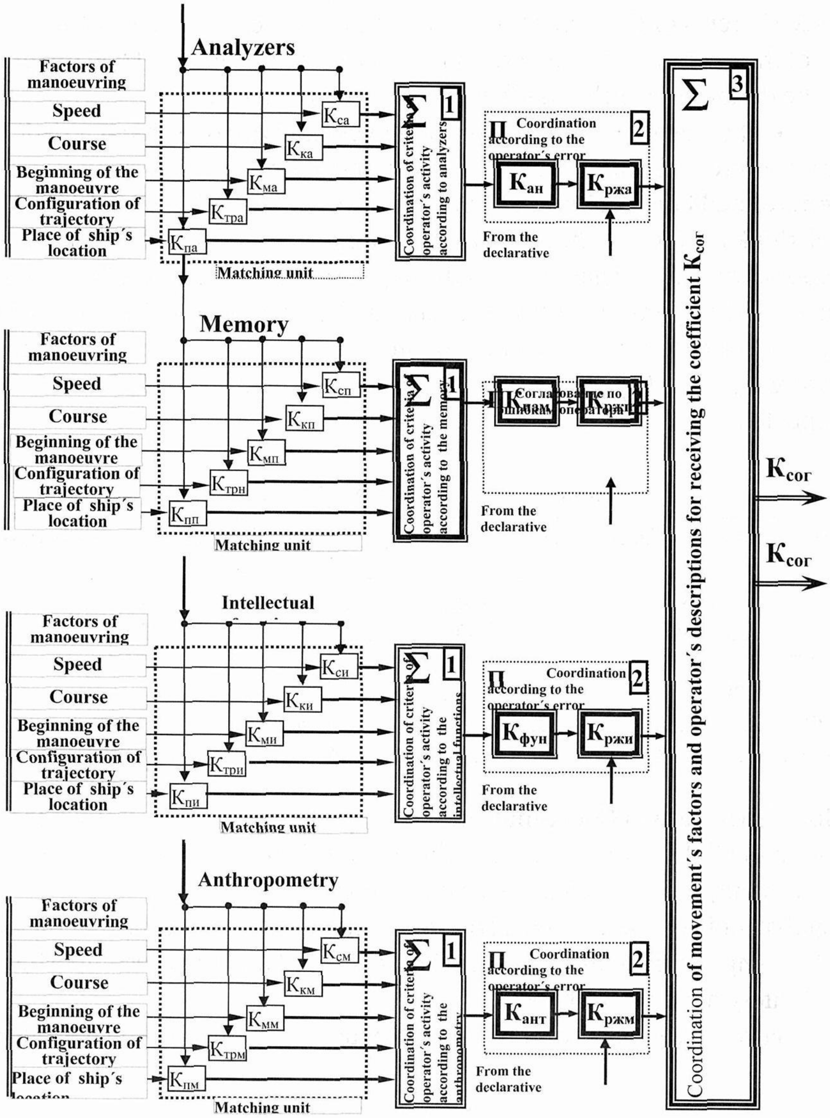
If global and generalized local criteria are equal to one it means that the agreement of all the components of the manoeuvring is ensured and the precompositions for the ensured safety have taken shape.

The analytical dependence for the determination of $K_{\text{сог}}$ will look in the following way:

$$K_{\text{сог}} = \sum_{i=1}^{4}\left(K_{\text{ржі}} \cdot \sum_{j=1}^{5} K_{\text{локij}}\right) \tag{1}$$

where i - the number of operator's characteristics ($i \in [1;4]$); j - the number of traffic factors $j \in [1;5]$; $K_{\text{рж}}$ - coefficient of operator's errors ranking; $K_{\text{лок}}$ - local coefficient of coordination (table.1).

The structural scheme of algorithm of determination of coefficient by formula (1) and is shown in the picture.1.



Picture 1 – Structural scheme of algorithm of coordination coefficient. Marking of blocs: 1 –coordination according to the local criteria; 2 –coordination taking into account operatorś errors; 3 – global coordination

Considered necessary and sufficient conditions allow to proceed to substantiation of process of assured safety of manoeuvring.

When the preliminary plan is made up, one may proceed to the fulfillment of the following manoeuvring stage–operation of transition process. For its realization it is necessary: to carry out the sea operation on going out from the port; to customize hydrameteorological factors and adjust the corrections, which had been taken according to the predicted data; to bring in to the work control unit of course (manual or automatic), navigational facilities which determine the shipś position , which evaluate the navigation situation and which determine the moment of appearance of variable limitations to the movement of the ship. When one defines the location and finds some deviations it is necessary to specify reasons, which stimulated removal and correct the course, without changing the preliminary plan, in order that the ship go out exactly to the following travel point.

When variable limitations appear, one should find out, if there is a danger of collision, and correspondingly, and the necessity to change the parameters of movement. If it exists, then one should correct the preliminary plan by means of removal of the following one or several travel points in the direction of cargoś delivery (transference lines between ports).After this the course or speed is changed to provide with the divergence and with the realization of the given algorithm of operation.

Out of the accident rates analysis and the study of the manoeuvring process, the existing practice of protection of the safety of traffic has a lot of shortcomings : there is no information about manoeuvring properties ; the conception of the prediction and the planning of the given algorithm of the system of operation, and the method of sea operation planning are generally absent; the systematized conception of the movement correction by the variable limitations is also absent ; there is not enough information about current parameters of the movement and their correspondence to the planned ones ; there is no supporting system of decisions ́assumption.

Thus, the safety of the manoeuvring operation is intended to assure due to the rise of level of awareness and to the speed system of processing information with the following elaboration of the algorithm of operatorś activity by means of : the structuring of the tactical and efficient tasks, the elaboration of the algorithm of intellectual actions of the operator while the planning or operation of the shipś movement; the elaboration of the algorithms and programmes which predict the safe speed in different conditions of navigation ; planning of the sea operation by means of the method of inversion; the creation of the supporting system of the assumption of decisions which concern the manoeuvring ; the creation of the algorithms of the current control of the divergence and correction means of the initial trajectory; the creation of the algorithms of the current control of the position, including the curvilinear motion, and the visualization of the current situation of the divergence with the ships which manoeuvre dangerously.

Bloc-scheme of the algorithm of the functioning of the system in the mode «preparation» is given in the picture.

In the mode «Transition» the work of the system of the manoeuvring safety, is presented by the procedure, in which the following operations are performed:

- B_1 –collection, processing and reflection of information about strict limitation for the beginning of the movement;
- B_2 - collection, processing and reflection of information about parameters of external influences and visibility conditions;
- F_3 - determination of the necessity of including the correction data in the compass course for the compensation of the external influences ;
- B_4 - determination of the safe speed in accordance with the conditions of navigation taking into consideration manoeuvring characteristics;
- B_5 - determination of the manoeuvring characteristics for the current situation in the organs of control and their assessment;
- B_6 - determination of the current meaning of the dynamic characteristics and the corrective coefficients to account for the shallow water;
- F_7 - comparison of the dynamic characteristics on deep water and current correlation H/T and assessment of the necessity of correction of characteristics of the current regime of movement;
- B_8 - determination of the actual meaning of the shipś course $KK_{тек}$;
- F_9 - comparison of $KK_{тек}$ and $KK_{зад}$ and making of the command to the rudder transfer for bringing the ship to the established course (operation along the inner outline);
- B_{10} - determination of the current position of the ship;
- F_{11} - comparison of the current position of the ship with the given one, assessment of the divergence from the line of the planned way and clearing up the cause;
- B_{12} - determination of new meaning of the corrections due to the external influences, $KK_{зад}$ and modification of the given algorithm of operation ;
- B_{13} -the establishment of the variable limitations;
- B_{14} -determination of the time of the modification of regime, the selection of kind of manoeuvre in the catalogue of situation;
- F_{15} - comparison $KK_{тек}$ and $KK_{зад}$ and formulation of the command to the helm for bringing the vessel to specified course or the assignment of a new value of the speed;
- B_{16} - determination of the beginning moment of return and the new value of course to the following travel point;
- B_{17} - determination of the angle of turning the rudder, a moment of starting and finishing of the turn, holding of the turning and the new meaning of $KK_{зад}$ taking into account the angle of windage and sea current;
- B_{18} - determination of the position data of the starting point of a rerunning of the rudder;

- F_{19} - transfer of the rudder to the specified angle after arriving at the point of the turning and keeping it taking into account the characteristics of holding of the turning;
- K_{20} - end of the lead cycle of the vessel trough the given section between the previous and the subsequent points, with an opportunity of reiteration of the cycle on a following section of the way and transition to operator B_2.

In the operational form of LSA operator's activity of a navigator during the transition by the sea is represented in a following way:

$$H\, B_1\, B_2\, F_3^{2\uparrow 4\downarrow}\, B_4\, B_5\, B_6\, F_7^{8\uparrow 6\downarrow}\, B_8\, F_9^{10\uparrow 8\downarrow}\, B_{10}\, F_{11}^{12\uparrow 8\downarrow}\, B_{12}\, B_{13}\, B_{14} \times \\ \times F_{15}^{12\uparrow 16\downarrow}\, B_{16}\, B_{17}\, B_{18}\, F_{19}^{2(20)\uparrow 16\downarrow}\, K_{20} \qquad (3)$$

and the block diagram of the algorithm of system activity of maneuvering in this mode is indicated in figure .3.

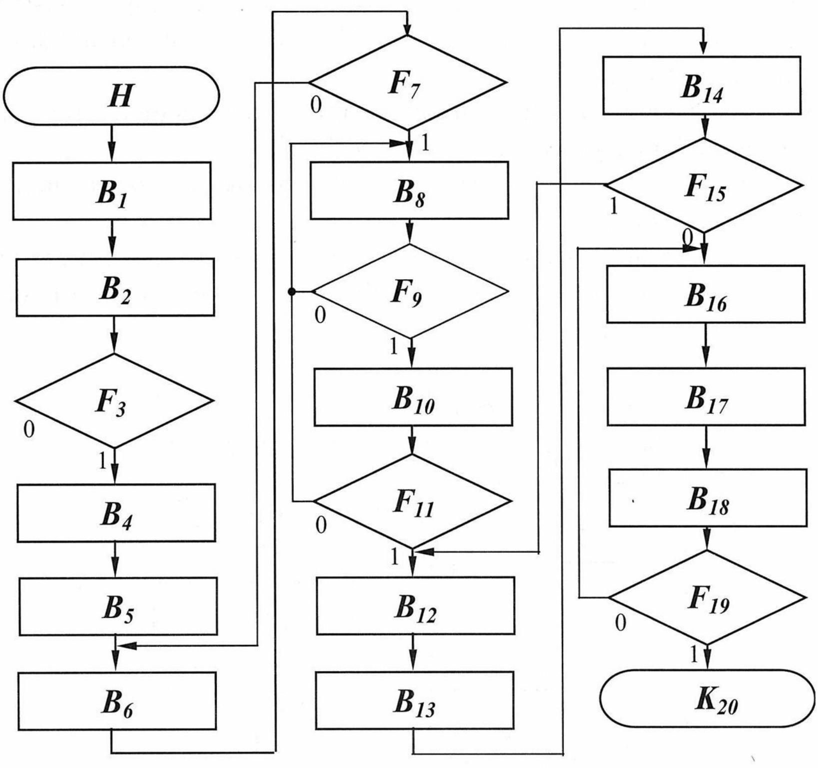


Fig.3. the block diagram of algorithm of operation functioning system of maneuvering «transition» in regime.

Operational peculiarities of assured safety system of maneuvering during the performance of marine operations consist in the fact that a vessel purposefully changes parameters of its movement. During the performance of marine operations, owing to the given limitation on a trajectory of movement, three classes of operational problems are distinguished: with the loose port end with unfixed time: with the fixed ends: with loose port or starboard ends.

Usually a starting point of maneuvering while entering a port is the initial point which coincides with last travel point, and while going out from a port maneuvering begins with the jammed point, and terminates in the initial travel point.

During the anchoring the jammed point is the point of going down of an anchor, and initial point is last travel point. During the mooring on the move the finish point of the maneuver moves evenly and rectilinearly.

During the performance of marine operations the procedure of system functioning is presented by following operators:

- Нм – beginning of structural logic algorithm of functioning the system;
- $B_{м1}$ – collection, processing and displaying of the information about strict limitation for starting flow;
- $B_{м2}$ - collection, processing and displaying of the information about parameters of external influences and conditions of visibility;
- $B_{м3}$ - choice of manner of arriving to the finishing point of the maneuvering, course and speed;
- $F_{м4}$ - determination of the necessity of corrections in the magnitude of compass course for compensation of external influence and the necessity of tugboats for safe maneuvering;

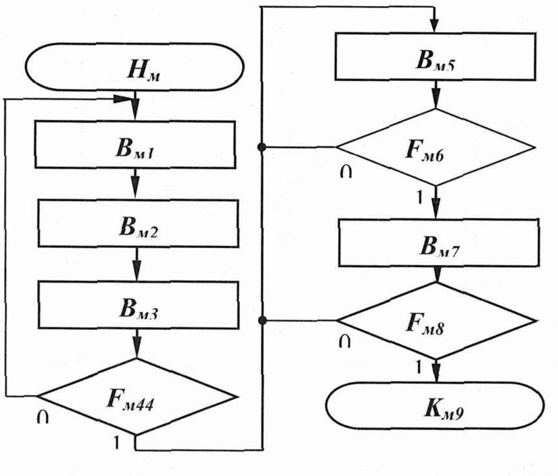


Fig.4. Block diagram of the operation algorithm of maneuvering during the marine operations

- $B_{м5}$ - graphic construction and analytic calculation of coordinates of the initial point of starting /finishing maneuver;
- $F_{м6}$ - check up of the transition points coincidence and initial one of starting of the maneuver, if there is any discrepancy subsequent plan of flow on the transition is corrected;
- $B_{м7}$ - determination of corrections for changing the course and/or speed for coming to initial travel point or position for starting the maneuver;
- $F_{м8}$ - check up of coincidence of points and transfer of the system to «transition» mode or its correction by changing either the starting travel point or by changing the course in the first travel point.
- $K_{м9}$ - the end of the cycle activity on the given segment of flow.

In the operational form of LSA activity of a navigator during the performance of marine operations can be written down in a following way

$$H_{м}\, B_{м1}\, B_{м2}\, B_{м3}\, F_{м4}^{5\uparrow 1\downarrow}\, B_{м5}\, F_{м6}^{7\uparrow 5\downarrow}\, B_{м7}\, F_{м8}^{9\uparrow 5\downarrow}\, K_{м9}\,,$$

and the block diagram of the algorithm of system activity of maneuvering is shown in the figure.4.

CONCLUSIONS AND PROPOSITIONS

1. Existing concepts in navigation are based on physicalistic approach, using basically kinematic and kinetic laws of flow and the cybernetic approach, using laws of the theory of automatic.
2. Suggested conception of control assured safety of maneuvers is based on system approach. The information processing function and the operation of a vessel function in it are automated to the maximum, and operator's activity of a navigator is exposed to algorithmization in processes of a choice and decision-making.
3. Automation is required the studying of processes of maneuvering, researching a quality of a vessel, as an object of the control, and external RFI and informational influences on the process of the control, and structure development of the control system, a decision-making support system and fast-acting algorithms of intellectual activity of the operator.
4. In the process of algorithmization of the navigator's activity on the base of the criteria of coordination his psychophysiological characteristics and factors of movement three modes of operative management were marked –preparation, transition and marine operations which were undergone preliminary research on the level of logical operations and determinations of block diagrams.

5. The following research is rational to direct to creating the structure of the operational system of maneuvers for different conditions of navigation, class of solving problems and create the conditions for providing assured safety of navigation, including the upgrading the pilotage as an effective means of navigation safety.

REFERENCE:

1. Зеленин М.П. Эргономика на морском транспорте. – Одесса. : Банто, 1999. – 382 с.
2. Антонов А.В. Системный анализ.-М. : Высшая школа, 2004. -454 с.
3. Наука,1978.-245 с.
4. Герасимов И.Г. Структура научного исследования.-М.:Мысль,1985.-217 с.
5. Колесников Л.А. Основы теории системного подхода. -Киев. : Наукова думка,1988.-171 с.
6. Кейхилл Р.А. Столкновения судов и их причины. – М.: Транспорт, 1987. – 248 с.
7. Юдович А.Б. Предотвращение навигационных аварий морских судов.2 –е изд., доп. – М.: Транспорт, 1988. – 224 с.
8. Романов Г.С. Анализ аварийности в районе БДЛК и ХМК за период 1999-2002 годы.//Судовождение: Сб.научных трудов ОНМА.-Вып.6.-Одесса :Феникс,2003.-С.108-114.
9. Мальцев А.С. Система управления движением судна// Судовождение: Сб. научн. трудов./ ОГМА. –Вып. 3.- Одесса.: Латстар, 2001.-С.106-121
10. Мальцев А.С, Романов Г.С., Гончаров Е.И., Вильский Г.Б. Подготовка лоцманов к управлению маневрами судна .//Судовождение :Сб. научн. трудов/ ОНМА,. Вып.8. –Одесса: Феникс,2004. –С. 63-76.

Ship Squat; An Analysis of Two Approximation Formulas Using the Physics of Hydrodynamic Flow

Christopher Pilot[1]

Abstract

Ship squat, the downward pull of vessels traveling at speed in restricted waters, is of great practical importance given the possibility for grounding, the implications for dredging, and the potential for sinkage and even loss of life. Since the groundbreaking work of Tuck, many formulas have surfaced which attempt to calculate and predict the actual amount of downward displacement given the size, shape, draught, under-keel clearance, and, most importantly, speed of the moving vessel. The formulas are, however, of limited utility because of their mathematical complexity; mariners often want a rough but robust estimate of predicted downward displacement without having to resort to a computer and spreadsheet. We analyze two such approximation formulae here, one due to Barrass and the other due to Schmiechen, and argue that one is correct based on physical principles at high speeds. The other must lead to false results at significant speed where squat is appreciable. We argue that the correct dependency of squat on speed must be velocity cubed (V^3), versus velocity squared (V^2), in the critical limit where the Froude depth number approaches unity.

1. Introduction

Since the groundbreaking theoretical work of Tuck (Tuck, 1967), many theoretical as well as empirical formulas have surfaced (PIANC/IAPH WG 30D, 1994; Vantorre, 1995; Landsburg, 1995, 1996) which attempt to mathematically predict the amount of downward displacement (squat) of a vessel given the ships' profile, physical dimensions, and speed in restricted waters. These formulas tend to be complicated in that a computer and spreadsheet are often needed to evaluate, i.e., calculate the actual amount of squat. Furthermore, even with a spreadsheet, a significant bandwidth, or spread, in the predicted squat amount is obtained from the different formulae given the

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same initial input parameters. (Qualitatively, however, the results look rather similar.) The problem rests with the fact that many parameters are involved, and it is difficult to correctly ascertain them empirically at any one instant in time in other than controlled conditions. Secondly, we are dealing with a problem in hydrodynamic flow approaching critical phenomena where a small variation of one parameter can lead to a remarkably different and dramatic change in the outcome as a whole.

Even if we decide on a formula giving middle-of-the-road predictions for squat such as the Huuska/Guliev formula adopted by ICORELS (Huuska, 1976; PIANC/IAPH WG 30D, 1994; Landsburg 1995, 1996) and which is a direct extension of Tucks' original work, the problem still remains to define a useful approximation formula. Barrass (Barrass, 1979a; Barrass, 1979b; Barrass, 1981; PIANC/IAPH WG 30D, 1994) has come up with a popular simplified formula (his second iteration) and we show in this paper that his latest and improved formula (Barrass II) can be derived from the more general Huuska/ICORELS formulation. As far as we know, Barrass' formula has never been derived from a more extensive underlying theory. His formula was based on empirical work having studied and analyzed about 300 cases of squat involving actual ships and ship-models. The motivation of Barrass for finding a simplified formula was simple. He was motivated by the desire to come up with a formula which could be utilized on ships by ship pilots which was accurate and which didn't rely on trial-and-error, rule-of-thumb guesstimates.

In this paper we will analyze two such approximation formulas. One is due to Barrass and the other originates with Schmiechen (Schmiechen, 1997). Both can be derived from the more general Huuska/ICORELS formulation as we shall show here. However, they each give remarkably disparate results. Our objective is to show why this is so and why one approximation is correct and the other limit is physically incorrect when there is significant squat. The key is to recognize and understand the correct limiting process at the outset of turbulence. Even though both results are physically correct, the physics will show that *only* one result is valid in the realm of practical interest.

In section 2 we derive what is essentially the Barrass II formula by taking a certain limit of the Huuska/ICORELS equation and making certain realistic assumptions. In section 3 we take a different limit of the Huuska/ICORELS equation and obtain Schmiechens' formula. Results are then compared from a physical perspective. Our conclusions and recommendations are presented in section 4, our final section.

2. Barrass' Formula as an Apprimation of Huuska/ICORELS

Ship squat is the tendency of a vessel to sink and trim when underway thereby reducing its' under-keel clearance. The downward pull can be measured as a displacement, S_M, in meters (m). The trim is typically measured as a rotation, , in radians (rads) about the horizontal transverse axis of the ship, i.e., about a line going through the beam. The total squat at the bow is given by the equation

$$S = S_M + ½\ L_{pp'} \tag{1}$$

where $L_{pp'}$ is the length between perpendiculars of the at-rest vessel by the waterline.

Squat is a hydrodynamic effect which depends critically on the speed of the vessel, but also on the draught, the length of the ship, the shape of the hull, and the under-keel clearance. A very good formula giving solid middle-of-the-road estimates for the actual squat displacement is the Huuska/ICORELS formula mentioned above. For simplicity we assume an open waterway laterally, i.e., no breath restrictions in a horizontal sense. Then that formula simplifies to:

$$S = 2.4 \cdot \Delta / (L_{pp'})^2 \cdot F_{nh}{}^2 / \surd(1 - F_{nh}{}^2) \tag{2}$$

In equation (2), S is the same displacement as in equation (1), measured in meters and is due to a ships' motion in shallow water, and Δ is the underwater volume of the vessel in cubic meters. Δ can be calculated as $\Delta = CB \cdot Lpp' \cdot B \cdot T$, where Lpp' is the length of the ship between perpendiculars (in m), B is the maximum beam width of the ship by the waterline (in m), and T is the ships' draught, or depth in the water, when at rest (again in m). The block coefficient, CB, is a unit-less ratio which measures the actual submerged volume of the ship in relation to a corresponding submerged rectangular block volume. By definition, CB = (submerged volume)/($Lpp' \cdot B \cdot T$). The Froude depth number, Fnh , is another dimensionless, i.e. unit-less, scale parameter defined as $V/\surd(g \cdot h)$ where V is the speed of the vessel in m/s, h is the undisturbed water depth in meters (m) and g is the acceleration due to gravity, 9.81 m/s2.

The block coefficient, CB, measures how streamline the hull of a vessel is. For bulky tankers, CB is about .85, whereas for finer formed vessels, CB is approximately .6. Maximum squat typically occurs at the bow (front) of the ship but for high speed vessels with a block coefficient less than about .7, the squat can actually occur at the stern (rear) of the vessel. We keep in mind that Δ is measured in cubic meters where a one cubic meter displacement means one metric ton (1000kg) of fresh water has been pushed aside. In seawater, a one cubic meter displacement means even more water mass has been pushed aside, approximately 1030 kg, due to the higher density of seawater. By Archimedes principle, the upward buoyant force acting on a vessel keeping it afloat is equal to the weight of the fluid which has been displaced, i.e., pushed aside. Obviously, by equation (2), we see that the amount of expected squat is directly proportional to Δ. Δ, in turn, is directly proportional to T, the draught in the water.

Bearing this in mind, equation (2) can be recast in dimensionless form; we can rewrite it as

$$S/T = C2 \cdot Fnh2/\sqrt{(}1- Fnh2) \qquad (3)$$

where C2 is a constant, defined by C2 = 2.4 · CB · B /Lpp' ,which depends only on the specific dimensions of the ship. The unit-less ratio, S/T, is the amount of squat in relation to the original at-rest draught of the vessel. From equation (3) it is clear that the Froude depth number, Fnh, is what we should focus on for hydrodynamic purposes since it is this term which depends on the speed of the vessel.

When a ship moves through water it creates a captive wave much like an aircraft when moving through the air. An aircraft can move at subsonic speeds where (Vobj/ Vsnd) < 1, at critical speed where (Vobj/ Vsnd) = 1, or at supersonic speeds where (Vobj/ Vsnd) > 1. Vobj stands for the speed of the aircraft, and Vsnd refers to the speed of sound. Aircraft approaching the critical speed, Vobj Vsnd (Mach 1), require much greater horsepower (in fact, an exponential increase is necessary) in order to overcome the increased aerodynamic resistance. This increased aerodynamic resistance is caused by the accompanying captive wave of the aircraft which it is now being overtaken. If the aircraft has sufficient horsepower, then it can literally punch its way through this envelope, break free of its captive wave, and, as a consequence, a sonic shock wave is produced. This can only happen when it goes at critical speed, or supercritical speeds.

So too with ships but now the resistance is due to a ship attempting to push its way through an envelope created by water which is, of course, a hydrodynamic (versus aerodynamic) effect. When attempting to overtake its captive water wave, a vessel requires additional and significant horsepower. For most large ships with substantial underwater draughts, this is virtually impossible... the hp is not sufficient. With certain fast moving ships, however, it is possible (even with significant draught) to go "critical" and "supercritical" if the horsepower is there. Then the vessel would literally lift up and out of the water in order to travel at these high speeds. We are thinking of speedboats, hydrofoils and hovercraft, which can travel at high speeds but only after lifting up and out of the water. Horsepower is what it takes to break free from the captive wave.

The Froude depth number is the hydrodynamic equivalent of (Vobj/ Vsnd). As Fnh approaches one, the hydrodynamic resistance to motion increases exponentially. Fnh < 1 denotes subcritical speeds, Fnh = 1 defines critical speed, and Fnh > 1 indicates supercritical conditions which can be achieved by speedboats, hydrofoils, etc. Typical upper values for Fnh are Fnh .6 for tankers and Fnh .7 for container ships, ships which both have sizable draughts. These vessels cannot simply lift up and out of the water for the required hp would be astronomical.

In a sense, $Fnh = 1$ determines the effective speed limit for vessels of sizable draught. In fact this speed limit depends on the depth of the water because $Fnh = V/\sqrt{(g \cdot h)}$, and h, *in turn, measures the water depth in meters.*

It is well-known experimental fact (PIANC/IAPH WG 30D, 1994) that ship squat is not significant for $V < 6$ knots $= 3.08$ m/s (1 knot = 1.15 mph = .514 m/s), i.e., for $Fnh < .3$. This has been shown empirically under a variety of conditions. Yet it is precisely in this limit that equation (2) reduces to the Barrass II formula. To see this we assume *that Fnh is small, i.e., significantly* less *than one.* Using the binomial expansion

$$Fnh2/\sqrt{(1 - Fnh2)} = Fnh2 \cdot (1 + \tfrac{1}{2} Fnh2 + \ldots) \qquad (4)$$

Since $Fnh2 << 1$, we keep only the first term on the right hand side of the expansion. Thus, by equation (2)

$$S \quad 2.4 \cdot CB \cdot B \cdot T \cdot Fnh2 / Lpp' \qquad (5)$$

$$(2.4 \cdot CB \cdot B / Lpp') \cdot V2 / (g \cdot (h/T))$$

$$(.245 \cdot CB \cdot B / Lpp') \cdot V2 / (h/T)$$

This can be further simplified. For the vessels that we are considering, the length to beam ratio is typically about 7. Some examples will substantiate this claim. For 250,000 tdw tankers (280,500 tonnes loaded), typical dimensions are Lpp'/B = 330m/50m = 6.6. For 65 tdw bulk carriers (85,000 tonnes loaded), typical values are Lpp'/B = 245m/35m = 7. And for Panamax container ships (65,000 tonnes loaded), good representative values are Lpp'/B = 270m/32m = 8.44. Thus, with the approximation that Lpp'/B 7, equation (5) can further be reduced to

$$S \quad .035 \cdot CB \cdot V2 / (h/T) \qquad (6)$$

It is this expression which we wish to compare to Barrass' latest formula (Barrass II).

The Barrass II formula, obtained as a result of analyzing about 300 actual squat results, some measured on ships and some measured on ship-models, reads

$$S \quad (CB / 30) \cdot (S2)\ 2/3 \cdot Vkt2.08 \qquad (7)$$

In equation (7), Vkt is the speed of the vessel in knots and S2 is the blockage ratio (sometimes referred to as the velocity return factor) defined as

$$S2 = As/\,Aw = As/(\,Ac - As) = S1/(1- S1) \tag{8}$$

In (8), As is the submerged mid-ship cross-sectional area, and Ac is the cross-sectional area of the channel including that of the submerged ship. Aw, on the other hand, is the so-called wetted cross-sectional area of the waterway excluding the submerged cross-sectional area of the ship. Finally, S1 is defined to be As/ Ac . For rectangular cross-sectional areas, As $= B \cdot T$ and $Ac = w \cdot h$ where w refers to the width of the waterway.

We are considering open water in a lateral, i.e. horizontal sense (no breadth restrictions), and according to Barrass, the effective width, w, for open water should be taken to range from about w 8·B for oil tankers to about w 10.5·B for passenger vessels. Also, for the Barrass formula to work, the assumed ratio of water depth to draught should lie between $1.1 < h/T < 1.5$. Finally the speed in equation (7) is measured in knots whereas in equation (6) it is measured in m/s. We convert the speed in equation (7) to m/s and obtain:

$$S \quad (CB/\,30) \cdot \{(B{\cdot}T/(w{\cdot}h))/[1 - (B{\cdot}T/(w{\cdot}h))]\}2/3 \cdot (V/.514)2.08 \tag{9}$$

$$(CB/\,30) \cdot \{(T/h)/[w/B - T/h]\}2/3 \cdot (V/.514)2.08$$

$$.133 \cdot CB \cdot \{(T/h)/[10 - T/h]\}2/3 \cdot V2.08$$

In the last line we have used the approximation w/B 10 as a representative value for an open waterway as Barrass advocates. Equation (9) is qualitatively and quantitatively very similar to equation (6) in the range $1.1 < h/T < 1.5$. Both are proportional to CB, both are essentially proportional to T/h, and both have what is essentially a velocity-squared dependency. To show that the results do indeed match in the ranges considered, two numerical examples should suffice. If we assume that V = 6.17 m/s = 12 knots, and if h/T = 1.1, then equation (6) gives (1.21· CB) as a calculated value for the amount of squat in meters. For the same parameters, equation (9) renders (1.26· CB) as a calculated result. We see that both equations give essentially the same value! At the other extreme where h/T = 1.5, using the same speed as before, equation (6) gives (.888· CB) whereas equation (9) gives (1.008· CB) in meters. Again, the results are close given the uncertainties in estimating w/B.

Barrass' formula is a popular one because hand-held calculators can be used to determine the amount of squat. And the amount calculated is not dependent on the specifics of the ship, i.e., no physical dimensions are needed... other than the general form of the vessel which is captured by the value of the block coefficient, CB. In fact, Barrass goes a step further and gives even more simplified expressions for squat based on his underlying equation, equation (7), to make it even easier for the pilot to make estimates. As far as we know, this is the first time equation (7) has been derived from a more complete theory. Remember that Barrass' formula was based solely on empirical observations. Equation (6), on the other hand, is based on theoretical work, dating back to Tuck.

3. Schmiechens' Formula Derived in a Different Limit

Again, we start out with equation (3). However, at the outset of turbulence which would indicate approaching a phase transition, we claim that Fnh must approach 1. In fact, Fnh will never reach one, for otherwise, the vessel would lift up out of the water. A good representative value for when significant, measurable squat sets in, is the limit where Fnh approaches .7. Remember that sizable squat can never occur below Fnh .3. It stands to reason that a larger value for Fnh is needed because a larger value indicates more speed relative to depth, and more speed indicates more water being flushed under the keel. Due to the Bernoulli effect this is precisely what pulls the ship down.

Another way to view this is from energy considerations. As a vessel assumes enough speed to generate significant squat, it comes one step closer to overcoming its captive wave. An exponential increase in hp is necessary to build up that speed, however, because part of that hp is now being used up to pull the vessel down. This happens to aircraft as well; as an aircraft approaches Mach 1 a sizable proportion of the power is now being expended in attempting to break free of its captive wave and not just increase its speed another notch. When approaching Mach 1, an aircraft experiences turbulence due to its stronger interaction with its resisting captive wave. The increased hp necessary in a ship is due to the increased resistance from the captive wave as the speed increases, and this increase in resistance (drag force) is not linear in V. Power in crude terms is Force · Velocity where the velocity is in the forward direction, and the force is the retarding force acting against this motion. (We are looking at the work done per unit time by an external agent, the engines of the ship.) Since the retarding force for a solid object moving through a fluid at significant speed is proportional to V2 (Raleigh equation (Serway & Jewett, 2004; Tipler, 2004)), the power expended in driving a vessel forward must be proportional to V3. Part of this power is what produces squat and we therefore expect a V3 dependency for squat as well at speeds of interest.

