INTERNATIONAL MARITIME LECTURERS ASSOCIATION
(IMLA)

Conference on Maritime Education and Training

PADECC

Preventing accidents, dealing with emergencies, coping with casualties - The Education and Training Perspective

and

WOME 10

Workshop on Maritime English Preventing accidents, dealing with emergencies, coping with casualties: The Maritime English Perspective

Volume 1

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A FEW THOUGHTS ON PADECC AND WOME

The combination of an IMLA conference on a technical subject (PADECC) with the biennial IMLA Workshop on Maritime English (WOME) is a first, it has never been done since 1980 when IMLA held its first conference or 1981 when IMLA held its first WOME. The reasons for the combination are, in general, that communication failure has increasingly been identified as contributing to the causes of maritime accidents and even as the main cause of some of these accidents and that the globalization of shipping and the internationalization of ship crews has increased the need for reliable communication and, more specifically, communication under challenging circumstances as PA and DE and CC is a key prerequisite for successful "preventing", "dealing with" and "coping with" "accidents", "emergencies" and "casualties", respectively.

The combination of PADECC and WOME is also an acknowledgement of lecturers training students for PA and DE and CC and lecturers training students in ME have different qualifications and that lecturers with marine engineering or nautical qualifications as well as linguistic qualifications are almost non-existent. It is also an acknowledgement of the need for linguistic qualifications for teaching ME and that a native English speaker who has either a marine engineering or nautical background will not be sufficiently qualified to teach ME.

The combination of PADECC and WOME should also suggest that a close cooperation of lecturers in technical subjects with lecturers in ME will help both of them and above all, the ship officers and MET students. An integrative approach to technical subjects with the participation of both technical and ME lecturers is probably more effective and more beneficial for the students than teaching the technical subject in the national language (if it is not English) and ME separately. The mobility of ship officers requires the use of a common language and the mobility of MET students and lecturers at MET institutions would profit from delivering at least part of MET programmes in English.

It follows from the internationalization of ship crews that the multicultural aspects of communication will have to be given attention and that ME lecturers should be trained in it. Onboard communication is more than just language.

In the late 70s, the colleagues in Rijeka and in Bremen were involved in a project of using computers for exchanging written messages between ships. The project did not succeed because of the lack of appropriate technology. Today, with modern IT, it would succeed. The use of modern IT for ship-ship and ship-shore communication has not been fully exploited yet.

These are a few thoughts on potential benefits from PADECC and WOME.

Finally, I would like to thank our hosts, and as their representatives the chairmen of the committee, my friends Pavao Komadina, Predrag Stankovic, Boris Pritchard and Damir Zec, for organizing these important events.

It is good to be back in Opatija after the second IMLA conference on MET in 1982 and the second IMLA workshop on "Human Relations and Conditions on Board Ships" in 1988. These conferences were very well organized. I do not expect it to be different this time.

Günther Zade
President, IMLA

FOREWORD

It seems that by combining the well targeted and formulated topics within PADECC and WOME 10 the International Maritime Lecturers' Organization (IMLA) has made a good decision. The IMLA Conference Organising Committee and the Papers Committees for PADECC and WOME 10 wish to express their satisfaction with both the number of the papers registered (out of over 40 reported papers 30 were received before the Conference) and with the approach, analysis and in-depth study of the respective topics. It is only expected that the Conference participants and subsequent readers will share the same or similar views and assessment.

The order of papers published in Volume 1 of the Collection of Papers presented at the IMLA PADECC Conference and WOME 10 Workshop strictly follows the sequence of paper presentation at the Conference. The papers presented at both plenary sessions (Opening and Closing Session) have been printed first and are followed by papers presented at the parallel working sessions, i.e. PADECC and WOME 10. The Organisers are confident that the method applied (instead of the alphabetic order of titles or authors of papers) will better suit the needs of conference attendants since the order chosen is intended for quick reference to the text in this Volume and to follow the sequence of oral presentations.

A very small number of papers had not reached the Organisers by the deadline, or was not printed in *camera-ready format'*, which required subsequent re-typing and re-editing. These papers will be published in Volume 2 and, together with Volume 1, will then represent a completely integrated Conference publication.

Editors

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PLENARY SESSIONS

HOW TO IMPLEMENT SAFETY IMPROVEMENT

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Introduction

Having a limited space, like any other contributors to this special edition on the ISM Code, I decided to have only a short introduction concerning a remark on the impact of the ISM certification.

"It means nothing tangible except more paper work"

This statement does not encourage companies and seamen to improve safety at sea. How can we see and measure the result of the ISM certification in a so short period of time ? We should not devalue the ISM certification, with such a statement. We must believe that the improvement will come year after year in the continuous way of progress.

ISM certification is not an award that we receive once in our life, it is a permanent challenge that we must win day after day.

Concerning the paper work, yes it is an administrative burden if we do not have the proper tools to manage a documented system. Today, the solution exists and is available on the market for a reasonable price (1) (2) Information Technology will reduce this burden and improve communication, indexing of documents and storage and retrieval of information in shipping.

A quality and safety improvement programme

The quality and safety improvement programme outlined may be tailored to the individual needs of any company. In fact, it will return substantial sums of money normally consumed by accidents defects and errors.

The return will be directly proportional to the participation of the senior staff. And, the degree of success will be directly proportional to the degree the general manager participates.

Investment can be minimal; the returns can be large. Savings during the first couple of years will drop straight to the bottom line, as they will be primarily the result of improved performance of staff.

The 10 steps in this programme are (figure 1) :

- policy statement,
- personnel orientation,
- quality and safety improvement committee,
- performances measurement,
- personnel training,
- error causes identification,
- objectives,
- corrective and preventive action,
- cost of error,
- recognition.

1. Policy statement

Objective: Make clear where the president / chairman stands on quality and safety. This first step consists of:

- defining the management performance standard,
- integrating the statement inside the company policy.

Money may be wasted on defects and errors. Improper attitude, lack of attention, and insufficient knowledge are the prime ingredients. Management strives to control these situations. Often, however, we become too busy with "managing the business" to give sufficient attention to these elements that cause mistakes. Reduction of error begins with an unshakeable management standard.

This standard should be included in the company policy. Everyone must understand that this is not simply a document to be placed in a book for executives; they must understand that it is a mandatory goal, and that anything less than systematic improvement toward that goal will be questioned.

2. Personnel orientation

Objective: Inform all personnel about the management standard for performance.

Everyone must understand that this standard must be apply at all levels of company and in every area of the company business. This second step consists of:

- briefing management staff on the programme concept and intent,
- obtaining their commitment to the programme,
- mobilising the personnel on the company's policy.

The general manager should assemble his staff and inform them that he is launching a formal quality and safety improvement programme. The programme is in accordance with company corporate requirements that there be systematic quality and safety improvement in every department and on board each ship. The staff should be informed that, along with mandatory quality and safety improvement, the president has established a single performance standard that the entire company must strive to meet.

We should not accept defects or errors as normal in our business. We should understand that there will be mistakes, that there will be reversals. But we should also understand that we must immediately muster activities to correct these situations as they occur.

The quality and safety improvement programme begins, therefore, with each manager and master making it very clear that there is no dual standard in the company. Everyone will strive toward error-free performance, and every management staff will question all performance that falls short of this standard.

3. Improvement committee

Objective: Develop and guide the quality and safety improvement effort to resolve systems problems adversely affecting the company performances.

Since every department has the potential of making mistakes, each should participate in quality and safety improvement. The general manager should appoint a quality and safety improvement committee large enough to encompass the major operating departments, but small enough to be effective. This third step consists of:

- defining the mission and the responsibilities of the committee,
- selecting the members of the committee,
- establishing the practical organisational structure to reach the objectives of the programme.

The quality and safety improvement committee should meet as the situation dictates.

The committee should not get involved in the treatment of non-conformities. Rather, it should concentrate on correcting the system which allowed the accident and defect to occur. While the committee has the responsibility for developing and implementing the quality and safety improvement programme, it is stressed that the individual departments are responsible for developing their own detailed plans to ensure systematic improvements.

The establishment of the Committee, and the implementation of a Quality Improvement Programme, does not generally represent an additional expense. It is usually only formalising and centralising what is presently happening in one form or another. Often it results in the elimination of duplicate or less-effective effort.

Members of the committee must have the authority to commit the respective departments to the improvement decisions of the committee.

A chairperson should be selected who will be more deeply involved in the total improvement effort, and who will have sufficient management clout to keep the entire programme on schedule. The chairperson should be someone who is constantly agitating for quality and safety improvement.

The elementary process for realisation of the programme is as follows:

- define the objectives,
- achieve the objectives,
- measure the results,
- recognise people.

4. Perfomances measurement

Objective: Provide timely information of current and potential non-conformities in a manner that permits objective evaluation and corrective action.

The quality and safety manager should obtain data from each measured area and present levels in trend format.

The non-conformity committee could list points at the operational level where they believe it would beneficial to know performance in terms of risk levels. All ship audits, deficiencies and performance indicators should be reviewed against the list for reduction, expansion or modification.

Operational departments are always measured and analysed. Service departments should also be measured. These include planning, commercial contracts, inventory control, stores, maintenance, purchasing, bunkers and so on. These departments all have the potential for making mistakes.

Their errors impact substantially on profit, and since everyone can improve, the white collar areas should not be ignored. This fourth step consists of:

- identifying area on board ships and in the office that need improvement,
- measuring the actual situation,
- reporting the results in term of progress, according to a schedule.

The use of a few strategically placed, easily understood charts will contribute much to the performance, awareness, and improvement of operations and management alike. These charts should be placed where both personnel and management will see them. They should be sent to all ships.

The charts should always identify the area being measured. This public display of performance measurement results provides a psychological impetus toward improvement, as well as a practical corrective action tool. There should always be a way of showing the gap between the actual and the objective can be closed.

5. Personnel training

Objective: Provide to each employee an appropriate method and tools to improve their performance and to participate in action team.

The aim of the personnel orientation was to inform all personnel about the management standard and to explain them why it is important to implement a quality and safety improvement programme in the company. The adhesion of the personnel to the programme is one other critical element for the success of the programme. This fifth step consist of:

- defining a simple problem solving method (Figure 2),
- identifying the appropriate tools box,
- teaching, through practical exercises, how to use the tools to fix a problem.

Method

It is out of the question to treat any problem with indifference: the cost is too high. First, we have to try and grasp the problem, in order to identify it. And this requires not only curiosity, but also a reliable method, if there is to be any hope of getting the result right.

The problem must be approached with due deliberation, in order to find out and define the causes, and propose a realistic solution, before taking action to eliminate the problem once and for all.

To be comprehensive, the method must provide for the outcome of such action to be followed up, in order to ensure that the problem is finally settled.

Toolbox

Many tools are available for solving a problem. It is only by using them that one learn their practical usefulness, So, identify those most suitable for you and choose the ones that make up the group's toolbox.

A tool should not be rejected out of hand just because it seems either too complicated or too elementary. Every one of them has its advantages and drawbacks. Some can even help release a situation when the group seems to be in a dead-end.

All the tools will be of the greatest help in moving a problem towards its final solution. However, never forget that commonsense must take priority.

Action team

Using tools in an unmethodical way is like building with a blindfold on.

Method becomes necessary when two people or more are working together on the same project; and is essential for any group with a common goal.

Tools are only means to an end, and the method is no more than a guide to conduct. The result depends not only on member's individual abilities. It is based on the conviction of the team, its determination, its cohesion, but also on acceptance of the proposed solution by those who will be most directly affected by its consequences.

6. Error causes identification

Objective: Provide personnel with a vehicle for communicating errors and problem situations to senior management for action.

One of the most difficult situations that employees face is management-employee communication. This programme will provide an unique vehicle for communication. It will ask employees to identify problem areas without having to supply a solution to the problem. This sixth step consists of:

- identifying the possible roots of the problem,
- providing the means to inform the management for taking action on the recognise problem.

This part of the programme is different from a suggestion programme in which the employee is required to know the problem and also to suggest a solution. The error cause identification (ECI) is successful on the basis that an employee need only recognise a problem. Management is responsible for finding the solution.

Asking employees to describe problems that cause errors is strong evidence that management is committed to the entire quality improvement effort. If management then acts on these barriers to defect-free performance, the employees will do their part.

Experience shows that over 90% of the items submitted can be acted upon, and fully 75% can be done at the first level of supervision. Frequently, first-level supervision is left to do the best they can in producing defect-free services in spite of serious obstacles left in their way by the senior staff. This programme is designed to provide a place on management's agenda for operating problems which cause significant waste, along with the routine meetings and reports, customers and telephone calls which so rapidly consume management time.

The error cause identification step should operate under the direction and the guidance of the quality and safety improvement committee.

7. Objectives

Objective: Engage all personnel in a continuous quality and safety programme to improve the global performance of the company.

Each year the general manager review the strategic company plan and fix objectives for the commercial and the operational sectors. It is good management practices to pave the road for the future.

The objectives of the quality and safety improvement programme are different. They are based on non-conformances observe during the daily operation and which need corrective actions to meet the policy statement concerning the improvement of the company performance. This seventh step consists of:

- defining the opportunities in term of objectives for the company,
- preparing appropriate action plans to eliminate non-conformities or to improve existing practices.

The content of the quality and safety improvement programme should be based essentially on management priorities. Each department of the company should identify area where they can contribuate to the expected progress. At this level of the organisation action team should be created with the participation of the line supervisor and personnel.

The result of these activities must permit individuals to propose specific objectives for themselves and their groups.

The specific objectives proposed by each action team must be review by the manager in charge of the concerned department. The proposed objectives must be compatible with the management priorities.

All the objectives approved by the Committee constitute the annual improvement plan of the company.

The objective must measurable, realistic and under the direct responsibility of the department who proposed it.

It must describe in the following terms:

- the reason of the objective
- potential saving for the company
- how the result can be measure
- the intended action plan to reach the objective
- an estimation of the cost investment to solve the identified problem.

8. Corrective action

Objective: Provide a systematic method of permanently resolving problems on a timely basis.

Corrective action is the "payoff" step ! It closes the loop of the quality and safety improvement programme and clearly fulfils a responsibility of contributing to the profits of a company. This is most successful when it operates on the well-known "Pareto" principle which states that the most important should be attacked first. Problems must be identified, classified as to importance, and formally resolved. This height step consists of:

- implementing the corrective action,
- auditing the process to validate the efficiency of the corrective action.
- short regular meetings should be held on board ships and in office to examine the problems detected and to prevent recurrence.
- monthly, or special meetings should be held by the general manager and his staff to review the problems with overdue resolutions.
- when an undesirable condition is noticed, a verbal corrective action request should be issued.
- when verbal corrective action requests are not complied with, a discrepant condition notice should be issued which indicates that verbal attempts at obtaining corrective action have been ineffective and a formal notice is necessary.
- a corrective action notice is sent to the department manager or ship when all else has failed to generate corrective action.
- the receipt of a corrective action notice should be a serious matter. Appropriate reprimand to those failing to heed earlier requests to correct discrepant conditions is in order. Any individual collecting a series of corrective action notices should be brought to the attention of senior management for appropriate remedial action.

9. Cost of error

Objective: Quantify the cost of error and the cost of activities necessary to prevent, appraise and remedy error as a means of reducing the total cost.

While there is no simple definition of the costs of error, but many general definitions, the following specific definition is established for the purpose of understanding the wide scope of activities which may be chargeable to quality costs.

"The cost of error is the difference between the actual cost of making and selling services and the reduced cost, if there was no possibility of failure of the services or errors of the people from the contract signature to the delivery of the product. This ninth step consists of:

- measuring major error costs in the company,
- analysing the actual situation,
- identifying area of potential saving for new quality and safety improvement.

The cost of error is the only practical measurement of quality and safety. It has long been said, "if you can't measure something, you can't control it". The most practical and meaningful measurement is still plain old-fashioned button line money.

However, in principle, restricting error costs in this manner is parochial. It should be construed as any costs relating to mistakes, defects and failures made by anyone in the company which hamper its operation. Now we have taken account of errors from the ships into the offices where the more far-reaching and costly errors occur.

A wider definition should be : "The error cost of a company is the difference between the actual operating cost of a company and the operating cost if there were no failures in its services and systems, no mistakes by its staff, and no possibility of failure or mistakes".

10. Recognition

Objective: Provide employees with recognition for whose who participate.

Employees who continually strive for quality and safety improvement or who are instrumental in effecting significant cost savings should be recognised for their contribution. This serves as a reward to the contributor and as evidence that superior effort is encouraged and appreciated by he company.

Recognition is a fundamental need of everyone. Studies show that people place recognition for their efforts among the aspect of employment they value most. The most effective type of recognition is one that is lasting and increases esteem among associates. A cash award is welcome, but generally soon forgotten. This tenth step consists of:

- defining means to recognise significant results but also for participation,
- awarding personnel to stimulate new participation in the quality and safety improvement programme.

As previously stated, it is important to emphasise that this recognition should, generally, not be in the form of money, prizes, or trinkets. Except in unusual circumstances, the employee is simply doing better what was hired to do anyway. Of course, if someone saves the company a large sum of money, a financial reward might be in order. It should not be considered a routine measure, however.

The type of recognition can be different from one company to the other. There is no strict rule.

For improved stimulation, the recognition awards should be sparse but meaningful.

Conclusion

When travelling, I meet employers who tend to say "We would like to set up a programme, but our employees are not ready".

In fact this is not the problem, the employees are ready to follow the management's example, if close enough to those engaged in the day-to-day business of promoting the company in the field.

The most serious obstacle is that the management is not approachable, and the management ego of "we are the thinkers and they are the doers".

This attitude is wrong at a time when we have to mobilise all efforts to be competitive on a global market.

So, are you ready to be a leader and to believe in your people?

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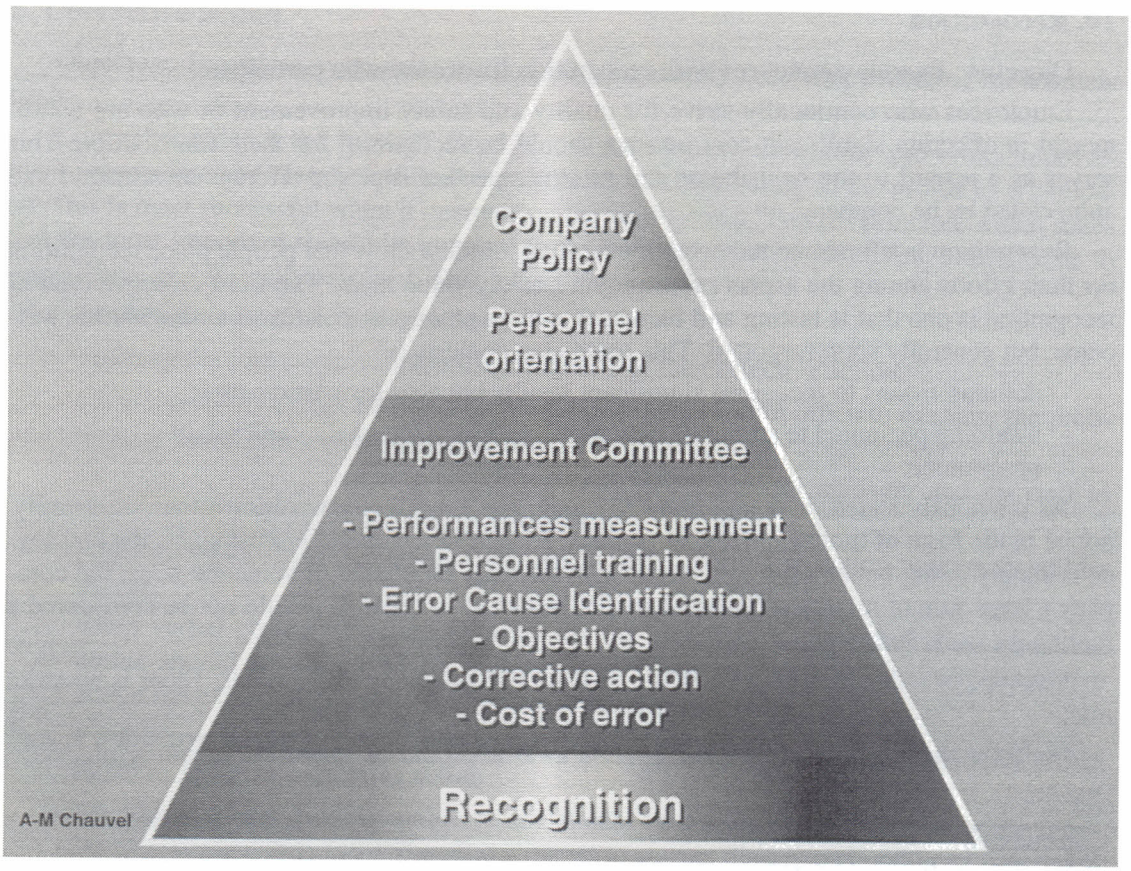
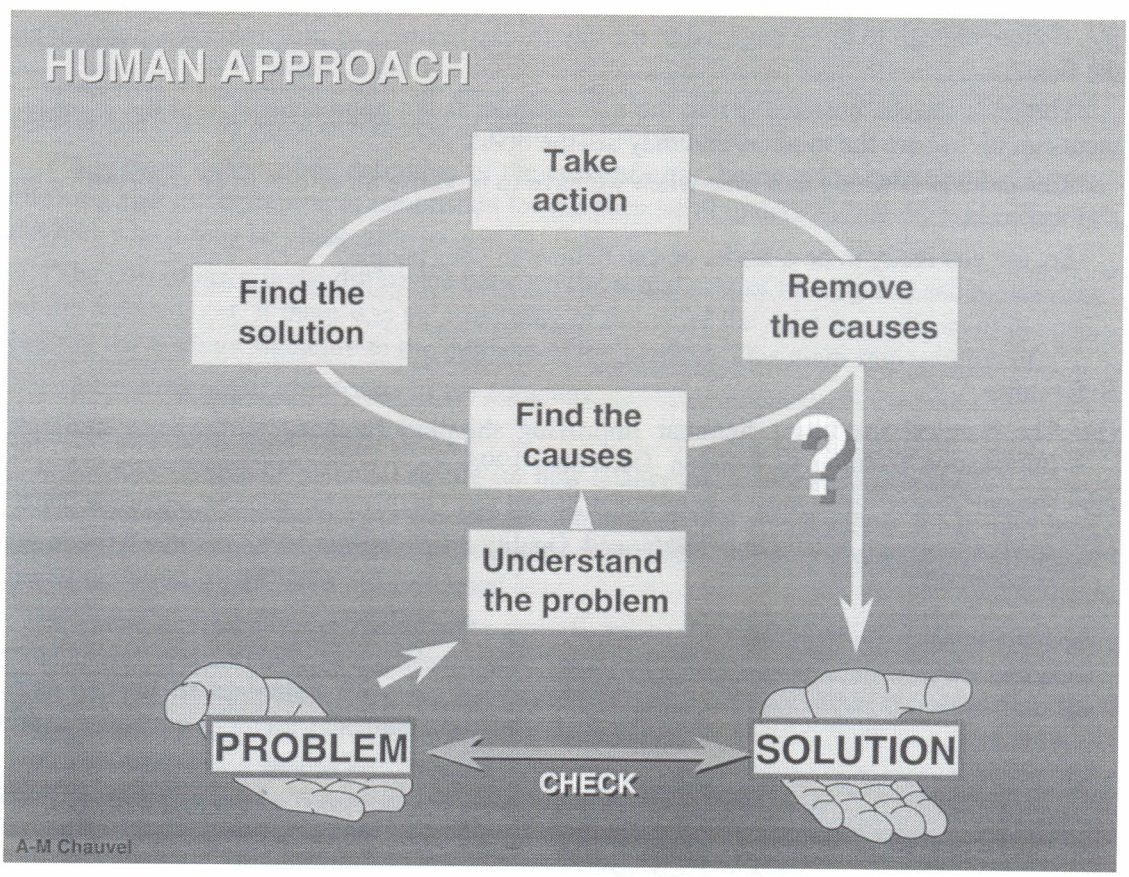

Company Policy
Personnel orientation
Improvement Committee
- Performances measurement
- Personnel training
- Error Cause Identification
- Objectives
- Corrective action
- Cost of error
Recognition
A-M Chauvel


HUMAN APPROACH
Take action
Remove the causes
Find the solution
Find the causes
Understand the problem
?
PROBLEM
CHECK
SOLUTION
A-M Chauvel

LINGUISTIC COMMUNICATION UNDER STRESS:
LESSONS FROM AVIATION[1]

STEVEN CUSHING, Ph.D. [2]

1. The Problem

1.1. Three Propositions. I argue here for three propositions regarding the effects of language differences on aviation communication. I would expect that they would also have relevance to maritime communications. The three propositions are as follows:

Proposition 1. Language differences do increase the likelihood and the severity of failures in aviation communication.

Proposition 2. Language differences themselves are not the fundamental problem they are commonly made out to be.

Proposition 3. Inherent properties of language itself necessarily cause miscommunications.

The first proposition is not surprising; I would guess most people take it for granted. The second proposition is probably surprising; it seems to contradict the first one. The third proposition is certainly surprising; language is the most familiar of human behaviors: how could it possibly itself be a problem?

1.2. Three Examples. Consider the dialogue in Figure 1, taken from the official accident report issued by the Spanish Ministry of Transport and Communications (1978a, b).

1705:44.6	KLM 4805: The KLM four eight zero five is now ready for take off and we are waiting for our ATC clearance (1705:50.77).
1705:53.41	Tower: KLM eight seven zero five you are cleared to the Papa Beacon, climb to and maintain flight level nine zero, right turn after takeoff, proceed with heading four zero until intercepting the three two five radial from Las Palmas VOR (1706:08.09).
1706:09.61	KLM 4805: Ah – roger sir, we are cleared to the Papa Beacon, flight level nine zero until intercepting the three two five.
	We are now at takeoff. (1706:17.79).
1706:18.19	Tower: OK . . . **Stand by for takeoff**, I will call you (1706:21.79).
	[*Note:* A squeal starts at 1706:19.39 and ends at 1706:22.06.]
	[PAA: And we're still taxiing down the runway the Clipper one seven three six (1706:23.6).]
1706:21.92	PAA 1736: Clipper one seven three six (1706:23.39).
1706:25.47	Tower: Ah – Papa Alpha one seven three six report the runway clear (1706:28.89).
1706:29.59	PAA 1736: OK, will report when we're clear (1706:30.69).
1706:61	[*sic*].69 Tower: Thank you.
1706:50	**COLLISION:** KLM on takeoff run collides with PAA on ground.

Figure 1. KLM and PAA, Los Rodeos Airport, Tenerife, Canary Islands, 27 March 1977

[1] Presented at the International Maritime Lecturers Association (IMLA) Conference on Maritime Education and Training and Tenth Workshop on Maritime English, Rijeka and Opatija, Croatia, 18-21 May 1999. I would like to thank Boris Pritchard, Vice-Dean, for inviting me to speak at this conference.

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At 1706:17.79, the KLM pilot (actually copilot) utters (1) to tell the controller that he has begun his takeoff roll; at 1706:18.19, the Tower responds with (2) to tell the pilot that he should not begin his takeoff roll.

(1) We are now at takeoff.

(2) Stand by for takeoff

Two questions arise in connection with this exchange:

Question 1: Why does the pilot utter such a non-standard phraseology?

Question 2: Why does the controller give such an inappropriate response?

The pilot's statement can be interpreted as a subtle form of what linguists call "code-switching," a phenomenon in which multilingual people inadvertently switch from one of their languages to another (and back). The pilot's native language is Dutch; in that language the present progressive aspect is expressed by using the Dutch equivalent of *at* with the infinitival form of the verb, in this case, *takeoff*.[3] Here, the pilot switches into Dutch grammar while keeping the English words, saying *are at takeoff* for *are taking off*. This answers the first question.[4]

The controller is proficient in English, but has not studied Dutch (or linguistics); he thus has no clue (nor does the pilot, by the way) that the pilot is performing such a switch. Since *at* is typically used to begin a locative phrase, he interprets the pilot's utterance in that way; he takes the pilot's utterance as meaning that the aircraft is at the takeoff point awaiting further instructions. This answers the second question.

Together these answers illustrate Proposition 1.

Now consider the dialogue in Figure 2, taken from the official accident report issued by the U. S. National Transportation Safety Board (1981). There are lots of interesting items in this dialogue, which I hint at through italics and underlining: for example, the similarity of the call signs at 0133:11 and 0133:33 and of the phrases *go around* at 0134:13 and *go ahead* at 0134:18, as well as the oxymoronic flavor of *just go ahead and hold* at 0134:18.

0133:11	Tower: Air California *three* thirty *six*, you're cleared to land.
0133:33	Tower: Air California *nine* thirty *one*, let's do it taxi into position and **hold**, be ready.
0133:37	AC 931: Nine thirty one's ready.
0133:52	Tower: Air Cal nine thirty one traffic clearing at the end, clear for takeoff sir, Boeing seven thirty seven a mile and a half final.
0133:57	AC 931: In sight we're rolling.
0134:13	Tower: OK Air Cal *three thirty six*, **go around** three thirty six, **go around**.
(0134:16	AC 336 captain: *Can we* **hold**, ask him if we can – **hold**.)
0134:18	Tower: Air Cal nine thirty one if you can *just* **go ahead and hold** —.
0134:21	AC 336: *Can we* **land** Tower?
0134:22	Tower: Behind you Air Cal nine thirty one *just* **abort**.
0134:25	Tower: Air Cal three thirty six, please go around sir traffic is going to abort on the departure.
(0134:27	AC 336 captain: Gear up.)
0134:36:	**IMPACT:** Aircraft lands with gear retracted.

Figure 2. Air California, John Wayne Orange County Airport, Santa Ana, California, 17 February 1981

[3] This fact about Dutch was first pointed out to me by Profs. Ken Hale of MIT and Nobuhiko Yamanaka of Saitama University.

[4] The Air Line Pilots Association issued an alternate transcript, in which the KLM pilot says (i), rather than (1).

(i) We are now, ah, taking off.

The original tapes themselves appear to have been lost or destroyed through normal procedures and the passage of time, but internal and comparative evidence can be brought to bear in an effort to determine the relative accuracy

Of particular interest here is the use of the word *hold*. At 0133:33, the controller issues AC 931 the instruction (3), meaning to taxi into position and stop there.

(3) taxi into position and hold

At 0134:18, the controller issues AC 931 the instruction (4), meaning to stop his takeoff roll, a meaning confirmed at 0134:22, when he rephrases his instruction as (5).

(4) just go ahead and hold

(5) just abort

This is the standard use of *hold* in aviation English: to *hold* an action is to *stop* what you are doing and do something else instead.

However, AC 336 has something else in mind. At 0134:13, the controller tells him to *go around*, meaning to stop his landing process and do something else. The captain responds at 0134:16 by asking the copilot to request permission to *hold*, meaning to continue what he is doing, namely, land. The copilot confirms that he understands the captain in this way by proceeding to ask the controller for permission to *land* at 0134:21. This is the principal meaning of *hold* in vernacular English: to *hold* an action is to *persist* in doing it.

In other words, though clearly operating in an aviation setting, the AC 336 captain inadvertently slips from aviation English to vernacular English and is understood by his copilot as having done so. Just as the KLM pilot in Figure 1 slips in grammar from English to Dutch, that is, from one *language* to another, the AC 336 captain in Figure 2 slips in meaning from technical to vernacular, that is, from one *variety* of a language to another. We thus get code-switching within a single language by native speakers of that language, the same process that occurs in multilingual speakers of clearly different languages. This illustrates Proposition 2 and begins to hint at Proposition 3.

Related mechanisms appear to be operating in the dialogue in Figure 3, taken from the official accident report issued by the U.S. National Transportation Safety Board (1991).[5]

2124:04 Tower: Avianca zero five two, you are making a left turn, correct, sir.

2124:06 Captain to copilot: Digale que **estamos en emergencia**. [English: Tell him **we're in an emergency**.]

2124:08 Copilot to Tower: That's right to one eight zero on the heading and, ah, we'll try, once again, ***we're running out of fuel***.

2124:15 Tower: Okay.

2124:17 Captain to copilot: Que dijo? [English: What did he say?]

2124:18 Copilot to captain: Mantener dos mil pies, ciento ochenta en el rumbo. **Ya le dije** que intentamos de nuevo, porque ya no podemos. [English: Maintain 2000 feet, 180 on the heading. I already advised him that we are going to attempt again, because now we can't.]

2124:22 Captain to copilot: Digale que **estamos en emergencia**. [English: Tell him **we're in an emer gency**.]

2124:26 Captain to copilot: **Ya le dijo**? [English: **Did you tell him**?]

2124:28 Copilot to captain: **Si, senor**. [English: **Yes, sir**.]

2124:29 Copilot to captain: **Ya le dije**. [English: **I already told him**.]

[2124:32-2125:07 Aircraft is handed off from Tower to Approach Control]

2125:08 Captain to copilot: Digale que ***no tenemos combustible***. [English: Tell him **we don't have fuel**.]

of the transcripts. For example, the controller's instruction (2) makes no sense at all as a response to (i), but can be explained in terms of known linguistic mechanisms (code-switching and construal of an *at* phrase as a locative) as a response to (1). It is not implausible that "wishful hearing" by a linguistically naïve but pilot-friendly transcriber might have projected a non-existent *-ing* onto the *take* in (1) in an effort to make sense of the pilot's utterance. See Cushing (1994a) for more on "wishful hearing." I thank Prof. Bill Waldock of Embry-Riddle Aeronautical University for information about the tapes and about the alternate transcript (personal communication).

5 Extraneous dialogue at 2125:15-2125:22, 2125:41-2126:34, and 2126:47-2130:30 is omitted.

2125:10 Copilot to Approach: Climb and maintain three thousand and, ah, ***we're running out of fuel***, sir.

2125:12 Approach to copilot: Okay, fly heading zero eight zero.

2125:28 Captain to copilot: Ya le dijiste que ***no tenemos combustible***? [English: Did you already tell him ***we don't have fuel***.]

2125:29 Copilot to captain: **Si, senor. Ya le dije**. Ciento ochenta en el rumbo mantenemos tres mil pies y nos va a volver a meter. [English: **Yes, sir. I already told him**. 180 on the heading. We'll maintain 3000 feet and he'll get us back.]

2125:29 Captain to copilot: Bueno. [English: Okay.]

2126:35 Approach to copilot: And Avianca zero five two heavy, ah, I'm gunna bring you about fifteen miles north east and then turn you back onto the approach. ***Is that fine with you and your fuel***?

2126:43 Copilot to Approach: I guess so. Thank you very much.

2126:46 Captain to copilot: Que dice? [English: What did he say?]

2126:46 Copilot to captain: El man se calento. [English: The guy is angry.]

2130:32 Approach to copilot: Avianca 52, climb and maintain three thousand.

2130:36 Copilot to Approach: Ah, negative, sir. ***We just running out of fuel***. We. Okay. Three thousand now. Okay.

2130:39 Captain to copilot: No, no tres. Tres mil. Tres mil. [English: No, not 3. 3 thousand, 3 thousand. [Aircraft soon runs out of fuel and crashes.]

Figure 3. Avianca, Cove Neck, New York, 25 January 1990

In this case, the copilot switches deliberately, not inadvertently, between two languages, because the pilot has chosen to speak Spanish and the controllers are speaking English. The pilot twice utters the word *emergencia*, the exact Spanish equivalent of the English word *emergency*, to the copilot (at 2124:06 and 2124:22), but the copilot never says the word *emergency* to a controller. Instead, he elaborates on the nature of the emergency, which he describes correctly as (6) (at 2124:08, 2125:10, and 2130:36), while assuring the captain that he has advised the controllers of both the emergency (at 2124:26-2124:29) and its nature (at 2125:29).

(6) running out of fuel

The noun *emergencia* means the same in vernacular Spanish as *emergency* means in vernacular English and, in both vernaculars, it is more natural to elaborate the nature of an emergency than simply to repeat the word itself; however, *emergency* has a special use in aviation English. Phrases such as those in (7) convey a special degree of urgency that requires the controller to give priority to any aircraft that transmits them; since there is no "aviation Spanish," there is no Spanish analog for that use.

(7) (a) declare an emergency
(b) fuel emergency

In shifting from one language to another, the copilot overlooks the fact that, although the word *emergency* has been said, it has not been said in the correct language to the correct person: aviation protocol requires that it be said in English to the controller.

The controller is listening for such a phrase, but never hears it. His apparent anger at 2126:35, reported by the copilot at 2126:46, suggests frustration at a crew that declines to declare an emergency, while claiming to be running out of fuel. He could take it upon himself to ask if there is an emergency, but he takes the crew's competence for granted and assumes on that basis that they would have declared an emergency if there had been one. Perhaps he wonders if they are playing around in an attempt to gain some advantage. It never occurs to him that, possibly, they could just be making a mistake.

The most striking feature of the dialogue in Figure 3 is that it all could have happened just as it did without any Spanish having been involved. The official transcript has the Spanish and English versions of the intra-cockpit dialogue listed side by side in parallel columns and either can be read without the other to determine what is going on. The air/ground dialogue is exclu-

sively in English and the controllers know nothing of what is said in the cockpit, including what language it is in.

The fact that the language being used to communicate with the ground is a technical variant of a language other than the copilot's own, leaving him twice removed from the vernacular with which he is most familiar, is likely to have compounded the miscommunication in this instance. This illustrates Proposition 1. However, an inability (or unwillingness) to shift between variants of a single language, or the lack of awareness of the need to do so, is the culprit. This illustrates Proposition 2.

Neither the copilot nor the controller is able to maintain his communicative bearings in the attempt to talk the aircraft down safely. Both are speaking and listening in what they think they know are the correct ways. The copilot shifts languages: Spanish to English; but not varieties: vernacular to aviation. He stumbles around the linguistic landscape, trying to get his point across and wondering why he keeps falling flat. The controller is so locked into the technical aviation protocol that he never thinks to step back a bit and try to listen in the vernacular; he, too, seems unable to shift varieties, though in the opposite direction. He tries to make sense of an apparent contradiction and finds himself unable to do so. The copilot is walking on quicksand; the controller is stuck in a ditch. It is language itself that has both of them tied in knots. This illustrates Proposition 3.

1.3. More Examples. The occurrence of inadvertent (and resistance to necessary) code-switching between and within languages is only the most striking and dramatic of the inherent properties of language itself that necessarily cause miscommunications. Following is a list of further such properties, each illustrated with an actual instance that occurred in an aviation setting.[6]

Ambiguity: The presence of two or more meanings in a word, phrase, sentence, or passage.

Example: A controller, knowing that B1 had called but not sure what the request had been, replied with (8) and then proceeded to talk to aircraft while waiting for a reply.

(8) B1, Ground, go ahead.

B1 misinterpreted the phrase go ahead as referring to his driving, rather than his speaking, and was halfway down his normal route of travel before the controller realized what had happened.

Homophony: Different words or phrases sounding exactly or nearly alike.

Example: Confusion between the intended *two* and the required but missing *to* in (9) led to a fatal accident.

(9) Descend 2400.

The aircraft descended to 400 feet rather than the appropriate altitude of 2,400 feet.

Prosody: The pattern of pauses, stresses, or pitches in an utterance.

Example: While checking out a pilot in a small airplane, an experienced flight instructor reports noticing considerable power on just before touching down. He thought he had said (10), but he was interpreted by the pilot as having said (11).

(10) Back – on the power.

(11) Back on – the power.

The two utterances normally differ in pronunciation only in the placement of the pause and in whether or not *on* is stressed.

Uncertain Reference: A degree of indeterminacy as to just who or what is meant by a pronoun or pronoun-like expression.

Example: The Tower issued (12) to an aircraft that had landed on runway 15.

[6] For more detailed discussion of these examples and citations, see Cushing (1994a,c, 1995).

(12) Taxi to the next and hold short of 21.

The pilot was confused as to whether *next* was intended to refer to a runway or a taxiway.

Implicit Inference: Unjustified assumptions or conclusions derived from indefiniteness or time lags.

Example: A pilot interprets (13) as a clearance to climb, misconstruing *can* as *do*.

(13) I can give you 290 but you will have to negotiate for higher.

(14) Roger, cleared to 290, leaving 230."

The controller does not challenge the readback (14) but queries the pilot at 24,000, informing him then of relevant traffic.

Ritualization: Statements and situations lose their cognitive impact and participants fall into a pattern of simply going through the motions for their own sake.

Example: After the dialog (15) with the controller, the pilot began a descent, but was then informed that he had not yet been cleared below 4,000 feet.

(15) Can you see the runway?

(16) Yes.

(17) Okay, turn to 360 degrees.

The instruction (17) had been followed so often in the pilot's prior experience by a clearance to descend that he assumed it was so in this case as well.