In the limit where Fnh approaches .7, the following approximation formula works [10]:

$$Fnh2/\sqrt{(1- Fnh2)} \quad 2 \cdot Fnh2 \tag{10}$$

Then equation (3) reduces to

$$S/T = C3 \cdot Fnh3 \tag{11}$$

where C3, defined as $C3 = 4.8 \cdot CB \cdot B/ Lpp'$, is a new constant which depends only on the characteristics of the ship. Equation (10) was first obtained by Schmiechen. We note that in equation (11), S/T is proportional to V3, as expected, versus the V2 obtained previously in equation (5). We maintain that equation (11) is a better simplified formula to calculate and approximate ship squat, versus equations (5) or (6), because of the above mentioned physical considerations. Experimental verification of a V3 (versus V2) dependency has been obtained (Akudinov & Jakobsen, 1995) with a model of the Herald of Free Enterprise.

For numerical estimates, we can again assume that Lpp'/B 7. Then, numerically, the relative squat can be determined from equation (11) to be

$$S/T \quad 4.8 \cdot CB /7 \cdot V3/(g \cdot h)3/2 \tag{12}$$

$$CB /45 \cdot (V/\sqrt{h})3$$

This is a simple formula to remember and to work with. For V = 6.17 m/s = 12 knots and h = 10m, one obtains for S/T a value of .16 CB. However, if V = 6.17 m/s and h = 5m, then the relative amount of squat is S/T = .468 CB, an almost three-fold increase, even for vessels which are very finely formed indicated by low values for CB. Equation (12) does not suffer from the restriction that $1.1 < h/T < 1.5$ as equation (7) does. Nor is the questionable approximation of w $10 \cdot B$ for open waterways invoked. If we are dealing with an open waterway in the sense that there is no breath restriction, then the proper limit to take, mathematically, is w .

4. CONCLUSION AND REMARKS:

We claim that Barrass' simplified formula, or any formula indicating a V2 dependency for ship squat, cannot be correct at speeds where squat is significant. It is obtained in an incorrect limit, and hence, cannot be valid. Ship squat is a hydrodynamic effect relating to a ship overcoming its captive wave and approaching a phase transition. Hence the Froude depth number should be approaching unity and not zero. Whenever turbulence sets in, it is a sign that the retarding force is proportional to V2 versus V.

Hence the power expended is proportional to V3. Since part of the power goes into generating squat, S/T should also be proportional to V3. S/T being proportional to V2 holds only for relatively low speeds and steady state flow (Stokes equation (Serway & Jewett, 2004; Tipler, 2004)), not indicated experimentally by the need for exponentially increased hp or other conditions.

In fact, in several of Barrass' papers (Barrass, 1979a; Barrass, 1979b), it is recognized that the onset of ship squat is accompanied by the following quoted tell-tale signs:

1) Wave-making increases at the for'd end of the ship
2) The ship becomes more sluggish to maneuver
3) The r.p.m. indicator will show a decrease. If the ship is in open water, i.e. without breadth restrictions, this decrease may be 15% of the service number of revolutions. If a ship is in a confined channel, this decrease in r.p.m. can be about 20% of the normal value.
4) There will be a drop in speed. If the ship is in open water the speed reduction may amount to about 30%. If the ship is in a confined channel, the drop may amount to 60% of service speed.
5) The ship may start to vibrate suddenly because of the entrained water effect, causing the natural hull frequency to become resonant with another frequency.

These are all experimental manifestations of the onset of turbulent conditions, when an object attempts to break free of its captive wave, and not low speeds and steady-state flows.

Schmiechen has correctly identified the correct limit, and come up with the correct approximation. Hence we advocate the use of equations (11) or (12) as good benchmarks to mariners for estimating squat. Note that equation (12), in particular, can be used with relative ease using a simple hand-held calculator. The specific dimensions of the ship do not come into play... only the block coefficient which is determined by the general type of vessel.

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REFERENCES:

1. Akudinov, V.K. & Jakobsen, B.K.: Squat Predictions at an Early Stage of Design. Presented at the SNAME Workshop on Ship Squat In Restricted Waters. Washington, D.C. October 4, 1995. See, in particular, page 52, figure 2E in the published draft of 1996 edited by Landsburg, A.
2. Barrass, C. B. (1979a): The Phenomena of Ship Squat. International Shipbuilding Progress, No. 26, p. 16-21
3. Barrass, C.B (1979b): A Unified Approach to Squat Calculations for Ships. PIANC Bulletin No. 32, p. 3-10
4. Barrass, C.B. (1981): Ship Squat – A Reply. The Naval Architect, November (1981), p. 268-272
5. Huuska, O (1976): On the Evaluation of Underkeel Clearances in Finnish Waterways. Helsinki University of Technology, Ship Hydrodynamics Laboratory, Otaniemi, Report No. 9
6. Landsburg, A. (Editor) (1995, 1996): Workshop on Ship Squat in Restricted Waters. SNAME Panel H10 (Ship Controllability) of the Hydrodynamics Committee. Washington D.C. October 4, 1995. Draft July 1996
7. PIANC/IAPH WG 30D (1994): Appendix: Prediction of Squat. September 29, 1994
8. PIANC/IAPH WG II-30 (1997): Final Report of the Joint PIANC-IAPH Working Group II-30 (June 1997). See, in particular, section 6.5.2.1, and appendix C, figures C8 and C9.
9. Schmiechen, M. (1997): Squat-Formeln. Duisburger Kolloquium 1997
10. Serway, Raymond A. & Jewett, John W. (2004). Physics for Scientists and Engineers (6th ed.). Brooks/Cole. ISBN 0-534-40842-7.
11. Tipler, Paul (2004). Physics for Scientists and Engineers: Mechanics, Oscillations and Waves, Thermodynamics (5th ed.). W. H. Freeman. ISBN 0-7167-0809-4.
12. Tuck, E.O. (1967): Sinkage and Trim in Shallow Water of Finite Depth. Forschungshefte fuer Schiffstechnik 14, p. 92-94
13. Vantorre, M. (1995): A Review of Practical Methods for the Prediction of Squat. Presented at the SNAME Workshop on Ship Squat in Restricted Waters. Washington D.C. October 4, 1995

Modern Tendencies of Shipping Development at Baltic Region and Their Influence on the Projects and Educational Programs of Regional Maritime Education in Russia

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1. Baltic Sea Region has historically played an important part in the internal as well as in foreign trade of Russia, especially in the ties of Russia with European states. Current regional situation in the Baltic Sea Shipping is characterized by considerable changes in the intensity of shipping, type and volume of the transported cargo, vessel types and in the list of the major cargo carriers.

The following basic characteristics of the Region can be highlighted:

- The volume of Russian cargo shipped across the Baltic Sea is rapidly growing and according expert's estimates will, by the year 2010 reach 185 ml tons. By the year 2010 25 ml tons of containers, 15 ml tons of coal, 11 ml tons of fertilizers will be shipped via the Baltic Sea. Current and forecasted by the experts commodity turnover puts on a serious pressure on the transportation corridors and port facilities of the Region.

- As a consequence, there is an active construction of new multi-purpose ports in the region, such as Port of Ust-Luga (design capacity of up to 35 ml tons of cargo) and oil ports: Port of Primorsk and Port of Vitino), port complex in Batareinoe.

For example, since the beginning of construction aggregate investments into construction of Port of Ust-Luga have amounted to RUR 10 bln. When the port reaches design capacity it will ensure more than 25% of all port facilities needs on the Baltic Sea.

Terminals for export shipping of oil are actively put into operation in the Port of Vysotsk. As of today the throughput capacity of this port amounts to more than 15 ml tons with future increase to 25 ml tons.

Alongside with that there is active development underway of the existing transfer complexes with the simultaneous renewal of the technical equipment of the existing ports, first of all – the Greater Port of Saint-Petersburg. At that the priority is set on the development of complexes for handling expensive and environmentally safe goods. The new distribution-transfer complexes have been built in the Port of Vysotsk.

In the last 4 years the volume of shipping via the ports of the North-Western Region of Russia increased by 2,3 times

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- one can see sharp and manifold increase in the volume of oil and oil products shipping across the Baltic Sea. Since 2005 there is active export of oil products from this part of Russia by the Russian and European companies, mostly via the ports of Primorsk and Vysotsk. The forecast for shipping of oil and oil products for 2010 amounts to 65 and 45 ml tons respectively, it is 3,8 times more than in 2003.

- Due to harsh climate conditions of the Region the major part of the coastline of the Baltic Sea and the Gulf of Finland as well as part of the Kaspian Sea is covered with ice. Ice situation lasts from November till May, that is more than half a year. Due to the activisation of the shipping situation there emerged a lot of new cargo carriers – large international transport companies, but the management and the crews of the vessels are not familiar with operation under ice conditions. Currently the largest tanker fleet operators of the Region are such companies as: Stena, Sweden (operates 69 vessels with the total deadweight of 6 ml tons), the principal area of activity – shipment of crude oil and oil products – is the leader of the world market on building high technology vessels), Sovcomflot (Cypress), Tsakos Shipping (Greece), Thenamaris Shipping, Capital Shipping, Global Shipping.

- There is constantly growing interest of the Russian companies to the exploration of the shelf deposits. Gazflot, a subsidiary company of Gazprom became a pioneer in this field – it carries out operations on the shelf of the Russian Arctic seas and abroad, using its own fleet of vessels as well as attracting fleets of other companies. Lukoil is also active in the construction of drilling platforms, including ice ones – one platform has already been built in Kaliningrad area. The construction of several ice platforms in The Pecherskoe Sea and at Sakhalin is planned yy the year 2010, drilling platforms will be built in the Azov and Black Sea.

- Further containerization of world transportation, that is increase in the share of goods being transported in containers can be seen in the Baltic Sea Region. For instance, in the Port of Saint-Petersburg in the few last years the volume of container handling has been on the rise – both in absolute values as well as in per cent. In the last 6 years the Port of Saint-Petersburg has increased his share in container turnover among the ports eastern coast of the Baltic Sea from 28% to 40%, having transferred in 2006 nearly 1559 thousand TEU. In its turn this surge in volume results in multiple load increase on container terminals of Saint-Petersburg, Kaliningrad, Archangelsk, Murmansk, which in many respects operate inefficiently, not coping with the new work loads.

- We can also see a sharp increase in passenger shipping in the Region. There is regular sea service between the capitals and the largest ports of Scandinavian countries and the North-Western part of the Russian Federation by the passenger ferries of the largest operator and manager of the Baltic passenger ferries and passenger vessels - "Silja Line". In connection with the changing social situation in the Region there appeared rather large number of small water crafts, large motor boats, private ocean going yachts. As a result, there is a dramatic shortage of qualified personnel navigating these vessels.

2. Against the background of the changing shipping situation there emerged the whole range of problems of the sea navigation and related issues of maritime education and training, which require their prompt scrutinizing and solution. They are as follows:

- the necessity of operative development and enhancement of the currently existing Vessels Traffic System at the Baltic, which can efficiently and safely cope with constantly growing traffic on seaways.

- due to the active construction of oil terminals and the sharp increase in the shipping of oil and oil products for the countries with sea borders at the Baltic the issues of utmost importance became the issues of the safety of transportation, transshipment, storage of dangerous cargoes such as oil and oil products, gas as well as a formation of the system of response to potential emergencies and preparedness to spill liquidation. At that, efficient solution of this problem in many respects depends on developing cooperation among bordering countries, expanding contacts between specialists and exchanging experience in training of personnel, involved in environmental protection programs.

- Starting with 2005 there is a noticeable interest of ship-owners exporting Russian oil from the ports of Primorsk, Vysotsk and Vitino to the simulator training courses for the navigators operating under ice conditions. It became necessary to organize a full scale specialized training of the crews of the largest tanker fleet operators at the Baltic.

- The necessity of scrutinizing the issues of environmental protection, including target training of port and terminal representatives, who are responsible oil transshipment. In particular, this is referred to in the Order of the Government № 490 as of 13.08.2006, which introduces the licensing of the activities related to transshipment of dangerous cargoes in ports and terminals.

- high demand for the organization of training of drilling platform specialists – operating and maintenance of the drilling platforms and ensuring safety measures – in particular training of the dynamic positioning operators (DP). The urgency of this kind of training in the North-West of Russia is determined by the intensive exploration of the oil and natural gas deposits on the shelf, which is connected with the operation of drilling platforms, supply vessels and pipe-lay vessels, that is vessels requiring high precision positioning. The Russian Federation does not have relevant experience, that is why we are faced with considerable problems. The high cost of the equipment, specific character of DP systems operation, high degree of risk of the environmental pollution require special training using the equipment, allowing to simulate different vessel types, navigation regions, operational conditions.

- There appeared a need for the training of port and container terminal specialists to provide personnel for newly commissioned port facilities, as well as for the effective reorganization of operations of already existing structures with the aim of optimization of the efficiency of ports operation as elements of a logistics chains and acceleration of container handling in ports.

- There appeared a need for the proper training of persons navigating small size ships and inspectors of the bodies, which control the operations of small size ships and additional training of the personnel of passenger vessels of the European lines, which call ports of the Region.

3. Keeping in mind regional, market and industry requirements starting from 2005 – 2006 Admiral Makarov State Maritime Academy initiated the whole range of new projects, training programs, developments aimed at the solution or at least smoothing out the problems that have emerged.

- The regional system ensuring safety of navigation in the Eastern part of the Gulf of Finland was developed and commissioned. The system includes efficient monitoring of vessels (upgrarded VTS RASKAT), increasing navigation efficiency within the sea coast area, environmental protection.

The training center for the VTS operators and sea pilots has been established at the Academy. Work stations for the training of operators have been connected to all three leading manufacturers of VTS equipment – Tranzas, MKIS, MKIS+.

Serious attention is being paid to the psycho-physiological aspect training of the above specialists. Together with the specialists from Saint-Petersburg Military Medicine Academy a laboratory of psycho-physiological testing and counseling was commissioned. The entire process of training and testing of pilots complies with the normative base and peculiarities of piloting practically in all ports of the Russian Federation, which have pilot services and are equipped with VTS (more than 15 ports), in the first place in the ports of the North-Western Region of the Russian Federation.

- From November 2006 the Academy carries out an educational course on transshipment of dangerous cargoes for the management and operational personnel of the ports who are involved in transshipment of the dangerous cargo. Upon a completion of the course one can receive a certificate required for granting the Company a license for transshipment operations.

- A simulator for the prevention of oil spills and fighting the consequences of oil pollution was set up at Admiral Makarov State Maritime Academy with the financial support of the Ministry of Transport. The simulator can model various navigational and meteorological conditions similar to actual conditions in the region an accident. The simulator use allows for conducting full scale exercises with the participation of the specialists from different services and departments with the aim of improving their interaction while responding to oil spills.

In the period of 2005-2006 the Russian-Finnish project SUMMERI, aimed at the ensuring safety of shipping and environmental protection in the Gulf of Finland was fulfilled. The objective of the project – development of the harmonized system for training oil pollution response specialists in Russia, Estonia and Finland.

(The risk of an accident is always present – emergency situation in the Baltic Sea in February 2007 with the Greek tanker with 110 thousand tons of oil onboard). This project consolidated the drive of the parties to join efforts in the preparation of oil pollution response specialists keeping in mind formation of unified approach to the solution of the problem of the efficient personnel interaction while reacting to oil spills.

.The project was financed by the European Union with the funds allocated for the development of transborder cooperation in the Baltic Sea Region and Gulf of Finland.

Within the framework of the project a regional Crisis Management Center was established with regional branches in Saint-Petersburg (on the basis of AMSMA), Tallinn and Kotka. The project is unique all branches are connected into one network for perfecting of interaction of forces of Russia, Estonia and Finland in response operations. The Russian party foresees active participation of the Administration of Saint-Petersburg acting through the Committee for Natural Recourses and Environmental protection.

The Crisis Management Center has been set up with the following objectives in mind:

- analytical forecasting of the emergency situations development
- expert study of the oil spill response scenarios
- conducting training and exercises for perfecting interaction
- specialized training of personnel – there are 6 different programs

An effective instrument for efficient management and elimination of emergency situations has been created. Moreover, the unique system of information, analytical and expert support for the decision making in the course of response operations has been formed.

In parallel with the creation of the Crisis Management Center the work on preparation of the set of documents on crisis management – methodology, procedures, certification, specifications of the equipment is underway. Preparation is carried out by the State Rescue on the Sea Service of the Russian Federation and AMSMA.

The study of the reaction to possible emergency situations by the coast forces and authorities – joint educational programs for the prevention and response to oil spills for the specialists of sea ports administrations, EMERCOM, special sea inspections, oil terminals, nature management committees have been prepared and implemented jointly with the Swedish Maritime Administration. The project was in part financed by the Ministry of Foreign Affairs of Sweden. In 2006 -2007 16 seminars on oil pollution response were held.

From March 2006 AMSMA is conducting training of rescuers from accident and rescue teams, working on prevention and response to oil spills. Preparation has been approved by the Central attesting commission of the transport complex of the Russian Federation.

- a program for training of the onboard personnel working under ice conditions has been developed. Training of not only Russian, but Greek, Romanian, Bulgarian, Spanish, Canadian, British officers on the specialized simulator are being conducted. At that, teaching is conducted not only in Russian but in English as well – this is a new experience for our region. For the period of 2005 – 2007 more than 200 specialists of the largest tanker fleet operators at the Baltic.

The training program includes theoretical part, which is conducted by the teachers from the Arctic department, including familiarization with different types of ice, compactness of ice, individual navigation and navigation with an ice breaker, maneuvering and mooring under ice-conditions. Practical part is being conducted on an ice simulator featuring models of the Primorsk and Vysotsk ports for perfecting elements of tanker navigating and maneuvering under various ice conditions. Training is conducting with the participation of ice pilots, who have experience of working in the Arctic. Simulator visualization is as close to the reality as possible – it allows to simulate vessel movement in crushed ice, ice field, movement in ice canal and canal compression, navigating in a convoy behind an ice breaker, entry into the ice. It is possible to track down the stress on the hull of the vessel.

Within the framework of this project AMSMA works jointly with Finnish educational organizations in order to organize practical training onboard a line Finnish tanker in real life conditions of winter navigation in the Gulf of Finland. In order to attain this goal the groups of trainees go to Kotka, Finland for 3 days of training practice.

In order to enhance and upgrade hard and software base of the simulator in the end of 2006 AMSMA signed an agreement with "Aker Arctic Technology" for the joint development of the mathematical models of vessels for simulators used for training in navigating under ice conditions. For instance, upon the order of "Stena Bulk" mathematical models of Aframax and P-max tankers were designed and installed on the simulator.

The "Aker" company has been involved in research and developed, design activities in the area of shipbuilding for Arctic conditions since 1960 and currently is one of the world's leading companies in this field. It is also planned to carry out joint educational courses in the model ice basin belonging to "Aker"..

The TACIS MSGOF (Maritime Safety in the Gulf of Finland) project has been approved and is now underway. The project is focused on summarizing of the European experience of simulator training for navigation under ice conditions, development of training methodology, preparing recommendations for the necessary level of competence. AMSMA partners in this project are Helsinki University of Technologies, Kotka Research Institute, Saint-Petersburg State Maritime University. Improvement of the training methodology for navigation under ice conditions will allow to decrease the degree of risk of possible accidents with vessels in the Gulf of Finland in the winter period.

From the beginning of 2007 the Academy gained new experience in this area – preparation of trainers in this field for other training and simulator centers (Norwegian Simulator Center and "Marstal" Navigation school, Denmark).

Another proof of the high level of training for navigation under ice conditions in AMSMA was our winning of the tender, announced by the Finnish Marine Administration for making a study DVD film for the training of the crews for navigation under ice conditions. The executor of works under this tender jointly with AMSMA are the Finnish company "Deltamarin"(sea engineering), Finnish state operator of ice breaker fleet Finstaship and Meriturva training center.

- The project "Dynamic Positioning Simulator" has been implemented at AMSMA in 2006-beginning of 2007. The aim of the project is creation of the training complex in this field of training for the crews of the vessels (mostly – supply vessels), which are servicing drilling platforms. Until now training of the drilling platforms operators was carried out only at foreign centers – in Norway, Holland, Great Britain, Singapore.

The simulator for 4 bridges and 2 models of vessels has been equipped In order to ensure high level of training of simulator instructors they have been sent for training to Aberdeen Training Center in Great Britain, which is recognized as one of the world's best in the field of training of drilling platforms operators.

Currently, training of the crews for the Russian company "Gazflot", which is servicing drilling platforms and Azeri company Svire Pasific (Baku) is underway. In the course of 1,5 years about 50 navigators have completed this program. In June voluntary certification of the course was successfully carried out in the Nautical Institute (Great Britain). That was necessary to extend the scope of potential and real customers for this kind of training.

- In the middle of 2006 AMSMA was certified to carry out training programs for the crews of small size vessels by the EMERCOM of the Russian Federation and became the first certified center in the Russian Federation for training of the small size vessels crews. Training is conducted with the help of simulators using mathematical models of small size vessels and tugboats, the simulator is equipped with the captains seat for navigating modern ocean going motor yacht.

Also, AMSMA has won a tender announced by the Inspection for small size vessels for the training of the inspectors and has been conducted this type of training since 2006; for the period of 2006 -2007 240 inspectors were trained.

Upon a request from the management of "Silja Line" 6 groups of ferry navigators of this company have undergone targeted simulator training aimed at the passage of ferries into the Port of Saint-Petersburg. The basic parts of the training were passing of the ferries through Saint-Petersburg sea channel, maneuvering in the port harborage in strong wind, interaction of the crew and pilot and shore services, peculiarities of mooring in the Port of Saint-Petersburg. To make training as close to real conditions as possible, before the preparation of the simulator training programs specialists from AMSMA went on a voyage aboard the ferry.

- in 2007 the "Containership" project was developed and approved by the European Union. The project is aimed at the training of personnel of the ports, servicing container terminals. The training program and requirements specification for the installation of the cargo handling simulator for the personnel are being developed within the framework of the project.

The joint program with the Russian Maritime Register of Shipping has been developed and implemented on the regular basis. The aim of the program is to provide training to the management of the companies regarding the issues of organization of shipping goods (cargo) in containers.

Thus, in conclusion one can say that regional maritime education of the North-West of Russia promptly reacts to the current requests of the modern shipping industry in particular as well as developing economy of the region in general. The market of maritime educational and research and development services offers study programs, scientific-research and methodology developments, technical solutions thus creating modern comprehensive educational infrastructure facilitating further favorable and safe development of shipping and economy of the North-Western Region of the Russian Federation.

Shipping Companies Policy to Improve the Seafarer's Competency

Radu Hanzu-Pazara[1], *Paulică Arsenie*[2]

Abstract

The present paper wants to present how it is possible to build strong relationship between shipping companies and seafarers and through the companies to have competent seafarers on board their vessel.

There is an identified and global need to improve the image of the shipping industry and the attractiveness of the seafaring profession, if competent people are attracted into it. Suggestion for improvements includes better rewards, a different or changed shipboard environment, improved working and living conditions, better communications between ship and shore and seafarers and their families. The decision takers should listen more to the seafarer and get closer to the contemporary life at sea, to understand their difficulties better. More attention might be paid to supporting families, scholarships for seafarer's children, better medical insurance for their families, better identified career path, or at the very least, more information about the link between seafaring and the maritime infrastructure. The recruitment must be done according to international regulations, but it is important to take care of a seafarer' nationality and cultural personality. Regular courses are necessary to keep the competency level of seafarers up to date.

Companies need to have specialized departments for recruitment regarding area of working on board, as deck or engine, with good professional people, able to decide the right level of seafarers' competency and, if necessary to recommend the proper training to reach this level.

1. Introduction

From the beginning of navigation activities there exist two participants, which must be in strong relationship: the owner, shipping company and the seafarers. One without the other can't comply their activities and aspirations.

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For these reasons both of them have to be able to offer satisfaction through competence and high level of skills. The competences and skills are reached through necessary level of acknowledge, as education and training.

Inside the company people able to coordinate the activities, good managers and personally well known people realize these. Is difficult to use for recruitment of seamen persons who never live on sea or didn't have contact with this activity. To be able to ask, first you must be a good connoisseur of activity, live inside and have had a good reputation in activity.

On the other side, as seafarer, the first requirement is to prove to have the proper training and skills for this activity.

Many countries have specialized schools for teaching navigation and engineering for marine activity. In the past, the seamen were accepted only if they wanted to participate in activities on board vessels, without any special training, in the present time, in accordance with the Conventions and Regulations active in domain, these must be first trained and after accepted onboard.

The STCW Convention present the minimum standards required, but many shipping companies have their own levels of training and offer this training to their employees.

This relation, company-employees, is able to be a good one, if, the companies pass over their own necessities and cover some of the seamen necessities, as, a good life on board, safety and security in working process, a good life ashore, care of their family through social programs, possibility to advance inside the company in case of a good activity and many others.

2. Improvement of Shipping Companies' Policy

A number of threads appeared to emerge from both the formal contributions and interventions, which support the concern, felt about the growing shortage of quality recruits for both ship and shore, and the potential which this problem has to grow to serious proportions. The lack of reward throughout the industry, its lack of positive images and the fact that marine transport is "taken for granted" are handicaps which need to be addressed.

There is an identified and global need to improve the image of the industry and the attractiveness of the seafaring profession, if good people are to be attracted into it. Suggestions for improvement include better rewards (more money), a different or changed shipboard environment or updated organisation, improved working and living conditions, better communications between ship and shore and seafarer and family. It is suggested that decision takers should listen more to the seafarer and get closer to the contemporary life at sea, to better understand their difficulties. More attention might be paid to supporting families, such as the financing of scholarships for the children of seafarers. It is suggested that there should be a more formal, better identified career path (or at the very least, more information) about the link between seafaring and the maritime infrastructure. If the skills base of European countries is to be enhanced or even preserved a fresh look perhaps needs to be taken at incentives to employ European seafarers, and to encourage their recruitment and retention. The blame cultur and the increasing desire to criminalise those who make mistakes is a serious problem that puts good managers off the industry and makes the attraction of good seafarers into the profession very difficult. It is a disincentive to the industry as a whole, not a positive encouragement to addressing the problems of human error.

An open culture within the company, where seafarers can report and discuss accidents and incidents and near misses would be an improvement to one in which seafarers are afraid to reveal such matters.

It is recognised that "under-qualified crews just won't work in the demanding and sophisticated ships of the present and future". There is thus concern about whether sights have been set too low with the STCW 95 requirements, which is manifesting itself, in general unease over the IMO "White List". There is great concern that chaos will result from individual administrations and even companies putting their own interpretations on the acceptability from abroad. Nevertheless, the White List is seen by many as a useful instrument which indicates a certain minimum standard. There is uncertainty about how much it is the responsibility of the company to train and develop trained labour sources with some regarding this as a public responsibility, others that of the employer. Training with simulators was seen as offering more potential than that of more theoretically based training

3. Seafarer's Safety Culture Through Competence

The STCW Committee recognized the need to promote technical knowledge, skills and professionalism of seafarers. Resolutions draws attention to the role of the revised Convention in the improvement of seafarer competence but also made recommendations on the selection of personnel exhibiting the highest standards of professionalism; encouragement for the training of junior officers and the adoption of measures to encourage pride of service and professionalism in the personnel that shipping companies employ. Some of these ideas perhaps sound a little old-fashioned these days but to meet the aim of the safety culture, it is in the professionalism of seafarers that it must take root.

That culture is more than merely avoiding accidents or even reducing the number of accidents, although these are likely to be the most apparent measures of success. In terms of shipboard operations, the competence to do the right thing at the right time in response to both normal and emergency situations is part of the training required to meet the STCW Convention standards. The quality and effectiveness of that training will play a significant part in determining the attitude and performance - the professionalism - the seafarer will subsequently demonstrate in his, or her, work. And the attitude adopted will, in turn, be shaped to a large degree by the "culture" of the company.

It is relatively unusual for new types of accidents to occur on board and many of those that continue to occur are due to unsafe acts by seafarers. These errors, or more often violations of good practice or established rules, can be readily avoided. Those who make them are often well aware of the errors of their ways. They may have taken short-cuts they should not have taken. Most will have received training aimed at preventing them but, through a culture that is tolerant to the "calculated risk", they still occur. The challenge for trainers and training, and managers ashore and afloat, is how to minimize these unsafe acts, how to instill the skills, and importantly the attitudes, necessary to ensure safety objectives are met. The aim should be to inspire seafarers towards firm and effective self-regulation and to encourage their personal ownership of established best practice. Internationally recognized safety principles and the safeguards of best industry practice have to become an integral part of an individual's own standards.

The competence-based approach at the heart of the STCW Convention seeks to identify those skills that are keys to safe and efficient shipboard operations. The Convention does not, and could not, identify all of the myriad of competences that are required in every situation on every type or size of ship. It concentrates on the core competences and establishes the specification of the minimum international standard for those competences. The training requirements in the STCW Convention almost certainly therefore require amplification to meet the demands of many sectors of the shipping industry. Nevertheless, the revised STCW Convention forms a sound foundation for safe ship operation. Many of the accidents and incidents that continue to occur could arguably have been prevented had seafarers met the minimum standards of competence and owners and managers fulfilled their obligations in the STCW Convention and Code. The STCW Code, recognizes the importance of establishing detailed mandatory standards of competence and other mandatory provisions necessary to ensure that all seafarers are properly educated and trained, adequately experienced, skilled and competent to perform their duties.

4. Seafarer's Training Process

At first sight the familiarization training for those new to the sea is very basic and, perhaps to many seafarers rather obvious, covering as it does such issues as safety information, emergency signals and what to do in the event of certain incidents. Unfortunately however, before the introduction of this mandatory international requirement, the safety of the new seafarer may not have been a priority and, in too many cases, simple instruction in basic safety matters was ignored. Yet, if we are to instill the safety culture in all who go to sea, what could be more appropriate than receiving familiarization in safety before being assigned work on a sea-going ship?

Company responsibilities for familiarization training are not limited to those unfamiliar with life at sea. For those who are newly joined and taking up their duties as master, officer or crew, companies have a responsibility to familiarize them with the ship's arrangement, equipment, procedures and characteristics relevant to both routine and emergency duties. For those seafarers new to a particular company's ship, this introduction will establish at the outset the "culture" of the company. Where appropriate importance is given to ensuring sufficient time is made available, requirements are carefully explained and safety issues are given priority, the seafarer will doubtlessly adopt the same methodical and safety-oriented approach to his duties.

Faced with the opposite scenario: a poor, rushed ineffective familiarization with his new ship, the average seafarer is likely to adopt the same approach to his duties, possibly with dangerous and expensive results. There is therefore a clear benefit to be gained from investing time and effort to develop a culture of safety within a company; starting with the first impressions gained during familiarization training.

A safety culture cannot be engendered within an organization by order or decree but must be inherent in the way a company operates and a seafarer responds to the demands of his job. The professional response needed from the seafarer can however be developed and encouraged through appropriate training.

The STCW Convention contains criteria for evaluating competence. These criteria strongly support the adoption of a professional approach to the functions undertaken on board through recognition of, and demonstration of the application of, established principles and procedures. The application of these principles and procedures should ensure the maintenance of international standards and the development of a safety culture. If the company environment supports rather than resists these norms, then the culture of the short-cut or "near enough is good enough" approach will be effectively nullified. For the higher levels of training the approach goes further. The criteria established for evaluating competence are strongly safety culture-oriented as they are proactive and in many cases require the seafarer to demonstrate his ability to promptly and fully identify potential non-compliance.

Those officers who can really make a difference to the culture on board are those in the highest management positions. Indeed, one of the competences required for certification is to organize and manage the crew. In order to meet the criteria for evaluating competence, a potential management level officer (master, chief mate, chief or second engineer) must ensure that the crew are allocated duties and informed of expected standards of work and behavior in a manner appropriate to the individuals concerned. Setting expected standards and acceptable behavior are at the heart of developing and maintaining a safety culture on board.

The manner in which the message is conveyed is also important in these days of multi-cultural and multi-lingual crews. Harsh words and treatment may bring about acceptable standards and behavior in the short term but, without the right approach, a proactive and self-regulating safety culture is unlikely to thrive.

The same holds true for those who are involved in the management and operation of the ship. If the activities of those who work in the shipping company ashore are not guided by the same safety principles they are unlikely to thrive in isolation on board.

Responsibility for establishing the operational culture on board lies with the company and is a clear objective of the ISM Code. The difficulty for the seafarer, particularly the master at times, is maintaining the safety first approach in the face of pressures outside of the ship and company. Pressures from port authorities, pilots, stevedores, agents and others with an investment in the ship and its cargo but not necessarily an interest in the safety of the crew. Clear and unequivocal guidance and support from the company, as required by both STCW and the ISM Code, are vital to maintain the safety culture on board in the face of these pressures.

The way forward is, on the face of it at least, clear. Seafarers need to be adequately rested before assuming their responsibilities if they are to do so effectively and efficiently.

Regrettable is that the safety culture is not yet sufficiently strong or widespread for those involved to see the benefits of adopting working practices that prevent fatigue without having them established internationally.