2. Solutions

2.1. Solution Types. There are two kinds of solution to the problem identified above:

Human Solutions: What can we do for personnel to help them improve their communication?

Technological Solutions: What can we give to personnel to help them improve their communication?

Note the phrase *for personnel*, rather than *to personnel*, in the formulation of Human Solutions. Jones (1994) questions the value of technological solutions with the comment, "As for me, I would try a few sackings first." However, that is not what I have in mind.[7] While discipline and enforcement are necessary components of any safety program, a stronger foundation is built by convincing people to cooperate voluntarily with safety measures through developing their understanding of the basis of and the need for those measures. Confidence is strengthened further by providing reliable technologies that make compliance easier.

2.2. Human Solution. Steps that can be taken to help personnel improve their communication include such general measures as shortening shifts and hiring more staff. However, there is one essential human solution to this particular problem, without which others will lose their effect, namely:

Provide aviation personnel with a deeper understanding of language, including:

- its basic characteristics
- how it works
- the kinds of ways it can malfunction in communication
- the consequent need to use it more mindfully

[7] See the reply in Cushing (1994b).

In other words, we must develop and promote the outlook of treating language as a crucial component of the aviation and maritime environments, entirely on a par with more obviously tangible components, such as aircraft, ships, radar, and communications equipment. People who use language as a tool must be trained in its effective use to the same depth and breadth as pilots are trained to fly aircraft, controllers are trained to read radar, and both are trained to use communications tools. This encompasses everyone in the aviation and maritime systems. A thorough awakening to the kinds of potential problems sketched in Section 1 can go a long way toward replacing the complacency engendered by language's familiarity with a willingness to master it to save one's own life and others'.

Awareness of language and the skills for using it more effectively can be promoted in numerous ways, including:

- **Books**, such as my own ***Fatal Words*** (Cushing, 1994a)
- **Newsletters and reports**, such as those published by the International Aviation English Association
- **Training materials**, such as those developed by the Centre of Applied Linguistics at the University of Franche Comte in Besancon, France

The point is to incorporate such materials into every aviation and maritime training program and to elevate their mastery to the highest level of priority.

Technological Solutions. The general background for potential technological solutions in the short-, intermediate-, and long-term time frames is sketched out in Cushing (1994a). Since this conference is concerned particularly with training, already discussed above, I mention here only one technological solution geared to an intermediate-term time frame. For more examples, see Cushing (1997).

Problems of voice-mediated language can be avoided by using a restricted English-like artificial language in connection with a *visual* communication system. Given a suitably restricted language framework, pilots and controllers can be given screens in variants of their own languages with automatic translation between them. This is illustrated in Figure 4.

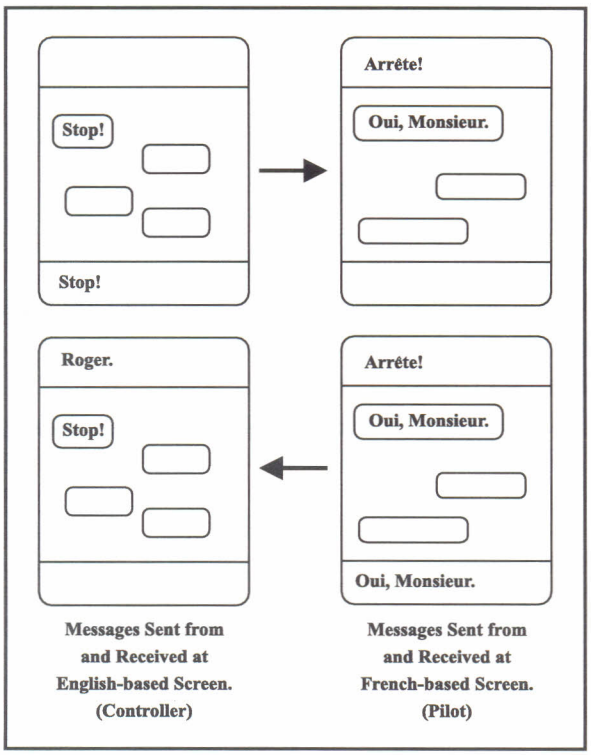

Figure 4. Visual Communication System with Translation

Ritualization can be avoided by having alternate equivalent formulations of an instruction selected randomly for presentation. This is illustrated in Figure 5.

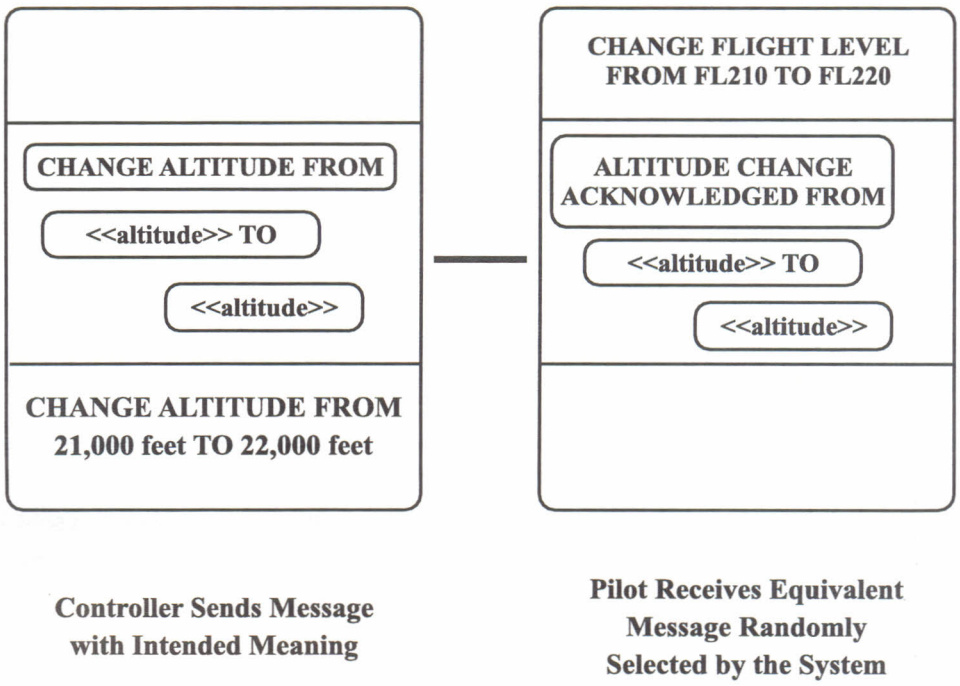

Figure 5. Visual Communication System with Randomization

A prototype of such a visual communication system is described in Cushing (1994a).

3. Three Conclusions

I end with three conclusions, each with an associated aphorism:

Conclusion 1. In regard to aviation miscommunications, language itself (not language differences) is the problem.

"Language: Can't live without it. Can't live with it."

Conclusion 2. Education and training (of a particular kind) are the principal solution.

"Knowledge is power. Knowledge of how language works is key to survival."

Conclusion 3. Sophisticated tools can help.

"Even with a mastery of basic mathematics, it doesn't hurt to have a calculator."

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PRACTICAL CASUALTY INVESTIGATION THE INVESTIGATOR'S PERSPECTIVE

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INTRODUCTION

During my career as a Marine Surveyor, I have investigated hundreds of incidents, from the miror bump to major oil spills. In this paper I discuss how investigations are conducted, evidence collected and conclusions drawn. As modern risk management techniques are increasingly used in a loss prevention context, the trend seems to be for more and more people based ashore telling fewer and fewer seafarers how to do their job!

What is a casualty? In general, the term casualty in the marine world is applied to a more serious accident or incident. In the context to this paper I will define a casualty as any incident resulting in injury to or death of personnel and any incident involving damage to property or pollution of the environment. The paper concentrates on more serious casualties; but I include a short section on minor incedents to cover the more routine type of work undertaken by surveyors.

Having examined the casualty, I address some of the practical issues raised during investigations and how lessons learned in the field can be passed into current training programmes.

THE MINOR CASUALTY

Most accidents are minor in that they have no serious affect on operational or commercial affairs. Marine surveyors spend most of their time investigating minor incidents such as damage to goods in transit, bumps and knocks between ship/tug/quay or machinery breakdowns. A minor incident may involve Port Authority or Health and Safety Representatives at local level and invariably it will be settled on an agreed commercial basis, often through insurance.

The key to investigation is observation; to assist insurers in claims handling the investigating surveyor must establish the nature of the damage, extent of it and the cause. Marine surveyors should be familiar with ships and what can go wrong wit them. The nature of domage may be obvious, wetting, fire or shifting cargo; the extent of damage will be determined during the survey and the cause may be obvious or require investigation. The surveyor is required to observe and record the evidence before reaching conclusions. This may appear to be an obvious point, but pressure is sometimes brought to bear by one party or another to reach conclusions unsupported by fact!

It is important that the marine surveyor recognises his limitations and recommends specialists be appointed if the cause is not marine. For example, infestation in a cargo may have nothing to do with the ship and be more to do with the origin and treatment of the cargo before shipment.

A feature of minor casualty work is that little is ever done to draw on the experiences of an incident; insurers pay up and files are closed. Occasionally a series of similar incidents may alert an insurer or sector in the industry and circulars may be issued to advise owners and operators accordingly. As with most incidents the causes are invariably avoidable and down to human action (or inaction).

THE MAJOR CASUALTY

When a major casualty occurs many more parties than those only participating in the commercial venture become involved. Consider the *"Sea Empress"* grounding and subsequent oil spill as an example. Not only did the commercial interests participate in the response, but local and national authorities also became heavily involved. In Annex A, I have attempted to list all those bodies present that I was aware of; I suspect a few others have been left out!

When a major casualty occurs, the attention in draws from the media and various tiers of government invariably results in a public debate on causation and response effectiveness. This sometimes detailed attention results in in-depth studies taking place to ascertain why the casualty happened and what lessons are to be learned to avoid repetition. Below I have subdivided the casualty investigation into Statutory and Commercial categories in an attempt to show how approaches differ. For most people involvement in a major casualty investigation is a once in a lifetime experience. Some states do have specialist departments set up to conduct investigations and there are a few private individuals and companies who specialise in casualty investigation.

THE STATUTORY INVESTIGATION

In this section I draw on my experience in the United Kingdom to provide the input. Methods may differ elsewhere, but the broad principles remain the same worldwide.

Once an incident has taken place the responsible government department will want to conduct a full investigation as soon as possible. This means despatching one or more investigators to the scene of the incident at the earliest opportunity. The investigator will have two primary objectives; firs, to examine the ship and second, to interview surviving crew.

As with any investigation a close examination of the physical evidence is essential. Most fron-line state investigators have a Merchant Marine or Naval background. This is important because most accidents involving ships will involve mariners and shipboard operations. An investigator with a marine background can quickly home-in salient points. If the establishes that the cause may involve other factors, such as metal fatigue, he can call upon government scientists of an appropriate discipline to assist.

The statutory investigator has a distinct advantage over all others; he usually has the backing of law that allows him unrivalled access to the ship and crew, if necessary to the exclusion of all the commercial investigators. Occasionally the action taken by state surveyors can prejudice any subsequent investigation because evidence is removed or compromised.

Crew interviews form an integral part of the statutory investigation. Speed is important because ship's crewmembers are often repatriated with indecent haste following an incident. The trend to arrest and imprison crewmembers immediately following a casualty may have developed in part because state investigator's efforts to interview crew have been hampered by speedy repatriation. Again, the state investigator has a distinct advantage in that he has virtually unlimited access to the crew. This invariably allows the state a first opportunity to control the situation. In practice however, things are not so clear cut. Owners lawyers are usually very quick off the mark and will try to ensure a presence at any crew interview. The success of this tactic often depends on jurisdiction. Problems can arise in situations where, because of the circumstances of a casualty, crewmembers might be advised to have their own lawyer present; there might be a direct conflict between an owner's and a crewmember's interests.

Apart from the likely backing in law to conduct an investigation, the full resources of government can be made available if the situation warrants it. From my own experience an investigation will be more successful if all parties rightfully involved conduct their affairs in a spirit of co-operation rather than confrontation.

COMMON PROBLEMS

Before addressing how the commercial investigator may approach his task, there are many aspects common to both state and non-state investigations.

The first hurdle to be crossed in physical access to the ship. The ship may be smouldering, lying at a large angle or even covered in ice. Sometimes I think the most hazardous part of the job is boarding and leaving casualties; safe access in a rough sea on a dark winter's night has its own challenges. Once aboard there are many things to watch out for such as slippery decks, poor lighting, fumes and unprotected openings. The rule "one hand for the ship – one hand for self" takes on a new meaning when operating in a casualty situation. Gaining access to the location requiring investigation is yet another challenge awaiting investigators.

Modern technology has an influence on investigators conduct on board. The apetite for "instant" information is insatiable; digital cameras, lap-top computers, mobile phones have increased pressure on the investigator to get information back to "head office" as soon as possible. There is a danger than an investigator, eager to please, may prejudice his safety.

If I may illustrate what I mean. Consider a surveyor properly equipped with safety shoes, safety helmet, goggles, gloves, high-visibility jacket; life jacket (or survival suit), safety harness, intrinsically safe torch (with spare batteries) noxious gas alarm and radio; now add camera, video, telephone, lap-top, spare films, measuring tapes, pencil, notebook and sustenance, it is just not possible to conduct the investigation safely. I urge those instructing surveyors to temper their lust for immediate information in the interests of safety of the surveyor.

COMMERCIAL INVESTIGATIONS

Each party interested in a voyage may want their own investigations conducted into an incident. The reasons for commissioning an investigation traditionally lay with issues of liability, but there is now a trend to try to establish what did happen in order to learn from an incident.

It is always worth bearing in mind who the people are and their objectives. Any investigation is essentially an information and evidence collection exercise. While there is little doubt about the rights of statutory surveyors, those representing commercial interests have different "rights" and priorities.

The question of who is entitled to access a casualty for the purposes of conducting and investigation is often vexed. Consider a major container ship incident where there may be charterers, slot charterers and numerous cargo interests involved; the number of lawyers and surveyors who may want to attend can be staggering. In one recent incident no less than 47 persons initially presented themselves as representing interests in the casualty.

The first thing to establish is who represents whom and who is entitled to board to see what! The primary casualty investigator after the statutory surveyor will be the ship owners' surveyor. Is it unreasonable that the owners should have access ahead of others?

The nature of the casualty will determine the make-up of the investigation team. Almost invariably a nautical input is desirable to deal with marine related issues. The marine surveyor may have to work with specialists in other disciplines such as fire, materials or chemicals in order to provide principles with as complete an investigation as possible. Most commercial investigations are still aimed at assisting in the resolution of liability issues. This means that priorities are different. The investigators, usually independents, may have slightly differing instructions which results in different parts of a ship or her equipment being examined. For example the party representing bunkers may have no interest in how a fire started.

Clearly the first investitgators on board have an advantage in seeing fresh evidence. This is why other parties may resort to Court to ensure a simultaneous survey. However the Courts will not normally allow a totally free hand or "fishing for evidence" survey.

As mentioned, keeping a careful record of the evidence examined is important. When further analysis is required samples must be drawn and retained in a Courtworthy manner and be properly catalogued. A good photographic record is also useful, especially when non-experts in a field are handling the claims.

After the initial survey, collection of evidence and issuing a report there may be a considerable interval, often years, before all the issues are resolved. This means that the investigator's file must be retained, the contents will be referred to long after the evidence was collected.

At the end of the day the investigator must present his findings in the form of a written report. Non-expert readers must be able to understand the significance of any evidence obtained, issues arising and conclusions reached, the good report should be able to do this is clear language without prevarication.

LESSONS

Some liability underwriters are taking loss prevent very seriously and research has been commissioned to draw together the results of investigations into many major casualties. The quality of such work depends upon the quality of the investigation conducted initially. Having concluded that 85% of maritime casualties are due to human error – is it now time to ask why?

Because liability issues often involve large sums of money and there is alwas a possibility that the issues may be decided by private arbitration rather than public Court proceedings, the circumstances of the casualty may remain undisclosed for quite some time. Therefore, unless matters of "the public interest" are involved, the lessons learned may never be made public.

It is important that academic and professional institutions open lines of communication with operators and underwriters so that an informal exchange can take place. An example of such co-operation exists between the Nautical Institute and a number of P&L Clubs. Similar co-operation exists between the U.S. Coast Guard and some Clubs.

April 1999.

"SEA EMPRESS"

GOVERNMENT	LOCAL	COMMERCIAL	OTHER
Marine Safety Agency	Police	Shipowner	R.S.P.C.A.
Marine Pollution Control Unit	Fire Brigade	Ship Manager	R.S.P.B.
H.M. Coastguard	Armed Services	P&I Club	WWF
Marine Accident Investigation Bureau	Pilots	Charterer	Greenpeace
Environment Department	Port Authority	Charterers P&I	Friends of the Earth
Secretary of State	R.N.L.I.	Cargo Owner	Media (x 50)
Minister of State	District Council	Receiver	Womans Institute (local caterers)
I.O.P.C. Fund	Town Council	Lawyers (x 6)	
		Surveyors (x 10)	
		OCIMF	
		OSRL	
		Briggs Marine	
		Salvors (x 3)	
		Tug Operators	
		I.T.O.P.F. Ltd.	

INTEGRATED SAFETY INVESTIGATION METHODOLOGY (ISIM) – A SYSTEMATIC APPROACH TO ACCIDENT PREVENTION BY TRANSPORTATION SAFETY BOARD OF CANADA

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ABSTRACT

During the past seven years (1990-1998), the *Transportation Safety Board (TSB)* of Canada, had investigated over 750 marine accidents and incidents (occurrences).

The analyses of these occurrences show that marine accidents, just like those in other industries, are the result of multiple causes and underlying factors. In any system operation, there is a complex interaction involving machinery, equipment, humans and the environment. Human and organizational factors are implicated in most accidents as underlying of contributing factors to the *immediate causes* of those accidents. In order for accident prevention strategies to be effective, an accident investigation must search beyond *the immediate cause*. This suggests a need for a much boarder system approach a look for contributing factors to the accident and underlying Safety Deficiencies[1] (SD) that pose a risk to life, property and environment. Hence, TSB developed the *Integrated Safety Investigation Methodology (ISIM)*. The ISIM embeds the function of safety deficiency analysis into the investigation process, commencing with the assessment of the initial occurrence notification through to the effective communication of the identified risks to those who can influence the necessary change.

However, discussion in this paper is limited to the systematic evaluation of an occurrence to determine the root causes, contributing, and underlying safety deficiencies commonly found in TSB investigations.

TRANSPORTATION SAFETY BOARD AND ITS OBJECTIVES

A few words about the TSB; the Canadian Transportation Accident Investigation and Safety Board, commonly known as TSB, is a Canadian federal government agency mandated to improve transportation safety by:

(a) conducting independent investigation, including, when necessary, public inquiries, in order to make findings as to their causes and contributing factors;

(b) identifying safety deficiencies as evidenced by transportation occurrences;

(c) making recommendations designed to eliminate or reduce any such safety deficiencies; and

(d) reporting publicly on its investigations and public inquiries and on the related findings;

TSB is independent of other government departments that regulate or operate elements of the marine, rail, commodity pipeline, and air transportation system. It is not the function of the Board to assign fault or determine civil or criminal liability, however the Board does not refrain

[1] In the context of this paper, SD is defined as any inadequacy in the marine transportation system which could cause or contribute to the severity of an accident or incident.

from fully reporting on causes and contributing factors merely because fault or liability might be inferred from its findings.

The TSB's sole objective is to advance transportation safety which is predicated upon the identification of *Safety Deficiencies* and associated *risks.* As such, the investigations are carried out with the prime purpose of identifying *Safety Deficiencies* in transportation occurrences and to propose corrective safety action designed to eliminate or minimize risks associated with any such deficiencies.

TSB APPROACH TO ADVANCING TRANSPORTATION SAFETY

Generally, an investigation of any occurrence may have three main objectives:

(a) to find out "What happened?"

(b) to determine "Who did it?"; and

(c) to improve safety;

Traditional investigations, in the past, placed more emphasis on (a) and/or (b). Objective (a) will be met if the investigation can just determine the causes. In a traditional investigation, once the *immediate cause* of an accident is found, the process of investigation often stops without further examining the underlying factors and contributory conditions leading up to that *immediate cause.* Determination of *immediate cause* is useful in identifying who had the last opportunity to intervene and prevent the accident. However, it does little in terms of developing an understanding of the unsafe conditions which lead to the accident.