The essence of a safety culture is taking the safe approach rather than necessarily the quickest, easiest or cheapest. When faced with a task to be done or an objective to be met the seafarer must make decisions on the information available using sound principles and procedures to guide him, or her. The principles to be observed for watchkeeping on the bridge, in the engine room, at sea and in port are not new but provide the foundation for safe watchkeeping. The overriding objective of these principles is safety in maintaining a watch on board. The issues to be considered are clear and the safe approach made explicit. The watchkeeper adopting fully the principles in STCW will have embraced the principles necessary for the development of a safety culture.

Once developed and instilled in a seafarer, the safety culture has to be maintained.

The STCW requirements and responsibilities on companies, coupled with the introduction of the safety management systems required by the ISM Code, should ensure that the working environment on board is a safe one. The ISM Code objectives of continuous improvement in safety management skills should establish the climate for an on-going commitment to safety. In this climate the well-trained and professional seafarer can properly adopt the safety culture so necessary to the successful completion of any maritime venture.

5. Companies Involved in Seafarer's Family Life

In many countries families are very important for seafarers, in spite of the short time spent with the family. According to the present policy of working at sea, usually the time spent at home is shorter than period at sea, like 4 to 6 months on board with 2 to 3 months ashore. During time of on board activity, the family keeps contact with the seafarer through company. This fact must conduct to a pleasant relation between family members and company personnel responsible for this.

The company have obligation to take care of the seafarer's family in order to obtain a good response from this in his activity on board. In case of worries about the home family, the activity of seaman onboard will be seriously affected.

Many officers and crewmembers work at this moment inside of foreign or international shipping companies and the contact with the families is done via the company agent in the country of origin.

Almost all companies have a department for personnel management or personnel relations, department in charge with the social relations of the company. But, the agency in the seafarer's native country doesn't have one. This part of activity is covered by the personnel manager or by the one of the agency employees. As usual the agency has only one manager, who is the owner of the agency, the other person always covers this responsibility. This person can be one without social relations skills and for this reason can result communication problems, problems that affect the seafarer and ship owner company in the end.

At this moment in Romania over 80% of seafarer's are under contract with an international shipping company. The good payment level and work conditions are the first elements in their decision. Anyway this option has the inconvenience of non-payment of social and medical insurance to the state administration. In many cases the seafarers' wives are housewives and neither of them have the insurance covered. Solution is the private medical insurance and private allowance.

A good solution will be for the company to undertake the responsibility of covering these insurances and in this way to fidelities his employees. From the company point of view, the seafarers are insured by company insurance, ship insurance and P&I insurance. These insurances are available only on duty period not and on time spent at home.

The contribution to the retirement found also must be supported by the company, even if for the period of activity inside the company, on board their own ship.

Usually the seafarer's children are attracted by a career on the parents steps, that is a career at sea. Many of these follow a medium or high form of training, in maritime lyceum and universities according to the parents' rank. The attraction is generated by the stories about the life at sea and the adventure aspects of this.

Company can interfere in this problem through a scholarship accorded to this young future seafarer, in this way stimulating their efforts for a high level of training and, in the end to have a good professional person onboard.

6. Conclusions

The level of competences for seafarers can be reached in many ways. The minimum level of these are stated in present Conventions in force, but for a good operation of ships need to pass over these, to reach the high standards of training, to have seafarers familiarized with the latest technology used in navigation and for the ship engine.

The first step can be done during their school training, using the technology as simulators and the presentation of the present and future state of maritime industry. Ships evolved and implicit must evolve the people who work on it. Maybe, for the moment there is a period of stagnation in interest for this industry, but the future can be very attractive for the people interested to perform a career in the area.

After the training standard is reached, the shipping company must do the next step, in order to wake up the interest of the seafarers to stay in this industry. In this way, companies have to make few changes of their policies and conceptions and to start a new age of the owner-employee relation. Implication of company in the private life of the seafarers will be made with precautions, preparing for these activity persons with a good skill in social and personal relations.

The persons on board the ships are very affected by the events produced at home and to avoid these, the company can develop a program to sustain the seafarers' families, this including the insurance covering, interest about family problems and scholarship for the seafarers' children interested to follow this career.

7. References

1. The impact of seafarers living and working conditions of changes in the structure of the shipping industry, Report for discussion at the 29th Session of the Joint Maritime Commission, International Labour Organization, Geneva 2001
2. IMO Assembly Resolution financial for seafarers, IMO Assembly Resolution A.930(22), adopted on 29 November 2001
3. Guidance on shipboard assessments of proficiency, IMO The Maritime Safety Committee, 11-20 May 1998
4. The human element, Copenhagen quality shipping conference, 2000
5. www.imo.org
6. www.ilo.org

Using Checklists to Guarantee the Effectiveness of Safety Drills Conducted by Shipping Companies with Examples from Some Egyptian Shipping Companies

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Abstract

The ISM code entrusted shipping companies with the task of conducting effective safety drills on the basis of the type of ships they operate and the most probable hazards encountered by such ships.

Considering the rationale underlying the ISM Code, which states that safety should become an inherent attitude resulting from repetitive effective safety drills, it follows that shipping companies should concentrate not only on the frequency of conducting safety drills but also on the effectiveness of safety drills. It is obvious that the effectiveness of any safety drill as a macro activity which depends on the analysis of the macro activity into its constituent micro activities, such as the fire-fighting scenario checklist developed in the west of England.

To achieve this target, IMO has issued and recommended the use of checklists for this purpose, an example of which is the checklist of the precautions that should be taken before entering any enclosed space.

This paper focuses on the development of safety checklists, together with examples from the national shipping companies.

Keywords: ISM Code, safety culture, safety drills, macro and micro activities and safety checklists.

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1. Introduction

The International Safety Management (ISM) Code was adopted by the IMO Assembly at its eighteenth session on the 4th of November, 1993, by resolution A.741(18). The mandatory requirements of this Code, which were included in the SOLAS Convention as chapter IX in 1994, aim at assisting shipping companies in the *development of a safety management system* to meet the SOLAS provisions. In November 1995, the nineteenth IMO Assembly adopted guidelines for the implementation of the ISM Code by Administrations (resolution A.788(19). The guidelines provide information on *the survey and certification procedures* that will be applied by governments. It should be noted that the ISM requirements will be implemented through *national legislation* by flag administrations, and shipping companies should make themselves familiar with the rules and procedures that are applicable to them, in addition to the organization and conduct of *internal auditing*, which – according to Section 12 of the ISM Code – should be carried out to verify whether their safety and pollution prevention activities comply with their safety management systems. The success of the ISM Code depends on effective internal auditing by shipping companies.

2. The Objectives of the ISM Code

The objectives of the Code are to ensure safety at sea, prevention of human injury or loss of life, and avoidance of damage to the environment, in particular to the marine environment and to property. Therefore, the safety management objectives of the Company should:

- *provide for safe practices in ship operation and a safe working environment;*
- *establish safeguards against all identified risks; and*
- *continuously improve safety management skills of personnel ashore and aboard ships, including preparing for emergencies related both to safety and environmental protection.*

(ISM Code, 1.2, Objectives)

It is clear that identification of risks is a prerequisite to the preparation of safety drills, the success of which depends on the preparation of safety checklist.

3. Assignment of Responsibilities

A basic feature of the ISM Code is the clear assignment of responsibilities to ensure proper implementation of the ISM requirements. For example, to ensure the safe operation of each ship and to provide a link between the company and those on board, every company should designate a person or persons ashore having direct access to the highest level of management.

The master's responsibility with respect to implementing the ISM Code is clearly defined. The master is responsible for:

- *implementing the safety and environmental protection policy of the Company;*
- *motivating the crew in the observation of that policy;*
- *issuing appropriate orders and instructions in a clear and simple manner;*
- *verifying that specified requirements are observed; and*
- *reviewing the SMS and reporting its deficiencies to the shore based management.*

(ISM Code, Item 5)

The responsibilities of the shipping company are also clearly defined. A shipping company is responsible for ensuring that:

- *the master is qualified for command and fully knowledgeable of the Company's SMS;*
- *each ship is manned with qualified, certificated and medically fit seafarers in accordance with national and international requirements;*
- *procedures to ensure that new personnel and personnel transferred to new assignments related to safety and protection of the environment are given proper familiarization with their duties;*
- *all personnel involved in the Company's SMS have an adequate understanding of relevant rules, regulations, codes and guidelines;*
- *procedures for identifying any training which may be required in support of the ISM requirements are established; and that*
- *the ship's personnel are able to communicate effectively in the execution of their duties related to the SMS.*

(ISM Code, Item 6)

4. Emergency Preparedness

The ISM Code stresses the importance of being prepared to face emergencies through the preparation and execution of safety drills. The Company should establish procedures for the preparation of plans and instructions for key shipboard operations concerning the safety of the ship and the prevention of pollution. The various tasks involved should be defined and assigned to qualified personnel. The ISM Code requires shipping companies to:

- establish procedures to identify, describe and respond to potential emergency shipboard situations;
- establish programmes for drills and exercises to prepare for emergency actions; and
- provide for measures ensuring that the Company's organization can respond at any time to hazards, accidents and emergency situations involving its ships.

It is clear that the ISM Code follows a systematic approach to the issue of safety which comprises (1) *identification of potential emergency situations*, (2) *preparation of effective safety drills*, and (3) *ensuring the efficacy of safety drills by using the technique of analyzing each macro hazard into its micro hazards and designing the required safety checklist*.

5. The Concept of Macro and Micro Skills

An important feature of the STCW95 Code is the analysis of macro skills into their constituent micro skills. In the STCW 78 macro skills were presented without further analysis. This was remedied in the STCW95 Code which presents Competency Tables containing the micro skills required to practicing a macro skill, which is the basis of preparing safety checklists. Table 1. illustrates this point:

Table 1. *The Micro Skills of Handling a Ship*

Competence	Knowledge, Understanding and Proficiency
Maneuver and handle a ship in all conditions.	Maneuvering and handling a ship in all conditions, including: 1. Maneuvers when approaching pilot stations and embarking or disembarking pilots with due regard to weather, tide, heard each and stopping distances. 2. Handling ship in rivers, estuaries and restricted waters, having regard to the effects of current, wind and restricted water on helm response. 3. Application of constant rate of turn techniques. 4. Maneuvering in shallow water, including the reduction in under- keel clearance caused by squat, rolling and pitching. 5. Interaction between passing ships and between own ship and nearby banks (canal effect).

	6. Berthing and unberthing under various conditions of wind, tide and current with and without tugs. 7. Ship and tug interaction. 8. Use of propulsion and maneuvering systems. 9. Choice of anchorage with one or two anchors in limited anchorages and factors involved in determining the length of anchor cable to be used. 10. Dragging anchor, clearing fouled anchors. 11. Dry-docking, both with and without damage. 12. Management and handling of ships in heavy weather, including assisting a ship or aircraft in distress, towing operations, means of keeping an unmanageable ship out of trough of the sea, lessening drift and use of oil. 13. Precautions in maneuvering to launch rescue boats or survival craft in bad weather. 14. Methods of taking on board survivors from rescue boats and survival craft. 15. Ability to determine the maneuvering and propulsion characteristics of common types of ships with special reference to stopping distances and turning circles at various drafts and speeds. 16. Importance of navigating at reduced speed to avoid damage caused by own ship's bow wave and stern wave. 17. Practical measures to be taken when navigating in or near ice or in conditions of ice accumulation on board. 18. Use of, and maneuvering in and near, traffic separation schemes and in vessel traffic services (VTS) areas.

(Source: STCW Code Competency Tables)

It is the analysis of a given macro activity into its micro activities which enables the designer of a safety checklist to check the performance of each micro activity. Another example of this type of analysis is the scenario of a fire exercise checklist presented in Table 2.

Table 2. *Sample Checklist Based on Micro Skills Scenario of a Fire Exercise*

#	Checklist	Check
1	Are muster lists posted conspicuously?	
2	Are muster lists full up to date?	
3	Was the fire/general emergency alarm sounded correctly?	
4	Did all the crewmembers appear to be familiar with their designated muster stations?	
5	Were all the crewmembers wearing their lifejackets?	
6	Were all lifejackets worn correctly?	
7	Were all crewmembers wearing safety helmets?	
8	Was it possible to distinguish officers from ratings?	
9	Was a roll-call held?	
10	Did the crew appear at their fire/general emergency muster stations promptly, suitably clothed?	
11	Were the checklists used during the roll-call?	
12	Were fire parties properly briefed and dispatched?	
13	Was the emergency fire pump activated without difficulty?	

14	Did the designated crewmembers appear to be familiar with the operation of the emergency fire pump?	
15	Was a satisfactory head of water pressure obtained?	
16	Were hoses and nozzles used correctly?	
17	Was the fire-fighting strategy appropriate to the situation? (e.g., sufficient hoses, boundary cooling, water walls, etc.)	
18	Were portable fire extinguishers used correctly?	
19	Were fire-flaps, remote closing appliances and other safety devices tested during the exercise?	
20	Was the breathing equipment worn correctly?	
21	Were spare cylinders available for use?	
22	Did crew members appear to be familiar with the operation of the breathing equipment?	
23	Was a lifeline attached to each crewmember using breathing equipment?	
24	Was the casualty rescued promptly and safely?	
25	Was the stretcher used correctly?	
26	Was first aid administered promptly and correctly?	
27	Did the crewmembers appear to communicate effectively?	
28	Did the crewmembers function well as a team?	

(West of England, 1995, Ship Safety Appraisal)

6. The Principles of Designing and Implementing Safety Checklists

6.1. Introduction

The objective of this section is to extract the principles of designing and implementing safety checklists by examining the published safety checklists by international organizations engaged in the field of improving safety practices in varied sectors. The National Institute of Occupational Safety and Health is one of such organizations.

6.2. The Benefits of Implementing a Safety Checklist Programme

A Safety Checklist Programme can benefit organizations, especially shipping companies, by helping them do the following:

- Improve the safety and health environment in the shipping company and its ships.
- Prevent injuries and illnesses among seafarers serving on board the Company's ships.
- Increase awareness of occupational safety and health on board ships.
- Find out the agencies which regulate safety and health in the maritime sector.
- Identify the regulations that may apply to seagoing ships.

- Set up a checklist programme in the shipping company that will help the company's personnel serving ashore and at sea analyze the possible hazards for each type of ship operated by the company. It should be noted that each checklist is designed to correspond to specific environmental, safety, and health conditions.
- Prepare for and participate in safety inspections both ashore and at sea.
- Help seafarers to learn about (1) the regulations relating to particular hazards, such as collisions at sea, (2) the benefits of using checklists to comply with these regulations.
- Detect areas that need improvement in the working environment of the shipping company both ashore and at sea.
- Find sources for more information about regulations, technical assistance, and educational materials.

6.3. Ensuring the Effectiveness of Safety Checklists Programmes

It should be noted that certain important considerations should be taken into account when designing a safety checklist. Safety checklists developers and designers should remember the following considerations:

- The occupational safety and environmental safety programme should be tailored to the needs of the shipping company.
- Considering that shipping companies operate different types of ships, and that certain hazards are associated with certain types of ships and cargoes, the first step in designing a safety checklist is to identify the hazards associated with the ships operated by the shipping company. This is emphasized in the ISM Code:

  8. EMERGENCY PREPAREDNESS

  8.1. The Company should establish procedures to identify, describe and respond to potential emergency shipboard situations.

  8.2. The Company should establish programmes for drills and exercises to prepare for emergency actions.

  8.3. The SMS should provide for measures ensuring that the Company's organization can respond at any time to hazards, accidents and emergency situations involving its ships.

  (ISM Code, Item 8)

It is important that cases of non-conformity should be reported to make sure that corrective action will be taken:

9.1. The SMS should include procedures ensuring that non-conformities, accidents and hazardous situations are reported to the Company, investigated and analyzed with the objective of improving safety and pollution prevention.

9.2. The Company should establish procedures for the implementation of *corrective action*

(ISM Code, Item 9)

- Top administration should issue a written policy supporting a safety checklists programme.
- Adequate financial resources should be available.
- Any safety checklists programme should be evaluated and updated periodically.
- Newsletters and bulletin boards should be used to communicate new safety procedures and assignments.
- All accidents should be investigated. Accidents report forms should have a space to answer, "What were the causes of the accident?", and "What precautions or controls could have prevented the incident?"
- Emergency response plans and procedures should be prepared when designing a safety checklist programme.
- Part of the success of a safety checklist programme is to ensure adequate maintenance of the safety equipment available. Equally important is the provision of personal protective equipment (PPT), e.g., respiratory protection equipment. Such items include welders' masks, hard hats, safety goggles, etc.
- Those in charge of developing and designing safety checklists programmes should seek expert advice when necessary. External advice is sometimes necessary.
- The development and design of a safety checklist programme should be accompanied by an effective safety training programme. Training should cover the response actions and use of the safety equipment necessary to handle a given emergency situation.

6.4. SAFETY CHECKLIST FLOWCHART

The reader is kindly requested to refer to Appendix A to examine the safety checklist flowchart used by NIOSH. Although it is general in nature, it can be tailored by the shipping company to suit the objectives of the safety policy of the Company.

6.5. THE DESIGN CHARACTERISTICS OF SAFETY CHECKLISTS

Examining the design characteristics of the safety checklists developed and published by both NIOSH and Seton revealed the following design characteristics:

6.5.1. GUIDELINES

A safety checklist begins with guidelines presenting the source of the safety regulations which necessitate the preparation of a given safety checklist and the situations in which it is to be used.

Example

Guidelines: This checklist covers regulations issued by the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA). It applies to fire detection and alarm systems and to fire and emergency action plans. The ideal fire and emergency action plan, however, should include all the requirements. Fire alarm and detection systems installed in full compliance with existing building codes may be upgraded to meet existing code regulations. Detailed annual testing requirements of automatic and manual fire alarm systems and fire detection systems have not be included in this checklist.

(Source: NIOSH)

6.5.2. COMMENTS AND CORRECTIVE ACTION

A safety checklist ends with a box for comments and the corrective action required to improve the safety checklist.

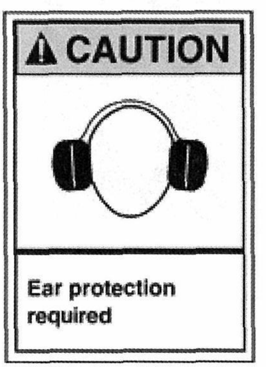
6.5.3. USING ILLUSTRATIONS

Using illustrations where appropriate is of great importance in clarifying the safety checklist, especially in the case of warnings and reference to safety equipment. Some illustrations extracted from Seton Compliance are listed below.

Examples

(A) Warnings associated with certain hazards.

(B) Warnings associated with protective equipment



Such illustrations reinforce the safety checklist questions.

6.5.4. The Need for Experts

A safety checklist includes remarks concerning the importance of having an expert in a given situation. A symbol is used to indicate this requirement. The following example is from NIOSH.

	Is the electrical wiring and equipment located inside the storage room especially designed to prevent possible ignition of any released flammable vapors?	Yes	No

(Source: NIOSH)

6.5.5. Branching of Checks

For perfection and comprehensiveness purposes, a safety check is sometimes branched to cover all the factors included in a given check. The following example illustrates this point:

25	**Is a written fire prevention plan available that includes the following items?**	**Yes**	**No**
	• Emergency escape procedures, signals, and routes.	___	___
	• Procedures for designated employees who must remain in the facility to shut down equipment before they evacuate.	___ ___	___ ___
	• Procedures to account for all building occupants.	___	___
	• Rescue and medical duties.	___	___
	• Preferred mechanisms for building occupants to report emergencies .	___	___
	Names and job titles of people who can be contacted for more information regarding evacuation plans	___	___

(NIOSH, Fire Prevention Safety Checklist)

6.5.6. Appendices to Provide Clarifications and Definitions

Analysis of the safety checklists published by NIOSH indicates that appendices are used to provide definitions of the terms used in the safety checklist to maintain consistency throughout the whole checklist. The following examples are extracted from NIOSH safety checklists programme.

An example of definitions

- *Dust mask: a filtering face piece type respirator.*
- *Engineering control: physical changes to equipment and operations to reduce exposure to air contaminants. Engineering controls may include: adding local exhaust ventilation, changing to better equipment that release less air contaminants and enclosing operations to prevent exposure.*
- *Filtering face piece (dust mask): a negative pressure particulate respirator*

with a filter as an integral part of the face piece or with the entire face piece composed of the filtering medium.

- *Immediately dangerous to life or health (IDLH): an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.*

(NIOSH, Appendix D)

An example of clarifications

You should do the following when using respirators:

1. *Read all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.*
2. *Choose respirators certified for use to protect against the contaminant of concern. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.*
3. *Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect against gases, vapors, or very small solid particles of fumes or smoke.*
4. *Keep track of your respirator so that you do not mistakenly use someone else's respirator.*

(NIOSH, Appendix D)

7. Field Studies

This part presents the results of comparing the collected checklists with their classical counterpart, i.e., Fire-fighting and Entry Into Enclosed Spaces. For the purpose of this study, the checklist technique was used in interviews held by the researcher in 5 Egyptian Companies.

With respect to Fire Fighting, comparing the companies' firefighting safety checklists with the classical counterpart: Table 2 gave the following indicators:

Shipping Company 1	No checks with respect to: posted muster lists, full up-to-date muster lists, familiarity of crewmembers with designated muster stations, wearing lifejackets , safely helmets, distinguishing officer from ratings, roll-call, suitably clothed, crew appearing at fire/general muster station, breathing equipment, stretcher and first aid.
Shipping Company 2	No checks with respect to: posted muster lists, full up-to-date muster lists, familiarity of crewmembers with designated muster stations, distinguishing officers from ratings, roll-calls, stretcher.

Shipping Company 3	No checks with respect to: micro skills, familiarity of crewmembers with designated muster stations, safety helmets, distinguishing officers from ratings, roll-calls, spare cylinders, providing prompt rescue services.
Shipping Company 4	No checks with respect to: Firefighting missing micro skills, availability of the following items: familiarity of crewmembers with designated muster stations, safety helmets, distinguishing officers from ratings, roll-calls, spare breathing apparatus cylinders, and rescuing casualties.
Shipping Company 5	No checks with respect to: posted muster lists, full up-to-date muster lists, wearing lifejackets, safety helmets, distinguishing officers from ratings, fire parties, breathing equipment, spare cylinders, lifeline, using breathing equipment and stretcher.

With respect to Entry Into Enclosed Spaces, comparing the companies' checklists with the classical counterpart in Appendix B gave the following indicators:

Shipping Company 1	Identical to the classical checklist.
Shipping Company 2	No checks of: Section 1: approved type of portable type, Section 2: section 1 not completed as necessary.
Shipping Company 3	Identical to the classical checklist.
Shipping Company 4	Identical to the classical checklist.
Shipping Company 5	No checks of Section 3: familiarity with breathing apparatus and testing it.

8. Conclusion

The issue of preparing and using safety checklists by Egyptian shipping companies should be given more attention.

References

1. Bradely, R., (1998) 'Developing a Safety Culture: a flag state perspective', BIMCO Review, Denmark, pp. 54-58.
2. Chaurel, A., (1998) 'Managing Safety and Quality in Shipping', BIMCO Review, Denmark, pp. 91-92.
3. IMO Website, <http://www.imo.org/>
4. Kaps, H., (2000) 'Management of Emergencies: The Curriculum Approach in MET', IMLA, Sweden, pp. 84-93.
5. Mathiesen T., (1994) 'Safety in Shipping: An Investment in Competitiveness', BIMCO Review, Denmark, pp. 56-58.
6. National Institute of Safety and Health, <http://www.cdc.gov/niosh/docs/2004-101/>

7. Pattofatto, G., (1994) 'The IMO Safety Management Code', BIMCO Review, Denmark, pp. 30-32.
8. Przybylowski, A., (2001) 'Standards of Environmental Management and Quality Assurance that should be incorporated into Maritime Safety Management System', IAMU, Japan, pp. 129-133.
9. Seton Compliance Centre., <http://www.setonresourcecenter.com/safety/checklists/comply.htm>
10. Valkonen, H., (2001) 'The Culture of Safety at Sea', IMO News, issue 4, London, pp. 10-13.

APPENDIX A

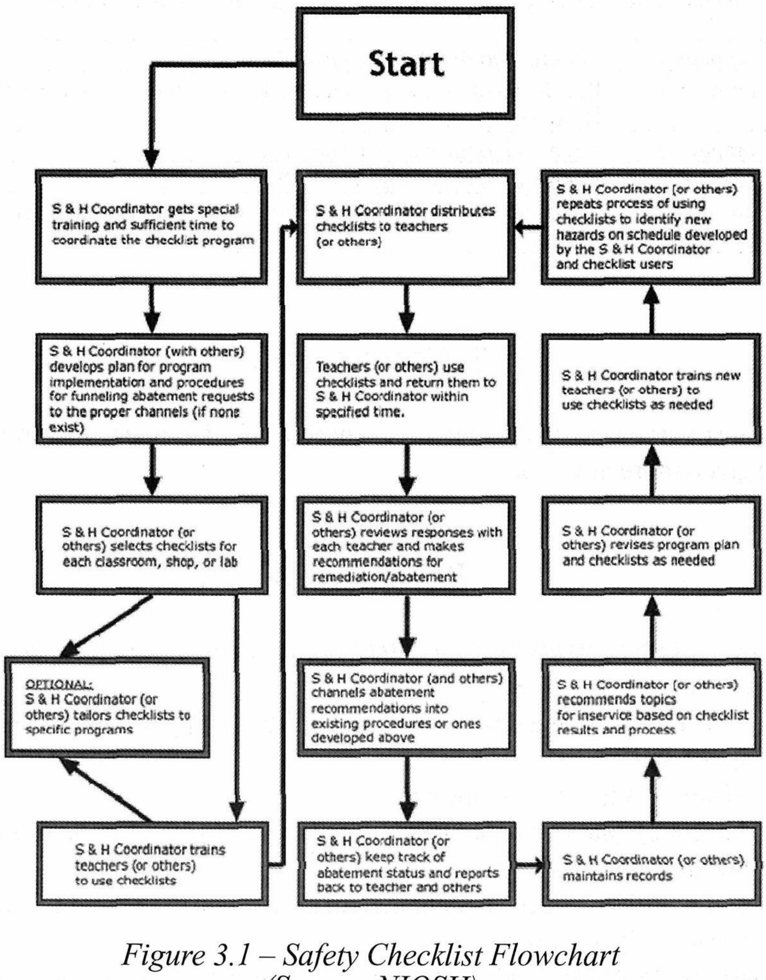
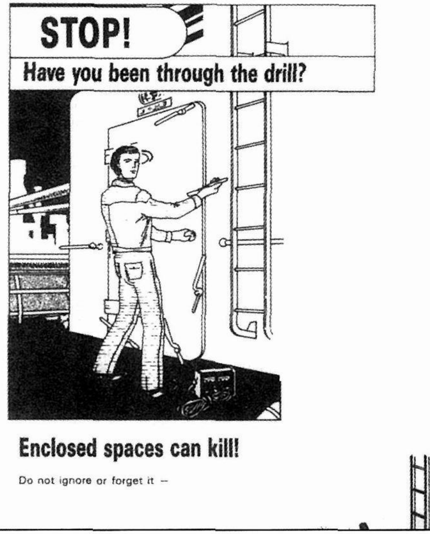


Figure 3.1 – Safety Checklist Flowchart
(Source: NIOSH)

Appendix B – Safety Checklist



Before entering any enclosed space all the appropriate checks listed here must be carried out by the master or responsible officer and by the person who is to enter the space

Recommended poster for display on board ships in accommodation or other places, as appropriate

Section 1

To be checked by the master or responsible officer

1.1 Has the space been thoroughly ventilated and where testing equipment is available, has the space been tested and found safe for entry?

1.2 Have arrangements been made to continue ventilation during occupancy of the space and at intervals during breaks?

1.3 Are rescue and resuscitation equipment available for immediate use beside the compartment entrance?

1.4 Have arrangements been made for a responsible person to be in constant attendance at the entrance to the space?

1.5 Has a system of communication between the person at the entrance and those in the space been agreed?

1.6 Are access and illumination adequate?

1.7 Are portable lights or other equipment to be used of an approved type?

When the necessary safety precautions in section 1 have been taken, this card should be handed to the person who is to enter the space for completion

Section 2

To be checked by the person who is to enter the space

2.1 Have instructions or permission been given by the master or a responsible officer to enter the enclosed tank or compartment?

2.2 Has Section 1 been completed as necessary?

2.3 Are you aware you should leave the space immediately in the event of failure of the ventilation system?

2.4 Do you understand the arrangements made for communication between yourself and the responsible person in attendance at the entrance to the space?

Section 3

Where breathing apparatus is to be used, this section must be checked jointly by the responsible officer and the person who is to enter the space

3.1 Are you familiar with the apparatus to be used??

3.2 Has the apparatus been tested as follows?

(i) Gauge and capacity of air supply

(ii) Low pressure audible alarm

(iii) Face mask air supply and tightness

3.3 Has the means of communication been tested and emergency signals agreed?

(Source: IMO, (1992) Code of Safe Practice for Cargo Stowage and Securing, London.)

Computer Teaching of Marine Specialists With Fuzzy Logic Using

Leonid Vishnevsky[1], *Violetta Vishnevskaya*[2], *Igor Voytetsky*[3]

Higher education in marine industry is in the stage of reformation. A requirement to provide more high level of knowledge is replaced a requirement to prepare a specialist which would quickly adapt oneself in the world of changing technologies and would be in a state of continuous to study. Reforms especially actual in marine universities. Marine technologies develop so stormily, that not always is known, what technique a just acting student will work with. It determines new requirements to the graduating student: he owes not only to know and able but also no less important for him able to study. A teacher, in same queue, must not only hand on torches but also develop capacities for self-training.

Presently made first the advances in area of intellectualisation of teaching process and practically there are not the computer systems which possess so high intellect, that able fully to replace a teacher in all of variety of his educational communications with taught.

The traditional computer teaching systems do not either have a reverse communication channel frequently or are not in a position of adaptation of teaching process to the level of student's knowledge and abilities. Exposure of estimation during conducting of the computer testing on the basis of correlation of erroneous and correct answers, sometimes is not objective, because the amount of technical errors, not reflecting the level of knowledge of student is taken into account, for example, key pressed by mistake.

Rigorisms to the graduating students dictate introduction of the modern teaching systems on the basis of computer technologies. The real lecture is devoted using of apparatus of fuzzy logic for creation of the adaptive computer teaching system. We are developed an instrumental shell, which can be filled with different subject knowledge. The got computer teaching system is counted on independent work of student. The of principle feature of its functioning is a permanent reflection on that, how a process of mastering of material is.

The use of the apparatus of fuzzy logic makes it possible to solve the problems accessible for the experienced lecturer.

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Let us consider the variant of teaching scenario when a week student solves suddenly a complicated problem. In this case the experienced lecturer will put some specifying questions and after this the knowledge of a student on this matter will become obvious and the possible ways for elimination of gaps will become be found. The intellectual teaching system shapes the activity of a coach that is the lecturer who is attentively watching the motion of the teaching process. The system possesses the information about the process of the teaching of this student that is it knows how conscientiously he has worked out this subject (theme), how long he was studying it, how many times he was coming back to the reference and previous material. That is why the conclusion about the further teaching is made on the basis of greater amount of information about the process of teaching the concrete student.

Let us consider the case when a student has proved a difficult theorem and at the same time he cannot solve and easy problem on the same material. In case of a traditional teaching a lecturer usually puts a specifying question and the results of the student on the given material become obvious.

The intellectual teaching program compares the number of wrong answers on theoretical and corresponding practical material and will draw a conclusion with the help of fuzzy logic whether the student should be proposed to read this material once more. An attempt to formalize the meditation as well as the action of the coach who is observing the process of studies of a concrete student is done in the present work.

This electronic teacher constantly reflexes the fact how the process of mastering the material is taking place, takes into consideration his individual peculiarities, knows the level of readiness to perceive the material, observes the time during which a student is studying the lecture, what questions are incomprehensible for him, tries to define the reasons of errors and offers the teaching trajectory for removing these errors and reception of further knowledge.

The process of studies can be considered as the process for controlling mastering of knowledge. This process is characterized by the aim for control (acquirement of knowledge), it has the object for control (student), the device for control as well as the feedback channel. The criteria of control quality are the results of knowledge control. When constructing such kind of systems the use of fuzzy controller has some advantages. First of all, describing the system instead of differential equation the knowledge of experts is used (lecturers at the black-board with the chalk in hand). This knowledge is expressed with the help of linguistic variables which are described in fuzzy sets.

In the second place there is some possibility to use operatively rich pedagogical experience and the possibility of tuning to any criterion of a mark.

The amount of knowledge on the mastered material is the value which is changing in time: during the teaching process this amount changes and after a certain period of time some details are forgotten.

It is impossible to estimate the amount of knowledge definitely.

In this case the most effective is the application of fuzzy logical conclusion of Mamdani type. For the construction of instrumental shell the methods of fuzzy modelling are used. Before the beginning of teaching we carry out the entrance control (test on the subject of the school course, the entrance mark or the average mark for the previous themes) depending on the place of this material in the process of teaching. The student is given the possibility to choose the level of studies.