With objective (b), the investigation will be looking for who is to blame with a view to taking deterrent measures as well as establishing damage compensation and punishment (civil/criminal liability). For example, an investigation might conclude upon determining that a collision occurred because the master of the fishing vessel did not proceed at a safe speed. Possible underlying factors such as the requirement to maintain a tight sailing schedule, to take advantage of a per-trip fishing quota, or the need to work long hours resulting in fatigue due to a small complement, etc. were usually left undetermined. As such, cause determination or apportioning blame by itself would not do much to improve safety except with respect to its deterrent value.

Today, more and more investigations are conducted to learn from the accidents. As indicated above, the ultimate objective of TSB investigations is to ***improve safety – transportation safety***. To that end, TSB investigations are conducted to identify inadequacies in the system which could cause or contribute to the severity of an accident or an incident.

WHAT IS "SAFETY" AND HOW CAN WE IMPROVE IT?

We all have our own understanding of what ***Safety*** is. However, for the purpose of this discussion, let us define **"safety"** one more time. The Oxford dictionary defines ***"safety"*** as *"freedom from danger or risks"*. Risk has two elements and is commonly defined as the product of the probability of an adverse outcome during a specific period of time and the severity of that outcome.

RISK = PROBABILITY X CONSEQUENCE

If we attach the units of measurement, the Risk equation may be written as follow:

$$\text{RISK}\left[\frac{\text{Impact}}{\text{Time}}\right] = \text{PROBABILITY}\left[\frac{\text{Event}}{\text{Time}}\right] \times \text{CONSEQUENCE}\left[\frac{\text{Impact}}{\text{Time}}\right]$$

Therefore, to improve safety means to eliminate or reduce risks. **Risk** can be treated by either reducing **probability** and/or by reducing the **consequences**. To do so, one must understand the causes and underlying factors that contribute to both elements of the RISK equation. If the focus of an investigation is only on the casual factors and on preventing *"recurrence"*, it will limit the potential for safety improvement by not considering the second element of the risk equation - i.e. the **consequence**.

Many of us can think of an accident which had factors at play that were not causal, but that contributed to the severity of the outcome, the consequence. An obvious example would be inadequate lifesaving equipment and inadequate knowledge and training in marine emergency duties. Another could be design characteristics of a vessel that allowed a relatively minor incident to become a serious accident. Eliminating such deficiencies will do nothing to prevent a future accident, but it may significantly improve safety by reducing the severity of consequences.

INTEGRATED SAFETY INVESTIGATION METHODOLOGY - ISM

As a broad approach to minimizing risk in the transportation system, the TSB developed an accident investigation methodology, termed *Integrated Safety Investigation Methodology (ISIM)* which places emphasis on the identification of safety deficiencies in the system and the assessment of risks associated with such deficiencies. The ISIM process is systematically made up of several steps commencing with the assessment of the initial occurrence notification through to the effective communication of the identified risks to those who can affect the necessary change. (Figure (1)). However, for the purpose of this paper, only the following five important steps will be discussed:

1 Collection of occurrence data;

2 Analysis of occurrence events (determination of occurrence events & identification of safety deficiencies);

3 Risk Analysis,

4 Barrier (Defence) Analysis, and

5 Consideration of Risk Control option.;

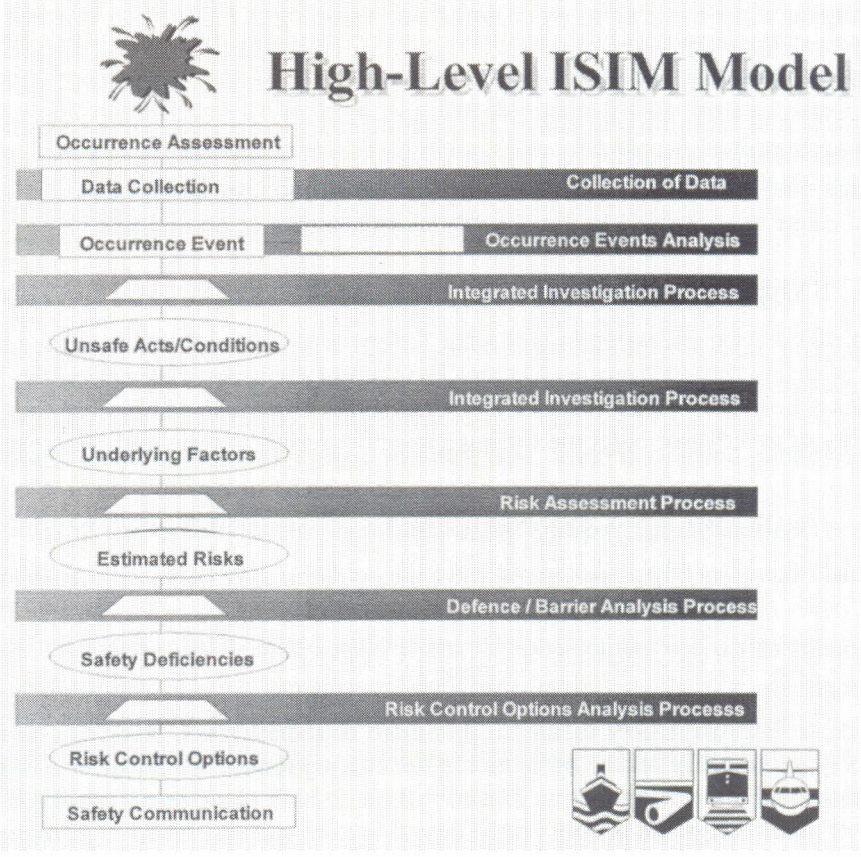

Figure (1) ISM Process Model

1. Collection of Occurrence Data

The firs step in an investigation process is the collection of information regarding the personnel, tasks, equipment, and environmental conditions involved in the occurrence. A systematic approach to this step is crucial to ensure that a comprehensive analysis is possible to determine not only what, who and when" of the accidents but also "why and how" the accident happened.

To conduct an effective systematic data collection, the investigator must recognize from the outset than regardless of the type of accident, there are five core element that can play an interactive role in causing such accident; **Men, Machine, Medium, Mission, and Management.** Like any industrial operation, marine transportation is a complex operation system where **Men, Machine** (vessels, equipment, machinery, etc.), and **Media** (external and internal environments) interact in a confine of **Mission** (goals, needs, financial objectives, etc.) and **Management** (organization, policy, procedures, regulatory framework, fishery resource management, etc.). Often, Mission and/or Management factors influence the way Men interact with Machine in certain Media which may be unsafe. The analysis of shipping accidents over the past several years, indicate that while one or a combination of aforementioned 5 basic risk element are generally present in all accidents, human and organizational elements play by far the biggest role in causing such accidents. Understanding the interrelationship of these elements can help the Safety Analyst in determining all the relevant causes and contributing factors of accidents. For a complex system, such as a ship, where there are numerous interactions between the component elements, there is constant danger that critical information will be overlooked or lost during an investigation.

One technique used to gain knowledge about the interrelationship of these elements in a system is a framework termed the SHELL model that was developed by Professor Edwards in 1972, and later modified by F.H. Hawkins. Although the SHELL model was intended as a tool for human factors studies, it also serves as an effective tool for data collection. The "**L**" block representing LIVEWARE, or human element, is it centrepiece of the model. The human component interacts directly with each of the other building block namely SOFTWARE (**S**), HARDWARE (**H**), ENVIRONMENT (**E**), and the second component of LIVEWARE.

The LIVEWARE interacts with the HARDWARE (the machine component, which could be a vessel, an engine, or any piece of equipment).

To operate a vessel, or a machine, humans have to use SOFTWARE (written or computerised information) such as equipment manuals and instructions, standing orders, operating procedures, nautical charts, etc. The interaction between LIVEWARE and such SOFTWARE is an important factor for the safe operation of the vessel and machinery.

The third interface is that between and individual and their ENVIRONMENT; internal or external. Human performance can be impaired by factors of external environment such as climatic conditions, ship motions induced by sea states, visibility, noise, vibration, etc. Performance of ship crews can equally be affected by the internal environment such as excessive heat, noxious fumes or gaseous vapours in engine-rooms.

Finally, individuals interact with other individuals (LIVEWARE). Human interaction occurs at various levels of the operation: communications among bridge personnel, bridge-to-bridge, vessel traffic service centres, coast guard radio station, master and crews, pilot and master, ship crews and company management, etc. Problems with this interface could lead to inefficiency, misrepresentation, miscommunication or breakdowns in communication.

In marine environment, vessels and equipment should be designed, installed and maintained for the environmental conditions (wind, wave and ice) they are required to function. As such, it is useful to consider the interface between Environment and the Hardware. The model in Figure (2) depicts this Hardware – ENVIRONMENT interface.

In this SHELL model, each component has the shape of a block whose edges are not straight and possess a unique contour, suggesting that these factors may not have a perfect interface.

Use of the **SHELL** model as an organizational tool for the investigator's workplace data collections helps avoid downstream problems because:

- it takes into consideration all the important work system elements;
- it promotes the consideration of the interrelationships between the work system elements; and,
- it focuses on the factors which influence human performance by relating all peripheral elements to the central liveware element.

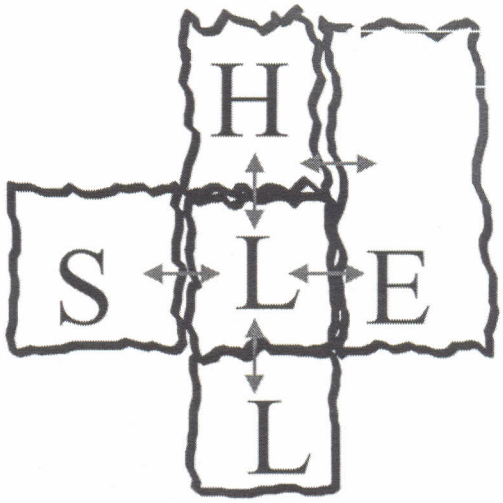

Figure (2) SHELL Model (Modified to include Hardware – Environment interface)

At this data collection stage, the investigator initially attempts to answer the more simplistic question concerning "what, who, and when" and then moves to more complicated questions of "how and why". The resulting data becomes, for the most part, a collection of events and circumstances comprised of acts and conditions. Some of these will be of interest as unsafe acts and unsafe conditions.

2. Analysis of occurrence events:

Having completed the task of collecting all relevant information surrounding an occurrence, the investigator must make judgements in analysing the data to arrive at meaningful and supportable conclusions. This process can be better defined in two stages as follows:

i. determination of occurrence sequence &

ii. identification of safety deficiencies

i. Determination of Occurrence Sequence
Events and Underlying Factors (E&UF) Analysis

This concept of accident investigation is not new and is based on the principle that accidents rarely result from a single cause; rather, they are generally multi-factorial and develop from defined sequences of events. The events are portrayed graphically by arranging them, chronologically left to right in rectangles, in a logical flow indicating 'what' happened. The entire sequence of events is built from the beginning of occurrence development to the actual end circumstance. (Figure (3)). Each event describes a single, discrete happening or an action

step in a sequence of happenings/actions that lead to the occurrence. Each event block should contain the time and date of the event when available.

ISIM's E&UF analysis is a structured technique which forces the investigator/analyst to systematically and logically document the events in a graphical format to arrive at causal and contributory factors. The benefits of this simple technique include:

- Clarifies reasoning;
- Illustrates multiple causes;
- Provides a cause-oriented explanation (the Why?) of the accident thus helping investigators to formulate most pertinent investigative questions;
- Aids investigators in ensuring the completeness of the investigation through the identification of each event deriving logically from the one proceeding it; and
- Aids in developing all causal and contributing factors through sequence development, i.e. the basis for more in-depth analysis.

During the process, the investigation team will identify safety significant events worthy of further investigation/analysis. Safety significant event is and event which has a potential to reveal unsafe conditions and underlying factors.

ii. Identification of Safety Deficiencies

Determination of causal, contributing and underlying factors

In order to understand the "how and why" of the accident, the investigators need to identify and document not only the events themselves, but also the relevant conditions, unsafe acts, practices and underlying factors affecting each event in the accident sequence. Once the graphical representation of the sequence(s) of events is complete, the investigators will select events that have safety significance for further investigation/analysis to determine if there are other unsafe acts or unsafe conditions associated with it. The analysis of each event continues until the root causes or underlying factors to that event have been determined.

Since its inception in 1990, TSB has systematically analyzed its investigative findings to arrive not only at the proximate causes but to understand the contributory and underlying factors that caused the accidents. It has been found that the majority of marine accidents can be traced back to compounded human and organizational factors. This finding is consistent with findings from many shipping nations around the world in that human and organizational factors are recorded as causal of contributing factors in most marine accidents. According to the UK P&I Club of Insurers report on the "Analysis of Major Claims - 1992", human *error* was the main cause of half the cargo claims, half the pollution claims, 65% of the personal injuries, 80% of the property damage, and 90% of the collisions.

Today, several models, analytical tools, and techniques exist to assist the investigator/analysis in analyzing accident causation not only for the purpose of understanding "WHAT" happened but also "HOW and WHY" it happened, by establishing the root causes, contributing factors and or underlying safety deficiencies to the accident. A brief description of such models/technique is given below.

Reason's Model

One such model was developed by Dr. James Reason of the University of Manchester. While some analysts refer to this as the *"Swiss Cheese Model"*, it is much better known as *"Reason's Model."* (Figure (4). TSB safety analysts in all modes of transportation often use this model. The second layer represents unsafe act(s) committed by front-line operator. Fortunately, a well designed system has built-in defences (the first layer in the model), structural or otherwise, to mitigate the circumstances of such unsafe acts. But the model requires us to look beyond the immediate circumstances of the accident. It will force the user the examine all the preconditions at the time of the occurrence, including such things as fatigue, stress, operating practices, etc. The fourth layer represents the effects of line management in such areas as training, maintenance, operating procedures, etc. The fifth layer depicts the involve-

ment of high level decision makers such as regulators, owners, the designers, manufacturers, and the unions, etc. Reason suggests that these decision makers frequently make "fallible" decisions and these latent defects stay dormant waiting for someone to commit an unsafe act and thereby triggering a potential accident scenario. If the system's defenses function as intended, a result is benign; if they do not, the result may be a tragic accident. Reducing or eliminating safety deficiencies can be represented by a reduction in the size or number of holes, and thereby reducing the probability of an accident. The Reason Model is particularly useful in illustrating the concept of multiple causality.

Integrated Process for Investigating Human Factors (Integrated Process)

TSB has developed this process that provides a step-by-step systematic approach for use in the investigation of human factors. The process is an integration and adaptation of a number of human factor frameworks - SHELL (F.H. Hawkins, 1987) and Accident Causation and generic error-modelling system (GEMS) frameworks (J. Reason 1990). The GEMS framework is used to determine the origin of a particular act or causal condition - Figure (5)). At the moment, human performance analysts at TSB use this model to identify underlying human and organizational factors by identifying error types, failure mode and behavioural antecedents. However, TSB investigators/analysts are being gradually trained to become adequately familiar with evaluating human behaviour and human performance.

For the scope of this paper, it is sufficient to recognize that to uncover the underlying causes behind the decision of an individual or group, it is important to determine if there were any factors in the work system that may have facilitated the error and the unsafe act.

Other Analytical Techniques

There are several other analytical tools that may be used to identify causal factors, contributing factors, and underlying safety deficiencies to an accident. In the nuclear industry, the MORT (Management Oversight Risk Tree) analysis technique is widely used and in considered the most comprehensive techniques. MORT analysis used a diagram which contains a comprehensive list of *system operation factors* and *management control system factors* that an ideal safety program or organization should possess. Each factor and activity under investigation is compared element by element with the system, facility, and activity of the MORT elements. When any MORT elements are missing, or are only partially present in an existing system or program, it is considered that deficiencies probably exist which contributed to or could contribute to accidental losses.

The principle of the Fault Tree Analysis (FTA) may also be used where appropriate. FTA is a technique, either qualitative or quantitative, by which conditions and factors that can contribute to a specified undesired event (called the top event) are deductively identified, organized in a logical manner, and represented pictorially. The faults identified in the tree can be events that are associated with component hardware failures, human errors, or any other pertinent events that lead to the undesired event. Starting with the top event, the possible causes or failure modes on the next lower functional system level are identified.

3. Risk analysis

Once the analysis has revealed underlying factors related to the safety significant events of the occurrence, it is important to understand the level of risk associated with that event or underlying factors. The level of risk is one of the most important criteria that an investigation team uses in setting investigative efforts and priorities.

Risk is a consideration in every decision made regardless of the role of the person making the decision. This consideration may be conscious or unconscious, formal or informal. The purpose of the Risk analysis is to estimate and evaluate risk potential associated with the identified unsafe conditions/underlying safety deficiencies. Many of the unsafe conditions, underlying factors and/or safety deficiencies identified through aforementioned processes may be neither casual nor contributory to that occurrence. Nevertheless, the potential risks these defi-

ciencies pose on the system must be assessed and addressed in the interests of accident prevention. As discussed earlier, **risk** is the product of the probability of an adverse outcome during a specific period of time and the severity of that outcome. As such, evaluation of risks in undertaken using available data, supported by judgements on the severity of potential adverse consequences and the probability of those consequences during any defined period of time.

In evaluating the probability, the investigators will consult with various databases to determine if there is a history of similar occurrences or if it is an isolated occurrence. The investigators must also consider the extent of risk a particular system or an operation is exposed to. The answers to some of the following questions can assist investigators in assessing the probability of adverse outcome:

- Is there a history of occurrences like this or is this an isolated occurrence?
- How many similar occurrences where there under similar circumstances in the past?
- What system defenses need to fail for the adverse consequence to be realized?
- How many pieces of equipment or vessels are there that might have similar defects?
- How many operating of maintenance personnel are following or are subject to the practices or procedures in question?
- To what extent are there organizational, management, or regulatory implications which might reflect larger systematic problems?
- What percentage of the time is the suspect equipment or the questionable procedure of practice in use?

For the second element of the risk equation, the impact of the occurrence on people (individual, societal, occupational, etc.), property, environment, and often on commercial and other intangible elements must be considered, as follows:

How many persons could be affected by the risk?

- Fare-paying passengers?
- Transportation employees?
- Bystanders or general public?

Property:

- What could be the extent of further property damage?
- Direct property loss to the operator?
- Damage to adjacent infrastructure?
- Third-party collateral damage?

Environmental:

- What could be the environmental impact?
- Dangerous commodity spill?
- Physical disruption of natural habitat?

Commercial:

- What is the potential impact on carriers?
- On commercial operations?
- Corporate viability?
- Financial markets?

Others:

- What could be the public and media interpretation?
- What might be the implications:
- Internationally?
- Nationally?

Once the probability and severity of adverse consequences have been analysed, investiga-

tors can evaluate the risk. Various agencies and industries uses numerous qualitative as well as quantitative criteria against which a level of risk can be estimated. Qualitative risk analysis uses expert opinion to evaluate the probability and consequences. Qualitative method offers analysis without detailed information, but the intuitive and subjective processes may result in differences by those who use them. Quantitative analysis generally provides a more uniform understanding among different users, but requires quality data for accurate results. Qualitative analysis is considered sufficient for the purpose of TSB.

4. Barrier (Defence) analysis

Barrier analysis is based on the principle that the absence of adequate barriers (whether they be physical and administrative) for preventing any harmful "contact" between *hazards* and *vulnerable persons* or *property* is found in every accident. The purpose of the Barrier analysis is to examine the status of barriers and to identify those that are less than adequate. Defenses/barriers, in the context of this methodology, are barriers/guards that isolate and protect persons, property, and environment (targets) from hazards. Barriers may be divided into two categories:

- **Physical defenses/barriers:** (such as guards, personal protection devices, life rafts, life jackets, etc.), and
- **Administrative defenses/barriers:** (such as training, safety regulations, policies, procedures, supervision, inspection, maintenance, safe system design, system support services, operational & personal readiness, etc.)

A worksheet may be used as a job aid to identify hazards, targets (person, properties, etc.), barrier and the status of the barrier before and after the accident; (e.g. *Were barriers provided? Were they used? Did they fail or did they function as intended? Has their presence been "advertised" to system and operators?*)

In fact, some degree of barrier analysis should be done at all level of the investigation process. The information on the status of both physical and administrative barriers must be collected during the data collection phase. Analysis of the defenses will lead to a better understanding of the safety issues, unsafe conditions and underlying factors associated with an occurrence.

5. Consideration of Risk Control options

Risks can be minimized by a wide range of control options normally available for any risk control situation. Some control measures are more effective than the other. One of the important aspects of risk management is to ensure that the full range of possible control measures is considered and that the optimal trade-offs between measures are made.

As we all know, risk can usually be addressed in one or the combination of four ways:

- Terminate risk;
- Transfer risk;
- Treat risk;
- Tolerate risk.

It is obvious that preference should be given to developing safety measures that will completely eliminate the deficiencies to prevent similar adverse consequences in the future. Regrettably, such solution are often the most expensive and are often impossible. In such situations, some organizations may decide to tolerate certain degree of risk as a result of hazard analysis or as a result of a cost-benefit analysis. In such cases, an investigator should determine the adequacy of the rationale and the extent of risk that is assumed by the organization. Risk can also be transferred to someone else, such as an insurer, for a price. But, since this is a safety conference, we are not interested in transferring the risk to someone else. In most cases, where the risk associated with potential safety deficiencies cannot be eliminated in a complex

system, the risk to the system may be treated by building one or more of the following defenses/ barriers in the system[2]:

- Designing for minimum hazards;
- Installation of safety devices;
- Provision of warning devices, sign, placards, etc;
- Establishment of procedures and practices;
- Provision of training and awareness.

Some argue that the sole use of administrative interventions, such as procedures and training, may not provide an effective hazard control method in certain circumstances, especially when the level of risk is very high. Rather, the use of administrative interventions in conjunction with engineering interventions, such as designing for minimum hazards, may be more appropriate. In keeping with the "depth in defense" philosophy for complex systems, the use of multiple interventions is often desirable where multiple and diverse lines of defense are employed to mitigate risks.

In Canada as in many other countries, TSB (as the investigation agency) does not have the mandate or authority to implement specific corrective actions. Such actions are taken by the regulatory agencies, and by the industry such as manufacturers, the operating companies, etc. The TSB's role is to identify risks and potential risks associated with system deficiencies and make a convincing argument for others to take corrective actions.

CONCLUSION

I hope I have succeeded in explaining that in order for the accident prevention strategies to be effective, they must be based on an in-depth understanding of the safety deficiencies in the system.

It is our experience that human and organizational factors play an important role in overall system safety. Meaningful analysis of the people of the system can help us understand underlying human and organizational factors so that appropriate safety action can be taken to minimize the human contributions to risk. However, humans have more failure modes and are far less predictable than machinery or equipment. Accurately determining human reliability is extremely difficult. Yet, accident prevention is critically linked to the adequacy of the investigation of human performance issues. I am optimistic that a systematic and broad approach to minimizing risks through the use of modern investigation techniques, such as ISIM, will help us improve the safety record of the marine transportation system in and out of Canadian waters.

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[4] Marcel Ayeko: *Safety Deficiency Analysis Approach to Fishing Vessel Safety*, IInd International Symposium on Safety and Working Conditions Aboard Fishing Vessels, Villagarcia, Spain – September 1992.

[5] Marcel Ayeko: *Knowledge, Skill & Training – Need Analysis Based on Transportation Safety Board's Experience*, IMLA Conference, St. John's, Newfoundland, Canada – September, 1997.

[2] While there are some disagreements as to the order of effectiveness in intervention (known as "safety procedence sequence"), safety professionals are unanimous in proposing these defences/barriers.

Figure (3) Events & Underlying Factors Diagram

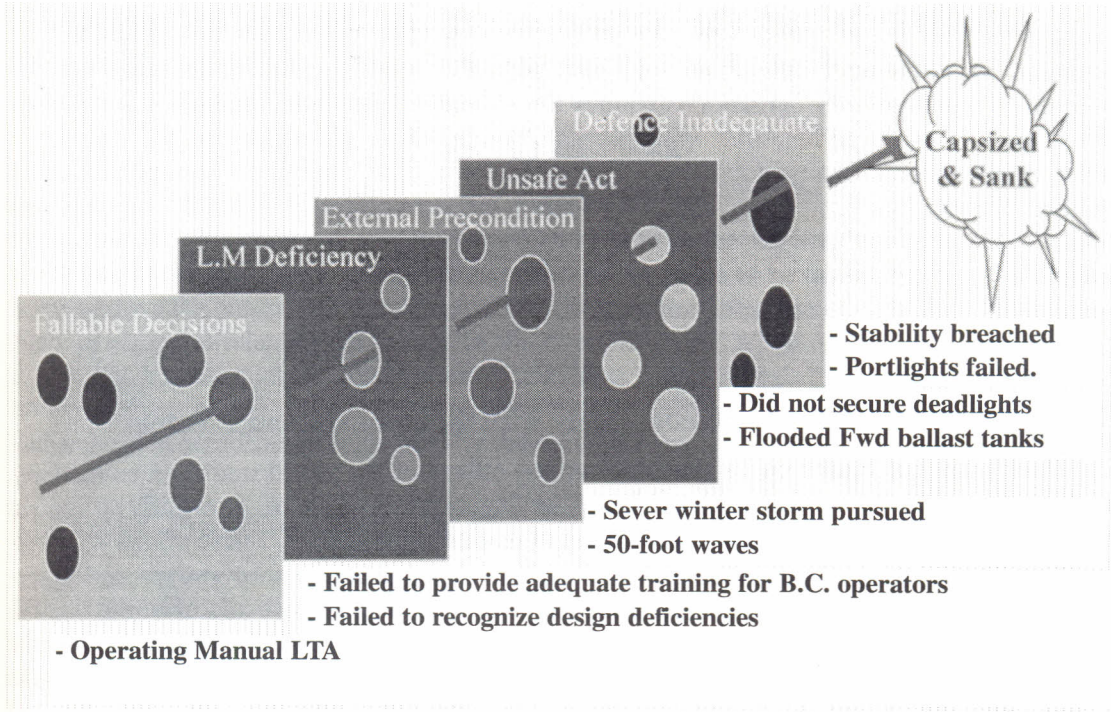

Figure (4) Reasons's Model
Case example on the sinking of the "OCEAN RANGER

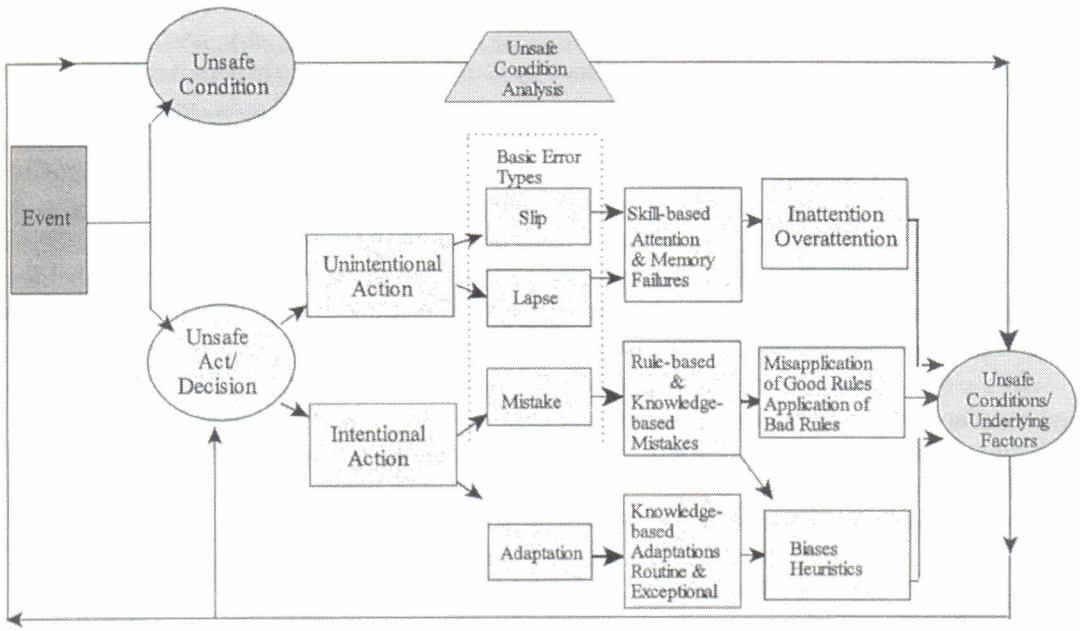

Figure (5) Generic Errors Modeling System (GEMS)

ACCIDENT PREVENTION – FOCUS ON THE HUMAN ELEMENT

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1. Regulatory Regimes to promote safety with focus on Human Element

During the last four decades the concentrated efforts of the world maritime community, under the auspices of the International Maritime Organization, have been towards promoting safety of life and property at sea and protection of marine environment. These efforts have culminated into the development of as many as thirty five international conventions and agreements with numerous protocols and amendments having a predominant role of improving the standards of ships' design, construction and equipment. Together with these has been the development of regulations and codes of safe practices for the operations of ships based on the types of cargoes carried and their geographical operating areas. Realising that the ships and equipment are only as good as the persons operating them, attention has also been focused, during the last two decades, on the standards of training and qualifications of the seafarers. These efforts have undoubtedly resulted in improved ship designs and better equipment on them but unfortunately have not succeed in their endeavour to achieve desired level of safety of life, property and the marine environments.

2. Degradation of Shipboard Management Standards

"Upto this moment the emphasis has been laid on ships, cargo, property and sea services. The component of ecology has been missing because there were not any norms and standards concerning environment" (Peev, MARIND'98). Perhaps same can also be said about maritime education and training. Over these four decades the shipping industry has also witnessed marked sophistication on ships, brought about by multifarious technological developments by way of large scale automation, special designs, construction and equipment for carriage of variety of cargoes demanding specialised operation. The ships also grew in size, had faster turnaround and carried variety of hazardous cargoes. Thus not only increasing the workload on the ship's staff but also putting on them increasing demands of specialised skills. "But the human factor on board ships has not been changed in its quality during all this period and this disbalance and disharmony in the tirad have remained regardless of new technical and tactical decisions" (Peev, MARIND'98, on environmental control, referring to the trinity of people that is crew, ship with its cargo and environment).

At the same time however, in order to cut costs of operations, the size of staff kept reducing reaching the bare minimum requirements as laid in the statutes, normally based on the size and power of the ships but ignoring the maintenance requirements. Quality of the seafarers had, in the mean time, gradually deteriorated. The young people in the traditional shipping nations were no more attracted towards the ship board marine profession and the standards of education and training in most of the labour supplying countries did not keep pace with the changing technology. Another contributing factor to this deterioration has been the decline of "on job training" which was prevalent on the ships belonging to the traditional ship owners keeping continuity of employment thus promoting a sense of loyalty. This depletion of the shipboard management staff as well as their professional standards had an evident damaging effect on the quality of operations.

3. Reactive Approach to Casualty Investigations and Corrective Actions

The approach of the regulating authorities, towards investigating causes of the maritime accidents and finding solutions for their future avoidance hitherto, has been more of reactive in nature. The investigations aimed at and unfortunately restricted in scope to finding the immediate causes of failures only resulted in imposing more stringent construction rules, requirements of improved equipment, modified operational procedures and specific training requirements. This approach evidently conforms to the belief that accidents are caused exclusively due to the technical factors and that these are the ones to be taken care of. The studies however, reveal a contrary picture, generally indicating that the cause of only 20 % of the accidents is technical-related. The cause of the overwhelming 80 % of all marine accidents is found to be human-related. The analysis of accidents further reveals that 20 % of the accidents, having human-related causes, are controlled by the operator and the cause of 80 % of the human-related accidents is controlled by the management.

4. Revised, Pro-active Approach

The immediate cause of an accident may appear to be equipment related or human related (human error as it is normally referred to). But deeper investigation is necessary to find the root cause which may lie in the 80 % of the management controlled causes. There is a need of a holistic, pro-active approach to safety, which should address rather pre-empt the underlying root causes of accidents, thus obviating the need to wait for an accident with disastrous effects to be wiser in future. Only this approach could be effective for achieving highest level of safety, the absolute safety, of course, being an unachievable ideal. The main constituting elements of quality operations are reliable equipment, sound procedures and trained and motivated operators. The recent attention of the international maritime community has been towards this end. To establish regulatory regimes for promoting quality operations. The two recent international treaties, namely the ISM Code and the revised STCW 95 Convention, address the issues of quality and reliability. The two treaties focus on procedures for safe operations and competence of personnel thus aiming at human related causes controlled by both the management and the operators.

4.1 The I S M Code

It is the International Code for Safe Operation of Ships and for Pollution Prevention (International Safety Management (ISM) Code). It was adopted by IMO through Resolution 741(18) as an amendment to the International Convention on Safety of Life at Sea of 1974 (SOLAS 74). The Code having entered into force on 1st July 1998 will be applicable to certain types of ships from this date and will be mandatory for all the other ships by 1st July 2002. The ISM Code focuses on the management aspects of operations and is a formal recognition of the shore management's responsibility for safe operation of ships and protection of marine environments through pollution prevention. For compliance with the Code, the shipping companies are required to establish a Safety Management System (SMS) approved by the Flag State Administration. A Document of Compliance is issued by the Administration to the company which complies with the Code, a pre-requisite for a company to operate ships. A Safety Management Certificate (SMC) is issued to the ship, which operates its shipboard management in accordance with the approved SMS. The provisions of Port State control are applicable to the SMC.

4.2 The Revised STCW Convention

It is the International Convention on Standards of Training Certification and Watch keeping of 1978 as amended (STCW 95). The first ever convention dealing with the standards of training and certification of seafarers, was adopted in July 1978 which entered into force on 28th April 1984. The text of the convention provided a great deal of flexibility in laying down the minimum standards of education and training as well as the requirements for certification

of seafarers. The convention not being very specific and precise, much was left to the Flag Administrations to set actual standards. This resulted in widely varying standards based on the interpretations of the individual administration. The standards were knowledge based and little was mentioned about the requirements and evaluation criteria of skills and competence.

One of the important aspects of maritime education and training has been the practical "on job training" on board ships with actual hands on experience for development of skills. Provision for remission of sea time, through shore based training in lieu of shipboard training, allowed the administrations to reduce duration of the latter. Consequent result was lack of practical on job training so very necessary for skills development. Demand for cheaper trained manpower, employed by some of the traditional maritime nations as a result of shortage of their own trained nationals, has been on the increase. Encouraged by this opportunity of employment for their seafarers and a substantial foreign exchange resource, some of the labour supplying countries took advantage of the situation allowing establishment of increased number training institutions. Unfortunately this, due to lack of control, resulted in commercialisation of maritime education and training in some of the training institutions. Inadequate facilities and qualified staff to cope with the increased demand had the telling effect on the quality of maritime education and training with consequent degradation of standards.

The investigations into the spate of shipping casualties and pollution incidents in late 1980s and early 1990s, attributing the causes to the human error, further diminished the confidence in the STCW'78. This coupled with the public criticism forced IMO to make all out efforts for necessary amendments to the convention to address the deficiencies in precision of standards and lacunae in enforcement measures. The revision process was put on a fast track and the text of revised convention prepared in record time, was adopted in July 1995, it entered into force in February 1997. The revised convention being more detailed and precise on the standards of knowledge, skills, practical training, competencies and the criteria for assessment. The details are contained in a mandatory Code to the convention. The standards for competencies have been specified for the support, operational and management levels thus providing a good guide for the standards of knowledge, understanding and proficiency at appropriate levels for setting training objectives.

5. Quality of operations through the ISM Code and the STCW 95

5.1 In conformity with objectives of the IMO, the purpose of both, the ISM Code and the STCW 95 convention is to improve safety on board ships and to promote protection of marine environment through pollution prevention. These two developments in the international regulatory regime intend to achieve safety of operations through emphasis on the quality of shipboard operations. Once quality is established the safety is automatically taken care of.

5.2 The ISM code, which requires establishment of a sound management system, envisages safety management objectives to provide safe practices and working environment on board, safeguard against all identified risks and continuos improvement in the safety management skills of the persons. The system intends to ensure that each company establishes a clear and concise safety and environment protection policy with strategies for its achievement, levels of authority and lines of communications amongst them and between shipboard and shore personnel. To ensure that companies develop, in line with the applicable legislation, well defined procedures for normal shipboard operations, emergency response, reporting non-conformities, internal audits and management reviews. In line with basic principle of any quality assurance system i.e. 'say what you do and do what you say', all the above elements are required to be in documented form, both on board ship and ashore, with necessary mechanism to ensure compliance and continued operational improvements thus focusing on the 80% of the management related causes involving human element.

5.3 In order to use the documented procedures, in the spirit and intentions they have been developed in, the responsible persons have to have the required knowledge, skills, competence

and the attitude. These qualities and values are to be developed, augmented or modified as appropriate in the persons responsible for operations and control, both on board as well as ashore. Provisions of the STCW 95 have been developed keeping in view the requirements of knowledge, skills and competence appropriate to the level of responsibility. While the ISM Code requirements may be the end, the STCW is one of the means to achieve quality of operations. Latter being complementary to the former.

5.4 It is to be noted that the Maritime Education and Training arrangements do not directly fall under the purview of the ISM Code, which primarily deals with the procedures for operations, is applicable to the companies and their ships. Mindful of the fact that if competent persons are to be developed the training establishments should have consistency of standards and reliability of product (trained personnel), the STCW 95 requires that the training establishments be covered by a suitable Quality Standards System. Thus the establishments should have well documented clear and concise policy, well defined procedures for training and assessments, qualifications of trainers and assessors, procedures of review, reporting and correcting non-conformities.

6. Qualifications of the seafarers

The Code requires that the Master is qualified for command, the seafarers are qualified, medically fit and certified in accordance with national and international requirements. The minimum standards for maritime education and training as well as for the certification of the seafarers have been specified in the Mandatory Code to the STCW Convention. Under the section Fitness for Duty, the convention requires proper rest periods for the watch keepers to ensure efficiency of watches is not impaired by fatigue.

7. Familiarization with the ship and duties

The Code requires that the seafarers are given proper familiarization with their duties. This requirement is identical to that laid down in the STCW 95 for specific duties (Reg. I/14). Further requirements are contained in a separate chapter devoted to the familiarization training. In fact the STCW stipulates written instructions, from the company to the master, detailing its policy on familiarization and procedures thereof.

8. Communications

The difficulties in communication, especially with the multilingual and multi-cultural crew on board are increasing and can be detrimental to safety especially in case of emergency operations. The Code requires the companies to ensure that the ship's personnel are able to communicate effectively in the execution of their duties related to SMS. This requirement is also adequately addressed in the STCW 95. In effect the convention stipulates adequate knowledge in English as one of the required competencies for watch keeping officers with clear communication and understanding as assessment criteria. In case of the ratings also, the convention requires that clear and concise communications are ensured.

9. Maritime education and training in the right earnest

Standards for knowledge, understanding and proficiency for seafarers have been specified in the mandatory Code A and guidelines in the optional Code B of the STCW Convention. Can the quality of operations be assured by compliance?

9.1 One of the stipulations of the ISM Code, 5.2 above, "safe guard against all identified risks and continuos improvement in the safety management skills of the persons" suggests more than the qualifications for the certification of the seafarers. Identification of risks cannot be considered a static one time process. This has to be a continuos and dynamic process requir-

ing involvement of the persons best suited for such identification, i.e. the persons on board. They should be educated and trained to act proactively to deal with potentially critical situations. Special skills are to be developed to get to the real cause rather than the immediate cause or the usual blame on 'material failure'. The seafarers should know how to investigate, know about the procedures and methodologies, should know the difference between what is really important and what is not. Development of analytical skills and achieving proficiency in them requires experience. However if exposed through specific training and encouraged, the seafarers will feel motivated and can establish a healthy culture of contribution as against the culture of mere compliance.

9.2 Success of operations on a ship depends upon good teamwork, by all the members contributing as a team for achievement of common objectives. Each member is to be encouraged to draw on his skills and experience for resolving problems and finding better ways of doing things. This encouragement, to start with, can come from their exposure to theoretical team building exercises. When those involved are trained at their appropriate levels and have basic knowledge, they can enhance their skills in actual work environment. Establishing good team work is possible through effective leadership, efficient communications and good human relations.

9.3 The pro-active approach to identification of potential dangers of accidents requires involvement of all on board. They will be forth coming provided right atmosphere exists. They are to be encouraged for their involvement. The people on the spot are the ones who have the first hand knowledge, exposure and experience of the situation. Getting their involvement solely depends upon the leadership of the senior staff.