Before answering the test task it is possible to address the previous or reference material. Then the practical part is studied: solving the tasks from the considered theme and the questions in the course of solving. The singularity of this chart consists in the fact that during the work of the student with the teaching system the meters also work: the number of addresses of a student to the reference and previous material, time spent for studying the material, meter of wrong answers on theory as well as the meter of the number of wrong answers on practice. It is very important to count the difference between the measure of wrong answers concerning theory and the corresponding practice, a part of wrong answers is fixed. The concluding control of knowledge after studying the theme on the theory and corresponding practice is carried out in the mode of the examination, that is the chart is the same but one should not refer to the previous and reference material and answer the same question.

When constructing the base of rules of fuzzy conclusion the reasoning is used the part of which is given at the beginning of the article. What will the lecturer do when he sees how the student who orient himself with the difficulties in the table of integrals brilliantly probes a row with the help of an integral sign. Naturally, he will ask to specify some moments in the solution. As for the teaching system in this case it will be easier to draw a conclusion because this student has a low potential of personality, low entrance control.

However, if this student spent a lot of time for studying this material, addressed very often the reference and previous material, gave correct answers to very many questions with the difference between the number of correct answers of theory and corresponding practice is not great, the system is going to draw the conclusion that there is no need to lower the mark, it will decide to proceed further. It is a different case if a student having a low input control did not practically read the material on the required theme, did not address the reference material, has great difference between the number of correct answers on theory as well as corresponding practice, the training system will propose to deal with this material more. The base of rules of fuzzy conclusion was made on the basis of pedagogical experience in estimating the knowledge of students and simply due to common sense.

By the time when the student has studied the theme the array of values for base variables is formed for the corresponding input linguistic variables. Then these values are fed to the fuzzy model for controlling the teaching process built in the environment of MATLAB (Fuzzy Logic Toolbox). After processing the data the value of base variable corresponding to the output linguistic variable is given, is the estimation of the level of obtained knowledge.

On the output of the object of control after the completion of testing the clear values are measured (for example, on the theme A the correct answers are given, for k questions for the main notions of the theme, the correct answers for m questions reflecting the knowledge of mutual ties between the notions and n correct answers for the questions requiring the knowledge of mutual ties as well as the skill for drawing conclusions; and for theme B the corresponding answers v, g, f. The block of fuzzification will convert these clear values into fuzzy ones (for example, he knows something on the theme A and knows something on the theme B) with the help of linguistic variable values from the base of knowledge.

The block of decisions will transform the unclear input data into controlling influences which also have unclear character, for example to clarify the theme A, and as to theme B - to read the material a little). In this case the fuzzy conditions (if - then) are used, i. e. rules which are in the base of knowledge. Besides, in order to avoid the accidental setting of correct answers it is necessary to estimate the coincidence of the number of correct answers in accordance with the theoretical and practical parts of the theme.

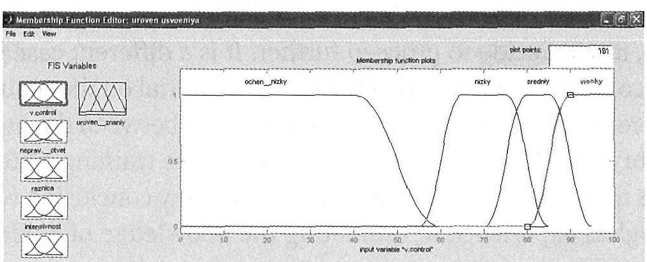
The block of defuzzification transforms the fuzzy data from the output of the solving block to the clear value (educational trajectory) which is used for controlling the object (for example, from the theoretical part of the theme A to read pages № n - k, from practical part of the theme A to clarify the solution of the problems № p, s, q).

The information about the amount of material studied by a student, about previous educational trajectory, results of testing and psychological peculiarities of a student personality are led to the fuzzy controller.

On the basis of this data the controlling influence is produced.

The type of functions belonging to the linguistic variable β_1 – input control is shown at the picture.

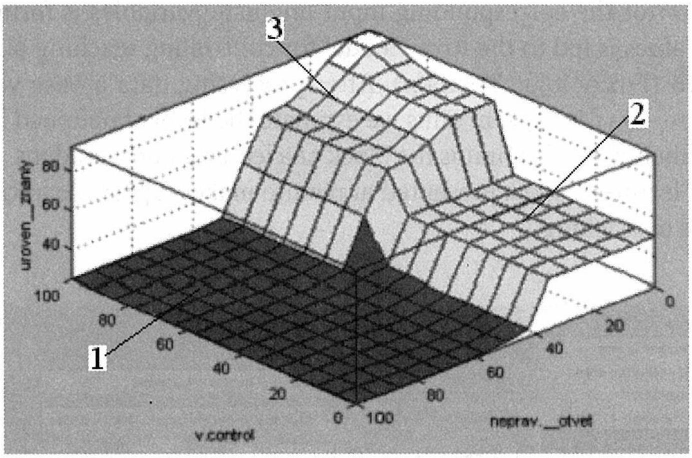
The chart of work of the teaching system with fuzzy logic: reading of measuring



devices in the process of teaching fuzzification, in other words, turn into fuzzy format, then processed, defuzzificated and finally led to the actuating device in the form of usual signals. Thus, the teaching trajectory is proposed to the student in accordance with the level of his knowledge.

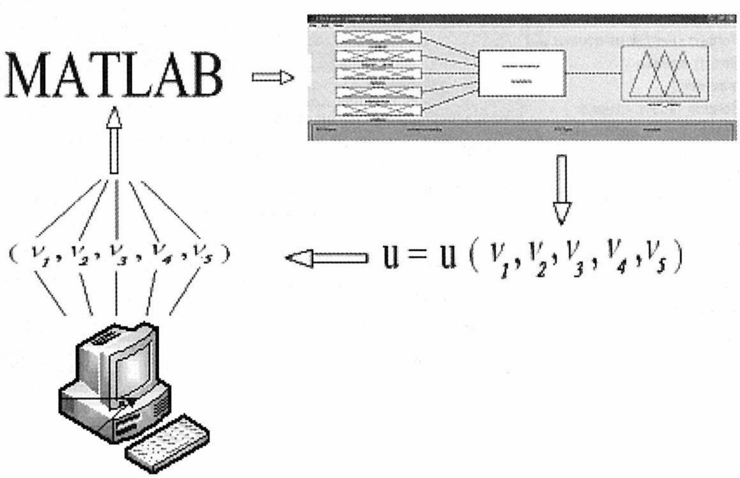
The surface of dependence of the level of acquired knowledge on the number of wrong answers as well as level of previous knowledge are shown at the picture.

The dependence of the level of the obtained knowledge on the input control and the measures of wrong answers are considered. Field 1 illustrates the fact that the student has got a bad mark, there the number of wrong answers is more than 40 with the arbitrary input control. Under these conditions the number of wrong answers is estimated in the same way.



Field 2 illustrates the fact that the student is not admitted for the estimation of his knowledge. In this case the input control is less than 60 with sufficient number of wrong answers in order to get the positive marks. In this situation when the traditional form of learning is used a student attends lessons and studies the material. However, he is not admitted by the dean's office for passing the examination.

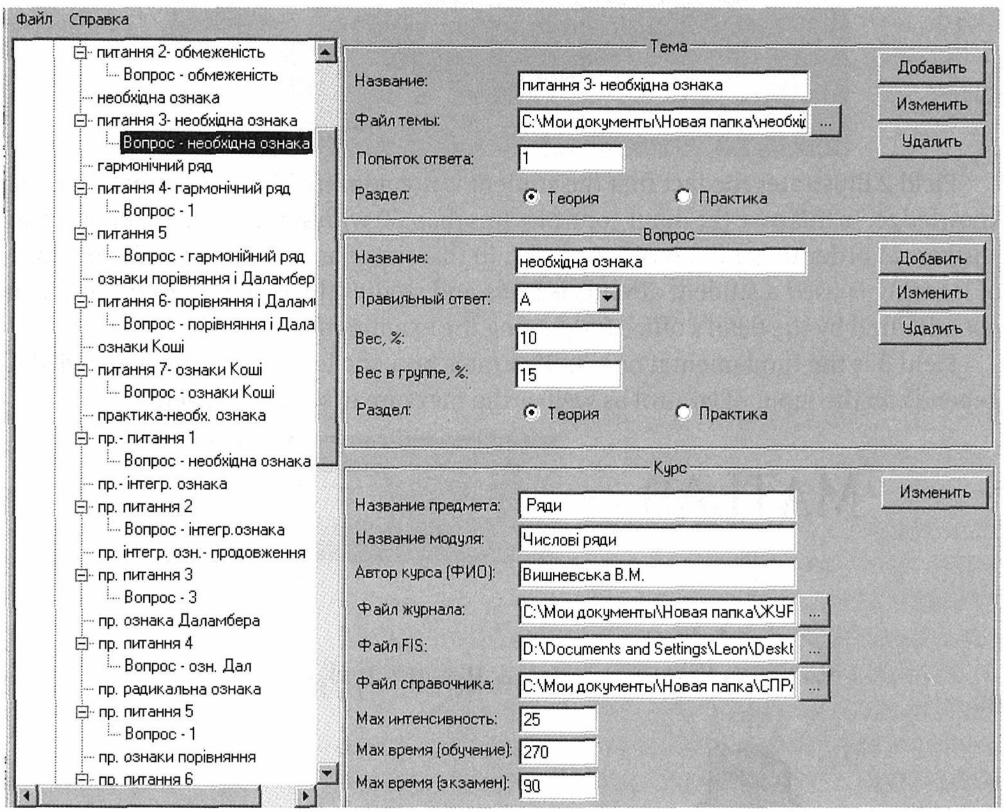
Field 3 is the fundamental one. It illustrates how the level of obtained knowledge depends on the input of control as well as the measure of wrong answers.



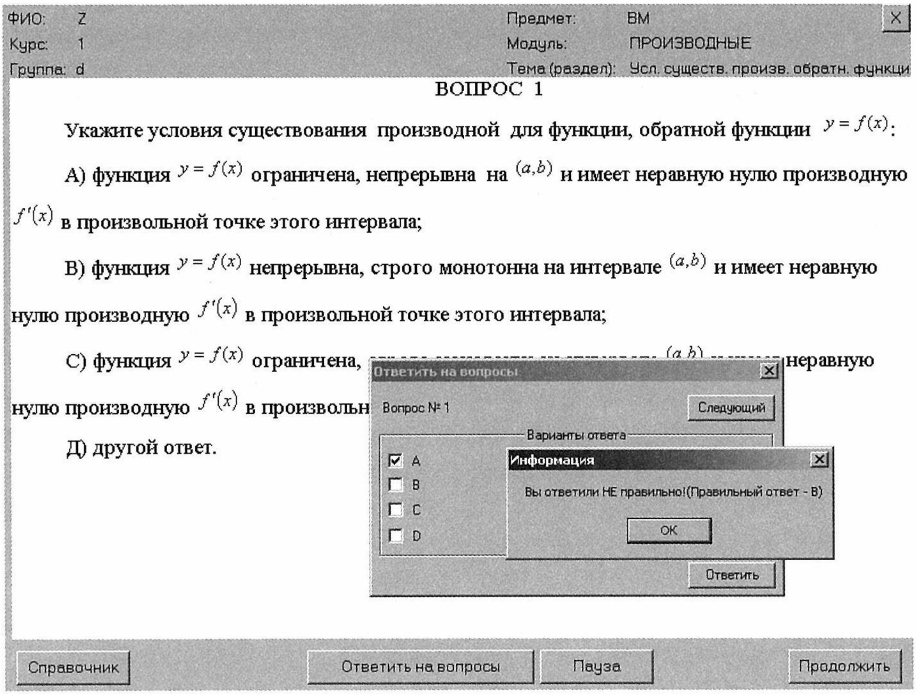
In the teaching program 'Teaching expert" the realization of the level of obtained knowledge was considered where the linguistic variables were dealt with: level of mastering, input control, time spent for studying, difference between the wrong answers on the theory and practice, part of wrong answers number of addresses to reference and previous materials. We note that all the linguistic variables are characterized by the measured properties.

After a student has studied the theme a cortege of values of base variables $(v_1, v_2,..., v_5)$ for the corresponding input linguistic variables is formed. Later on this array of values is fed to the fuzzy model for controlling teaching built in the medium MATLAB (Fuzzy logic Toolbox). After processing data a base variable value $u = \omega\ (<v_1, v_2,..., v_5>)$ is given. Thus we estimate the level of obtained knowledge.

The instrumental shell contains the block of a lecturer and a student. The program module of the lecturer's block presented at picture makes it possible to create and correct the course of teaching.



The screen form of the mode of teaching is presented in the following figure:



The obtained instrumental shell of the teaching system has a universal direction and can be used in different fields. The use of the given teaching system in higher educational establishment will make it possible to provide the personification of the teaching progress. Such system can be used for teaching students at extra- mural courses as well as for the subject courses.

The use of algebra of fuzzy sets provides the possibility to form the charts of logical conclusion for the estimation of the level for mastering the knowledge of the trainees. In this case the base of knowledge of the rules of fuzzy conclusion possesses the property of universality which can be used for a great number of education subjects.

The program is written on the C++ programming language and requires following resources of the personal computer: RAM - 32Mb, HDD - 1Gb, processor-300MHz.

Our personal experience and the analytical researches of home and foreign developments show that at present time the first steps in the field of intellectualization of the teaching process are made and practically there are no computer systems which possess such a high intellect which is able to substitute a lecturer completely in the whole variety of the education communications with the trainees. The values of the traditional education are indisputable, however indisputable is the value of the intellectual teaching systems which help the teachers and the trainees to work more effectively and successfully while gaining knowledge.

Developing Information Literacy for the Maritime Curriculum: Strategy and Pedagogy

Constantia Constantinou, Shafeek Fazal[1]

Abstract

"Developing Information Literacy for the Maritime Curriculum: Strategy and Pedagogy" demonstrates the instructional program of the Stephen B. Luce Library in response to the academic requirements of the maritime curriculum. The paper outlines the strategic directions of the Stephen B. Luce Library in developing a comprehensive plan to integrate information literacy for the core curriculum in the areas of maritime studies and scholarship. Furthermore, the study demonstrates pedagogical techniques employed for achieving positive student learning outcomes, methodologies for integrating information literacy through course-integrated lectures, collaborations with the teaching faculty in enhancing the design and development of the maritime curriculum, and implementation of assessment tools to measure student learning outcomes in response to maritime program review and accreditation requirements. In addition, the study demonstrates the expansion of the information literacy instructional program during the two-month semester at sea.

Introduction

Information literacy and the integration of information-literacy instruction are concepts which have been recognized by a variety of assessment tools for measuring learning outcomes as the key to successful student learning. The terms and conditions of information literacy have been defined by the American Library Association (1989) as, "Information literacy is a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information" (para. 3).

The mission of higher education institutions is to develop lifelong learners with the intellectual abilities of reasoning and critical thinking. In order to achieve consistency in student-learning outcomes, accrediting agencies such as The Middle States

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Commission on Higher Education (MSCHE), the Western Association of Schools and College (WASC), and the Southern Association of Colleges and Schools (SACS) have incorporated information literacy into discipline-based competency standards for using, managing and evaluating information.

The Boyer Commission Report (1998), *Reinventing Undergraduate Education,* states that students require to engage actively in "'framing of a significant question or set of questions, the research or creative exploration to find answers, and the communications skills to convey the results..." (p. 27). The Stephen B. Luce Library has incorporated information literacy to the core maritime curriculum in order to create the distinct learning environment for the students to center their information inquiry in relation to discipline-specific problem solving skills.

THE STEPHEN B. LUCE LIBRARY INFORMATION LITERACY AND INSTRUCTIONAL PROGRAM

The Stephen B. Luce Library sought the challenge and the opportunity to develop and implement a comprehensive information literacy program that addresses the maritime core courses and reflects the demands of the specialized maritime curriculum.

The maritime curriculum displays academic content and rigor that serve specific sectors of the maritime industry and further the professional opportunities of graduate students. With an unusually large number of credits and undergraduate requirements, in addition to semesters at sea and merchant marine license exams, the maritime curriculum prepares and positions its students for high-level professional opportunities.

Due to the rigorous academic demands of the maritime core curriculum, the Stephen B. Luce Library of SUNY Maritime College adopted an information literacy program which is both equally rigorous and complementary to the maritime core curriculum. The Library's instructional program serves the teaching and learning needs of the SUNY Maritime College through instruction, assessment, and evaluation of scholarly material (print and electronic). In addition, the Library's involvement with the College's curriculum committee plays an integral role during the development and revision of new and pre-existing curriculum programs and courses. The Stephen B. Luce Library instructional and information literacy program focuses on three strategic directions to successfully integrate information literacy to the core curriculum in the areas of maritime studies and scholarship.

Strategic Directions

Strategic Direction #1: Librarian-Faculty Collaboration

The first strategic direction was to bridge the divide and elevate the level of collaborations between library faculty and classroom teaching faculty. The Stephen B. Luce Library positioned its subject-specialists to serve as liaisons to the academic departments. In addition to Master's degrees in Library and Information Studies (MLS), all library faculty at the Luce Library hold a second subject Master's degree in science, engineering, and the humanities.

The library faculty has assumed additional responsibilities which allow them to develop close working relationships with the teaching departments. Library faculty attends the academic department meetings of their respective area of concentration. They schedule information literacy meetings with the teaching faculty. They organize one-on-one or small group tutorial sessions for faculty and students and demonstrate new and existing resources to all faculty. They work along with the teaching faculty to conduct syllabi analysis as it relates to information literacy.

In order to maintain the relevancy of the library's collections, resources and teaching mission, a librarian serves as a voting member on the college's curriculum committee. As part of the curriculum committee's process, the librarian is entrusted to work with any of the teaching faculty and academic departments offering new courses or revising pre-existing courses prior to the courses being brought to the faculty senate for final approval. During the curriculum committee's process, and prior to the committee's approval of any new course or program, the librarian works with the proposing department to identify the learning/teaching objectives of the course and supplement the proposal with additional resources needed. A critical component of the process is identifying the type of bibliographic instruction required to fulfill the development of students' information literacy competency skills.

Strategic Direction #2: Student Outreach

The second strategic direction for carrying out the information literacy program is reaching out to the students of SUNY Maritime College and engaging their sense of inquiry and discovery.

The Stephen B. Luce Library information literacy program is designed to develop students' skills at various levels of their college careers. An extensive library orientation program provides all new students with an introduction to the information literacy concept. Working closely with the Dean of students, the faculty and program coordinator of graduate studies, and the leadership of the Regiment, all incoming students, undergraduate and graduate alike, receive their first library orientation session.

The goals of the first library orientation session are to familiarize the students with the library facility, the physical environment and locations of resources, the history of the library, to remove barriers such as anonymity and introduce familiarity of library personnel. The objective of the first orientation session is to transfer ownership of the library to the students. Phrases such as "your library" and "you belong to the library and the library belongs to you" become the constant refrain during orientation sessions.

The concepts of transferring the library's ownership to the students are reiterated during the following weeks of students' assimilation to the college and campus life. Subsequent to the first library orientation session, the first and second semester freshman students receive a general information literacy course integrated session. Most common courses during the first and second semester freshman year are introductory English, History, Science, Engineering and International Trade and Transportation courses. Upper level students receive a more discipline-specific information literacy session; information literacy sessions are taught for English composition courses, American History and American Civilization, Introduction to Business and Economics, General Science, Marine Biology, Oceanography, Computer Science and General Engineering. Graduate level students receive in-depth sessions for various courses, including preparation for the graduate capstone course.

In addition, the Library's Research Assistance program, a one-on-one information literacy consultation session, is available to all students at all levels. The Library's Research Assistance program is widely promoted to students through the library's web portal and campus announcements.

Strategic Direction #3: Tutorials

In order to continue building upon and improving the library's teaching objective, a third strategic direction was established to create print and online publications. The library's print and online publications provide a base line for consistency in teaching and convey a methodology for communicating the information needs of the students. Based on the demands of the curriculum, the Library continuously creates online pathfinders and online research modules (general and discipline-specific) to address the information needs of students. In addition, the library faculty liaisons collaborate with instructors to create course-specific research guides. The library's research publications also serve an additional purpose - to provide the student with the choice and the flexibility to complete their assignments independently outside of the classroom teaching environment.

PEDAGOGY

The new generation of learners arrives to our campuses far more prepared in computer skills, far more skillful in multi-tasking and far more experimental. The students are also far more demanding in their expectations for instantaneous access to information. To acknowledge the students' new mode of learning the Stephen B. Luce Library set forth to bridge the generation gap by ensuring the information and formats through which it is conveyed to students remains relevant.

As is the case with other types of instruction, the Library is committed to teaching information literacy using various pedagogical techniques to achieve positive student learning outcomes. All information literacy sessions are computer-assisted, utilizing state of the art equipment for effective multimedia instruction and hands-on experience. General information literacy sessions for freshmen include a library orientation component where students are taught to visually and physically identify various types of sources. Library assignments, both library-only and course integrated are fundamental to all information literacy sessions and are carefully designed to incorporate the Association of College and Research Libraries (ACRL) information literacy standards (ACRL, 2000). Course-specific web tutorials serve to guide students in their research and to reinforce learning beyond the information literacy session.

METHODOLOGY

The primary focus for teaching information literacy is to immerse information literacy instruction with regular course work. As Ward (2006) stated "Students do not achieve information literacy by attending one or more library sessions. Rather, students learn relevant information skills when they are systematically integrated and sequenced throughout the curriculum" (p. 397). Librarian-faculty collaboration and student outreach beyond the basic reference transaction are methods used to systematically integrate information literacy in the maritime curriculum.

The core methodology for integrating information literacy through course-integrated lectures involves close collaboration between librarians and teaching faculty to design the information literacy lectures and to develop assignments that stress critical thinking as well as information literacy skills development. Librarians hold meetings with instructors prior to the information literacy sessions to discuss lesson plans and assignments. During the librarian's lecture it is common practice for instructors to be present in the classroom to further stress to students the course-related importance of the information literacy concept. Course integrated assignments are designed to introduce information literacy as well as to meet the teaching faculty's instructional goals.

For course-integrated information literacy it is essential that the program articulate well with the maritime curriculum. Therefore, the collaboration between teaching faculty and library faculty remains critical in enhancing the design and development of the maritime curriculum as it relates to information literacy. Each librarian serves as liaison to academic departments to provide advice and assistance for course-integrated information literacy, collection development, and information literacy component for the design of new courses or programs and/or revision of pre-existing courses or programs. In addition, the library takes a proactive role in the college-wide curriculum committee to ensure that the library's resources could support the demands of the courses and that information literacy is included in appropriate courses and programs.

Continuing information literacy instruction beyond the classroom on a one-on-one level is the underline objective of the Library's Research Assistance program. Optional and available to students on an appointment basis, this program seeks to engage the individual in interactive and hands-on instruction to fulfill research needs for a specific course assignment. This particular instruction method epitomizes the concept that instruction in information retrieval is most effective if it is course-integrated and delivered at the time of need (Fullerton, 1998).

ASSESSMENT

Libraries play an important role in helping academic departments meet their accreditation requirements. The information literacy curriculum integrated instruction program is structured in a way that all efforts are concentrated to contributing to program accreditation and program outcomes.

By integrating library instruction into the curriculum, the library provides a quantitative means of documenting progress towards the College's education goals. Course assignments and exercises are used as assessment tools to measure student learning outcomes in response to maritime program review and accreditation requirements. Teaching faculty, in designing course assignments, collaborate with their liaison librarian to make sure students are exposed to a variety of information resources both in formats and types. For example, in American History course, information resources mandatory for the research assignment include primary sources, scholarly articles, and monographs. Library-specific assignments are carefully designed by librarians to test student information literacy skills. These assignments, once completed, are reviewed, graded, and assessed by librarians to measure learning outcomes and the grades are provided to instructors for extra credits. This arrangement of grading the library-specific assignments demonstrates to the students the serious nature of the assignment and encourages them to learn the information literacy concepts (Williams, Blowers, & Goldberg, 2004). Overall quantitative assessment of the information literacy program is measured by statistical data of number of sessions, number of students, and number of faculty. Chart 1 shows a 200% growth in number of students taught in academic year 2005-2006 as compared to academic year 2000-2001.

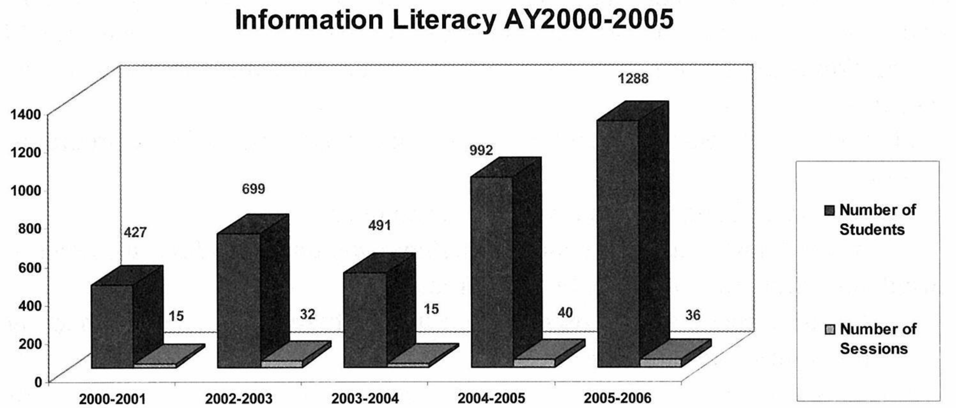

Chart 1

In the case of the Accreditation Board for Engineering and Technology's (ABET) accreditation requirements for engineering programs, among other competencies, institutions must demonstrate that their students attain (ABET, 2006, p. 4):

a. an ability to apply knowledge of mathematics, science, and engineering
b. an ability to design and conduct experiments, as well as to analyze and interpret data
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. an ability to function on multi-disciplinary teams
e. an ability to identify, formulate, and solve engineering problems
f. an understanding of professional and ethical responsibility
g. an ability to communicate effectively
h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i. a recognition of the need for, and an ability to engage in life-long learning
j. a knowledge of contemporary issues
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

The highlighted educational outcomes of the ABET accreditation requirements demonstrate that the SUNY Maritime College engineering graduates must have a mature understanding of the information environment in which they will work as future engineers. These learning outcomes require tailored information literacy courses which will provide the graduates with the ability to conduct research throughout their engineering careers.

As a part of the State University of New York General Education Assessment requirement for student learning outcomes, the Stephen B. Luce Library is required to conduct an information literacy assessment exercise on a two-year cycle. The SUNY General Education process of assessing information management skills consists of two objectives:

(1) Information Management for courses embedded within Library programs and

(2) Understand and use basic research techniques

The methodology used for assessing each *Knowledge and Skills* Area and *Competency* must demonstrate the following two requirements:

(1) the assessment criteria used to determine whether students are meeting the program's goals and objectives

(2) the sampling procedures used to choose students who provided data for the assessment, as well as the description of the sample itself

The 2004 SUNY General Education assessment for information management drew a sample from random bibliographic instruction sessions. Though not distributed across all sessions in which exercise was administered, sample includes students taking English 090, English 101, and Engineering 101 who attended a library instructional session on research skills and select information literacy issues related to their respective sections of English 090, English 101, and Engineering 101. The structure and the content of these library instructional sessions on these topics is highly standardized, providing a fundamental uniformity across the different sessions. Exercises included multiple-choice, short answer, and yes/no questions. Scale for grading was set for 90-100% = exceeding; 70-89% = meeting; 60-69% = approaching; 0-59% = not meeting.

Major findings of this assessment demonstrated that 22 percent of the SUNY Maritime College student exceeded expectations, 39 percent met expectations, 34 percent approached expectations, and 5 percent did not meet expectations.

To improve on teaching information literacy it is essential to continue to learn more about assessment and to participate at some level in planning and conducting assessment (Lindauer, 2004). At SUNY Maritime, librarian's participation in information literacy assessment goes beyond the teaching faculty-librarian collaboration arrangement. Membership on College-wide assessment committees such as Middle States Self Study, ABET Self Study, and Faculty Assessment Committee are opportunities that librarians always take advantage of.

Semester at Sea

Stephen B. Luce Library's information literacy program extends offshore on T.S. Empire State VI, the training ship for SUNY Maritime College. During the 9-weeks' long semester at sea the librarian onboard the Ship's Library is actively involved in planning and conducting information literacy instruction. Staying on course with the program's strategic directions, the Ship's Librarian conducts one-on-one and group/ class oriented information literacy sessions. In addition, the Ship's Librarian conducts research sessions on the information needs of all crew members as visitors to international ports and a port facts sheet supplements these sessions.

Conclusion and Future Directions

Information literacy, an issue widely discussed in higher education and an issue mandated as a requirement by accrediting agencies, is recognized by SUNY Maritime as foundationally critical to producing graduates who are lifelong learners. This article illustrated Stephen B. Luce Library instructional program's strategic directions, including the methodology, pedagogy, and assessment techniques, used to effectively integrate information literacy into the maritime curriculum. Librarians are serving as partners in the classroom, collaborating with teaching faculty in a variety of ways to ensure the systematic integration of information literacy in the curriculum. In addition, librarians' efforts reach beyond the classroom as exemplified by the Library's Research Assistance program and the ongoing development of online research guides and pathfinders.

Librarians are looking ahead to improve and expand the instructional program at Stephen B. Luce Library. First, reaching out to the distance learning students is a top priority. Work is already underway to develop a completely online information literacy module to incorporate into online courses. Second, more rigorous procedures to assess the program and learning outcomes are being discussed. Developing a pre/post test to determine student skill levels and to measure effectiveness of information literacy sessions, using the online environment to streamline assessment, and incorporating information literacy assessment in graduate level courses are all future directions for the program.

REFERENCES

1. Accreditation Board for Engineering and Technology (2006). *Criteria for Accrediting Engineering Programs*. Retrieved December 16, 2006, from http://www.abet.org/Linked%20Documents-UPDATE/Criteria%20and%20PP/E001%2006-07%20EAC%20Criteria%205-25-06-06.pdf
2. American Library Association (1989). *Presidential Committee on Information Literacy: Final Report*. Retrieved December 16, 2006, from http://www.ala.org/ala/acrl/acrlpubs/whitepapers/presidential.htm
3. Association of College and Research Libraries. Division of the American Library Association (2000). *Information Literacy Competency Standards for Higher Education*. Retrieved December 16, 2006, from http://www.ala.org/ala/acrl/acrlstandards/informationliteracycompetency.htm
4. Boyer Commission on Educating Undergraduates in the Research University (1998). *Reinventing Undergraduate Education: A Blueprint for America's Research Universities*. Retrieved December 16, 2006, from http://naples.cc.sunysb.edu/Pres/boyer.nsf/
5. Fullerton, A. (1998). *Instructional Development Grant Recipient Highlight Fall 1998*. Retrieved January 3, 2007, from http://www.adm.uwaterloo.ca/infotrac/idno8.html
6. Lindauer, B. G. (2004). The Three Arenas of Information Literacy Assessment. *References & User Services Quarterly*, 44, 122-129.
7. Ward, D. (2006). Revisioning Information Literacy for Lifelong Meaning [Electronic Version]. *Journal of Academic Librarianship*, 32, 396-402.
8. Williams, B., Blowers, P., & Goldberg, J. (2004). Integrating Information Literacy Skills into Engineering Courses to Produce Lifelong Learners. Proceedings of the 2004 American Society for Engineering Education Annual Conference & Exposition. Retrieved January 5, 2007, from http://www.asee.org/acPapers/2004-2405_Final.pdf

Study of Kobe Regional Maritime Cluster

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Daichi Kawasaki[3], *Shintarou Nishimura*[4]

1. Introduction

This paper focuses on Japan's "Kobe Maritime Cluster."

Discussions about forming maritime clusters in Japan are prevalent. The maritime industries of Japan are challenged by many rivals in international competition. Since many maritime professionals are concerned by this, we will discuss about the "maritime cluster" as in Japan.

The "maritime cluster" is expected to find the role of towing the maritime industry.

The cargo volume of the ocean-going vessels which depart and arrive in Japan is becoming less; Japanese seafarers are insufficient, as also are engineers, and shipbuilders. In 2000, the government made the slogan "Maritime Japan" as a motto towards creating a new maritime perspective, and to energize the Japanese maritime industry. Progress has been made and the industry has started to grasp the momentum. However, doubts remain of what a maritime cluster really is. Hence, at the present time, the problem is of definition, in order to proceed with the vision that the government initiated, for back in 2000.

Recently, the industrial policy, which used the cluster as the base, became a powerful tool for strengthening the competitive edge of a local area, a country, an industry, and or company. The maritime cluster has used Michel Porter's "industrial cluster theory." The company and the organization of the maritime field is approached geographically, and these cooperations complement and heighten the international competitive edge in the maritime field.

In the maritime cluster argument, making a maritime cluster of the whole of Japan was thought important that is until now. Kobe was chosen in order to utilize the local

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level, which has special character of a cluster. Kobe, which is a port city in Japan, is globally famous in the maritime industry, and a long tradition of shipbuilding and as a port. But on the domestic and the international level, Kobe has been losing competitive edge gradually, this because of acute competition. Therefore the policy of developing Kobe as once again a famous service provider, is very important!!