"Whilst masters and senior officers have the opportunity to exercise elements of leadership in the normal course of their day to day duties, other members the crew do not. An appreciation of the demands of leadership, if not practice in leader ship is important for all team members. It reaffirms the importance of a chain of command in ship and establishes an essential and familiar cornerstone for the team to build upon" (J. McAree 1997). Leadership an all important part of team development is needed at all levels. The provisions of the STCW Convention do refer to some of the man management aspects to be imparted through short training programmes. The competency tables in its mandatory code refer to these aspects under personnel management but only at the management level. It is felt essential that the administrations and the training establishments give importance to these subjects in right perspective while setting syllabi for training. These trainings should emphasize on the need for leader ship qualities and good moral character. The need for developing intrinsic status by building trust rather than imposing one's extrinsic status due to rank (Moreby). The persons should be made aware of the pre-requisites of good leadership such as sincerity to help fellow beings, being approachable to the team members, consistency in decisions, being fair yet firm. They should be made aware of the need for delegation of work and exposed to its benefits and dangers through suitable practical examples.

9.4 The need for effective communications can not be over emphasized as it is the backbone of any management endeavor. Decision making, planning, controlling, feed back cannot be achieved without proper communication. Both the ISM Code and the STCW Convention refer to the requirements of effective communication, para 6 above. However it involves much more than that stipulated in these documents where in the main emphasis is placed only on the language of communication on board. The communication through words alone plays a very minor role in conveying the message. The words constitute only 7% of the impact of the message (Dzugan '98). Communication has much larger dimension. The ships officers should be aware of the influence of other modes, verbal and non-verbal, that contribute to the communication. They should know about the barriers to communication that exist due to the nature of operations, social conditions and geographical disposition of the ship. They should know about the barriers to communications that exist on board as well between ship and shore. Ship shore

communications should also percolate down, especially the information of the crew's interest, e.g. regarding the achievements and future planning of the company so that the ship's crew feel as a part of the company. The officers should know the necessity of two way communication, not only conveying what is to be done but also why and need for feed back.

The personnel should be made aware of the cultural barriers to communication and dangers of preconceived notions which may contribute to creating such barriers. They should know that the effects of rhythm, speed, tone, pitch, volume gestures, may be misunderstood if the implications of these are construed other than normal which may be due to cultural background. The power differential background of the persons from different cultures will have influence on the communications and different strategy is needed when working with such group. This is a predominant factor with the present day's multi-lingual and multi-cultural crew on board.

9.5 All personnel on board should know the importance of good human relations and should be aware of the concepts and mis-concepts about the human relations. Lack of good human relations is one of the causes of frustration amongst the ship board personnel. Leadership and communication have influence on human relations. The techniques of man management have changed with time. The old autocratic ways of dominance for getting work done are no longer valid. The seniors should know what is involved in the supervision of work. They should know the positive effects of appreciating good work and negative effects of unfair criticism (Morby). Should know the expectation of persons as individuals having their own identity and self respect.

Marked difference was noticed when analyzing information collected from over one hundred masters on their opinion regarding cadets and junior officers, who worked under them, regarding discipline, dedication to duty and relationship with others on board. Those who had received their training on the training ship and in the shore academy with residential regimentation type of setting received a ranking of 83 % in these qualities and values while those who came as direct entry cadets on ship had a ranking of only 56 % (Gupta '98). Those from the training ship and the academy had the opportunity of learning about interpersonal human relations due to pattern of training, learned leadership traits due to their involvement in acting as in-charge of the groups of peers and juniors in rotation. Improved their communication skills because of living, studying and playing together with persons from different areas and different cultural background.

10. Conclusions

The ISM Code and the revised STCW Convention, both aim at quality of operations for safety of life and ships and protection of marine environment by putting focus on the human element through quality of management and quality of people. They require establishment of quality assurance system for the shore management, shipboard management and the training establishments.

The success of this endeavor will depend singly upon the intentions with which the shipping companies and the ship operators follow the stipulated requirements. Sincere intentions to improve quality are needed rather than an exercise only to obtain certification for the purpose of flag state and port state control.

Standards for knowledge, understanding and proficiency have been specified for different levels of shipboard management with criteria for assessment to ensure quality of trained persons for safety of operations. Important aspects of management techniques however, require greater elaboration. It is felt necessary that formal training in these aspects should form part of curricula right from the entry level to the maritime education and training up to the highest level.

Along with the required knowledge, understanding and proficiency it is essential that the seafarers have the right attitude towards safety of operations. The design and implementation of the curricula in the right earnest can initiate the attitudinal development.

The seafarers should be exposed to the concepts and implications of good human relations, effective communications and leadership traits. These skills should be developed through training programmes with practical shipboard examples, suitably designed exercises and management games. Help of specialists in these areas will be required and the trainers of the maritime education and training institutions will have to be trained in these aspects so that effective training programmes can be developed and implemented.

Other references

ISM Code and Guidelines on Implementation.

IMO News No. 3 of 1996 and other publications.

Background paper on Safety Management in Shipping.

Revised STCW Convention, STSW 95

Personnel Management in Merchant Ships by D. H. Moreby

EUROPEAN COMMISSION METHAR PROJECT: HARMONIZATION OF EUROPEAN MET SCHEMES

CASE STUDY: PROPOSAL FOR SYLLABUS ON THE PROTECTION OF THE MARINE ENVIRONMENT

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ABSTRACT

Maritime Education and Training, has evolved following technical developments in the maritime transport. In general terms, before 1950, training of seafarers in the subject of marine pollution prevention was not included in the syllabus of MET institutions. The adoption of MARPOL 73/78 convention provoked the need to pay more attention to the teaching of marine pollution subject.

Nevertheless, the teaching on prevention of and response to maritime pollution has been, and still is, very different in the European Union MET institutions. Some countries have introduced changes in the training programmes to cover this aspect even creating a specific subject but another countries have given little attention to his matter which is taught as a few lectures included in other subjects as Maritime Safety or Cargo Handling.

During the last two decades we have observed the proliferation of specialized training courses, seminars, conferences and workshops dealing with maritime pollution prevention and oil spill response. But institutions and private centres other than maritime academies have organized most of the training activities. Can we deduce from these initiatives that there is a lack of adequate training on this matter in the maritime academies?

Seafarers play an important role in the protection of marine environment and that in many cases they become staff members of maritime administrations and other institutions in charge of marine pollution prevention and response. Consequently, the requirements for their certification should be updated to cover the present needs in that field.

This paper contains a proposal for a syllabus to harmonize the teaching of maritime pollution subject in the European Union MET maritime academies.

Keywords: Marine Pollution, STCW 95, Training of seafarers and Syllabus.

EUROPEAN COMMISSION METHAR PROJECT: HARMONIZATION OF EUROPEAN MET SCHEMES

CASE STUDY: PROPOSAL FOR SYLLABUS ON THE PROTECTION OF THE MARINE ENVIRONMENT

1 SUBJECT TITLE: Protection of the marine environment (Common for Deck and Engine Officers)

2 TYPE OF DEVELOPMENT: Extension

3 RELATIONSHIP TO STCW 95 FUNCTIONS AND LEVELS

The proposal is in line with following requirements of the STCW Code.

- Controlling the operation of the ship and care for persons on board ant the **operational level** to ensure compliance with pollution-prevention requirements and to monitor compliance with legislative requirements on protection of the marine environment (Tables A-II/2 and A-II/3 for Deck, Table A-III/1 for Engine).
- Controlling the operation of the ship and care for persons and board at the **management level.** Monitor and control compliance with legislation requirements and measures to ensure the protection of the marine environment. Preparation of emergency plans and handle emergency situations (Table A-II/2 for Deck, Table A-III/2 for Engine)

4 JUSTIFICATION

Before the adoption of the International Convention for the prevention of pollution of the sea by oil (OILPOL) in 1954, marine pollution was not a matter of much concern, as it is today, because the quantities of oil transported by sea were not great and maritime accidents involving pollutant cargoes had still not caused massive causes of sea pollution. In addition to these facts it is important to mention that public opinion was still not sensitive enough to promote actions aimed at the establishing more stringent regulations in the protection of marine environment.

The experience gained with the application of the OILPOL convention, the continuous increase of oil and chemical tanker traffic and the occurrence of accidents producing major oil spills motivated the promotion of new initiatives in the protection of the marine environment, namely the adoption of a new Convention for the Prevention of Pollution from Ships (MARPOL 73/78). At the same time, in 1978, the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW 78 Convention) was adopted taking, *inter alia*, protection of marine environment into account.

The evolution of maritime transport and the introduction of new technologies motivated frequent amendments to MARPOL convention. This convention has been amended almost every year during the last decade, for instance the important concept of tankers with "double hull" was introduced in 1992 and a new annex on "air pollution from ships" was adopted in 1997. At present IMO is preparing regulations on the "harmful aquatic organisms in ballast water" which will be presented for adoption as a new annex of MARPOL convention in the year 2000. Training of seafarers should be adapted to cover the new technical aspects of marine pollution.

Until 1978, the Maritime Education and Training (MET) in the area of sea pollution was not relevant. In general terms, until the second half of this century, no specific subject on his matter was included in the syllabus of maritime training institutions. The adoption of the STCW 78 convention required these Institutions to introduce some basic topics on maritime

pollution in their programmes of studies and nowadays more attention is paid to this question world-wide.

The STCW 78 convention was substantially amended in 1995, in the fact the old convention was almost completely replaced by the 1995 amendments which are usually referred as STCW 95. Part A of STCW Code contains specifications on the knowledge, understanding and proficiency of the topics, including marine pollution, to be learn to obtain the certificates of competence.

Nevertheless, fast technical developments in the field of marine pollution and the growing interest of the public and the media in environmental matters have produced a trend towards better trained seafarers with respect to preventing and fighting marine pollution. This evolution has prompted the organization of training activities in the field of prevention and control of marine pollution by institutions other than maritime academies. We can mention the following two important initiatives:

- The Civil Protection Unit of the European Commission has assisted from 1985 in the organization of training courses on accidental marine pollution response. Through this initiative, have been delivered in different EU Members States two or three courses per year with the participation of two representatives from each country. It is considered that this training activities have produced a harmonization of the knowledge about the topic at EU level.
- The International Maritime Organization (IMO), as part if the work of its Marine Environment Protection Committee (MEPC), have prepared model courses on maritime pollution preparedness and response. IMO, with the co-operation of other institutions and the private industry, has delivered these courses in many developing countries. The impact of these training activities is another positive step ahead in the preparation of personnel to respond to accidental pollution at sea.

The entering into force on the 1st July 1998 of the International Management Code of the Safe Operation of Ships and for Pollution (ISM Code), is other important aspect that should be considered for the design of MET schemes. The ISM code establish that every shipping company should develop, implement and maintain a Safety Management System (SMS) which includes, *inter alia*, a safety and environmental protection policy in compliance with relevant international and flag State legislation. The Code also establishes that the shipping company should clearly define and document the master's responsibility with regard, *inter alia*, to implementing the safety and environmental protection policy of the company.

Following the evolution and amendments of marine pollution related conventions and considering the above mentioned initiatives, MET Institutions should be ready to introduce updated material into their syllabuses and to improve training systems in order to bring up to date the knowledge of seafarers with respect to the new developments in the field of marine pollution.

The recent amendment of STCW convention which requires specific knowledge on marine pollution prevention should be consider by the MET institutions in order to develop a satisfactory training programme aimed at having Masters and ship Officers well trained for the protection of the marine environment.

5 AIMS OF THE SUBJECTS

- To provide general knowledge of the pollution of the marine environment.
- To promote understanding on the application of national and international regulations for the protection of the marine environment.
- To provide planning capabilities and strategies to organize shipboard emergency response to accidental marine pollution.

6 SPECIFIC LEARNING OBJECTIVES

- To identify the main marine pollutants related to maritime transport and to describe their impact in the marine environment.
- To describe the different sources of marine pollution with emphasis on maritime transport activities.
- To understand national and international regulations concerning the prevention of pollution from ships.
- To acquire basic knowledge on the procedures, arrangements and use of equipment for the prevention of pollution from ships.
- To acquire knowledge on the preparation of contingency plans for response to on board pollution emergencies.
- To become familiar with the organization of shipboard pollution response to accidental spills.
- To acquire basic knowledge on the international compensation schemes to cover pollution damage.

7 SUBJECT LENGTH

Total hours: 40

TOPIC	THEORY	PRACTICE
Marine pollution.	2	
Fate of impact of marine pollutants.	2	
Sources of marine pollution	2	2
Prevention of pollution from ships	8	4
Organization and structure for pollution preparedness and response	2	
Implementation of pollution emergency response	2	2
Pollution response operations	4	3
Storage, treatment and disposal of recovered products and wastes	2	1
International conventions on the protection of the marine environment and co-operation in emergency response	2	
Compensation schemes for pollution damage	2	

8 SYLLABUS CONTENT

MARINE POLLUTION

Definitions.

Physical, chemical and biological characteristics of sea water.

Description and characteristics of the main marine ecosystems.

Physical and chemical characteristics of main marine pollutants.

Harmful aquatic organisms in ballast water.

Antifouling paints.

Cathodic protection, sacrificial anodes.

FATE AND IMPACT OF MARINE POLLUTANTS

Fate and movement of hydrocarbons spilled into the sea.

Fate and movement of other noxious liquid substances spilled into the sea.

Impact of oil spills on the following ecosystems: Open sea waters, coastal waters, ports and bays, rocky coasts, sandy beaches, sheltered waters and mud flats, marshes, mangrove and coral reefs.

Impact of other noxious liquid substances in the same ecosystems.

Impact of oil and other noxious liquid substances on fish, crustaceans, mollusc, birds and mammals.

Impact of sewage and garbage in marine flora and fauna.

Impact of radioactive substances in the marine environment.

SOURCES OF MARINE POLLUTION

Maritime transport, operational and accidental pollution.

- Oil tankers.
- Chemical tankers.
- Transport of dangerous cargoes.
- Off-shore installations for oil exploration and extraction.
- Other ships, fishing vessels, yachts, small boats, etc.

Land-based sources of pollution.

Natural pollution.

Air pollution from ships.

PREVENTION OF POLLUTION FROM SHIPS

MARPOL CONVENTION

- General description.
- Certificates.
- Inspections.
- Violations.
- Evidence to court.
- Reports on incidents.

ANNEX I OF MARPOL CONVENTION

- Application.
- Control of discharge of oil.
- Special areas.
- Shipboard waste management. Reception facilities in port.
- General description of oil tankers. Segregated ballast thanks. Double hull tankers and other alternative.
- Retention of oil on board.
- Crude oil washing. Inert gas system.
- Monitoring and control systems for oily-water separating equipment
- Oil record book

ANNEX II OF MARPOL CONVENTION

- Application.
- General description of chemical tankers.
- Categorization and listing of noxious liquid substances.

- Regulations on discharge of Noxious liquid substances.
- Control of discharges.
- Shipboard waste management. Reception facilities in port.
- Cargo record book.
- Standards for procedures and arrangements for discharge of noxious liquid substances.

ANNEXES III, IV AND V OF MARPOL CONVENTION

- Application.
- Regulations of discharge and disposal.
- Documentation.
- Shipboard waste management. Reception facilities in port.

ANNEX VI OF MARPOL CONVENTION

- Air pollution from ships.
- Requirements for control of sulphur oxides emissions.
- Requirements for control of nitrogen oxides emissions. Technical Code on the control of emission for nitrogen oxides from marine diesel engines.
- Regulations on ozone depleting substances.
- Shipboard waste management. Reception facilities in port.

ORGANIZATION AND STRUCTURE FOR POLLUTION PREPAREDNESS AND RESPONSE

National and international contingency plans for pollution emergencies.

- Basic principles.
- Command structure.
- Combating equipment and other resources.

Shipboard oil pollution emergency plans, IMO guidelines.

Local, National and International organization regarding marine pollution emergencies

Specialized equipment, personnel and support logistics

IMPLEMENTATION OF POLLUTION EMERGENCY RESPONSE

Activation of contingency plan

Organization of combating operations

Logistics

Communication media and public relations

Collection and recording information. Reporting

POLLUTION RESPONSE OPERATIONS

Evaluation of pollution. Aerial surveillance and other monitoring of spill

Planning of combating operations

Containment of spill and protection of sensitive areas. Use of booms and other means.

Recovery of spilled substances. Use of skimmers and other means.

Use of dispersants, sorbents and other products. Oil burning.

Bioremediation techniques

STORAGE, TREATMENT AND DISPOSAAL OF RECOVERED PRODUCTS AND WASTES

Temporary storage recovered substances and wastes.

Transport of recovered substances and wastes.

Organization of wastes storage on board vessels or barges and land installations: refineries, reception facilities, industry.

Treatment of recovered oily wastes: Incineration, land farming, landfilling and burial.

Treatment of recovered chemicals and its wastes.

INTERNATIONAL CONVENTIONS ON THE PROTECTION OF THE MARINE ENVIRONMENT AND COOPERATION IN EMERGENCY RESPONSE

International convention on oil pollution preparedness, response and cooperation, 1990.

Convention on the prevention of Marine Pollution by Dumping of Wastes and other Matter (London Convention).

General knowledge on Regional Conventions and Agreements on co-operation for the protection of maritime environment with especial emphasis on conventions applied to the region where the Maritime Institution is located.

COMPENSATION SCHEMES FOR POLLUTION DAMAGE

International convention on civil liability for oil pollution damage (CLC, 1969)

International convention on the establishment of an International Fund for compensation for oil pollution damage (FUND, 1971)

International convention on liability and compensation for damage in connection with the carriage of hazardous and noxious substances by sea (HNS, 1996)

9 RECOMMENDED REFERENCES AND READING RESOURCES

- MARPOL 73/78, consolidated edition, 1991. London: IMO
- MARPOL amendments, 1996 edition. London: IMO
- MARPOL – How to do it, 1993 edition. London: IMO
- Pollution prevention equipment required under MARPOL 73/78, 1996 edition. London: IMO.
- Manual on oil pollution. London: IMO, following sections:
  - Section I, Prevention
  - Section II, Contingency planning
  - Section III, Salvage
  - Section IV, Combating oil spills
  - Section V, Administrative aspects of oil pollution response.
- IMO/UNEP Guidelines on oil spill dispersant application including environmental considerations. London: IMO
- Guidelines for the development of shipboard oil pollution emergency plans. London: IMO
- Comprehensive manual on port reception facilities. London: IMO
- Crude oil washing systems. London: IMO
- Manual on chemical pollution. London: IMO
- International safety management code, ISM code. London: IMO
- Civil liability for oil pollution damage. 1996 edition. London: IMO
- International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea, 1996 (HNS Convention). London: IMO.

- International code for the construction and equipment of ships carrying dangerous chemicals in bulk (IBC code), 1994 edition. London: IMO
- Inert gas systems. 1990 edition. London: IMO
- The London dumping convention, 1991 edition. London: IMO.
- Annex VI of MARPOL 73/78 and the nitrogen oxides technical code, edition 1998. London: IMO.
- STCSW 95. STCW Convention, resolutions of the 1995 conference and STCW Code
- Response to marine oil spills. London: The international tanker owners pollution federation (ITOPF).
- Reports and studies: The evaluation of the hazards of harmful substances carried by ships. GESAMP. London: IMO.
- Oil in the sea. Inputs, fates and effects. National Research Council, National Academy Press. Washington
- Oil pollution and marine ecology. Nelson-Smith. Paul Elek (Scientific Books) Ltd. London.
- Fate and effects of oil in the sea. Exxon background series. Exxon, New York
- Response to oil and chemical marine pollution. Cromack, D. Applied Science Publishers, London

10 TEACHING MATERIAL

The subject can be taught with the following basic facilities:

- Overhead, slides and video projectors.
- Computer resources with capacity to operate simulation programmes on oil spills and decision support systems for the management of emergency operations.
- Computer software on marine pollution emergencies.
- Videos on marine pollution prevention and control
- Library services

Practical training will be carried out through the visit to ships, shipyards, port reception facilities, treatment plants, marine emergency centres, equipment stockpiles and other facilities concerning maritime pollution.

In addition it would be desirable to have oil spills simulators and other simulation equipment in the academy.

11 SUGGESTED FORM OF ASSESSMENT

Written examination.

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HOW TO SPELL FIGURES IN MARITIME COMMUNICATION

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ABSTRACT

Officially this dilemma does not exist. For this purpose we have to use the »International Phonetic Alphabet and Figure Code«. But in practice things are different – almost nobody uses it. In the authors' opinion using the official form of spelling the figures can lead to many difficulties in all kind of messages. This problem could especially arise in cases of distress communications leading to serious consequences. As the lecturers we have to follow official instructions, but is this good for future watchkeeping officers? This paper analyses the present situation, specially in cases preventing eventual accidents and suggests some solutions to such problems.