The arrival and departure of a foreign cruise ship is a business which has not been developed in the maritime field of Japan, and Kobe. The new and heterogeneous industry of tourism is fast growing. This facet cooperates with the existing port and maritime industry, and naturally contributes to the physical distribution and a logistics of people.

People in the West say that they are "yearning for a mystery and a challenge" and they find it in the word "maritime." European countries have for long explored the oceans. Much scientific development and technology were acquired, also wealth and glory. On the other hand Japan, protected from invasion by the sea (until, the 19th Century) has a different image. The sea wraps itself around us like air, and it was often who dared to challenge. However, future Japan has to make the sea its domain. Japan should lead the world by demonstrating its power in the maritime field. It is surrounded by this "yearning, the mystery, and the challenge."

2. History of Kobe Maritime Cluster

Kobe has a great maritime tradition and today the maritime sector plays an important role in the economy, creating value and employment. Kobe was the first East Asian maritime city to form a maritime cluster since its port opened to international trade in 1868. Kobe is the birthplace of world class maritime enterprises, such as Kawasaki Shipping and the ship-builders Mitsubishi and Kawasaki. From 1915 to 1917, 78 shipping companies were established in Kobe.

Kobe maritime cluster was located near Kobe port, which was lead by shipping companies and two large shipbuilding companies(including repair,) port logistics (or port transportation) and auxiliary ship industries Kobe has reaped huge benefit. Effects such as a strong image as an international maritime city, a high business efficiency level, a large accumulation of maritime related information, and transactional business etc. With the growth of global maritime enterprises and related support industries, active business operations with spin-offs, Kobe maritime industry was secure as an industrial dynamo.

Today, however, the physical distribution of overseas-shipping-business in Kobe is tending to word decline (Fig. 1). The following can be considered as reason; the role of the harbor in Japan's freight dealings is quoted like an export, which is required near the factory (Example: Nagoya's car industry.) As an import it is required near the large consumer cities such as Yokohama and Osaka. Kobe lost its position because of the Great Hanshin-Awaji Earthquake (1995). Other cities in Japan grew as regardless:-

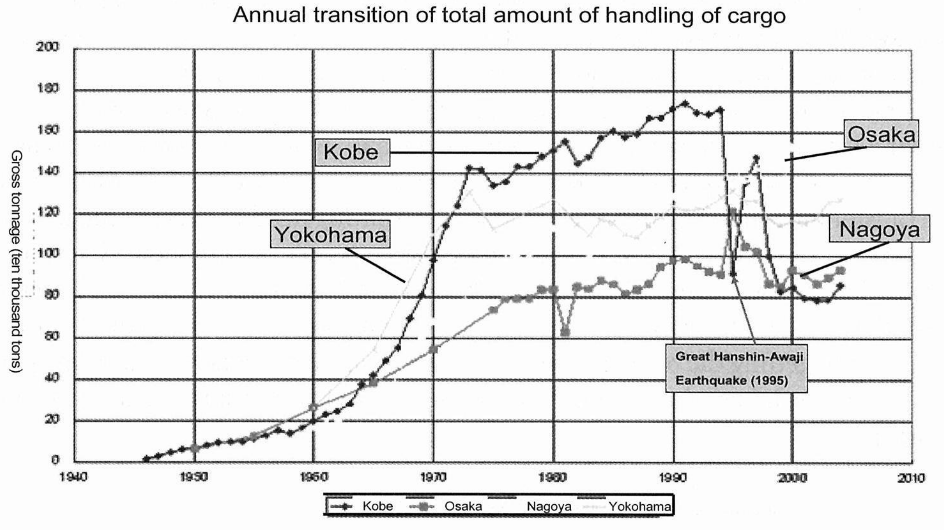

Fig. 1 Annual transition of total amount of handling of cargo [1)2)]

3. Maritime Cluster

Michael Porter, who advocated the cluster theory, was the first to define the cluster and as follows:-

In the specific field, by common technology and know-how, are connected by:-

- Research institutions, such as universities
- Related companies
- Suppliers with high specialty
- Service donors, such as financial institution
- Related organizations (administration, economic, etc.)

Cluster is a state that gathers in one, local area. Cooperation is also given simultaneously, competing.

The view of a cluster is not an old view. In the middle of the 19th Century, Kobe was one of the very first ports in Japan to be opened to the West. The maritime companies were accumulated, centering on the harbor and Kobe University of Mercantile Marine [Present Faculty of Maritime Science of Kobe University.] The latter produced excellent navigators and engineers to the sector, and to industry, and to administration and academia. The cooperation was the building of the port town, Kobe. This can be called a cluster centering on shipbuilding and the marine business.

The rapid development of IT and transportation networks in recent years has changed Kobe. Technology flows out rapidly. Countries which have low production costs, create intense international competition. Moreover, the jump of wages and the shortage of youth are the problem of developed countries. This enlarges the crisis of the reduction of the maritime industry, and marine businesses in Japan.

Efficient and low cost competition is a reality in the world. Since imports use the harbor near large consumer areas, exports use the harbor near big production areas, the ratio of export and import use in Kobe harbor is declining, since the earthquake 1995[4]. The Cluster infrastructure of Kobe was taken by shifting headquarters of the maritime industry to Tokyo. Result, loss of logistics of goods, people, and money. Therefore, accumulations of the cluster effect needs to be artificially created. The notion which hits "cluster" is "Maritime Japan." However, the present condition is difficult. "Maritime Japan" is not getting the result because it is hard to take out a concrete maritime policy. This is because did not think from the range of the local area, but thought as the whole of Japan.

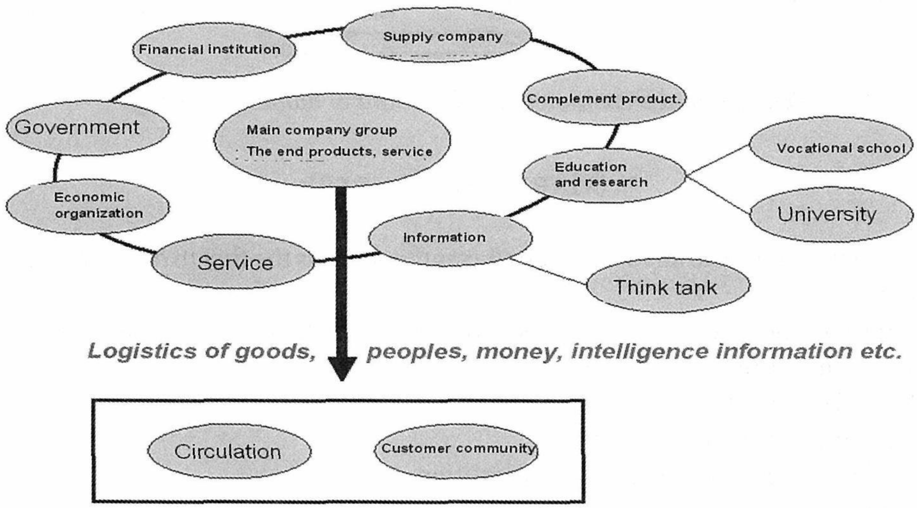

Fig.2 The concept of a cluster

4. Maritime Specialist Opinion of Kobe Maritime Cluster

Since the decline in the cluster effect is obvious, we conducted research into the opinion of maritime specialist opinion on strengthening the Kobe's maritime cluster, as well as the port itself. The research was carried out in July and August of 2005, and targeted shipping, port and shipbuilding industries, as well as maritime administration and the academic community. We sent out 114 questionnaires and collected back 44 sheets in return.

The followings are the results of the SWOT analysis, from their replies. The concern was of the lowering competitiveness of the Kobe maritime cluster. Reasons include

1. Transferring headquarters of local enterprises to Tokyo
2. Lack of talent among the younger generation
3. Lack of inter-industry cooperation between shipping and shipbuilding
4. Lowering of understanding of the maritime industry by the local society
5. Lack of competitiveness based on production costs
6. Lack of a leading company to lead the Kobe maritime sector [Such as Toyota of Nagoya]
7. Lack of a platform for the exchange of inter-industry information
8. Severe competition from neighboring ports, example Busan and Shanghai
9. Improper measures for developing, the maritime sectors
10. Lack of a world class, leading maritime company
11. Lack of world class leading education and research system

From the result of the questionnaires, the Ocean Policy Research Foundation co-ordinated the research committee of "Renascence of Kobe as international maritime centre" with 23 institutions in 2006 and the committee proposed to set up a working group consisting of the Municipal Office, the Chamber of Commerce and Industry, Kobe branch of the Ministry of Land, Infrastructure and Transportation and Kobe University, The working group will propose the road maps for realizing the maritime city of KOBE-2009.

5. PROPOSING "KOBE MARITIME & SIGHTSEEING CLUSTER"

We examined what kind of maritime cluster can be constructed in the Kobe maritime field.

The physical distribution of marine business of the oceangoing vessel in Kobe has been declining for ten years. It is because Kobe is losing large consumer areas, large-scale factories, etc. In order to activate the maritime sector in Kobe, logistics of goods, people and money required. Then, we must pay attention to cruise ships are of the purpose taking a "ship" and enjoying oneself aboard. Moreover, it is accompanied by the stay onboard. The function of the harbor for a cruise ships is mainly divided into two kinds, "destination type" and a "homeport type." In Japan, the homeport of Asuka II (one of Japan's cruise ships) is Yokohama. All ports in Japan are "destination types" for the foreign cruise ships. Cruise ship can give high economic impact to her homeport. A "destination type" has a restrictive economic effect. [5]

Therefore, we propose to invite foreign cruise ships to Kobe as a "homeport type."

Thus we can focus cooperation and also synergistic effect of the existing maritime industry. Tourism, which is cross-industrial, is proposed. This diversifies the maritime industry and develops the cluster of Kobe.

.The following is from the SWOT analysis of the Kobe, and about inviting cruise ships.

Strength	**Opportunity**
● Big consumer place and sightseeing location (Himeji, Kyoto, and Nara) which included the waterfront ● Great accumulation of shipping and the shipbuilding industries with 50,000 employments ● Convenient East-West public transport ● Good image of city of port, Kobe ● Support of residents and administration ● Traditional maritime knowledge ● An accumulation of universities including a maritime	● More cruise-ships attractive activities ● Development of Kobe airport for sea and air ● Economic growth in East Asia area ● Ships are prosperous in the National Project of "Yokoso! Japan"
Weakness	**Threat**
● Few berths for cruise ships ● The cruise terminal and shopping quarter are placed quit for apart. ● Insufficient of CIQ equipment	● The high cost risk for carrying out a new enterprise ● Competition from Busan and Shanghai ● Most tourists to Kobe are Japanese

6. CONCLUSION

Since the 2000, Ministry of Transport's "Maritime Japan", so far the maritime cluster theory is not progressing. This is because it was a cluster based on shipping which lacked the concept of "geographical proximity." Moreover, there is also another view, one which considers "marine business" in maritime industry.

The global image of the Sea of Japan is as a place connected to a maritime cluster it is formed for every local area, to widely catch the "sea". The mission is to make an answer which can overcome the uneasy element of a maritime correlative industry. It is required for a cluster to develop by cross-industrial cooperation, taking advantage of the maritime industry, the culture, the geographical features, and the features of a local area for that purpose.

When considering the maritime cluster of a local area, such as Kobe, which used to be the center of marine business of Japan. The industry, administration and academia exists from a century ago. The "Kobe Maritime & Sightseeing Cluster" centering on cruise ships, are a new possibility as a model of the maritime cluster, in the feature.

Japan has been developing many integrated factory areas but it is not building a cluster. The talented people supporting the whole maritime industry are decreasing in number, and competitors overseas are increasing.

It is important to build a new maritime correlative industry for Japan.

References

1. PORT & URBAN PROJECTS BUREAU KOBE CITY GOVERMENT, Kobe harbor encyclopedia, (2004), 47.
2. City of Nagoya, The Nagoya harbor statistics annual report, (2004), 17.
3. Youko ISHIKURA, Strategy for cluster initiatives in Japan, (2003.12), p19,p16, Tokyo of JapanYuhikaku Publishing Co., Ltd.
4. Masaki MORITANI, RM:Bunmei no gijutsu shikan : ajia hatten no kanosei, (1998.6), 113, Tokyo of Japan&Chuokoron-sha.
5. A hearing with Ms. Toshimi Wakase (Kaiji Press Co., Ltd.ц Executive director), (2006.04.20).

Key Roles Played by Shipping Companies in the MET Process

Eugen Barsan[1]

Abstract

In the last 10 years, The Constantza Maritime University (CMU) had to surpass great difficulties in order to ensure places for the compulsory 12/6 month sea training period for its students. Year after year, one of the most difficult tasks for the rector and the deans was to find and convince Romanian and mainly foreign owners to accept our cadets on their ships.

In these circumstances the University manages to provide official placement for the full time sea training for 60-65% of our students. Before 2005, none of the crewing companies operating in Constantza wanted to sign an agreement with the University regarding the placement of cadets. Consequently, a lot of students had to use their own personal relations or their luck in order to find an owner disposed to embark them as cadets.

However, things changed rapidly in our favor during the last two years. Starting with 2005 the crewing and shipping companies came to our University asking for cadets and officers. At first we were surprised by such a change in attitude. After a while it became clear that the new approach of the owners was dictated by the already existing lack of officers and the prognosis confirming shortage of well trained officers for the merchant fleet during the next 10 years.

Our paper will discuss the major role that could be played by shipping companies if they will get involved in all the stages of the maritime education process and not only to act as a passive beneficiary of the maritime training institutions' outputs. We will also underline the key role of a good onboard training program for cadets and the leading role of the owners to implement and monitor such a program onboard their ships. The paper also reveilles the perception of cadets regarding the on board training period, based on their responses to a questionnaire designed by our university and ran as part of the OPTIMPORT project.

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1. INTRODUCTION

As a result of the IMO STCW 95 Convention, the on board training period for deck and engineer cadets became a very important part of the training process of merchant marine officers.

The STCW 95 Convention not only stipulates the compulsory duration of the on board training period (12 months for deck cadets and 6 months for engineer cadets), but it also gives some important provisions regarding this on going process, as follows:

- the on board training programme must be approved and certified as meeting the requirements of this section AII/1 or AIII/1;
- during the required period of seagoing service the candidate must receive systematic practical training and experience in the tasks, duties and responsibilities of an officer in charge of a navigational/engineer watch, taking into account the guidance given in section B-II/1 or BIII/1;
- the cadet must be closely supervised and monitored by qualified officers aboard the ships in which the approved seagoing service is performed;
- the on board training period must be documented in a training record book.

For all of us that have been working for many years in the field of maritime education and training it is obvious that from the above mentioned STCW 95 requirements, only the duration of the on board training period and the existence of the training record book are clauses fully respected by all players in this field.

Because this paper is focused on the roles played by shipping companies in the MET process, we have to state from the beginning that only few shipping companies have an on board training program approved and certified by a maritime authority and that there are also very few officers that supervise and monitor the training of cadets and are really qualified to deliver training at cadet level (MAIB, 2004).

For the clarity of the following pages, a series of abbreviations will be used frequently:

- CMU — Constantza Maritime University
- DTO — Designated Training Officer
- MET — Maritime Education and Training
- OBT — On board training
- RMA — Romanian Maritime Authority
- TRB — Training Record Book

2. Finding Places for Cadets' on Board Training

Entry in force of the STCW 95 Convention imposing the compulsory 12 month of OBT for deck students had a direct impact over the maritime universities' curricula all over the world. All of us had to modify the teaching yearly schedules in order to include, as much as possible, time for the OBT in the basic education period. In most cases the solution was to develop a sandwich curriculum where university education was combined with OBT stages.

Romania has only 15 ships under Romanian flag (Barsan E., 2004) and a very limited number of private owners. On the other hand, around 150-190 deck officers, 90-110 engineers and 30-40 electrician officers graduate from the Romanian MET system each year.

During the last 10 years, and mainly from the entry of the STCW 95 Convention, the Constantza Maritime University (CMU) had to surpass great difficulties in order to ensure places for the compulsory 12/6 months sea training period for its students. Year after year, one of the most difficult tasks for the rector and the deans was to find and convince Romanian and mainly foreign owners to accept our cadets on their ships.

In these circumstances CMU manages to provide official placement for the full time sea training for only 60-65% of our students.

We think that such problems were common to all maritime universities, probably with few exceptions in countries with very large national maritime fleets such as China, Russia, Japan, Turkey, US, speaking only from the point of view of IAMU members.

Before 2005, none of the crewing companies operating in Constantza wanted to sign an agreement with our University (CMU) regarding placement of cadets. Consequently, a lot of students had to use their own personal relations or their luck in order to find an owner disposed to embark them as cadets. In order to fulfill their compulsory sea training time, many students had to accept embarkation as AB instead of cadet.

The Romanian Maritime Authority (RMA) wanted to help, but they could only make pressure upon the owners of the fifteen Romanian flagged ships. Each of these ships could take on board only 2 to 4 cadets. We also managed to do some training voyages with the two ferryboats undertaking short sea voyages between Romania and Turkey. Because of the fact that ferries had accommodations for truck drivers, we could embark up to 10 deck cadets and 8 engineer cadets on board these ships simultaneously.

Until 2003 we also owned a cargo training ship where we could embark up to 110 cadets, perform training voyages and carry cargo at the same time. The running costs of this ship were very high and year after year we had to plead for governmental financial support in order to undertake the two training voyages of two months each (Barsan E., 2006). Moreover, the ship was 20 years old and in 2004 we had to sell it because we did not have the money to undertake the capital repairs imposed by the shipping registry. Any how, as all of as are aware, a training ship is not a solution for undertaking the compulsory 12 months OBT for deck cadets. Many of the national Maritime Authorities did not consider the time spent on these types of training voyages as part of the compulsory OBT period.

However, things changed rapidly in our favor during the last two years. Starting with 2005 the crewing and shipping companies came to our University asking for cadets and officers. At first we were surprised by such a change in attitude. After a while it became clear that the new approach of the owners was dictated by the already existing lack of officers and the prognosis confirming shortage of well trained officers for the merchant fleet during the next 10 years.

As a direct consequence, many owners changed their strategies regarding the recruiting of personnel and established new policies in order to develop or extend their cadets' training programs or at least try to take on board their ship as many cadets as possible.

This change of attitude has first of all economic reasons, based on the predicted lack of qualified officers in the near future. The lack of officers, in accordance with the world scale forecast, will be a consequence of the world merchant fleet increase (as number of ships) and the aging process of the maritime officers. More than that, the increasing volume of new electronic navigational equipment requires well trained young officers, able to quickly understand and accommodate with the use of electronic equipments (Bordal J., et al., 2002).

During the past few days, our university accommodated a job fair where crewing and shipping companies came to present their job opportunities for deck, engineers and electrical officers. This is the second similar event this year and it is very encouraging for us to see the real competition between these companies and their wish to attract as much audience as possible. However, the race for gaining future officers for their fleets is not enough to motivate the shipping companies to invest in the training of students while they are still in faculties, although they are happy to have on board young watch officers with 4 years of academic studies as educational background.

On the other hand, in accordance with our information, shipping companies have made investments in education in countries where the labor force is cheaper then in Eastern Europe (i.e. India, Philippines, Myanmar, etc.).

At this moment, our university has fifteen agreements signed with seven crewing companies and eight shipping companies. We encourage our students to undertake the OBT stages with these owners but around 22% of the students are still making voyages on ships owned by other companies. For the moment, we do not want to restrict their own will regarding the choosing of the shipping companies.

We consider it is very good that the number of agreements signed with owners is greater than the number of agreements with crewing companies, because working directly with owners gives us the opportunity to have a better feedback regarding the achievements of our students. In the next chapter we will see that are also other reasons for preferring to interact directly with the owners, instead of using a crewing company as intermediate between the university and the owner.

We, as a maritime university, are pleased that our deck students could find without much effort a ship to serve as cadet and to fulfill their 6/12 months OBT stage. We are also pleased by the perspective that all of our graduates that want to embrace a professional carrier at sea have this great opportunity and they will receive a fair payment for their job.

3. The Cadets' Opinion Regarding the OBT Process

Two years ago, as part of the research in OPTIMPORT project, CMU has designed a questionnaire (containing 20 questions) that has to be filled in by the cadets returning from their OBT period. In order to encourage students to answer with maximum sincerity, it is not compulsory for them to give their names. They have to mention the name of the ship, the crewing company and/or the owner.

The main purpose of this questionnaire is to help us in identifying the shipping companies that implemented the best OBT system and where the cadets are being integrated in a real and professional job training scheme.

The results that we will present and the comments that we will make in the following pages are based on the answers collected in 235 questionnaires. We will not reveal the names of the shipping companies that have best or worst performances from the point of view of fulfilling the requirements of the STCW 95 Convention regarding the on board training process, but we think that analysis of this answers will outline the real picture of this professional building-up period for young cadets.

For the purpose of this paper we selected only seven questions (from the total of twenty), the most important regarding the on board realities that had to be faced by a cadet in his training voyages. The selected questions are:

Q2 – Was there a Designated Training Officer on your ship?

Q3 - Did you receive a dedicated Training Record Book issued by the shipping company?

Q4 - Have you been asked about the level of your theoretical knowledge?

Q5 - Did you receive a written training plan that prioritized the training steps and stages?

Q11 - How would you appreciate the activity Designated Training Officer (DTO)?

Q12 - Please give a score for the quality of the on board training period

Q14 - Please give a score for the overall feeling on the on board training period

3.1. QUESTION Q2

Question Q2 is „Was there a Designated Training Officer on your ship?"

Cadets are instructed to answer this question with Yes or No, and an affirmative answer means that there was one deck/engineer officer on the ship on board which they served as cadet, that had very clear duties regarding the OBT program and was directly involved in the guidance, monitor, review, assessment of cadets, during the voyage (MNTB, 2005a). This officer was also reporting to the Master/Chief Engineer about the progresses made by cadets.

The question seems to be very harsh and it may look hilarious for many of the professionals involved in MET, but as you will see from the answers, the reality is not very encouraging.

As you can see from figure 1, we had 93 negative answers, meaning that in almost 40% of the voyages undertaken our cadets were not guided and monitored by a dedicated DTO. A negative answer to this question does not mean that there was no training running on those ships. As the students explained, in most of the cases, they received guidance from any of the watch officers, including Chief Officer/First Engineer and any available officer was allowed to undertake assessment and to sign and declare the cadet as proficient in the tasks mentioned in the TRB.

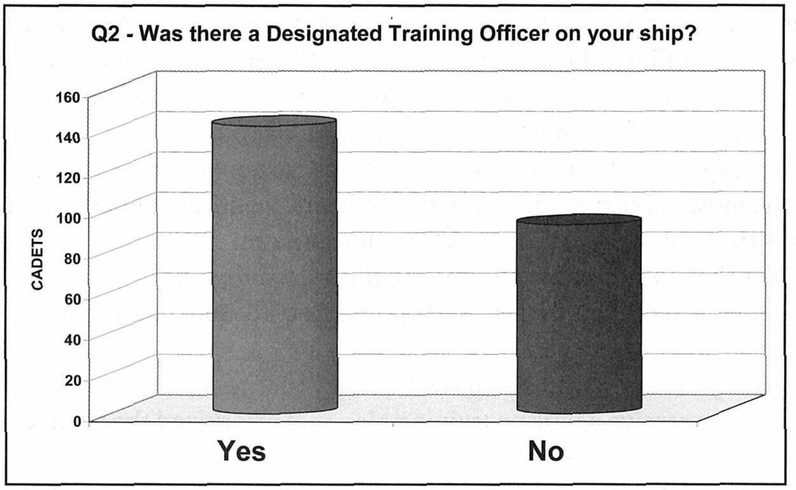

Figure 1. Answers to Question Q2

It is also true that in some cases, representing around 12% of the negative answers, there was no OBT program running on board. The on board policy encouraged cadets to "steal", in the old fashioned way, the professional skills from the on board officers without any explanations and guidance.

3.2. QUESTION Q3

Question Q3 is "Did you receive a dedicated Training Record Book issued by the shipping company? "

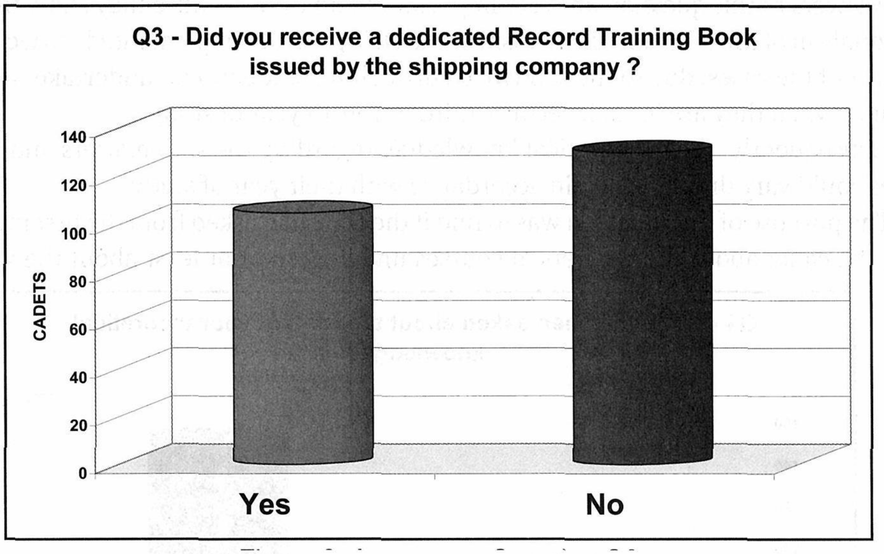

Figure 2. Answers to Question Q3

The Romanian Maritime Authority (RMA) published a TRB and the Constantza Maritime University (CMU) has the obligation to provide all of our students with this TRB. In order to avoid duplication of projects and tasks completion confirmation, CMU agreed with RMA that any TRB issued or used by a shipping company that meets the standards of the Romanian TRB will be accepted as valid.

Because we are not very pleased with the content of the TRB published by RMA, we asked our cadets if they worked with other types of TRB, copies of the standard TRB model published by ICS/ISF or other TRB issued in accordance with the provisions of other national maritime authorities (MNTB, 2005b).

As you could se from figure 2, the number of negative answers represents 55%, meaning that in most of the cases the cadets have used the TRB provided by the university to record their training progress.

Because the number of negative answers is greater than in the case of question Q2, this means that even if on board some ships there was an OBT system implemented by the owner and a DTO, they still used the TRB provided by the cadet to provide evidence of training.

In 45% of the cases, the shipping company had their own TRB and the student had to use this publication and to comply with the training program specified in that TRB.

3.3 QUESTION Q4

Question Q4 is "Have you been asked about the level of your theoretical knowledge? "

Answers to this question are very important to analyze because they show the professionalism of the DTO and the realism of the OBT program implemented. As we know, in most of the cases, due to the sandwich curriculum, students can undertake training voyages when they are in their second, third or fourth year of study.

Consequently, their theoretical knowledge, regarding the ship matters and procedures could vary dramatically, in accordance with their year of study.

The purpose of this question was to find if the DTO had asked from the first meeting with the cadet about the theoretical courses undertaken or at least about the year of

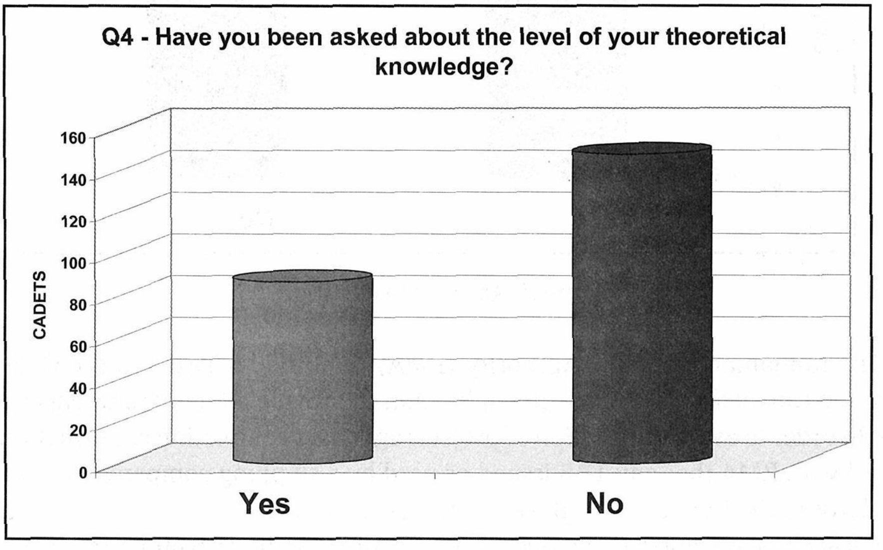

Figure 3. Answers to Question Q4

study of the cadet. As we can see from figure 3, there are 148 negative answers (63% from the total of 235 answers). By requesting explanations from our cadets regarding their answer to this question, we have found that in most of the cases the DTO was interested whether if the cadet is at the first, second or third voyage as a cadet and was eventually looking in the TRB to see what tasks had already been accomplished by the students.

In the context of a sandwich curriculum education the number of voyages already performed by the students are not very relevant. The year of study alone is also not relevant, because there are essential differences regarding the curricula for each year of study between maritime universities.

Usually, if the DTO asks about the year of study of the cadet he assumes that the cadet had the same theoretical training as the DTO had when he finished the same year of study, without taking into account that he graduated a different MET institution.

In order to make things easier, we think that it will be a good practice to provide cadets with copies of the official teaching curricula of the university, attached to the TRB - which will prove the level of theoretical knowledge achieved by the cadet.

3.4 Question Q5

Question Q5 is "Did you receive a written training plan that prioritized the training steps and stages? "

An affirmative answer to this question will reveal a good management of the OBT. The training schedule must be established in accordance with the theoretical and practical knowledge of the cadet and with the remaining tasks and objectives as ascertained by the TRB.

If this schedule is not prepared by the DTO, the only job aid that could give a clue about what has to be done remains the TRB. Standard TRBs usually present tasks in the order established by STCW and the guidelines established by IMO and not in the

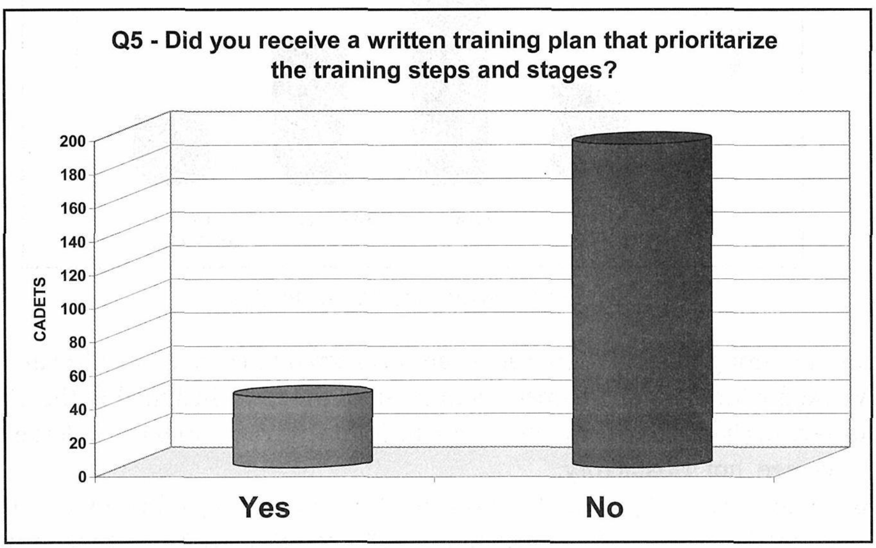

Figure 4. Answers to Question Q4

logical and chronological order for accumulating knowledge and skills during the OBT period.

In accordance with the questionnaire results, only in 18% of the cases (42 affirmative answers) the students encountered a very good training management that was able to prioritize the activities of the cadets (figure 4). Only 3 shipping companies, from a total of 32 where our cadets were embarked during the last two years, had the procedure to draw up a personalized training schedule for their cadets.

3.5. QUESTION Q11

Now we will jump to the second part of the questionnaire, where the student is asked to give an overall opinion on the quality of the OBT period, from his own point of view. It is obvious that the following questions have a higher degree of subjectivism, but in our opinion it is very interesting to see the general perception of the students on their live on board experience.

Question Q11 is "How would you appreciate the activity Designated Training Officer? "

Figure 5. Answers to Question Q11

For answering this question, cadets are instructed to consider as DTO any officer that worked with them and helped them to fulfill the tasks included in the TRB. The cadets have to choose the best match from the following categories of grades: excellent, good, average, not satisfactory.

As we can see from figure 5, the efforts made by the training officers were positively evaluated by the cadets (16% excellent and 49% good). Only 10% of the answers appreciate as "not satisfactory" the activity of the DTOs. We are reluctant about these negative answers, so from question Q11 we analyze mainly the above average results, because we consider that these answers reflect better the on board realities. Consequently, we have to observe that even though there are a lot of ships where the OBT system is not very well implemented or managed, there a lot of officers that voluntarily or not help cadets to achieve their required practical skills and competencies and cadets are grateful for this help.