REGULATIONS AND RECOMMENDATIONS

ITU

The International Telecommunication Union (ITU) in their Regulations regulate regulations and recommendations in Chapter IX »Distress and Safety Communications for the GMDSS«, Article 37 »General Provisions«, in Chapter XI »Maritime Mobile Service and Maritime Mobile-Satellite Service«, Article 65 »General Radiotelephone Procedure in the Maritime Mobile Service« and in Appendix 24.

Article 37, Provision N 2941 – Mob 87 defines:

The abbreviations and signals of Appendix 14 and the Phonetic Alphabet and Figure Code in Appendix 24 should be used where applicable,[1] and further in Provision N 2941.1 – Mob 87:

The use of the Standard Marine Navigational Vocabulary and where language difficulties exist, the International Code of Signals, both published by the International Maritime Organization (IMO), is also recommended.[2]

[1] ITU: Manual for use by the Maritime Mobile and Maritime Mobile-Satellite Services, page RRN37-3

[2] Ibiden, page RRN37-3

In Article 65, Provision N 4914 is defined:

When it is necessary to spell out certain expressions, difficult words, service abbreviations, figures, etc., the phonetic spelling tables in appendix 24 shall be used.[3]

Appendix 24 is divided to three items. For the purposes of this paper the second item is the most important: »When it is necessary to spell out figures or marks, the following table shall be used:[4]«, followed by the table.

INTERNATIONAL CODE OF SIGNALS (ICS)

In The International Code of Signals the Chapter X determines how to spell figures. Practically is the same as above mentioned ITU Phonetic Alphabet and Figure Code[5]. ICS do not give any extra explanation about this matter.

STANDARD MARINE NAVIGATIONAL VOCABULARY

Standard Marine Navigational Vocabulary in Part I »Introduction« defines:

Only the letter spelling table as contained in Chapter X of International Code of Signals and in the Radio Regulations to be used on any occasion when spelling is necessary.[6]

In the draft version of »Standard Marine Communication Phrases«, which will replace Standard Marine Navigational Vocabulary, the spelling of figures is not mentioned. This matter is only referred to in the introduction:

"The use of Standard Phrases in ship's external communication does not in any way exempt from applying the relevant ITU – Radio Regulations and Procedures for Radio Telephony. [7]"

IMO MODEL COURSE

The authors of the book IMO Model Course 1.25 »GENERAL OPERATOR'S CERTIFICATE FOR THE GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM« recommend the following: »When transmitting certain expressions, unusual names or words, figures or abbreviations, the International Phonetic Alphabet and Figure Code should be used«.[8]

INTERNATIONAL PHONETIC ALPHABET AND FIGURE CODE (IPAFC)

Let us now look into the International Phonetic Alphabet and Figure Code referred to by all above mentioned regulations. It is defined in the ITU Radio Regulations Appendix 24. Item 1 defines letter spelling table, item 2 defines how to spell out figures or marks and item 3 defines the use of other spelling within the same country. The table in the ICS is exactly the same.

3 Ibiden, page RR65-2

4 Ibiden, page AP24-2

5 Međunarodni signalni kodeks, page 28

6 IMCO: Standard Marine Navigational Vocabulary

7 Trenkner P. & others: Draft version of the Standard Marine Communication Phrases

8 IMO: IMO Model Course 1.25, page S10-1

Table: Extract from International Phonetic Alphabet and Figure Code

0	Nadazero	NAH-DAH-ZAY-ROH
1	Unaone	OO-NAH-WUN
2	Bissotwo	BEES-SOH-TWO
3	Terathree	TAY-RAH-TREE
4	Kartefour	KAR-TAY-FOWER
5	Pantafive	PAN-TAH-FIVE
6	Soxisix	SOK-SEE-SIX
7	Setteseven	SAY-TAY-SEVEN
8	Oktoeight	OK-TOH-AIT
9	Novenine	NO-VAY-NINER

EXISTING PRACTICE IN MARITIME COMMUNICATIONS

And what is the real situation in maritime communications? All maritime radio operators make a good use of the before mentioned International Phonetic Alphabet and Figure Code, except in case of figures' spelling. These are simply spelt using ordinary English words.

What must be a reason, that all around the world all maritime radio operators consciously violate International Radio Regulations?

When we were looking for the reason of these transgressions, we found out two essential reasons:

· unclear pronunciation and

· longer pronunciation time.

Other reasons are also non-familiarization with IPAFC, absence of adequate tables in vicinity, ignorance of the regulations, etc.

Radio Regulations Chapter IX, Article 37, Provision N 2939 – Mob 87[9] defines:

»Transmissions by radiotelephony shall be made slowly and distinctly, each word being **clearly pronounced** to facilitate transcription.«

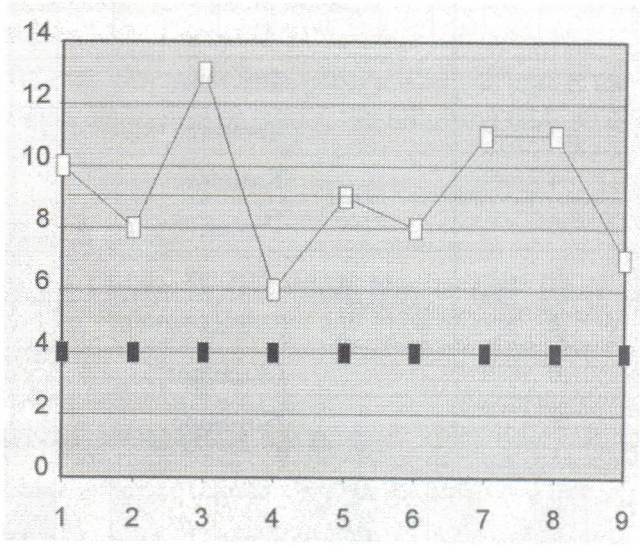
Here we can pose a question, in which mode figures are more clearly pronounced, in the simple English language or according to IPAFC. When it is necessary to pronounce one or two figures there is not a big difference. Difficulties arise when we have to pronounce longer numbers, such as MMSI, telephone numbers or ship's position. But if operators speak slowly there is no difference between these two modes. The problem occurs only when radio-operators are not familiar with IPAFC.

In our opinion the greatest problem is time. For pronouncing figures according to IPAFC we need considerably more time than pronouncing them in the English language. To find out the difference in time, we tested students. They first read a message pronounced figures in English, then the same text with phonetic pronunciation. All population tested for the first time met with phonetic pronunciation.

[9] ITU: Manual for use by the Maritime Mobile and Maritime Mobile-Satellite Services, page RRN37-3

First test was: Spell call sign J 8 E M 5

Student No.	1st mode	2nd mod
1	4	10
2	4	8
3	4	13
4	4	6
5	4	9
6	4	8
7	4	11
8	4	11
9	4	7
Average	4	9



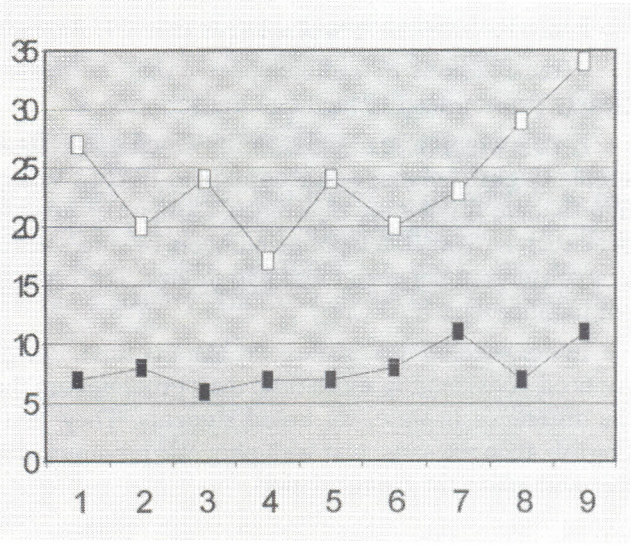
In both cases they had to spell words according to IPAFC. The difference was only in the way to spell figures, first in the English language then according to IPAFC.

From the first test results we could see that they all needed the same time - 4 seconds for spelling figures in English. In the second combination the time varied between 6 to 13 seconds, in average 9 seconds.

Second test:

Students had to say: MY MMSI IS 278123456

Student No.	1st mode	2nd mod
1	7	27
2	8	20
3	6	24
4	7	17
5	7	24
6	8	20
7	11	23
8	7	29
9	11	34
Average	8	24



Here, in the second test, students needed for the spelling between 6 and 11, in average 8, seconds spelling figures in English against 17 to 34 seconds, average 24 seconds, spelling figures in IPAFC mode.

Third test

In this case students had to say:

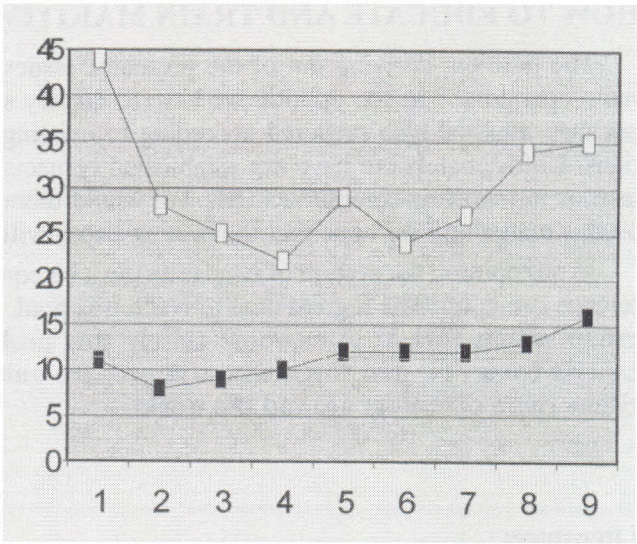
MY POSITION IS

45 28 N

13 17 E

spelling each figure separately.

Student No.	1st mode	2nd mod
1	11	44
2	8	28
3	9	25
4	10	22
5	12	29
6	12	24
7	12	27
8	13	34
9	16	35
Average	11	30



As we see from the test results, they needed from 8 to 16 seconds, average 11 seconds, spelling figures in English and from 22 to 44 seconds, average 30 seconds, spelling according to IPAFC.

From the tests results we can conclude that students needed 2,25 times more time in the first test, 3 times in the second test and 2,73 times more in the third test. Of course, we have to consider the fact that all of them first time met with this mode of spelling. This difference could be reduced with training. A test on ourselves had shown that the figures were reduced to 1,5.

DISTRESS CALLS

The greatest problem could arise on distress calls. In these calls there is a great chance of misinterpretation if using IPAFC spelling. Let us try to spell following message both ways:

MAYDAY

THIS IS M/V BLED, J 8 E M 5, MMSI 278123456

ON POSITION

45 28 N

13 17 E

We also have to take into consideration people's reactions in distress situations. Operators' voice becomes less distinct and the speed of communication increases which is not more in accordance with the Radio Regulations Chapter IX, Article 37, Provision N 2939 – Mob 87[10] stating »Transmissions by radiotelephony shall be made slowly and distinctly, each word being **clearly pronounced** to facilitate transcription.«

[10] ITU: Manual for use by the Maritime Mobile and Maritime Mobile-Satellite Services, page RRN37-3

On routine calls mistakes in pronouncing are not so much important. But in case of distress calls every single word, letter or figures are very important. Probably this is the reason why all maritime radio operators use the way to spell figures in English, especially in cases of distress communication.

Considering all these facts, we have to ask ourselves, why maritime radio operators intentionally infringe international rules? Is it something wrong with the rules or with the maritime radio operators?

HOW TO EDUCATE AND TRAIN MARITIME RADIO OPERATORS?

The problem deriving out of the presented issues is "How to educate and train maritime radio operators"? In our opinion we have to qualify students according to international rules, but they must be also prepared according to existing practice in maritime radiocommunications. Unfortunately we have not established contacts with colleagues worldwide holding the lessons in maritime communications. We would therefore appreciate the exchange of opinion on this matter and we hope that the present paper will encourage it.

In our opinion the system of education must be equal all around the world. This IMLA conference can contribute a great deal to reach this goal. **So we propose to establish a working group within IMLA, to examine closely this problem, of course in coordination with experts from ITU and IMO, who will prepare unified instructions to lecturers and maritime radio operators around the world.**

Literature:

IMO Model Course 1.25 »General Operator's Certificate for the Global Maritime Distress and Safety System«, IMO, London 1997

Manual for use by the Maritime Mobile and Maritime Mobile-Satellite Services, ITU, Geneva 1996

Međunarodni signalni kodeks (International Code of Signals) 1969, Ustanova za održavanje pomorskih plovnih putova, Split 1971

IMCO: Standard Marine Navigational Vocabulary

Trenkner P. & others: Draft version of the Standard Marine Communication Phrases

SAFETY AS A GUIDELINE IN MARITIME OCCUPATION

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SUMMARY: At the beginning of this paper a few basic characteristics of occupation in general are set forth through seven determining components (skill, knowledge, vocation, economic value, social status, moral principles and legal regulation). Further on through these seven components a more detailed explanation is given of the maritime occupation itself. Since the last of the these components, which is legal regulation, has been gaining importance during last decades, there is a special chapter containing a concise review of the main international conventions adopted by ILO and IMO concerning seamen's occupation and maritime safety, as well as their implementation in the national legislation of the Republic of Croatia.

Following chapters represent the short description of accidents and their causes and of a system of protection against them, stressing particularly the importance of maritime accidents and seamen's injuries together with the framework elements of the system of safety measures, both on board ship and on shore. Finally, in the conclusion arguments are set forth to demonstrate that safety is a significant factor of maritime occupation and a guideline in maritime industry. On the other hand, there is a tendency of adopting too many regulations which may produce an adverse effect, because by incorporating safety too rigidly into other components of maritime occupation one might petrify it rather than develop it. It is not possible to create new development potentials within maritime occupation without previously constructing its consistent theory.

1. INTRODUCTION

Conventions and Recommendations of the International Labour Organization lead us to the conclusion that safety is the key element of maritime occupation. In order to verify this the determining components of all occupations and particularly those of maritime occupation will be examined, further on a general framework of maritime accidents will be set forth, as well as seamen's injuries and the systems of protection against them. By comparing the significance of occupation and safety, examining things that they have in common, the place of safety in the system of maritime occupation will be established.

2. OCCUPATION COMPONENTS

An occupation is a complex phenomenon which consists of several components. Skills needed to transform or to handle things represent the first component. This component includes physical effort and its result, acquiring and developing the skills needed.

K. Bicher thus considers the source of occupation are skills developed by local cottage industry making weapons and tools, clothes and footwear, decorations and building houses. Because of the lack of land some members of the household started acquiring these skills and practising them to earn a living, travelling from one village to another or settling down in towns. Thus the medieval town craftsmen were formed. Each of them worked with his own capital, manufacturing a product from the beginning to the end, selling it at the price he

could get on the local market. He had to start as an apprentice, then to work as a journeyman in order to become eventually a skilled workman. For five centuries manual trade dominated Europe and thus in a certain way it became the synonym for occupation (Parson, 1969: 576--580).

The second component of occupation is knowledge. Knowledge is generalised experience gathered in a system of notions and assertions, i.e. in a theory. At the beginning an occupation is rather a practical skill handed down from one generation to another. When the knowledge of a certain occupation is developed into theory then conditions are acquired to establish that occupation as a profession. The knowledge of today's occupations range from simple notions, which explain a subject in a very limited way to notions which give patterns and regularities of high abstractness and considerable power of explanation. In a profession problems related to it are solved relying on theory and producing conclusions inspired by it.

The third component of occupation is the spiritual one. It consists of mission, of the sense of vocation, of a complete dedication to one's profession. M. Weber explores and sets forth the characteristics of the magician, the priest and the monk as first professionals. The magician creates an occupation out of his art to submit gods to his magic power. The priest through his rite honours god and is a functionary of the religious organization. The monk is relatively independent of the ecclesiastical apparatus, but through his enthusiasm and self-control achieves a high level of devotion and ability to diffuse faith efficiently (Sayfarth, 1991 : 13).

The fourth component of occupation is the economic one. One practises a certain profession in order to acquire goods necessary for living. The quantity and the value of goods a person gets is the result either of needs (in a tribal community) or from effort, responsibility and risk (in a market-oriented society). Profit can be gained only from work someone is willing to buy as a service or work materialised in a product. On the market, rough and simple work for which training is not necessary is paid less, as well as comfortable work for which there is no need for any hard work or work which does not require trust or confidence. Complex and precise work which requires long training and talent, a greater physical and mental effort, which can be accomplished only if there is a lot of trust on the part of clients and environment, is paid more (Smith, 1952: 91-99). Profit is always a combination of several elements and is under the influence of the constellation of interest and power in society (Rawls, 1990: 1178).

The fifth component of occupation is the social one. Occupations occupy certain positions in a society based on several criteria. The social status of every occupation generally defines the motives and the role of the person practising a certain profession. Robert E. Clark (A. Laird, C. Laird, 1964: 298) and Pineo, Porter (1970: 174-188) explored and categorized occupations in the USA and Canada into those with high, medium and low level of reputation. A high level of reputation is assigned to those occupations requiring university education, those in which rich owners personally manage their companies, as well as those of senior executives and civil servants. Occupations such as qualified workers and junior clerks have a medium level of reputation. Finally, those occupations where there is no need for any special training and which offer no permanent jobs have a lower level of reputation.

The sixth component of occupation is the moral one. Occupations and particularly professions very often imply some inner, moral rules, principles and values which oblige those who practise them to behave in a certain way. These rules can come in written form of a code of ethics as well. Moral rules, whether written or not, oblige members of a certain profession to use their knowledge for everybody's benefit, to observe their professional standards regardless of connections and pressures, to act honestly towards their colleagues, clients, in the organization in which they work and in their community in general. Solidarity and truthfulness, helping each other and preventing others to make mistakes and to act improperly, are things that should characterize the relationship between colleagues. A job has to be done and services offered regardless of the client's social characteristics (ethnic, affiliation, income scale, school qualification etc.). Clients' interests have to come in the first place while their own personal interest and comfort have to be put aside as much as possible. Professional standards and truth have to be defended against the political authorities and general public.

The seventh component of occupation is the legal one. Occupations define the existential and social position of an individual and an occupation as a whole is an important segment of society. Therefore the conditions of practising many occupations have been legally regulated. The state control of occupations is directed towards establishing educational programmes and titles, compulsory expert analysis (in construction industry for example as a compulsory building design and licence) (Šporer, 1989: 48-49), towards protecting certain occupations by making licence obligatory for those who wish to practise them

(McConnell, Brue, 1992: 339), towards creating workplace where only highly qualified workers can be employed (Kruger, 1983) and towards various obligatory safety measures in the mining industry and traffic. We can say that, in general, the state regulates some questions and conditions of occupations for the protection of common interests, of the interests of those who use the services provided by certain occupations and to ensure to those who work safe and undisturbed practising of their occupations.

3. SPECIFIC CHARACTERISTICS OF MARITIME OCCUPATION

General components of occupation are contained in maritime occupation in a specific way. The first component is the skill. The maritime occupation requires the skill of navigation and manoeuvring a ship in various weather conditions, then the skills of operating the ship's driving engine, its various equipment, electric and other systems and finally the skill of handling the equipment for loading and unloading the cargo as well as the safety equipment for the ship and her crew.

The second component is knowledge. In maritime occupation the knowledge refers to ships (their construction and parts); to the organization and workers' management; to functioning of the ship, her engines and equipment; the safety of the ship and her crew, and the knowledge of overall conditions: the sea route, the weather, ports and communications (Regulations on Professional Titles and Certificates of Competence of Seafarers on board Ships of the Merchant Navy of the Republic of Croatia, "Official Gazette" No.103/98). All this knowledge cannot be gathered in one single theory. Part of that knowledge can be included in models and laws of mechanics, electrical engineering and mathematics, but many parts because of their heterogeneity cannot be put into a single theory. Nevertheless some traditional maritime skills are hastily being replaced by technological knowledge. In the related transportation branches there is no consistent theory either. All this is an obstacle preventing maritime occupation to be established as a profession.

The future of maritime occupation will also be influenced by the tendencies developed as a consequence of mechanization and automation. The first tendency is to decrease the importance of the traditional role of an officer (and his authority) and to increase the importance of technical skill. The second one is the division of the ship's system into the functional departments of navigation, cargo, engine, electric and automatic systems, telecommunications and services. The third tendency is to transmit the traditional and to acquire current knowledge and skills through in-service training and courses. The fourth tendency is to decrease the number and the professional level of the navigation staff.