3.6. Question Q12

Question Q12 is "Please give a score for the quality of the on board training period.

"Answers to this question are also analyzed with some precautions, because in our opinion, only the cadets that are at their second voyage could have a tangible basis to compare on board experiences. For the cadets returning from their first voyage, this answer has a higher degree of subjectivism.

Any how, as shown in figure 6, almost 60% of the students considered that the quality of the OBT could be better, and this state of facts are not a good mark for the realities related to the OBT process.

The truth is that the universities are not very well connected to the on board training process and these education institution could not control the on board activities of their cadets.

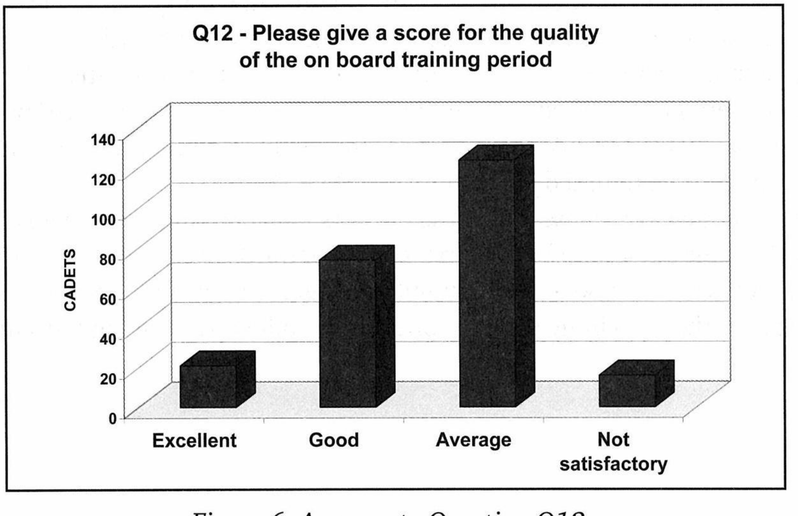

Figure 6. Answers to Question Q12

3.7. Question Q14

Question Q14 is "Please give a score for the overall feeling regarding the on board training period"

This is the last question that will be presented in our paper and reflects the feeling of the cadets about their training experience on board ships.

Figure 7. Answers to Question Q14

It is true that there are very good chances that the feelings about the training to be mixed with the feelings about general life on board, but we appreciate that most of the students made positive appreciation about the time spent on board.

Taking into account that 40% of the students were not very satisfied about their on board experience (marked as "average"), and 3% of the cadets were "not satisfied" about that stage, it is possible that part of them will not embrace a sea carrier and will prefer from the start to find o job onshore (Little A.D., 2004).

By maintaining a database with these answers, we are trying to compare the answers given by the same students after the first, second or third voyage. By corroborating with other answers we can make some assumptions regarding the influence of the on board social life over the remaining state of spirit of the cadet after leaving the ship.

4. Conclusions

We agree that this analysis is based mainly on answers given by cadets, at the returning from their training voyages. We know also that when a student has to evaluate his teachers or his education system, his answers may not reflect the reality 100%.

Before the graduation exam, an evaluation of the practical skills of the students from the last year of study is being made. Students have to undertake a 3 hours navigation watch, in a maritime area difficult for navigation and during that time they have to solve different tasks intended to reveal, as much as possible, their practical knowledge and skills.

Consequently, for the analysis of OBT quality, we compare the answers of the questionnaires with their achievements during this evaluation and we consider that we can draw up realistic conclusions regarding the quality of OBT programs implemented by the shipping companies.

In order to summarize, we can say that:

- the OBT period is a very important part of the building up of the professional skills and competences of the young merchant officer. Despite the students' opinions, only on board training is not sufficient for the creation of a modern officer. OBT must be an integrated part of the MET system, based on academic theoretical knowledge;
- there a great differences between the quality and complexity of the OBT programs performed on board ships;
- the number of shipping companies that have a modern and systematic OBT system is very low;
- in most of the cases, the cadets have to learn by themselves, looking and copying the actions and work style of the ship's officers;
- the quality of life on board is very important for the professional progress of cadets and what they feel in the first 2-3 voyages could determine their options for their future;
- many cadets are motivated only by the money that they will receive as cadets and choose the shipping companies that offer them a better payment, without considering the quality of the OBT. This is the reason for which 20-22% prefer to go at sea with shipping companies that are not on the least agreed by our university;
- it will be idealistic to think that the university could direct its students only towards the shipping companies that have a good OBT program. For the moment we could not afford to make such a positive discrimination between the shipping companies, because the OBT period imposed by the STCW is very long, and we need all the available places offered by the shipping or crewing companies;
- it will be best only to work with shipping companies, without the brokerage of crewing companies, because the university will know from the beginning where the cadets will go and could avoid some unpleasant experience for the students;

- it will be very good if the universities could maintain some sort of supervision regarding the OBT, but this thing is not practically possible, excepting maybe the ships under national flag. Universities have to ask for feedback from owners, regarding achievements of their students, during the OBT period. This is the only way to make owners responsible and aware about the great importance of the OBT process.
- Universities must review the level of competences achieved by cadets by monitoring the tasks completion from TRB and by evaluating the practical skills of the students at the end of the sea training period.

It is very important that students consider the sea going intervals an integrated part of their professional training and make no disjunction between the theoretical courses and the OBT stages. The universities must emphasize by all means the necessity of building up practical skills on solid theoretical knowledge.

REFERENCES

1. Barsan E., 2004, *Sea Service Equivalency for Full Mission Simulators training*, 5th General Assambly of International Association of Maritime Universities - Launceston, Australia, published in Advances in International Maritime Research ISBN 0-646-44200-7, pag. 120-129, Pub. Nella Australia, Launceston, Australia
2. Barsan E., 2006, *Social aspects of the Seafarers' integration on the Maritime Jobs Market,* International Conference "E-COMM-LINE 2006" – Bucureşti, published in One eEurope & Europe, pag C7/28 125-136, ISBN 973-88046-0-4, Ed. Ecas Trade, Bucureşti
3. Bordal J., Haeselich H., Kohli G.P., Meling J., 2002, Future Competence of Seafarers, Norwegian Shipowners' Association - The Research Council of Norway, Bergen, Norway
4. Little A.D., 2004, Identification of Leadership Qualities for Effective Safety Management, Final Report to Maritime and Coastguard Agency, Reference 17767, Cambridge, UK
5. Marine Accident Investigation Branch (MAIB), 2004, Bridge watchkeeping safety study, Southampton, UK
6. Merchant Navy Training Board (MNTB), 2005a, Deck cadet training manual, London, UK
7. Merchant Navy Training Board (MNTB), 2005b, Planned training at sea - guidance for companies and seagoing officers, London, UK

Consideration on Limiting the Elements of Human Factor Influence on Breakdowns of Ship's Machinery Illustrated by Some Case Studies

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Abstract

The paper in the first part introduces the reader into general issues contributing to the complex role of the human factor in safe ship operation. Further the capacity which the International Maritime Organization (IMO) attaches to the human element in shipping is discussed. Next the International Safety Management (ISM) role towards safer ship operation and the economic viability of a ship-owner is highlighted. The last part of the paper contains two case studies the first illustrating the need for training expertise and certification for shipboard electrical officers and the second case giving an example how not observing simple procedures and checklists by the crew can lead to fatal and costly accident.

1. Underpinning background of the human factor element issue

Merchant seafaring is rated as the second most hazardous occupation with seafarers 260 times more likely to have fatal accidents as compared to those employed in any other industry (Roberts vol.360, p.543)7. Maritime accidents involving ships in collisions, foundering, groundings, fires, explosions etc. in the period 1999-2004 are presented in Fig. 1, these are responsible for heavy loss of property and long-term environmental damages, they on the other hand account for large number of valuable lives.

Large floating population of passengers at sea along with over a million seafarers, inevitably on board for operation of some 88 000 ships at any given time continues to be at risk exposed to the vagaries of seas and operational hazards.

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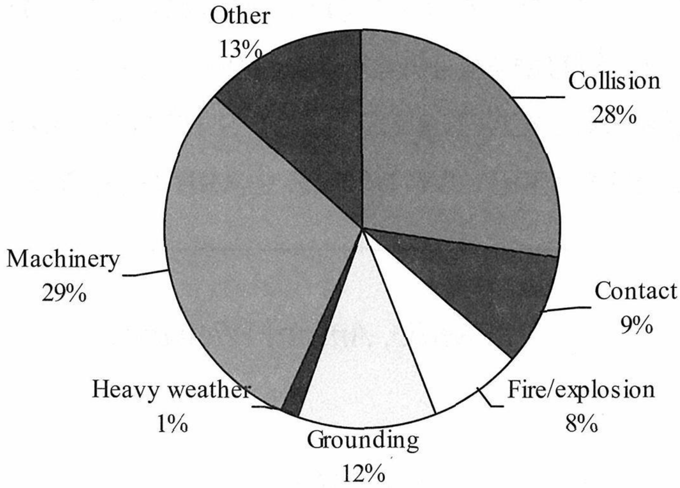


Fig. 1. Hull & Machinery. Claims 1999-2004. Costs in per cent

In the aftermath of the oil crises of the seventies and trade slump of early eighties the ship owners, to survive in this highly competitive shipping business, were left with no other option but to drastically cut down their costs of operations. Crew expenses, accounting for 25 to 35% of total operational costs (Stopford 2000)[8] were the primary targets. The strategy adopted was, firstly to replace a portion of human element by technology. Such partial replacement had also became unavoidable from the standpoint of higher surveillance of operational parameters that became necessary for monitoring and control of contemporary shipboard propulsion and power plants, which for the same reasons of economy needed to be more efficient and consequently demanded operations within tighter tolerances.

Safe and efficient operation of shipboard propulsion plants and their auxiliary equipment within narrow limits of operational parameters is not possible without certain degree of automatic controls. Second course of action to support this strategy was to target cheaper workforce. This necessitated many traditional ship owners to flag out their vessels for necessary freedom to employ seafarers ready to work at lower wages, wherever they could get them from. This change in ship operating pattern however has not been without repercussions. In many cases the 'flags of convenience' became associated with the term 'crew of convinience' (Alderton 2001)[1], because of seafarers with lower levels of knowledge and skills from nations where maritime education and training systems could not keep up with the standards dictated by changing technology, obviously for the same reasons that produced cheaper workforce. In contrast though, these seafarers needed higher knowledge and skills commensurate with contemporary advancing technology. Present pattern of crewing is generally characterized by multinational seafarers in short-term employment contracts, normally provided by crewing agencies (Couper 2000)[4]. While according to a research conducted by the Cardiff University (Kahvechi 2002)[6] which states that approximately 65% of the world fleet have adopted multinational crewing strategies with about 10% of the fleet staffed with crew composed of five or more different nationalities, there are reports that there may be as many as 15 or 16 nationalities on a single ship.

This global diversity is also indicative of widely differing training and skills levels among other attributes of such seafarers. The process of globalization has introduced a broad social and ethnic diversity as a result of multinational crew (IMO News 2002)[5]. Globalization of crew dictates not only a higher level of knowledge of common language and skills to apply it, but also a compatible technical knowledge commensurate with levels and structures of shipboard management for effective teamwork. The physical barriers to communications get exacerbated due to language and cultural diversities of the personnel involved. Outcome of these changes in the ship management pattern and in shipboard technology have had adverse influences on personal safety, ship and environment safety as well as on the efficiency of operations.

These concerns have been prompting the maritime community to direct its concerted efforts towards enhancement of maritime safety for protection of life, property and the environment.

2. The Human Element in the Work of the IMO

The lone figure standing atop the international memorial to seafarers outside the London headquarters of the International Maritime Organization (IMO) is symbolic of the importance that IMO attaches to the human element in shipping – the complex multi-dimensional issue that involves the entire spectrum of human activities performed by ships' crews, shore based management, regulatory bodies and others.

An analysis of 187 instances of groundings and collisions carried out by IMO's Sub-Committee on Flag State Implementation (FSI) indicates that, in 150 cases, or some 80 per cent, the human element was a contributory factor. Broadly equivalent results have emerged from similar analyses and fatigue has emerged as a significant factor in maritime accidents – along with others such as communication, competence, culture, experience, health, situational awareness, loneliness, isolation, stress and working conditions.

IMO has to date accomplished a significant amount of work in addressing the human element in shipping, at sea and ashore. In 1991, a Working Group was established on the role of the Human Element in Maritime Casualties and since then Assembly resolutions have set forth the human element vision, principles and goals for the Organization (resolution A.850(20) updated by A.947(23)) and requested the IMO Committees to focus their attention on "shifting emphasis onto people" (A.900(21)).

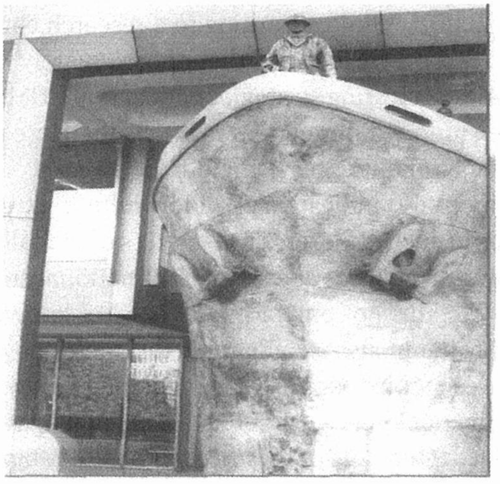


Fig. 2. International memorial to seafarers

Key human element regulations include the STCW Convention – particularly the revision of the Convention in 1995 – and the ISM Code – mandatory for most ships since 2002. IMO has also developed Guidelines for the Investigation of Human Factors in Marine Casualties and Incidents, included in the IMO Code for the Investigation of Marine Casualties and Incidents, and comprehensive Guidance on fatigue mitigation and management has been published.

There is also the STCW-F Convention for fishing vessel personnel, which unfortunately is not yet in force due to lack of sufficient ratifications – but this has not stopped IMO from holding a series of regional familiarization seminars around the world and developing a number of model courses for fishing vessel personnel, which are nearing completion.

Meanwhile, IMO's Maritime Safety Committee (MSC) agreed at its 81st session in May 2006 that a comprehensive review of the STCW Convention and STCW Code is needed, in order to ensure that the Convention meets the new challenges facing the shipping industry including, but not limited to, rapid technological advances today and in the future. The MSC instructed the Sub-Committee on Standards of Training and Watch keeping (STW) to define, as a first step, the issues to be reviewed and advise the MSC accordingly, before embarking on the actual work. The target completion date is 2008.

In the light of analyses of accidents indicating that fatigue was a main contributing factor, a new work program item on review of the principles for establishing the safe manning levels of ships has also been included in the work program of the STW Sub-Committee.

IMO's Joint MSC/Marine Environment Protection Committee (MEPC) Working Group on Human Element continues to meet annually and MSC 81 approved MSC/MEPC circulars on: checklist for considering human element issues by IMO bodies; strengthening of human element input to the work of IMO; framework for IMO consideration of ergonomics and work environment; and the Organization's strategy to address the human element, which includes a related action plan.

Amongst other items, the next session of the Joint Working Group on the Human Element, meeting during MSC 82 in November-December 2006, will analyze the report of a study into the impact and effectiveness of the ISM Code which was carried out by a Group of Independent Experts selected from administrations, organizations, academia and the shipping industry. Based on the data collected, the report concludes that where the ISM Code had been embraced as a positive step toward efficiency through a safety culture, tangible positive benefits were evident; and ISM Code compliance could be made easier through a reduction in the administrative process.

From the above, it can be seen that work on the human factor continues to evolve – while it remains at the heart of IMO's work. Effective implementation of the STCW Convention and the ISM Code through appropriate education and training will continue to have a significant impact on the quality of seafarers and the operational safety of ships. By focusing on the human element in general IMO is strengthening the link between management ashore and performance afloat to sustain a safety culture. The achievement of safer, more secure and efficient shipping on clean oceans will always be dependent on human factors.

The various Conventions and Resolutions mentioned in this article can be downloaded from the IMO website: www.imo.org.

3. Towards safer ship operations and the economic viability of a ship-owner

The International Safety Management (ISM) guidelines were developed to provide a framework for the proper development, implementation and assessment of safety and pollution prevention management.

When ISM was rolled out, many companies produced large volumes of manuals, which clouded or failed to address key issues. They hoped to raise the safety culture through the use of lengthy procedures and checklists, which did not bode well with those who were supposed to use them. Some companies then changed their strategy by first soliciting feedback and participation from those using the manuals and then writing concise, user friendly procedures. Checklists which did not serve any purpose were removed; data flow was better managed through the intelligent use of information technology; and improved transparency between the vessel and the office removed the blame culture.

Ship vetting, the needs of the ISPS Code and reduced turn-around times in port presented an added administrative burden for ships' staff, particularly where numbers had remained the same or had reduced, resulting in increased fatigue. Some ship managers have recognized this imbalance and have taken action to redress it by:

- Placing additional deck officers and/or ratings on board for vessels on short trading patterns or difficult routes or difficult cargo handling processes.
- Recruiting Administrative Assistants to manage the shipboard administration (a role previously undertaken by the Radio Officer).
- Providing shore assistance for maintenance routines and increased dry-dock budgeting.
- Reducing the duration of crew contracts.
- Increasing onboard recreational facilities.

Although this resulted in increased operating costs, there have also been huge indirect cost savings through a reduction in accidents and incidents.

With the shortage of properly qualified seafarers, the burden of providing additional training is becoming more evident. Training is not about just providing what is available in the market or meeting regulatory requirements. Some companies are providing training to understand company systems and internal workings. These programs are internally developed using feedback from ships' staff and applying lessons learnt from incidents, coupled with management business objectives.

Almost all shipboard systems and operations are heavily dependent on human intervention and the human link will constantly remain a weak link in this equation. Therefore the human element needs to be continuously managed and improved. In the final analysis, continued 1earning processes, renewed strategies in managing human capital, and improvement of work practices will form the basis for safer ship operations and for the economic viability of a company.

For a fuller version of Captain Sivasundram's article go to: www.he-alert.org/displayArticle.aspx/articleID=HE00565

4. Some accidents case studies

A. Passenger vessel switchboard fire (Alert - The International Maritime Human Element Bulletin. Issue 2005)[2].

This report of a switchboard fire in a 55,451gt 'state of the art' passenger vessel, built in 1992, demonstrates that some regulatory, design/construction and training deficiencies only manifest themselves after an emergency has occurred – in this case some 10 years after the ship first entered service. The report, from the Transportation Safety Board of Canada, highlights a number of important Human Element issues.

Following the catastrophic failure of the main circuit breaker for one of the diesel generators, fires were started in the main switchboard room (MSR) and the adjacent engine control room (ECR). During the events leading up to the failure of the circuit breaker, none of the senior engineering or electrical officers demonstrated sufficient knowledge or expertise in troubleshooting problems with medium-voltage propulsion plants.

It was company policy for senior engineer officers who were standing by the construction of a new ship to be trained in the vessel's 6.6 kV electrical systems by the equipment manufacturers, with these officers then training the incoming generation of ship's crew, who in turn would train the ones who followed them. However, this system of succession training had fallen into disuse such that, at the time of the accident, neither the engineers nor the electricians had been trained in the ship's electrical generation, distribution, and application systems.

Because the MSR did not have an independent smothering system, the crew extinguished the fires using portable carbon dioxide (CO_2) extinguishers. The lack of an independent connection to the ship's CO_2 smothering system in the MSR deprived the vessel of an effective and safer means to fight fires in this compartment. Furthermore, as the fire was being fought, one of the diesel generators continued to supply 6.6 kV power to the switchboard, located approximately one meter from the firefighting activities. This exposed the crew to undue risk, albeit there were no injuries.

The report recommends a review of the requirements for structural fire protection and fire-extinguishing systems to ensure that the fire risks associated with compartments containing high levels of electrical energy are adequately assessed; and that the provisions of the International Convention for the Safety of Life at Sea (SOLAS) dealing with structural fire protection and fixed fire-extinguishing systems are addressed.

Furthermore, the report highlights the need for internationally accepted minimum standards for training, expertise, and certification for shipboard electrical officers.

This comprehensive and very technical investigation report is essential reading for all those involved in the regulation, design, construction and operation of ships with medium-voltage generation and distribution systems.

The full report can be downloaded from: http://www.tsb.gc.ca/en/reports/ marine/2002/m02w0135/m02w0135.pdf.

B. Case Study 2 (GL Flensburg Presentation, May 2002)[3]

A container ship built in 1995 of 2480 TEU capacity and a MAN-B&W 6S70MC main engine of 16860 kW, 91 rpm suffered a very serious main engine crankshaft breakdown two crank webs on cylinders No. 3 & 4 have slipped. Crank web on cylinder No. 3 has been turned by 10° in astern direction and cylinder No. 4 crank web was shifted by 315° in the ahead direction (see Fig. 3). Following sequence of events took place: Automatic ME safety system triggered an engine slow down due to "Piston Cooling Flow on cylinder No.

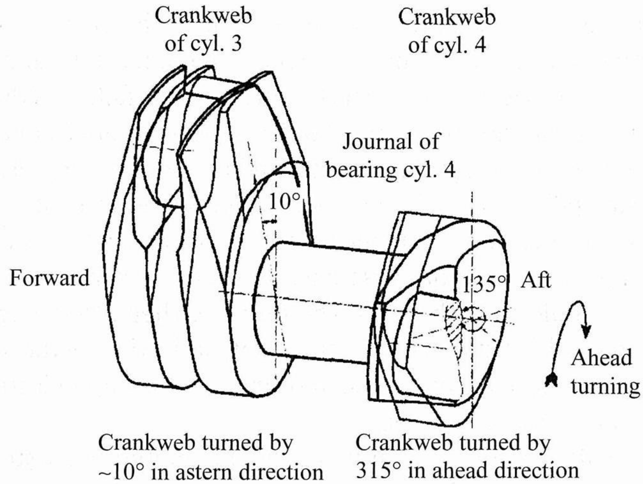
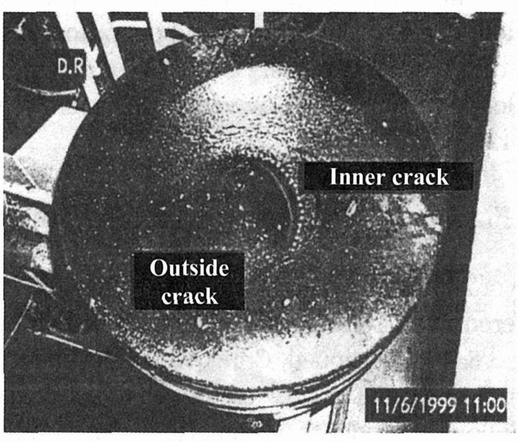


Fig. 3. Detailed picture of damage to crank webs cylinders No. 3 and No. 4

3" announcement. The engine was stopped manually by the engineer on watch. The ship was in ballast condition, stormy weather caused the ship to roll up to 45° both sides.

The engineers checked the piston cooling oil flow-found o.k. Drain pipe from under piston space of cylinder No. 3 was checked and no flow present – o.k. (but later it was stated that the drain pipe was clogged). After 5 min. M.E. stoppage, the engine was started again in ahead rotation. Immediately after that an enormous thump was heard (like an internal explosion), and the engine brought to a stop. Cause stated: hydraulic impact in combustion chamber of cylinder No. 3 what has caused the slippage of crank webs cylinder No. 3 and cylinder No. 4. During later inspection it was discovered that the piston crown of cylinder No. 3 had two cracks (an inner crack and an outer) during



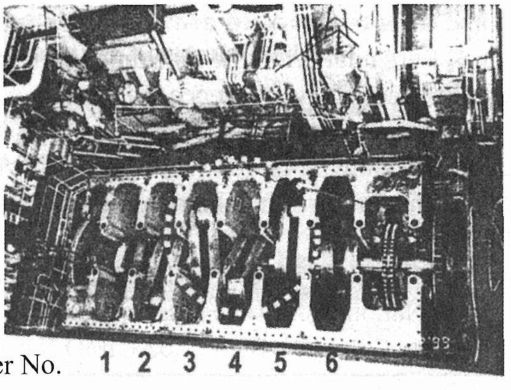
Damage
Craks in piston crown
Cause:
- Hydraulic thump in combustion chamber of cyl. No. 3
- Slippage of crankwebs on cyl. 3 & 4

Fig. 4. Damage details on piston crown of cylinder No. 3

the 5 min engine stoppage the cooling oil seeped through into the combustion chamber of cylinder No. 3 (see Fig. 4).

The final picture of the damage (see Fig. 5), crank webs of cylinders No. 1, 2, 3 turned by about 35° i relation to crank webs of cylinders No. 4, 5, 6. The aft crank web of cylinder No.3 and forward crank web of cylinder No. 4 have shifted outwards by about 2 mm. Undertaken temporary repair to bring the ship from Azores area to Hamburg; piston of cylinder No. 3 pulled out. Cylinder No. 1 and No. 2 cut off. Permanent repair – first it was intended to bring back the slipped crank webs into original position but was given up due to the excessive turning of the crank webs, second proposal was to built in new crank webs but this turned out to be too expensive compared with fitting a new crankshaft.

The question arises if this damage could be avoided. The straightforward answer is yes. It could be avoided if routine procedures were observed. It means that the turning gear was clutched in and the engine rotated with open indicator cocks to observe eventual emission from the indicator cocks. If this procedure would be carried out the engineers could notice the oil being ejected from cylinder No. 3 but this was not done, the normal procedure has been violated with fatal results. The only excuse concerning the engineers action can be the state in which the ship was sailing (heavy rolling) and the clogged drain pipe from the under piston space of cylinder No. 3, but if this drain valve has been regularly opened it would not be chocked so again some negligence on the engine crew side.



Damage Picture

- Crabkwebs of cyl. 1, 2, 3 turned by about 35° relative to crankwebs 4, 5, 6
- Aft crankweb of cyl. 3 and forward crankweb of cyl. 4 projecting about 2 mm outwards

Firing:
1 – 5 – 3 – 4 – 2 – 6

Fig. 5. Picture of turned crank webs seen from top of the engine bedplate

Conclusions

It makes sense of continuing projects to improve the awareness of the Human Element in the maritime industry. In the time to come we should be focusing on the application of the body of knowledge that has already been accumulated to address the specific Human Element issues of: fatigue, effective communication, automation and alarm management, strict observation of procedures, complacency and routine slips, trips and falls, health, safety and wellbeing, recruitment, retention, education, training and competence, and information management. There is also an urgent need to review the STCW convention with respect to introduce the electrical engineer diploma as more and more electrical systems are introduced on today's ships (diesel-electric propulsion), case study A is an obvious evidence of having on board electrical engineers familiar with the vessels 6.6 kV electrical systems. Thus there is a need for internationally accepted minimum standards for training, expertise and certification for shipboard electrical officers.

Finally there should be a decisive reverse in financial outlays for technology development and crew training, i.e. 80% of finances should be devoted for in depth training and less for a continuous development of technology with which the crew cannot catch up.

References

1. Alderton T. et al.: Globalization & Deregulation in the Maritime Industry. marine Policy, vol. 26, pp. 35-45, Pergamon, Reed Elsevier Science Ltd. 2001.
2. Alert – The International Maritime Human Element Bulletin. Issue No. 8, July 2005.
3. Betriebserfahrungen und neue Entwicklungen in der Schiffsbetriebstechnik – 24 Insformationstagung des ISF 2002 (Institut für Schiffsbetriebstechnik) an der Fachhochschule Flensburg; May 2002.
4. Couper A.: Implication of Maritime Globalization for the Crews of Merchant Ships. Journal of Maritime Research, pp. 2, National Maritime Museum, London 2000.
5. IMO: Safer Shipping Demands a Safety Culture. Volume No. 3, IMO News, p. 5, Periodical magazine of the IMO, London 2002.
6. Kahvechi E. et al.: Transnational Seafarer Communities Report by Seafarers International Research Centre, p. 6, Cardiff University, South Wales, UK, 2002.
7. Roberts S.E.: Hazardous Occupations in Great Britain. The Lancet, vol. 360, pp. 543-544.
8. Stopford M.: Cost Revenues. Maritime Economics, p. 160 Routeledge, London 2000.

Empowering Seafarer — Role of Maritime Universities

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Abstract

Shortage of seafarers can be broadly attributed to two factors namely inability to attract talented youth to sea career and retaining the trained seafarers. The main motivating factors that influence students in choosing a career are money and the job satisfaction where as they are mainly influenced by parents and teachers (Kniveton, 2004). Students look for short term motivating factors in a career whereas parents and teachers look for long term motivating factors. In career at sea the short term factors are good and students like to join career at sea but the parents influence is lacking as career at sea is not a lifelong career and there is negligible academic growth. The talented seafarer of today does not want to be at sea throughout his life especially when jobs ashore are equally rewarding. The problem is more aggravated in that the seafarer is leaving sea career too early to prepare for shore job. Solution to the problem is in empowering the seafarer by providing quality education at sea, so that he learns while he earns and develops multiple competencies and qualifications. This will provide for a life long career thru the career at sea thereby increasing thru put via the sea career route. It will also assist in retaining the seafarers for longer time. The paper will outline the role of Maritime Universities in empowering the seafarer. The programs offered, eligibility requirement for each program, basis and procedure of granting equivalent credits based on his certificate of competency, method of delivery of remaining credits and assessment procedures will be discussed. A structured and flexible academic path will be suggested from bachelors' level to doctors' level. Integration of maritime disciplines into other disciplines will be suggested. Topics of research and dissertation possible on board ships will be suggested.

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1. INTRODUCTION

Seaborne trade forms 90% of the total world trade and ship operations is one of the main activities to execute the trade. Seafarer is critical in the efficient and safe operation of ships to ensure intact and timely delivery of goods without harming the environment. Complex techno-dynamic shipboard operations in a highly demanding commercial environment constrained by plethora of regulations require the seafarer of the future to possess higher analytical skills, abilities and competencies. Most shipping journals, magazines, shipping conferences and seminars highlight the crisis of shortage of well educated and trained manpower on board ships.

The problem can be attributed to two main factors namely inability to attract good students and retention of seafarers. The talented seafarer and youth of today do not want to be at sea throughout there life especially when jobs ashore are equally rewarding. The problem is more aggravated in that the seafarer is leaving sea career too early to prepare for shore job. Seafarers are the main ambassadors of promoting the career at sea and sometimes play the role of career counsellors as far as sea career is concerned. At the same time view of the society about the career is important as the student is mainly guided by the opinion of the society (family, teachers and friends). Reflection of seafarer's views on his own career and perception of the society about present scenario of career at sea is important has been established by analysing responses received from seafarer trainees, ship's officers and seafarers working ashore through a set of questionnaires. The over 150 responses collected reflect dissatisfaction, isolation, and lacking in academic qualifications to make the career at sea as a lifelong career path. Seafarer's career satisfaction, his better integration into the society and lifelong career options is the key to attract good candidates and retain them longer at sea.

Empowering seafarer through higher integrated education and multiple skill development makes the career at sea more attractive by opening up multitude of career options to him thru the sea career path. Higher level education will also empower him with flexible functional abilities required in shipboard operations today. Empowerment of the seafarer as required above is suggested in this paper thru an empowerment model and its positive affectivity is reflected in the analysis of responses to the questionnaire by the seafarers after reading the empowerment model. The role of the maritime universities and International Association of the Maritime Universities is very important in empowering the seafarers. Recognition of seafarer's previous learning demonstrated by certificate of competency, providing higher education programs necessary for multiple competencies and obtaining higher academic qualifications are suggested. The "learn while you earn" concept of delivery of these programs that makes optimum use of seafarers time at sea and ashore is explained. The paper also discusses the necessity of programs on social sciences in seafarer's better understanding of self and integration into society. The role of International association of maritime universities and other universities in adopted marine education and training is briefly outlined.

2. Present Scenario

Present status of sea career has been collected through a set of questionnaire circulated amongst trainees, sailing officers and seafarers working ashore which is reflection on his career at sea and society's perception about the sea career. The samples include seafarers from India, Philippines, Indonesia, Algeria, Egypt, and the Netherlands. The factors that influenced seafarers in choosing the career at sea are:

- Parents and family influence below 50%
- Pay and conditions over 80%
- Foreign travel over 70%
- Flexibility below 50%

The above data shows that the seafarer has been influenced by short term motivators pay, foreign travel and adventure. The long term influencing factors of family and flexibility show less influence. At the beginning of his career the seafarer is satisfied but with passage of time his satisfaction level drops from 3.8 to 2.7 on the Likert scale. Similar result is obtained when the satisfaction level is analysed from trainees to the seafarers working ashore. The trainees are more satisfied than the ship's officers 3.4 as compared to 2.9. However if the comparison is done with seafarers working ashore they were more satisfied with career at sea recording 3.8 which can be attributed to there continuous growth and development on shifting ashore. Hence it can be correctly said that for seafarers to be more satisfied with career at sea, route to shore employment that ensures lifelong career is essential.

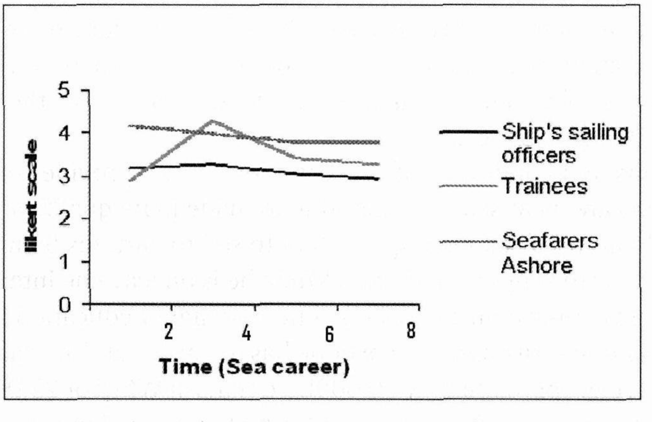


Figure: 1 (Seafarer's Career satisfaction)

Most seafarers feel isolated at sea and ashore which is evidenced by there response as 3.8 and an equal response shows that the career at sea is boring after sometime. Over 70% of the seafarer's who responded do not feel that the career at sea is life long career. Over 90% of seafarers sailing and ashore feel the need for higher education. The Present day training and development of seafarers, in areas other than safety, needs to be reviewed (OECD Project, 2003). The survey conducted by Chinese shipowners also suggests "low social status" and "lack of mental stimulation at sea" is hampering recruitment (Grey, 2007). Seafaring Empowerment Model (SEM) is suggested below in order to provide for integrated, flexible and less expensive higher education.

2.1. SEAFARING EMPOWERMENT MODEL

2.1.1. WHY EMPOWERMENT?

Empowerment is a complex word used in many disciplines like community development, psychology, education, economics, and studies of social movements and organizations, among others. According to Bailey (1992), definition of empowerment depends upon the specific people and context involved. Empowerment discussed in this paper is the constraints on seafarer's right for further education and training.

To be empowered one must be disempowered, i.e to say one does not have freedom or ability to make choices (Sen, 1999 & Mosedale, 2005). Seafarers are among the most exploited and abused group of workers in the world. "Life at sea is at sharp end of multinational capitalism – the free market let loose with limited restrictions and sometimes little morality" (ITF, 2007). Criminalization of seafarer's is more of a norm now then an exception. The imprisonment of the masters of the ill-fated ships ERIKA and PRESTIGE in Europe and of the master and crew of the TASMAN SPIRIT in Pakistan provide sufficient evidence of this. Denial of shore leave, unfair treatment of seafarers and undue harassment of seafarers are some of other violation of basic human rights and dignity. They are frequently treated as serious criminals before their guilt has been established (Mukherjee, 2006).

Present terms and conditions of seafaring job do not provide freedom to make choices between careers at sea or ashore due to inadequate qualifications. Moreover the contractual nature of sea job requires him to sail to earn his living, thus he must sail for long periods to support his family. When he is on leave he intends to stay with his family whom he missed during his sea time. For higher education he has to spend time in college or university and moreover he has to pay handsome amount as fees for higher education e.g. approximately 50,000US dollars at WMU or 25,000£ in a college in UK. Thus he has to spend hefty amount for higher education when he is on leave when not earning and also he has to stay away from his family. It can be said in the present scenario the environment is not conducive to his lifelong learning, hence his rights of further training and education to provide for skill development and portable competencies in order to secure and retain decent work to improve individual employment prospects is not provided for (ILO, 2006).

Appropriate provision of resources and regulations shall be provided to enable them (seafarer) to pursue their interests (Kilby, 2006). Maritime labour convention regulation 2.8 "career and skill development and opportunities for seafarers' employment" has provided a base for flag states to implement certain procedures but the convention is yet to be ratified and enforced. European Union green paper on maritime policy for the union has identified knowledgeable and skilled maritime human resource as one of the twin pillars to achieve strategic objectives of the policy:

> "the particular need for an all-embracing maritime policy aimed at developing a thriving maritime economy, in an environmentally sustainable manner. Such a policy should be supported by excellence in marine scientific research, technology and innovation"

It also states that continued investments in knowledge and skills are key factors for maintaining competitiveness and ensuring quality jobs. Thus it is fair to conclude that empowerment of seafarer is need of the hour.

2.1.2. Seafarer Empowerment Model

The objective of the model is to provide higher education to the seafarer using complimentary teaching methods such as work based learning and learning thru conventional methods. Work based learning takes place at sea and learning thru other methods takes place ashore. The purpose is to make optimum use of time at sea mainly mid oceans thereby making higher education less expensive on time and money. Thus it provides opportunity to the seafarer to "learn while he earns". This will motivate seafarers to take up higher education, which will enhance his employability ashore by providing him with necessary competencies and educational qualifications. It is also suggested the maritime education universities and colleges shall offer non marine programs and associate with main stream universities. This will provide for vertical and horizontal integration as well as permeation of one stream into the other. It also opens opportunities for seafarer to interact with future regulators, managers, financers and socialists or they become one. At the same time this will spread awareness among the students of other streams which is in a way subtle marketing of the seafaring career and shipping industry. Such a learning environment will help in better integration of the seafarer into the society and remove the feeling of isolation at sea and ashore.

The projected benefits of the model are that it provides:

- Competent and professional human resource to the shipping industry
- the seafarer with stable and secure career

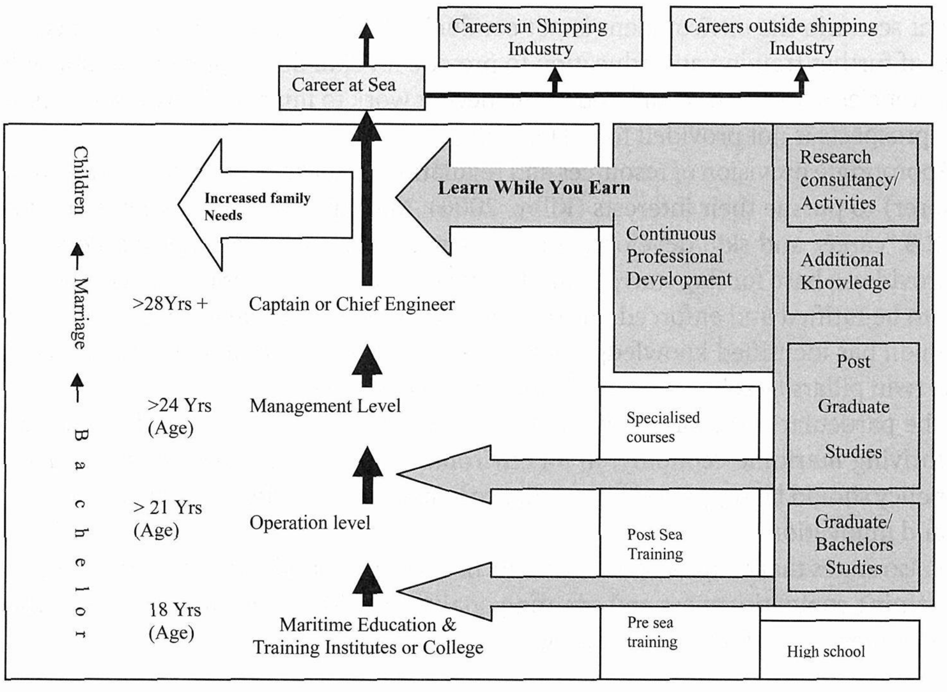


Figure: 2 Seafarer Empowerment Model

– motivation to the seafarer by reducing feeling of isolation, boredom and by raising self esteem
– for rotational employment onboard ships and ashore
– opportunities of consultancy and research on board ships and ashore
– seafarer with more time for family life as better job flexibility
– attraction to good students to seafaring by making the career challenging, flexible, stable, secure and rewarding – a career option for life

2.2.3. BENEFITS OF SEM

To see the affectivity of the model it is required that the model is validated. Towards this objective a set of questionnaire was requested to be filled up by the respondents of the earlier questionnaire after reading the objectives of the model and the result obtained are positive. Over 90% of the respondents feel that the seafarer will be empowered academically, socially and professionally that is to say they will be able to perform better aboard ship and ashore, get better shore jobs and better integrate into the society. Over 85% of them will sail longer if empowered as above. Over 80% will recommend the sea career to good students compared to below 60% before empowerment and over 75% will recommend the sea career to their son compared to below 50% in the present scenario. Therefore it can be rightly concluded that empowerment of the seafarer as outlined above will help attract good student to the shipping industry. Adoption and implementation of the Seafarer Empowerment Model (SEM) may provide the necessary impetus to attract young talented students to seafaring. World Maritime University (WMU), International Associations of Maritime Universities (IAMU), its members and MET institutions play a critical role in facilitating implementation of the SEM.

3. Role of Maritime Universities

The role of maritime universities is important in delivery of higher education.The SEM uses the learn while you earn concept of learning thereby not only making the learning less expensive in time and money but also utilizes the best features of both cheaper and flexible but also making best use of both in class teaching and online learning that promotes independent learning and reduces in class seat time (Granham & Kaletta, 2002). Another special feature of the SEM is the integral learning environment.

3.1. "Learn while you Earn" Concept

The objective of the SEM is optimum utilization of the time compulsory spent by ship's officers on board ships during their contract periods for sea time requirement for higher level Certificate of Competency (COC) or as normal employment to earn his living. As during deep sea sailing ship's officers can easily spare about 2hrs. i.e. (8hrs of watch keeping, 10hrs rest period, 2hrs maintenance, 2hrs of other activities, 2hrs free time). This spare time can be used for higher learning which will not only benefit the seafarer but also the shipping company and the industry. Hence this time combined with some contact teaching hours will be used towards higher education. This is efficient as in class time has reduced and seafarer is earning as well as learning that too at the place where it is very easy to visualize and understand. The credit system suits this method of delivery very well as credits may be awarded for work based learning, in class teaching and they may be easily transferred into other programs even if offered by other universities. The other advantage of the credit system is that the course may be done in modules hence it supports better flexibility. Thus the maritime universities need to offer programs and infrastructure to support this learning activity on board ships and ashore.

3.2. Integrated learning

Maritime industry does not operate in isolation of economical, social, political activity. But the seafarer is educated and trained in an isolated environment of maritime education and institutions only teaching maritime related subjects. Not only he is physically isolated but also academically isolated where he is only exposed maritime related subjects and resources. SEM suggests that maritime universities and maritime education and training institutes shall collaborate with other universities to offer other streams at their campuses so that both maritime and other streams are offered in one campus, this encourages cross facilitation and permeation of human resource.

Providing resources is one aspect and the other is to educate seafarer to better integrate into the society. Also to enable the seafarer to make optimum use of the provisions and resources for growth, development the SEM suggests subjects like social science and psychology, management and leadership skills. These subjects will also assist seafarer in better understanding of the human element concepts in shipboard operations. Management programs will assist seafarers to learn how to live with, manage and positively motivate others in a shipboard environment (Mc Mullen, 1988). These subjects and integrated environment will broaden his horizon and encourage him to venture into other fields such as politics, bureaucracy, legal, financial, economics, management, sociology, media etc. Thus the concept is of vertical integration into the hierarchy as well as in thinking thus influencing decision and policy making towards betterment of the shipping industry and seafarers.

3.3. Facilitation of the SEM

To effectively deliver higher education at sea collaboration of maritime training institutes, maritime universities and non marine universities is essential which will not only improve quality of education in maritime world but also make the seafarers truly global and assist there better integration into the society. Thus development of a network of learning and facilitation centre across the maritime nations is required. A large number of already existing Maritime education and training institutes can be networked to run the program. WMU already has a number of branches that may be activated to facilitate the delivery of the programs. This decade belongs to consolidation of industries across the globe where mergers and collaboration is in vogue not only in shore industries but also in aviation and shipping (Star Alliance, Maersk take over of APL etc.). In education world collaboration also exits e.g. Universitas 21 Global (Chua, & Lam, 2007) (U21G). May be the role of IAMU becomes important in facilitating such a process or providing a common platform.

3.3.1. Higher Education Programs

Based on discussions with focus group of ship's officers working ashore and earlier research papers and publications (METHAR, OECD Project 2003, Grey, 1980) and the requirement for higher learning has been identified in subjects related to Human factors (Sociology, Psychology), socio-technical factors (Ergonomics and designing), Technical (Surveying, Maritime administrations, Meteorology, Dredging and offshore operations, IT applications, Naval architecture), Management and commercial (Port Management, Ship Management, Consultancy and Project Management, Human Resource Management, financial management, Logistics and chain management, Commercial ship management, Integrated transport Management, Marine insurance and claims, Maritime economics), Legal (Maritime Law and Policy, Marine labour laws, arbitration) and Maritime Education and Training.

3.3.2. Duration and Eligibility

Seafaring is a unique career as the time spent at sea whether on watchkeeping duties or otherwise continuously exposes him to a learning environment. Work based learning has existed since the development of mankind as skills were passed from one generation to the next. As far as accreditation of work based learning is concerned it has existed in the maritime industry since the requirement of certification as per ILO convention 53. Prior to STCW 95 flag states were awarding certificate of competencies based on sea time and oral and/or written assessment. STCW 95 clearly lays down a competency table in which the competency to be learned is associated with knowledge required for the competency, the method of demonstrating the skill learned and the tools for assessment. Thus the seafarer has to demonstrate his competence for each competence as per the STCW tables which is also the case in credit based learning. For awarding a degree in credit based learning number of credits and level at which they are achieved is clearly outlined in the table 1, which uses 10 hour of notional learning as 1 credit.

Table 1

Qualification	Min. Overall credits	Range of levels	Min credits at highest levels	Max. Credits at Lowest level
Bachelor's Degree	300	3,4,5,6	Min. 60 credits at level 6	Max. 30 credits at level 3
Master's Degree	180	6,7	Min. 150 credits at level 7	Max. 30 credits at level 6
Integrated Master's Degree	480	3,4,5,6,7	Min. 120 credits at level 7	Max. 30 credits at level 3
Professional Doctorate	540	6,7,8	Min. 360 credits at level 8	Max. 30 credits at level 6
Source: Quality Assurance Agency for Higher Education (UK)				

The above credit system is meeting the requirements for Bologna Declaration and also provides for a common framework of qualifications supported by a consistent approach to credit levels and by ECTS (European Credit Transfer System).

As STCW competency tables are based on demonstrable learning outcomes at operation and management levels. The learning outcomes can be assigned credit levels using Bloom's Taxonomy. Assessment of competence does not only encompass immediate technical requirement for the task but is to also reflect relevant knowledge, theory, principles and cognitive skills at varying degrees to work competently in different ships across a range of circumstances. Officer of watch has to also demonstrate competence to anticipate, prepare for and deal with emergency (STCW Code BII/13). He is expected to appraise, plan, execute and monitor his actions regularly, hence his competence reflects cognitive skills at all levels. Once the levels are defined then using detailed teaching syllabus outlined in IMO model courses 7.01, 7.03, 7.02 and 7.04 and compulsory sea time requirement the competencies can be assigned by a number of credits.

The total credit calculation for nautical stream is given below.

Table 2

COC	College Time Hrs (Credit)	Compulsory sea Time (Work based Learning)	Total Credits	Levels	Available Learning Hrs
Operator level	1560(156)1 997 (99)2	730(73)3	328	3,4,5	730(73)5
Management level	707 (23)4		23	6,7	2190 (219)5
Total	1704 (108)	11520 (360)	638		292

1. Pre sea training time (one year face to face learning)
2. learning hours as per IMO model course 7.03
3. One fourth of sea time taken as learning time (one year of sea time at cadet level and three years up to masters level.)
4. Learning hours based on IMO model course 7.01
5. Available learning hours based on 2hrs daily of compulsory sea time days

Hence it is seen that the STCW competencies table associated with the Certificate of Competency (COC) can be easily assigned equitable credits and levels. On comparing the tables 2 and 3 we find that the ship's officer at operator level is going thru 328 credit hours of learning which is much more than credit hours required by bachelor's degree program of 300 credits. However since the certificate of competency learning is more task and skill based therefore it is required that seafarer is exposed to higher learning environment and methodologies by offering him one of the compulsory 30 credit module like human resource Management, General Management principles, social sciences and another non credit compulsory module on research methodologies and writing spread over one year to get his Bachelor's degree. This should be offered to all holders of operator level certificate of competency for existing seafarers thru distance learning mode with compulsory research project after eight weeks of contact classes on the specialized subjects and a workshop of one week on research writing. The course once built in with pre sea training than the cadet shall be able to obtain his bachelors along with operator level COC. Minimum duration of the course shall be one year including nine months compulsory sea time for research project.

The master's program shall be offered to all management level COC or seafarers holding a Bachelor's degree. For masters program 180 credits are required compared to 242 credits available for learning at sea (table 2) hence the master's program can be easily delivered during this time. Since master's program is a specialized module therefore it shall include initial lectures on the specializing subject, workshop on research methodologies and writing for five months followed by an assignment and compulsory writing of dissertation on the specialized topic with applicability to shipboard scenario. Sea time may be made compulsory to carry out such research activity. The IAMU can play major role in making uniform guidelines for recognizing seafarer's competencies and suggesting a structured post graduation program built in with management level COC for the seafarers desiring higher education. The authors are in the process of developing such a program.

21st century is seeing exponential growth of information and technology. Maritime education has not yet made the most of it as yet. Internet connectivity to ships at sea is crucial in delivery of higher education programs and for conducting research activity on board ships. Cooperation from ship owners and mangers is necessary in supporting this need of the seafarers. The ships need to be provided with Internet facility, mail and e-mail connectivity. Mentoring and monitoring on board are essential to keep the learners motivated and for them to derive maximum benefits from the learning environment.

4. Conclusion

Shipping industry is often referred to be the veins or lifeblood of world trade but this lifeblood will stop flowing if the heart (the seafarer) stops pumping. Shortage of well-trained and educated seafarers is looming large with shipyards churning out ships faster than ever before. Romance of the sea and wage differential has given way to more social and rewarding careers ashore. Retention of trained ship's officers and attracting talented youth to the seafaring is a challenge today. Attracting talented youth to take career at sea and providing them with good education and training is critical to safe and efficient operation of the shipping industry. Educational organizations like IAMU, the marine universities and colleges have major role in the facilitation of the above goal. Empowering seafarer with higher education along with competency skills will provide necessary flexibility, stability and security to the career at sea. Higher education will not only help in developing seafaring into a lifelong career but will help in better shipboard management. It will provide seafarers with much needed appreciation and motivation. Social integration through cross-stream education and awareness will also assist in attracting young talent to shipping. Maritime universities will have access to unique research facility (Grey, 2007) and talent. The role of maritime universities is to take this opportunity and develop and offer programs related with maritime cluster activities and humanities so that the talented youth is wooed by the internationally recognized academic qualifications. Awarding of work based credits to seafarer's certificate of competencies and facilitating learning at sea is essential to quality education that is most efficient in time and money. In today's globalised world where shipping being first and most global in nature it is surprising the shipping industry is still talking of local harmonized education instead of global integrated education. When majority of ships with multinational crew operate in a socio-economic environment "why are the seafarers being trained in isolation?" This will raise the educational standards and provide for easy transition from seafaring to onshore employment (Laubstein, 2007). The role of International Association of Maritime University (IAMU) is most important in providing a platform for the global maritime universities to collaborate and share academic, financial and human resources with each other in order to meet the challenges of the industry. Thus to realize the objective of sustainable global system of MET of excellence the IAMU has a role not only in horizontal integration but also in vertical integration of the maritime education and training.

REFERENCES

1. Bailey, D. (1992). Using participatory research in community consortia development and evaluation: lessons from the beginning of a story. American Sociologist, 23 (4), 71-82. Retrieved on April, 15 from http://www.joe.org/joe/1999october/comm1.html
2. Chua, A. & Lam, W. (2007). Quality assurance in online education: The Universitas 21 Global approach. British Journal of Education Technology, 38 (1), 133-152.
3. Credit guidelines for HE Qualifications in England, Wales and North Ireland. Novemebr 2001. Retrieved on May,15 2007 from world wide web http://www.nicats.ac.uk/doc/summ_guidelines.pdf
4. Dolleris, L. (2001). New Model to abolish Ship's master. Interview with Lief dolleris President of Danish Engineers Association, 2001. Lloyds List 2001.
5. European Union, 2006. Background paper no. 2 on Employment, Social and Training Aspects of Maritime and Fishing Industries and Related Sectors. Retrieved May 20, 2007. http://ec.europa.eu/maritimeaffairs/pdf/SEC(2006)_689%20_2.pdf
6. Garnham,C. & Kaleta, R. Introduction to Hybrid Courses. Retrieved on May, 14, 2007. http://www.uwsa.edu/ttt/articles/garnham.htm
7. Grey, M. (1980). Changing course, a second career for the seafarer within the marine industry. London: Fairplay Publications.
8. Grey, M. (2007). Do the designers of ships really understand the seafarer's needs? Lloyds list. March 12, 2007.

9. Grey, M. (2007, Jan/Feb). Seafaring should not be dull. The Sea, 185, 4-5.
10. ILO, 2006. Consolidated Maritime Labour convention 2006. Retrieved April, 16, 2007 from http://www.ilo.org/public/english/standards/norm/mlc2006/text.htm
11. Kilby, 2006. Accountability for empowerment: Dilemmas facing non governmental organizations.. Retrieved May 31, 2007 from http://www.mande.co.uk/docs/Accountability-World%20Development%20Final.pdf
12. Kniveton, B. (2004). The influences and motivations on which students base their choice of career.
13. Practice and Research in career counseling and development (Professional literature review). Retrieved April, 15, 2007 from http://goliath.ecnext.com/coms2/gi_0199-5210998/Practice-and-research-in-career.html
14. Laubstein, K. (2007). A professional career in maritime transportation. Address to the consultation conference on EU Green paper on Maritime Policy, Sopot, Poland. 2007.
15. Mosedale, S. (2003).Towards a framework for assessing empowerment. Retrieved May, 15, 2007 http://www.enterprise-impact.org.uk/pdf/Mosedale.pdf.
16. Mukherjee, P.K. (2006). Criminalization and unfair treatment: the seafarer's perspective. Retrieved May, 18, 2007 from http://www.comitemaritime.org/Capetown/pdf/11.pdf
17. OECD Project (2003). The availability and training of seafarers- Future Impact. Retrieved on April, 16, 2007 from http://www.oecd.org/dataoecd/32/62/2489394.pdf
18. Sen, A. (1999). Development as freedom. Oxford: Oxford University press.

Quality Standards in Maritime English Education in Ukraine

Ivasyuk N.A.[1]

Quality assurance system in training merchant fleet officers in Odesa National Maritime Academy, particularly in English language, is based on the pyramidal hierarchy of requirements of International Standards Organization, standards ISO 9002, ISM code, STCW – 78/95 and IMO Model courses.

Referring to the mass/ general professional/ experience, we've carried out:

1. the analysis of everyday practice of mariners – the chain of business situations – contracts and necessities in English language usage;
2. the study of standard regulations, rules, codes, conventions which define the materials of the syllabus;
3. the analysis of mariners' aspirations to improve their previously obtained knowledge, stressing on the weak points traditionally omitted in their education.

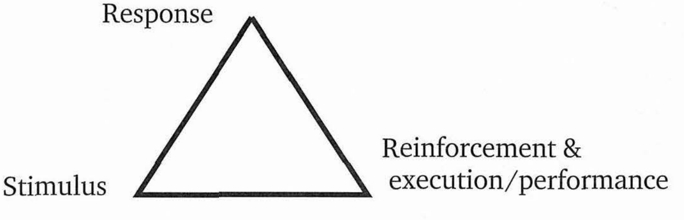
The whole EL teaching process in ONMA is now the continuous multistage cycle of testing- teaching – knowledge estimation/checking (as tests, modules, exams) with the well defined terms and limits of every stage:

I stage / level – teaching the subject "English Language"

II stage / level – teaching the subject "Professional terminology in English"

III } stages – teaching the subject "Business English"
IV

We think that EL teachers of engineering institutes should think over the arguments for motivating their students in order to further interact/ cooperate with them in close partnership and under the following scheme



All of us know the main advantages of programmes psychologically and pedagogically adapted to the learners' mental and linguistic abilities, i.e.:

[1] Professor, Odesa National Maritime Academy

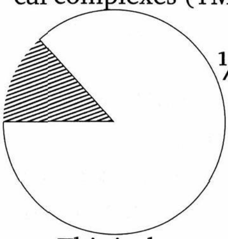
- learners will follow them without difficulty;
- slow learners will have the sense of progress;
- further learning tasks are encouraged to attempt;
- faster learners will not be held back by the pace of slow learners;
- the content of the programme will be carefully controlled.

The teacher will have a clear idea of:

1. the ground the student has covered;
2. the programme will be successfully completed

We have started carrying out the experiment on creating the non-interrupted continuous cycle of learning EL by future navigators within the framework of IMO model course 3.17 to make the process of our cadets' teaching at the Academy more closely interlinked with their participation in the seamanship training at sea.

The communicative space of cadets' future business activity field which is supposed to be studied by them is planned to be expressed and covered by teaching methodological complexes (TMC), aimed at the solution of the definite professional speech task.



$1/6$

EL of teaching coverage in the System – Bachelor – Master – Post-Graduate Course – in Odesa National Maritime Academy is now being under this credit-module arrangement. Our Syllabus for EL teaching has already been elaborated and detailed in Units of textual modules at the 1st year.

This is the example - Sample:

Subject thematic plan

Table 2. *EL Syllabic material presentation in contextual module blocks Units $^{\underline{CTM}}$ (4) I year, Navigation Faculty*

Contextual nomination of modules & curriculum disciplines modules	Code of contextual module blocks	Academic hours				Sources of literatures Bibliography
		Lectures	Laboratories	Practice	Individual studies	
1	2	3	4	5	6	7
I. Contextual module blocks № 1 Block 1.1. Introduction, presentation of one's personality. Grammar: Present Indefinite Tense, pronouns.				6	4	17, 20, 27, 28, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42
Block 1.2. Ship Organization and working day on board ship. Grammar: Present Indefinite Tense (questions, negative form) prepositions of time.				10	5	
Block 1.3. Types of ships. Ships construction. Grammar: "there is, there are", articles, prepositions of place relations of objective case in EL.				10	5	
Block 1.4. Location and purposes of life - saving appliances. Grammar: prepositions of time and place						

Contextual nomination of modules & curriculum disciplines modules	Code of contextual module blocks	Academic hours				Sources of literatures Bibliography
		Lectures	Laboratories	Practice	Individual studies	
1	2	3	4	5	6	7
Totally CTM № 1				34	19	
II. Contextual module blocks № 2				8	5	17, 20, 27, 28, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42
Block 2.1. Navigation routes and geographical positions, Bridge orders: to the helmsman and engine room. Grammar: prepositional word combinations - for geographical positions and distances.						
Block 2.2. Location of ship premises, structures and spaces, escape routes. Procedures of launching and landing. Grammar: Imperative Mood.				10	5	
Block 2.3. Accommodation in cabins, free time on board. Grammar: future intentions “going to, will”.				10	4	
Totally CTM № 2				18	14	
III. Contextual module blocks № 3				8	5	17, 20, 27, 28, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42
Block 3.1. Description of everyday ship operation. Grammar: Present Continuous Tense in comparison with Present Indefinite Tense				8	4	
Block 3.2. Personal priorities, ordering meals on board. Grammar: “some / any, would like”.				8	5	
Block 3.3. Emergencies on board the ship and emergency orders and signals. Grammar: demons -trative pronouns, modal verbs: “must”.				10	4	
Block 3.4. Ship’s stores, checking amount, weight. Loading operations … Grammar: nouns countable and uncountable ‘some, any, much / many, few / little”.						
Totally CTM № 3				34	18	
IV. Contextual module blocks № 4				10	5	17, 20, 27, 28, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42
Block 4.1. Ship construction; description of ship main equipment and devices. Grammar: degrees of comparison in adjectives, verb infinitive forms.				8	4	
Block 4.2. Visitors on board ship. Grammar: two ways of using “like”.						
Block 4.3. Weather conditions on ship passage. Grammar: “it, going to”				10	4	
Totally CTM № 4				28	13	
Totally in 1st term “EL course”				124	64	

The target of our Research is to assimilate the whole cirruculum in EL at three stages to the credit module arrangement of teaching and what is more important – knowledge assessment process in marine higher educational establishment.

Now I'd like to demonstrate you one of the teaching methodical complexes

- one of the building bricks
- in which we are going to present the whole curriculum / syllabus in EL for general and special purposes.

We join the idea of Sam (1990) that these complexes should be:

a) purposeful. They are beyond strictly practicing particular though Syllabic grammar and lexical structures;

b) interactive. The activities are often polylogical and involve different forms of discussion;

c) Authentic materials are used. The language models given are planned to be authentic.

d) based on the information gap principle.

We tried and are aspiring still when implementing our methodology to keep to 5 principles of communicative methodology / as Morrow 1981/ :

I - Know what you are doing;

II – The whole is more than the sum of the parts.

III- The processes are important as the forms;

IV- To learn, do it;

V - Mistakes are not always a mistake.

The main target of our research is the attempt to prove the possibility of combining two methods in teaching EL to seafarers – situational communicative and emotionally cognitive methods. We start from the consideration that there is no direct correspondence (harmony) between the units of thinking and units of language. But we know that the thinking information has as language context and other types of mental representations.

There are many factors which need to be integrated into the learning process coming from the capabilities of

The *right brain* and the *left brain*

The *reflex brain*

The *limbic system*

The *new brain*

The idea is in combining the benefits of in one teaching massif. Different learning styles

In our project we've distributed the Syllabic EL material in the following way:

Bachelor Degree Modules

- At a Crewing Agency. Asking for and giving personal information
- Traveling by plane
- Shipboard training
- In the messroom
- Navigational aids
- Ship handling
- Communication at sea
- Safety on board
- Accidents and incidents at sea. Visiting a doctor
- Free time on board. Going ashore
- Lifeboat drills and firefighting drills
- Survival technique
- Arrival in port
- Anchoring
- Mooring
- Clearing the ship in. / Medical Inspection
- Loading operations

Master Degree Modules
Grounding. Oil pollution
Salvage operations
Stranding. Flooding. Towing
Firefighting at sea
Piracy
Terrorism. Security
Collisions

And as an example I'd like to demonstrate you a string of several units from our Project which is being implemented in our teaching process in Navigation Faculty.

For organizing my workshop I've chosen the combinatory topic, consisting of a limited number of scenes from our Project scenario. It includes extracts from such activities of navigating officers and trainees as:

a) Ship Organization and Ship Construction Familiarization.
b) Ship Handling Characteristics, affecting the ship movement.
Keeping watch on Bridge. Familiarization with Navigational Aids.
c) Familiarization with ship safety equipment, appliances.
d) Participation in lifeboat and fire-fighting drills.
e) Preparation for arrival in Port.
f) Anchoring Arrangements in outer road.
g) Mooring at berth.

Participants involved in this workshop may be as more as posible. I'm planning them in bridge teams in 3-4 persons / crewmembers. All teams will be working out the same tasks.

The goals of the workshop: to convert as close as possible the framework of the teaching-learning process into the authentic professional activities of future seafarers at the level of everyday routine communication of one ship crewmembers.

That's why the program steps of realizing the scenes of the scenario of one voyage are going to be:

1. to submerse into the ship atmosphere;
2. to adapt, to the certain ship and crewmembers;

3. to intrude into new duties through learning new textual vocabulary;
4. to attract and explode paronimically speakers' attention to the comparison of equivalent language elements / norms and transfer of additional highly demanded professional knowledge;
5. to approach as realistically as possible to the canonic communicative situation.

Planned activities:

a) demonstration of the ready-made material-dialogues, polylogues, textual questions-interviews, etc.
b) accurate reproduction
c) immediate creativity on the spontaneous discussion of the details of the presented material – presented problems.

Time limits of each scene are about 10 min. The duration of the workshop is planned to be approximately 45-50 minutes but it can be interrupted after each scene of the presented chain of situations.

The outcome of the workshop is planned to be ended as a result of commenting on the feelings of the participants (as they may be as cadets / students) during the Workshop, their sociability, swiftness of reactions, their dependence – independence on each other, profundity of counteraction and the possible positive results of the activities performed by them

Bibliography

1. Captain Wan Shukry Wan Karma MSC. The Responsibility of a College Principal – Integrating a Maritime College with The Maritime Environment – in Maritime Education and Training, The Nautical Institute, 1997, p, 127
2. Professor Captain F. Weeks. Language training For Non-Native English Speaking Mariners. – in Maritime Education and Training, The Nautical Institute, 1997, p.273

BASED ON SERIAL PORT COMMUNICATION METEOROLOGY INFORMATION RECEIVING SYSTEM

Zhou Kui, Wu Jianhua, Jin Jianguo, Liu Huaping[1]

ABSTRACT

Radiophotography is being widely used in meteorological observatory, research center maritime safety office, especially in ocean-going ships. It has been proved to have paramount importance to the safety of life at sea. In this paper, a receiving system is designed to receive HF single side band (SSB) radio signal and then feed them into the computer via the serial port and properly treated there. The meteorological map could then simply be demonstrated, stored and analyzed by the computer.

Key words: serial port, meteorological map, receiving system

1. THE PRINCIPLE OF THE DESIGN

Radiophotography is being widely used in meteorological observatory, research center maritime safety office, especially onboard ocean-going ships. It is very important for safety navigation and to the safety of life at sea. But the currently existing weather FAX system and its facsimile machine with its radiophotography prints may not meet the need of requirement. Not only keeping and inquiring meteorological map is difficult onboard ship, but also receiving quality is not satisfied since the influence of environment and attenuation of propagation. Since computer has widely used onboard ships, could we design small equipment, which connects between shortwave receiver and computer? The equipment could translate the sound which receiver patters from short wave signal into the computer. No other equipment can match the superiority on computer's data storage, reproduction and handling. So computer can be responsible for printouts, image storage and do further image processing to improve the level of automation. The study has been started with the research by using a single sideband shortwave radio, which could receive radiophotography signals and convert the signals into audio frequency. The voice-frequency signal will be rectified, amplified and filtered

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through the designed hardware module, and the resulted signals is to combine SCM to make software program for achieving the corresponding function with PC computer.

2. HARDWARE DESIGN AND ANALYSIS

Meteorological information signal can be broadcasted by HF (3-30 MHz), in general for one-way transmission. Currently radiophotographs are debugged into black-and-white color base on band signals, which are correspondence to the double audio band frequencies 1500Hz and 2300Hz. The working process of radiophotography fax is as follows: First audio frequency is treated such as filter and so on, then detect enveloping signal. The envelope signal is judged and compared with the standard binary image signal (TTL Level). This binary image synchronization signal will be detected. While detecting the synchronization signal, produce reliable synchronization trip of simulation, and then is sampled by a certain of sampling pulse clock, finally print out the received meteorological chart in stylus printer.

Through detailed research, we have acquired the radiophotography signals simply by a single side band radio. The radio converts the signal into different audio frequencies, which is Base Band double audio band frequencies. From different audio frequencies, we select and keep signals, which their frequencies are 1500Hz and 2300Hz as working frequency. Then the signal is amplified by amplifiers to the voltage range that the Schmidt trigger can be handled. Schmitt Trigger, which is composed by the timer, can be appropriate to input to the SCM to analysis as TTL digital signals. The principle of hardware circuit chart design is shown in Figure 1. Audio signal uses normally pulse code modulation (PCM-Pulse Code Modulation) to achieve conversion from continuous analog signal to discrete digital signal. Meanwhile Schmitt Trigger has a digital transmission gate, which is a characteristic of lagging. Its circuit has two threshold voltages, will be known as the positive threshold voltage and the negative threshold

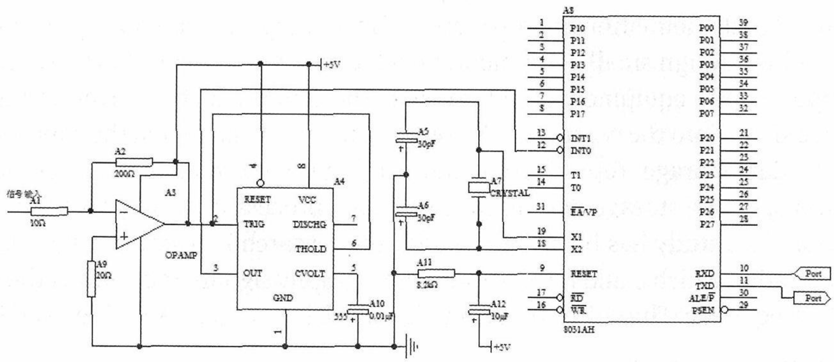

Fig. 1 Principle of hardware circuit chart

voltage. Schmitt trigger belongs to the "trigger level" - type circuit, is not dependent on the steep edge pulse, which is different from monostable trigger and bistable trigger. Schmitt Trigger, which is composed by timer, can be appropriate to input to the SCM to analysis as TTL digital signals.

The standard TTL digital signal from the Schmitt Trigger is output and received by SCM. According to detecting level value from external interrupt INTO, let internal timer in SCM to record INTO cycle of high and low levels, and will send the recorded signal through the interrupt from the serial port communication. The standard TTL digital signal handled by Schmitt trigger for processing and controlling, and link with computer RS232 serial port through the common conversion chip MAX3232 .The signal information will be sent into the computer through the computer's serial data bus for achieving some operation linking with the meteorological signal. RS232 serial port is shown in figure 2. When SCM microprocessor sends data, the data is paralleled into and sent to the SBUF. At the same time SCM start TXD pin of serial mouth to send data. When finish sending a frame of data, that is, the SBUF is empty, set the TI (which is interruption sign) to send the CPU with interrupt request. CPU response to the interruption, the software will use TI reduction after software's interruption. Repeat of the writing of next frame data in SBUF until completing all the data sending.

Computer RS-232 serial port provides the logic level, which is different level from the general processor and the SCM. Serial communication is a means of communication that every bit data of one certain information will be transmitted sequentially. The signal accessing to host computer, which is recorded in the 16-band signal manner, will carry on the distinction and post-processing.

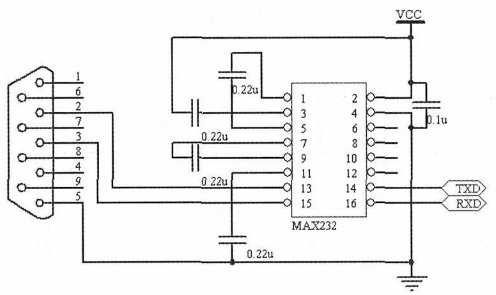

Fig. 2 RS232 serial port communication

3. SOFTWARE DESIGN AND ANALYSIS

In this research, the host computer establishes the communication with the SCM on the procedures using Visual $C^{++}6.0$. The SCM will adopt 51-series SCM and the procedure is carried on with the compilation of C51 language. We need to set up the serial port communication parameters before serial mouth communication, including communication's baud rate, data bits, initiation bit, stop bit, the test bit of odd and even number and etc. For SCM, some parameters are fixed, such as data are the bits of eight, initiation bit and stop bit are one. The variable parameters include baud rate and the test bit of odd and even number. In addition, we should decide the agreed data format of communication, the control method of data flow and so on. The software system design has two parts.

The SCM software design: The interruption by external 0 (both INT0) access to the TTL signal, which is reflected by weather fax signal and output and processed by Schmitt trigger. When the SCM detect the high level from the INT0, immediately start the internal timer/register 0(both T0) to count with the machine cycle decided by CPU. T0 will stop counting as soon as the INT0's high level is terminated. The value of counting is deposited into THO and TLO directly and make transmission to certain unit in internal memory. Meanwhile set up serial transmission parameters and carry on serial data transmission. The low-level duration on INT0 can be recorded through internal timer/register 1(both T1) in the same principle.

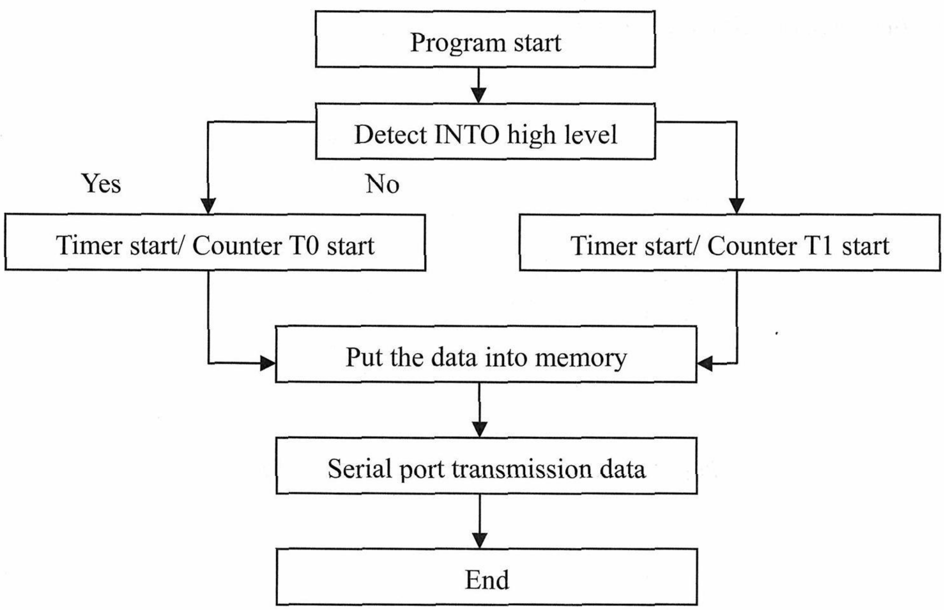

Fig. 3 Program flow structure

The flow chart used by the compilation language is shown in figure 3.

The software design in the host computer: The reception and processing of data will be carried out through the serial port. Firstly, we can use C Serial Port class, which is based on multi-thread. To receive data, its workflow is followed: First, the serial mouth parameters are set up, start the serial monitoring thread on work. The serial monitoring thread monitors the data received by serial port, the incident by flow control or other serial incidents received, then give the information to notify the main procedure, and inspire information processing function for data controlling. Secondly, we can use the MSComm controller (Microsoft Communications Control) carried by VC in serial communication for data reception, which is provided by Microsoft as ActiveX controller, function better. It provides a series of using interface with standard communication orders, and serial link can be established for using it. MSComm controller provided communication handled in two ways: event-driven communications and inquiry method.

Use the MSComm controller in this subject, the first procedure is to establish procedural framework based on single document using $VC^{++}6.0$; Then cite the head document and declare variables; Load controller and set up it's attributes; Send data-requests; Receiving data and handle; Close to the serial port opening.

4. CONCLUDING

From the perspective of technical development, meteorological information of shortwave receiver is get on the transition from a totally functional hardware for receiving to the direction of hardware and software combination, from hardware modules to software forms, from the simple combination of modules to the common hardware platform based on computer as a core. This is a general trend. No other systems cannot match superiority of this manner in which short-wave wireless information is received and handled with the use of the host computer combined with other equipment.

However, electromagnetic wave transmission in short waves has "fading" phenomenon during the weather fax map sending with the use of short wave. The SNR of meteorological map, which is received already, is lower if level interference added in the environment is high, and even make the quality of maps poorer. This is present as the major problem update. First, to overcome the "decline" of the phenomenon and improve signal-to-noise ratio of output signal it should improve sensitivity and automatic gain control performance of weather fax receiver. Moreover, effective measures to interference should be taken in the analog signal preconditioning stage so as to ensure minimize interference effects in the fax image signal that is input into host computer.

Reference

1. Tang Xinyuan. Radio communication. Dalian Maritime University, 2001
2. Wen Zhili, Dai Xuchu. New type numerical short wave receiver, PC and application, 2004, 9

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The Innovative System of Training Specialists in Studuing and Technological Opening Up of the World Ocean

Viatcheslav Sedykh[1]

I. Principles

The role and significance of an intellectual component in the inner structure of the scientific and technological progress (STP) has increased (basic notions have shifted from machinery to technology). The importance of scholars who would not only act as "generators of ideas", but also ensure all the chain of technological applications and social changes of technological solutions has grown.

Structural stratification of STP means such a sphere of "High Technologies" in whose development material resources occupy an insignificant place as compared with intellectual resources including production organization and entering the market of innovations.

Realization of the Strategy of Development of the Far eastern Federal District regarding doubling the gross regional product before 2010 requires reorienting its economy to the innovative path of development. Evidently, it cannot be carried out without effective use of the current potential of professional specialists of sea, river and fishery fleets, all the branched shore-based maritime infrastructure of transporting, fishing and processing enterprises.

To make the economy of the transport complex efficient, specialists having only higher education in more than 60 specialties and specializations should be trained. High technologies and constantly developing education potential of personnel are the main driving forces of a stable economic growth.

Russian maritime education possesses a high potential. Together with traditional for marine training institutions system of education and training of highly qualified professionals, modern technologies of training being used now form future specialists' skills to organize production of competitive items, to think in a non-standard way, to work in a team and with a team, to possess new innovative culture.

There are two main needs for education: the economic and social ones.

[1] Professor, Maritime State University named after Admiral G.I. Nevelskoy

In maritime education the economic need, first of all, is determined by the need of marine economic and naval complexes of the Far East for specialists in the number, quality and profile required.

The social need, on the one hand, is aimed at meeting growing spiritual demands of society that are not directly connected, but influence greatly the efficiency of the marine economic complex operation. On the other hand, social need directs higher school toward providing higher education to all members of society.

Sometimes the needs of a person and of a country are at variance. In particular, unrestricted need of members of society for higher education (even when abilities are lacking) conflicts with a limited possibility of economy to use qualified specialists or with necessity to finance economic and social needs and effectiveness of using means of a country budget for the benefit of all society.

A specific feature of reforming higher education in Russia is re-orienting it toward maximum satisfaction of social need at the expense of paid education in government-funded higher education institutions and a wide network of non-governmental education institutions.

During this process, the hopes for a market self-regulating mechanism in government-funded education institutions have been dashed, the quality of professional training of specialists in the majority of various non-governmental education establishments is low and the system of educational work has been in fact destroyed. Suffice it to remember how active reformers, while declaring the state of market demand, sharply decreased admission of students to engineering and technical specialties.

At present, global-scale upgrading of higher education adopts a rigid policy of government regulation of economic need. An idea of alleged excess of personnel is constantly instilled with reference to training of economists, lawyers and emphasizing that economic need is considerably lesser than the existent range of training specialists. But labor market dictates it. The best ones will find a situation in accordance with their specialty. But social need is not limited, an educated and trained person is always more helpful for society, the more so trained at the expense of his/her family budget.

Engineers and technical specialists are mentioned absolutely timidly, and specific features of training specialists in such spheres as marine transport are ignored.

Reforming of maritime education in the Far East has always been based on the mechanism of government regulation of economic need for marine specialists that increased significantly of late.

Thus, for the last two years the Maritime State University meets 60% of demand in engineers and technical specialists (crew members).

Objectively, under the conditions of adopted upgrading of education in Russia, it is necessary to use new opportunities in perfecting maritime education organization, to apply effective methods of a system planning of content of training specialists proceeding from integration of activities of education, research and manufacturing institutions and diversification of curricula of purpose-oriented training of specialists.

2. STATE OF THE QUESTION

The Admiral Nevelskoy Maritime State University: navigation; maintenance of marine power plants; maintenance of marine electric equipment and automation means; maintenance of transport radio equipment; water transport and transport equipment management; ship's equipment; organization of transportation and transport management.

The Far Eastern State Technical Fishery University: navigation; maintenance of marine power plants; maintenance of marine electric equipment and automation means; ships' electric equipment and automation; organization of transportation and transport management.

The Far Eastern State Technical University: marine power plants; ships' electric equipment and automation; organization of transportation and transport management.

The Pacific Naval Institute: navigation; maintenance of water transport and transport equipment; maintenance of transport radio equipment.

The Nakhodka Engineering and Economic Institute (Branch) of the Far Eastern State Technical University: ships' power plants.

The Nakhodka Branch of the Far Eastern State Technical Fishery University: navigation; maintenance of marine power plants; organization of transportation and transport management.

The Nakhodka Branch of the Admiral Nevelskoy Maritime State University: navigation; maintenance of marine power plants; organization of tranportation and transport management.

KHABAROVSK

The Khabarovsk State Technical University: organization of transportation and transport management; maintenance of water transport and transport equipment; maintenance of marine power plants.

The Khabarovsk Branch of the Novosibirk State Academy of Water Transport: navigation; organization of transportation and transport management.

The Komsomolsk-on-Amur State Technical University: marine power plants; organization of transportation and transport management.

Petropavlovsk-Kamchatsky

The Kamchatka State Technical University: navigation; maintenance of water transport and transport equipment; maintenance of marine electric equipment and automation means; maintenance of marine power plants; ships' electric equipment and automation; maintenance of transport radio equipment.

The Yuzhno-Sakhalinsk Branch of the Far Eastern Technical University: Organization of transportation and transport management.

Kholmsk

The Sakhalin Branch of the Admiral Nevelskoy Maritime State University: navigation; maintenance of water transport and transport equipment; maintenance of marine power plants.

Yakutsk

The Yakutsk Branch of the Novosibirsk State Water Transport Academy: navigation; maintenance of water transport and transport equipment; maintenance of ships and ships' equipment.

The Vladivostok Marine College: navigation; maintenance of marine power plants; organization of transportation and maintenance of sea transport operation.

The Vladivostok Marine Fishery College: navigation; maintenance of marine power plants; maintenance of ships' equipment and automation; organization of transportation and management of marine transport operation.

The Vladivostok Marine Technical College: navigation; organization of transportation and sea transport management; maintenance of transport power plants.

The Vladivostok Shipbuilding Technical College: mounting and maintenance of ships' machinery; maintenance of transport electric equipment and automation.

The Artyom Branch of the Far Eastern Power Engineering Technical College: maintenance and repairs of electric and electro-engineering equipment.

The Far Eastern Nautical College (town Nakhodka): navigation; maintenance of transport power plants; maintenance of ships' radio communication and electric radio navigation equipment; maintenance of transport electric equipment and automation.

The Primorsky Mining Technical College (town Partizansk): maintenance and repairs of electric and electro-engineering equipment.

The Kavalerovo Mining Technical College: maintenance and repairs of electric and electro-engineering equipment.

The Khabarovsk Shipbuilding Technical College: mounting and maintenance of ships' machinery.

The Shipbuilding Technical College (town Nikolayevsk-on-Amur): mounting and maintenance of ships' machinery.

The Polytechnic Technical College (town Komsomolsk-on-Amur): mounting and maintenance of ships' machinery; shipbuilding.

THE AMURSKAYA REGION

The Polytechnic Technical College (city Blagoveshchensk): mounting and maintenance of ships' machinery.

Vocational School No.5, Vladivostok: able seaman, motorman 2nd class; donkeyman, able seaman; ship's mechanic, able seaman; motorman 1st class, ordinary seaman; motorman 1st class, mechanic 2nd class; motorman 1st class, electrician 2nd class.

Vocational School No.7, Vladivostok: seaman, motorman (operator); seaman ships' carpenter; motorman (operator) of refrigerating plants; motorman (operator), mechanic-ship repairman; motorman (operator), ships' turner; ships' cook, baker, electrician.

Vocational School No.9, Vladivostok: electrician mounting electric circuits and electric equipment.

Vocational Lycee No.15, town Bolshoi Kamen: ships' hull builder-repairman; shipbuilder-repairman of metal ships.

Commercial Lycee No.18, town Nakhodka: ships' cook-baker.

Nautical Lycee, town Nakhodka: ships' electric navigation.

Vocational School No.14, town Nakhodka: ships' cook-baker; ships' metal worker-fitter; ships' joiner, carpenter; ships' electric radio fitter.

Vocational School No.34, town Nakhodka: ships' cook-baker; able seaman; operator of refrigerating plants, ordinary seaman; motorman 1st class, operator of boilers; ships' electrician, ordinary seaman.

Vocational School No.35, settlement Slavyanka: shipbuilder- ship repairman of metal ships.

Electro-Engineering Lycee No.7, town Khabarovsk: electric fitter of electric networks and electric equipment; electric fitter to repair and maintain electric equipment.

Vocational School No.5, town Khabarovsk: navigator-assistant engineer of river ships.

Vocational School No.17, town Komsomolsk-on-Amur: navigator, assistant engineer of river ships.

Vocational School No.21, settlement Okhotsk: navigator of small-size ships.

Vocational School No.19, town Sovetskaya Gavan: navigator of small-size ships, ships' cook-baker.

Vocational School No.11, settlement Vanino: ships' cook-baker.

The Amurskaya Region

The Officers' Amur Water Transport College, town Blagoveshchensk.

Vocational School No.4, town Blagoveshchensk: navigator, assistant engineer of river-going ships.

- reduction of real funding by the government;
- growth of scales of higher education and students' desire to obtain a person-oriented education;
- heightening consumers' requirements to the quality of education services and results of scientific research;
- need to raise productivity and quality of teachers' work;
- need to involve cadets and students in active creative activities, ensuring their effective activities in research and engineering work and entrepreneurship.

350 education institutions are engaged in training personnel for world navy and merchant navy. In 2000 shortage of officers was equal to 4% of the required (total requirement was approximately 420,000 persons), excess ratings amounted to 30% of the required (total requirement was 599,000 persons). Toward 2010, with the world tonnage growth of 1 %, shortage of officers can reach from 12 to 20% of the required.

An intensive process of aging seafarers is being observed in developed countries. In 1995 there were 5800 officers older than 55 in fleets of developed countries, in 2000, 26000. At the same time 28 industrially developed countries (OECD members – Organization of Economic Cooperation and Development) control over 64% of all the world fleet.

Vigorous acceleration of upgrading materiel and technical base of APR maritime universities due to intensive development of ships' systems of navigation and communications is observed. In particular, new projects of integrated bridge are being developed and put into operation; they include cartographic systems, automated control, situation evaluation and collision prevention systems, control over ships' life support systems.

Cardinal changes take place in the systems of telecommunication service of cargo transportation and fleet operation. A spectrum of telecommunication technologies when chartering ships, forwarding cargoes, settling accounts, making deals in buying/selling ships etc. is being expanded rapidly.

Transition to a new system of maritime education has come into being in compliance with requirements of international conventions, raising the quality of obligatory practical training as the basis of all training, operating modern equipment and having special practical training aboard training and production ships.

The present organization of maritime education and training in the Far Eastern Federal District embraces government-funded and non-governmental education institutions. Many of them, first of all non-governmental ones, do not ensure in fact high-quality training of specialists as per requirements of safe navigation and complying with requirements of international conventions and national standards. The budget, means from other sources are being wasted, which does not make it possible to handle tasks of forming and opportune upgrading of logistical base for training seafarers in accordance with the appropriate conventions in a consolidated way and up to high quality standards.

These problems should be tackled in a well-balanced way under the present conditions of fragmented organization of maritime education.

3. Basic Principles of Organization of Maritime Education

Are aimed at realization of mechanism of coordinating requirements of marine economic and naval complexes of the Far East and resources of maritime education institutions, increasing responsibility of all participants for violation of regulations of that mechanism.

The essence of applying the principles offered is understanding that specialists for marine transport are to be trained in specialized maritime education institutions, and maritime education is part of the basic sector of economy and promotes not only economic development, but also defensive capability of the Far East.

Technology of training and educating should be accompanied with forming a status of a statesman in a marine specialist. It is evident that since the country budget bears considerable expenses for training a marine specialist, a graduate should not take a position not related to a marine economic complex because he gets specialized education extremely important for continuous development of economy of defensive capability of the Russian Far East.

Ensuring maximum effectiveness of coordination between the government, maritime education institutions and a trainee. Realization of this principle is accompanied with conclusion of a tripartite contract.

The government undertakes to finance training of a specialist, find employment for him and has the right to require a graduate to work at least three years in enterprises of marine economic and naval complexes of the Far East.

A maritime education institution undertakes to train a specialist with high quality and has the right to get a government **budget oriented at certain results** and in compliance with standards approved by Russia's Government.

A trainee has the right to get education at the expense of a government budget (subsidy), undertakes to master knowledge and skills and to work during a certain period at an enterprise where government sends him. If a young specialist does not fulfill his obligations (including his attrition for lack of progress in studies or violation of discipline), he is to return a subsidy taking into account inflation during a period of not more than 10 years after graduation of a maritime education institution or his attrition.

Ensuring government regulation and control of functioning of the adopted mechanism envisages legal personal responsibility of all its subjects for violation of its regulations. Responsibility for violating the rights of young specialists when placing him in a job in accordance with the government order, rights to get payment for his job in accordance with his qualification, rights to provide him with housing. Non-fulfillment of these conditions by an employer makes it possible for a young specialist to find a job of his own choice, and the responsibility to pat back subsidies lies with an employer.

Expanding accessibility of obtaining a profession in the system of continuous maritime education according to the following stages of the education process: vocational primary, professional secondary, higher education, post-higher and additional education from positions of continuous training and unified requirements to the quality of training marine specialists.

Ensuring non-budgetary activity based on market-self-regulating mechanism to meet social need of citizens for higher maritime education. A maritime education institution establishes rules of admission and the level of entrance examinations (threshold barrier). Entering the maritime education system enables to satisfy personal need for higher education.

Ensuring multi-channel funding and tax preferences. At present government is funding 35% of means required by maritime education institutions. The founder is not funding expenses for major construction. Maritime education institutions cover a part of their expenses – for purchasing equipment, major repairs and many other items – by revenues from non-budget and other activities. Under these conditions, a unified approach to taxation of commercial organizations and government-funded institutions makes the situation for maritime education institutions unequal. The principle of just taxation is violated.

Differentiation of powers between the federal budget, budgets of Federation units, municipalities and enterprises of a maritime economic complex when they carry out orders to train, re-train and raise qualifications of specialists.

4. MAIN DIRECTIONS OF UPGRADING MARITIME EDUCATION AS PER THE "UNIVERSITY COMPLEX" TYPE

Forming the system of quality control of maritime education in order to train a competitive specialist of the 21st century is the main content of such work. Improvement of logistics, personnel, structure, organization and content of education, innovative and international activities of maritime education is being effected taking into account the requirements of both national and international systems of certifying in quality control of training specialists.

Ensuring conditions for meeting international requirements to training seafarers and safe navigation managers is an important direction of the University activity. Education standards, curricula, good seamanship training have been agreed upon, criteria of evaluating effectiveness of its results have been identified. Our objective is to make education more flexible to expand intellectual view of future specialists, upbringing their mobility and ability to social adaptation, responsibility and ensuring a high level of professional training.

Maritime education is being regarded in connection with general problems of development of Russian society that create quite certain conditions for education functioning, predetermine its mission, objectives, tasks, structure and contents.

Shipping is becoming more and more based on the system of open Registers and determined by intense price competition, rather than considerations of safe navigation, quality of service and environment protection. To rectify such a situation, reassessment of the future system of higher maritime education and associated with them systems of national and international certifications is required.

In effecting maritime education quality management, we proceed from the requirements of two groups of consumers: trainees and potential employers. Experience shows that conceptions of education quality that the said groups of consumers have got differ. The difference can be explained by the fact that while the students ‘ motivation is to a greater extent oriented at the process of training itself and is determined by such factors as psychological comprehension of the material of a course and of a teacher, availability of innovative technologies of training, social and every-day conditions, leisure activities, sports facilities etc., potential employers are first of all interested in professional skills of a specialist.

A category of ensuring good quality of training a maritime specialist consumes a lot of resources, finances and high technologies. Under present-day conditions of Russia's socio-economic development its upgrading will be successful if the government, Russian shipping companies and those who in fact control fleets of open registers undertake a financial burden of developing the system of higher maritime education in the 21st century. Undoubtedly, the rules regulating the relations between an education institution and an organization that gets education services are required in such a case.

Wider involvement of students in the process of scientific research. Expansion of a spectrum of the University scientific research on the basis of integration relations with academic and industry science. Creation of a mechanism of introducing innovative, research and engineering developments to production as test samples.

Practical solutions of a competitive quality of maritime education are based on the use of standardization, metrology and certification as effective means of developing and improving standardizing, evaluating and controlling systems of ensuring maritime education quality. In particular, we are guided by series ISO 9000 international standards, principles of total quality management (TQM) and methods of self-assessment of organizations in compliance with the national requirements.

5. Objective

Work at the Maritime State University according to the "University Complex" type (State University Maritime Complex – SUMC) is organized in order to form an education system to train a competitive specialist of the 21st century on the basis of principles of training and educating used at maritime state education institutions by means of implementing education, innovative, research and technological and manufacturing programs in compliance with the directions of the Russian Federation Marine Doctrine and strategy of Russia's economic development.

SUMC being a government-funded education institution having the rights of a legal entity, is set up by attaching the institutions, organizations and enterprises to the Admiral Nevelskoy Maritime State University as its structural units by means of reorganizing as per the Russian Federation Government decision and is situated in the Far Eastern Federal District.

6. SUMC Structure and Content

Educational component (education institutions of various levels: maritime education institutions of primary, secondary and higher professional education; schools, gymnasiums and centers of pre-university upbringing and education);

Scientific component (research institutes, designing bureaus, diagnostic and test centers and enterprises);

Innovative component (industrial parks, innovative centers, small innovative enterprises and certification centers);

International component (the Department of International Activities, the International Center of Marine training as per Conventions and the Center of Marketing Studies);

Educational component (organization and education centers, youth centers, clubs, socio-psychological service, etc.);

Training and production component (training and production fleet, training and technological centers);

Facilities for retraining and raising qualification (regional centers of retraining and raising qualification, the Center of Marine Training as per Conventions)

Finance and economic service (the Department of Strategic Planning, auditing service, marketing service, financial service);

Social and every-day component (dormitories, medical centers, catering facilities, maintenance services);

Legal component;

Personnel.

Training maritime specialists at SUMC

The advanced development of maritime education as an intellectual sector of economy of the Russian Far East units, acquiring by future specialists of fundamental system knowledge in the sphere of natural sciences and humanities, as also professional skills in the field of sea transport, fishery and processing systems.

Integration, widening opportunities and versions of acquiring a profession in the system of continuous maritime education according to the following levels: vocational training – secondary specialized training – higher professional education – post-university education – additional professional education.

Optimization of the current network of receivers of budget funds at the expense of administrative and financial re-subordination of a number of receivers of budget means. This leads to removal of double training in specialties, which will make it possible not only to optimize a network of training institutions, but also economize budget and non-budget means and material resources for creating logistical and simulator base for training maritime specialists as per conventions.

The effective solution of the principal task of maritime education lies in raising the quality of training specialists at the expense of more complete use of the potential of highly qualified faculty, modern and prospective methods of training, purposeful and efficient use of expensive equipment, telecommunication equipment and simulators, timely upgrading and renewal of logistics.

Consolidation of resources in maintaining the leading role of Russian maritime education on the international labor market, development of fundamental and applied scientific studies, training and retraining on this scientific base of educated and qualified specialists in accordance with priorities of developing science and requirements of modern market of high technologies.

Purposeful use of scientific and technical, innovative and cultural potential when developing and fulfilling scientific and technical, humanitarian, social and other programs of federal and regional levels, solution of certain production, research and technological tasks of the Russian Federation Transport Ministry and organizations of the region.

7. Certification and Accreditation

In 2004 the University successfully passed a complex procedure of licensing, attestation and accreditation. Its complex accreditation showing amounted to 97% of the highest university level (K=0.97). Index of conformity with accreditation criteria J=1.60

The University has got a Certificate of State Standard of Russia of conformity of the quality management system as applied to education activities and doing scientific research as per the System GOST R ISO 9001-2001 (ISO 9001:2000)

The University is an associated member of the International Association of Maritime Education and Training Institutions in the Asian Pacific Region (AMETIAP)

Classification Society DNV certifies the University for conformity of the system of training maritime specialists with international requirements.

8. Problems

8.1. Perfecting the normative and legal base

The normative and legal base regulating economic, organizational and methodological aspects of SUMC functioning needs to be improved:

Development of standards of planning financial and material resources, ensuring optimal cost of training specialists;

Elaboration of a single method for calculating the number of faculty and staff in compliance with labor intensity involved in training maritime specialists;

Development of the state education standard of training as per integrated programs of vocational special secondary and higher maritime education.

8.2. Financing and Logistics

The main objects of investment are:

Construction of a library complex in **2005-2006;**

Annual allotment of budget funds for major repairs of the main means to the amount of not less than **Roubles 45 million;**

Annual allotment of budget funds for purchasing equipment to the amount of not less than **Roubles 50 million;**

Allotment of funds for participatory construction of housing for young specialists to the amount of not less than **Roubles 27 million** annually.

8.3. Logistics support of training and production ships

The main articles of expenditures are:

Annual maintenance expenses (fuel, supplies, maintenance to the amount of not less than **Roubles 55 million;**

Financing classification and repairs of training and production ships to keep the class of the Russian Marine Register as per calculations;

Financing of actions aimed against terrorism activities not less than **Roubles 15 million** annually.

Author Index

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The Local Executive Committee trust this book will be useful to those who are involved with the issues of Maritime Education and training and all fields related to maritime affairs.

Captain Dmitriy Zhukov

Senior Lecturer of the Odesa National Maritime Academy
Head of Local Executive Committee of the 8th Annual General Assembly

Наукове видання

World Maritime Exellence

Edited by

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World Maritime Excelence

Proceedings of the 8th Annual General Assembly and Conference of the International Association of Maritime Universities

The volume collect the papers presented at the 8th Annual General Assembly and Conference of the International Association of Maritime Universities (IAMU), which was held in Odesa, Ukraine from 17 to 19 September 2007, and hosted by Odesa National Maritime Academy.

After being reviewed by relevant experts in the maritime fields, 36 academic papers were presented at the 8th Annual General Assembly of IAMU are included in this book. Book presents a broad range of academic papers on the theme of World Maritime Excellence. Other topics are also covered, including Globalization and MET, Maritime Safety and Security, Maritime English, STCW Convention/Code Review, IAMU Standards Implementation, IAMU Competence Certification System, Response of World MET to Industry Request.

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