The third component of occupation is the spiritual one. A great power of spirit has always been necessary for navigation. In spite of modernization (better living and working conditions, greater help from the mainland) the crew feels very much the same as they did in the past. A ship carries the destinies of seamen divided by the ship's bulkheads, splashed by the sea on the bow, swept by the eternally threatening winds (Horvat, 1997: 163). Little has changed in a seaman's soul. The loneliness still creates home-sickness, bad weather still provokes fear, darkness causes nostalgia, the fog anxiety, and the watchkeeping is still endlessly long.

The less known difficulty of the maritime occupation is that seamen are thorn between the life on the ship and that on the land. They service the ship mechanism which in its basic movement functions uniformly, they make part of a system of hierarchy which follows a unique technological mechanism. This creates a certain level of team spirit. Being separated from their

families and life on the shore, they concentrate on their work with more energy and emotions. "Saturated" by their work they start feeling nostalgia for their families, but on the other hand maladjustment to the life on the shore causes them to long for the shipboard again. They are very often tormented by this contradictory feeling: when they are on the ship they want to be on the shore, and when they are on the shore they want to go back to the ship.

The fourth component of occupation is the economic one. The maritime occupation consists of various jobs demanding great mental and physical effort and with the change to market economy the seamen's salaries have become higher than the average ones on the land. Working on board a ship implies responsibility towards the value of cargo and safety of people, and there is always a certain risk of shipwreck. Ships are mechanized and automated and to perform certain jobs, medium or higher level of qualification is required. National trade unions, ITF and other seamen's associations act on the national and international level taking care of the wage rates, of the regularity of payments and of implementing other seamen's rights.

The fifth component is the social one. In current conditions the prestige of seamen has increased primarily not only because of high salaries, but also because of a higher level of education necessary for all categories of seamen. But certain roughness is still present in the relationship among seamen themselves and towards people outside their own circle. This roughness is the result of their way of living since they constantly have to take care of their own basic safety and because while they are on the ship they lose some of the good manners they have acquired while they were on the shore. We can conclude that seamen belong to the group of occupations with medium and high prestige. Master, ship's mates, engineers and maritime experts on the shore enjoy high prestige, while members of the crew enjoy medium prestige.

The sixth component is the moral one. Higher or lower degree of morality is also a component of maritime occupation. Morality of seamen is realized through solidarity and truthfulness towards their colleagues, helping each other at work, covering and correcting mistakes, and in an effort to prevent improper behaviour. Working in conditions where great importance is given to formal ranking, seamen do not like to get around the rules of getting a promotion and they condemn every rise in rank which is not strictly based on merit. Seamen are used to self-sacrifice and are happy to satisfy their clients' interests at the expense of their own comfort and they treat all clients equally. Since they lead isolated lives and are used to obedience, they feel real awe towards the management and the authority, which sometimes is an obstacle in realizing their rightful interests.

The seventh component is the legal one. Maritime occupation is one of the few occupations so highly regulated by legal provisions. International conventions and national regulations prescribe with more or less details:

- the programmes of education for all categories of seamen and their professional titles
- obligatory medical check-ups and examinations of occupational ability
- documents every seaman, ship and cargo must have
- safety measures in navigable waterways and on board a ship
- various kinds of behaviour for example in ports, when bringing goods into a country, when unloading it, the conduct concerning alcoholic drinks etc.

There are so many regulations concerning the work and behaviour of seamen that one could consider it an exaggeration. Many people agree that in the near future emphasis should be directed towards carrying out of the already existing regulations; towards standardization of certain patterns of behaviour on all ships, seas and shores, and towards consistent and unified implementation of regulations referring to seamen's dignity, working environment and safety.

4. LEGAL REGULATION OF MARITIME SAFETY AND SEAMEN'S OCCUPATION

Many of the earliest instruments of unification of the maritime law were related to the technical and other questions regarding the safety of navigation and protection of human life at sea. Shipping had always had international characteristics and therefore the legal regulation of maritime safety as well as the problems of the seamen's profession, conditions of their life and work on board, and their social position could not be left exclusively to national legislation, but it was necessary to create international regulations in order to secure the improvement of standards on a global level.

The International Labour Organization (ILO) which, since 1946, has been a specialized agency of the United Nations, and today has about 150 member states, was founded in 1919 (Part XIII of the Treaty of Versailles) with the intention of improving the labour conditions all over the world on the basis of international co-operation. ILO has been especially active and successful in maritime industry. The General Conference, through its sessions which are held once a year, has so far brought over 150 conventions and 160 recommendations. Though many of these apply to various professions including seamen, essential for their status are special conventions and recommendations which have become the most important source of Maritime Labour Law. A special body has been formed: Joint Maritime Commission, consisting of representatives of seamen and shipowners, meets more frequently than the General Conference, and is concerned with the employment issues in shipping and carries out preparatory activities for the sessions of the General Conference dealing exclusively with maritime industry (ten such sessions have been held so far).

The ILO conventions prescribe the conditions which should be met by the crew members, the health requirements for various duties on board, the contents and procedures for issuing seamen's certificates, safety at work, the right of repatriation, vacations and leaves.

The Republic of Croatia became a member of the ILO in 1992, and a year before, on June 25th 1991, the Parliament of Croatia brought the Constitutional Decision on the Sovereignty and Independence of the Republic of Croatia which, in Art.3 contains the following provision: "The international agreements which SFRJ has signed and ratified, will be applied in the Republic of Croatia unless they are contrary to its Constitution and legal order, on the basis of the provisions of the international law on the succession of states, regarding international agreements" ("Official Gazette" No.31/91). An identical provision is to be found in the Art.33 of the Law on Concluding and Executing International Conventions ("Official Gazette" No.53/91). On the other hand the Constitution of the Republic of Croatia provides, in Art.134, that the international agreements, which are signed, ratified and published, constitute an integral part of the national legal system, with the legal force below the Constitution but above all the other laws ("Official Gazette" No.56/90).

By notifications on succession, Croatia has been since October 8th 1991 a party to the following ILO conventions: 8/1920, 9/1920, 16/1921, 22/1926, 23/1926, 27/1929, 32/1932, 53/1936, 56/1936, 69/1946, 73/1946, 74/1946, 91/1949, 92/1949, 109/1958. ("Official Gazette – International Conventions" No.2/94).

The International Labour Organization adopted, in 1976, The Convention No. 147 concerning Minimum Standards in Merchant Ships, which entered into force on November 28 th 1981, regulating the implementation and enforcement of previously adopted standards like the lowest age limit for employment, medical examinations and health care, safety at work and medical insurance, shipboard living arrangements of the crew, repatriation, the contract of employment, certificates on professional titles of officers, trade union freedoms as well as the right of organizing and collective negotiating. This Convention is already binding for the countries of the European Union and a considerable number of maritime countries, and the countries which join it, must coordinate their internal provisions with the eleven previously adopted conventions of the ILO quoted in the Annex of the Minimum Standards Convention.

In distinction from the enumerated conventions to which Croatia became a party by succession, this ILO convention, which is probably the most important one, is at the same time the first one that the Republic of Croatia has ratified ("Official Gazette – International Conventions" No.4/96). Thus Croatia binds itself to supervise effectively the ships registered on its territory regarding all the enumerated standards and also to make an official inquiry of any serious maritime accident in which these ships took part.

By ratifying the Merchant Shipping (Minimum Standards) Convention Croatia has, previously becoming a party to other required international conventions, fulfilled the conditions for joining the Paris Memorandum of Understanding on Port State Control of January 26th 1982 (ILM, 21, 1982).

This memorandum is a result of Regional European Conference on Maritime Safety, convoked by the French Government in December 1980, in which thirteen European countries participated. The final Declaration of the Conference stresses the need for improvement of maritime safety and protection of the marine environment, as well as an improvement of the conditions of life and work of seamen.

The aim of the Memorandum, which entered into force on July 1st 1982, is to ensure an effective and harmonized implementation of standards laid down in international conventions in the area of maritime safety. Namely, although the responsibility for the implementation of these standards rests in the first place with the authorities of the flag states, the Preamble of the Memorandum emphasizes the necessity of an efficient action of port states in order to prevent the use of substandard ships. In conformity with this, the signatory countries effected the inspection, during the initial two years of the application of the Memorandum, of 25 % of merchant ships flying foreign flags which entered their ports, so that by the end of June 1984, 18 000 examinations had been made whose consequence was the detaining of over 700 ships having serious defects. In order to improve mutual cooperation and coordination of activities, a computerized information system was established in St. Malo, as a data bank at disposition of inspectors.

Although the Memorandum has proved useful in practice, in 1989 the European Commission brought the Recommendation on improving the effectiveness of Port State Control in the European Union, inviting the member countries to consistently fulfil the obligations taken by the Memorandum. The Recommendation had three aims: 1) reduce and ultimately prevent substandard shipping; 2) avoid unequal conditions in European ports which would negatively affect the competition; and 3) ensure complete and uniform Port State Control system in the whole of the European Union (COM/89/266 final, 1989: 15).

The Paris Memorandum demands its member states to sign and ratify a series of international conventions regulating safety of life at sea, standards of employment and shipboard conditions, and protection of the marine environment. These are, besides the above mentioned ILO Merchant Shipping (Minimum Standards) Convention, the following IMO conventions: Loadlines 1966, Tonnage 1969, COLREG 1972, MARPOL 1973/78, SOLAS 1974/78, STCW 1978/95.

Besides becoming a party to the enumerated conventions, the Republic of Croatia has implemented their privisions into its national maritime law: the Maritime Code and other laws and regulations. The Maritime Code in the chapter regulating the safety of navigation prescribes the required conditions of the sea lanes in the internal waters and territorial sea of the Republic od Croatia, of its ports, ships, small boats and floating craft registered in the Republic of Croatia, the crew, navigation and pilotage at sea ("Official Gazette" No.17/94). The Code also regulates the inspection control over the implementation of this part of it. As regards the navigation the Code adopted from the Convention on the International Regulations for Preventing Collisions at Sea (COLREG 1972) the obligation of applying the rules of navigation, as well as the signals and marks which must satisfy the conditions of safe navigation.

The Maritime Code confers an important role on the Croatian Register of Ships, whose status, activities and organization are regulated in detail by the Act on Croatian Register of Ships,

which in Art.1 states that the main function of this public institution is "the public care regarding the protection of life and property at sea and in the internal waterways, as well as the protection of the marine environment and the environment of the internal waterways" ("Official Gazette" No.81/96). The activities of the Croatian Register of Ships are to establish the seaworthiness and the tonnage measurement of ships, of certain types of small boats and floating craft, ascertaining the safety of containers, ascertaining the adequacy of the shippowers' organization regarding the safety at work and the protection of the environment during the ship's exploitation, co-operation in investigating the causes of accidents at sea as well as participation in work and fulfillment of the commitments to the international organizations. The tonnage measurement and the technical control while establishing the ship's seaworthiness are done by the Register according to technical rules which are in conformity with the Tonnage Convention, and comprise the provisions of the enumerated (SOLAS, MARPOL, Loadlines) and other international conventions from the area of the safety of navigation which Croatia has joined. Among other things this control applies to the safety of life at sea, safety at work and conditions of accommodation of the crew and the passengers.

On the other hand, the Maritime Code provides that the inspectors of the safety of navigation from the Ministry of Maritime Affairs, Transport and Communications also establish the ship's seaworthiness by means of an inspection control, checking whether there is a minimum number of qualified members of the crew on board and also whether the ships is loaded with cargo and whether the passengers are accomodated in conformity with the conditions from the ship's documents and certificates. More detailed provisions are contained in the Regulations on the Safety of Navigation Inspection Control which, besides conforming to the international conventions (Loadlines and STCW), also represents the first Croatian regulation making possible the application of the Paris Memorandum of Understanding on Port State Control ("Official Gazette" No.34/97).

The International Convention on Standards on Training, Certification and Watchkeeping of Seafarers (STCW) which was adopted in London on July 7th 1978 and entered into force in 1984, has in the meantime undergone changes and amendments three times: in 1991 the amendments relating to GMDSS were adopted, in 1994 additional regulations on special training of the crew on board tankers were brought, while the most comprehensive modifications were adopted at the Conference which took place in London from June 26th to July 7th 1995. There were several causes that led to this Conference: in the first place, the fact that the human factor is the most frequent cause of accidents at sea imposed the solution for their prevention thanks to higher standards of seamen's qualifications, then the incompleteness and insufficient accuracy of the provisions of the 1978 causing the impossibility of monitoring their application in the internal legal systems of the states parties, and finally the improvements of maritime technology during the last two decades which demanded the bringing up to date of the Convention (Young, 1995: 1). At the Conference however, there were no interventions in the text itself of the articles of the old Convention, but within the Attachment 1 of the Final Act of the Conference, the Annex to STCW 1978 was revised, being systematized in eight chapters marked by Roman numerals, while Attachment 2 contains the STCW Code. It consists of two parts: Part A, which represents the compulsory minimum standards which the states parties to STCW must adopt, and Part B, which is in fact an instructive guidance to the parties, and contains the recommendations about the application of the Convention. Both parts of the Code are systematized in eight chapters following the pattern of the Attachment whose provisions they elaborate, forming a consistent legal structure with it.

Croatia has, in conformity with the provisions of the revised STCW Convention, and based on the Maritime Code, brought Regulations on Professional Titles and Certificates of Competence of Seafarers on board Ships of the Merchant Navy of the Republic of Croatia ("Official Gazette" No.103/98). These Regulations prescribe professional qualifications, examination programmes, conditions and modes of obtaining renewing, substitution and suspension of certficates of competence and additional supplementary qualifications of Croatian seafarers, and also the conditions which must be satisfied by the members of the examining bodies which

establish the qualifications of seamen as well as by the institutions engaged in the education and training of seamen.

The International Safety Management Code, is an expression of the aspirations of the international community for the improvement of the safety at sea by means of higher global standards not only regarding the operation of the ship by the master and crew members, and prevention of pollution, but also regarding the functional requirements dealing with procedures of the management of the shipping companies on land. The ISM Code precisely enumerates the obligations of all the links in the chain: from the flag state and its maritime administration, to shipowners and to ship's masters, but it also includes every country whose ports ships enter by means of the system of Port State Control. It is the duty of all states to bring national regulations, applying the ISM Code to their own fleet and shipping industry. Croatia did it last year by issuing the Regulations on Duties and Watchkeeping of Crew Members on board Sea-going Ships of the Merchant Navy of the Republic of Croatia ("Official Gazette" No.91/98). However, there is a provision in Art.112 (6) of the Maritime Code, which decrees that the technical supervision (performed by Croatian Register of Shipping in accordance with its technical rules) comprises also inquiring whether the shipping company has been properly organized to enable safe operation of ships and protection of the environment during the ships' exploitation.

5. SAFETY AND THE PROTECTION SYSTEMS

Safety is:

- a condition in which workers do not find themselves in any form of danger which may threaten their health and life

- a positive feeling or a positive value which is the result of accidents as negative and undesirable experience and events

- rational insight into accidents and dangers possible in a certain working environment and safety measures which can minimize or prevent predictable dangers.

Accidents can be caused by human error, by the lack of machinery and equipment in the construction and maintenance or because they have become obsolete, but also because of unfavourable circumstances in our more immediate and wider environment.

Psychophysiological science has come to the conclusion that accidents at work are caused by:

- insufficient training for a job or maladjustment to work tasks and situations

- the lack of interest for an occupation

- unfavourable general mental state (negligence, superficiality, not being able to concentrate at work, feeling depressed)

- feeling tired (tired people cannot react to danger on time and in the best possible way)

- the lack of experience (young workers are incautious, have too much self-confidence etc.)

- harmless sicknesses (like headaches, colds, blood pressure)

- being euphoric or unrealistic about the work situation as a consequence of taking alcohol, drugs etc. (Bujas, 1964: 332-359).

Protection against accidents or increasing the degree of safety can be direct or indirect. Indirectly it can be done by carrying out systematic control of the machine's and equipment's good working order, and through their constant technical improvement from the point of view of safety. Also through systematic training of those workers connected with safety and trying to stimulate their alertness in various ways. Finally, higher degree of safety can also be achieved indirectly by strictly observing some regulations, for example that tired or inexperienced workers should not work in dangerous places. To act in a direct way means to remove from the potentially dangerous posts those workers who show little interest in the work, those with unfavourable personality traits or those suffering from some light sickness or working

under the influence of alcohol. We can observe the establishing of safety from the technical, psychological and legal aspect. In the technical area safety can be established by changing dangerous machines and ways of working; by constructing and by installing various protective equipment and by marking dangerous places in a conspicuous way. In the psychological sphere safety can be achieved by the right choice of workers, by practising only safe work methods, forming the habit of safe work and by developing attitude about the need for co-operation and constant caution. In the legal sphere safety is introduced and maintained by making adequate regulations. These regulations are made at international and national level and on the level of companies and trade unions. They determine persons responsible for safety measures; the development of safety methods is encouraged for all occupations, not only for workers but for the owners and managers of companies as well. Fines are very high for the owners in order to make accidents something undesirable from the business and economic point of view, and not only as something tragic for the workers (Maier, 1965:550).

6. MARITIME ACCIDENTS AND SAFETY

In maritime industry there is a difference between maritime accidents and seamen's accidents at work. Causes of maritime accidents are the result of the lack of technical and professional competence, navigation defects and inadequate help from the shore and unfavourable circumstances coming from the outside. Because of faulty material, construction defects, unstandardized overhaul and unreliable maintenance a ship cannot meet the needs of navigation and can experience a shipwreck. When the crew or some of its members do not fulfil properly their tasks concerning navigation of the ship or operating the engine and the cargo, when major faults are present in managing the ship and the shipping company, the probability for an accident increases. If the signs, equipment and landmarks on shore are not well marked or if the system of navigation guidance is on a very low level the probability is higher. Finally an accident can be caused by natural forces (thunderstorms, waves, fog, ice) or by another ship, no matter how much the equipment or the crew may be impeccable. Nevertheless, the majority of maritime accidents are caused by men. This means that they can be avoided if the right preventive measures are taken (Scharnow, 1984:19-20).

These preventive measures can be taken through the system of ship's safety. Numerous subjects should take part in creating and carrying out such a system, starting from various services on the shore to the management of ships and shipping companies. In carrying out these measures, workers on a ship, according to their degree of personal responsibility have an important part. The system of protection against maritime accidents can function well only as a part of a constantly coordinated whole. All parts of the system must function according to certain standards and regulations. The main parts of the system of protection against maritime accidents are:

- construction, building, equipping and maintaining a ship,
- education, professional training of the crew, taking care of their health, and filling up work posts with qualified and competent men,
- services for marking, extinguishing, informing, watching, pilotage, towing and salvage.

If all these do not function, if some of these services do not exist or do not work properly, more maritime accidents happen and more people suffer from injuries on various sides.

Seamen's accidents at work are caused by negligence, inexpertness, alcohol, defective machinery and inadequate work organization. Seamen's injuries at work can be caused by bad weather, noise, high temperatures and old ships (Vuksanoviæ, 1983: 184). Seamen working on deck and in the engine room suffer injuries more often while those working on other duties suffer far less. Out of all injuries 43% are those of hands, 31% of legs and 26% of head and of the trunk. The following injuries are the most frequent ones: contusions, cuts, open wounds, fractures, dislocations, burns, etc. The rate of those who recover: 90% of the injured get well and continue to work normally, 8-9% become invalids and 1-2% die on the spot or some time later.

The system of protection against injuries and accidents on board a ship is carried out by regulating and controlling the working conditions and workers' duties. The regulations are determined by the international conventions and recommendations, and by national regulations on safety at work. The control is carried out by the state inspectors, the managers and inspectors of the shipping company, and ships' captains.

On an average the shipboard safety systems function better than those in companies on the shore. This is so because, among other things, the dangers of navigation force people to be more cautious and do not allow them to develop routine self-confidence. However, this does not mean that the system of protection on ships does not have its bad sides. Creation and maintenance a high level of safety are obstructed by:

- economizing on financial resources
- tendency to pass on the responsibility for personal safety on lower ranking managers and on workers n themselves
- constant crew reductions
- formal inspection by the government authorities

The managers of safety departments in shipping companies introduce safety measures only to the point to which that legal regulations and state inspectors force them. These services tend to estimate the situation in an optimistic way, take measures only partly and do not react too promptly and thoroughly when minor accidents happen on board ships. That is why they economize wherever they can on direct costs for personal safety and even more on indirect costs such as the substitution of inadequate equipment with a more adequate one.

Passing on the responsibility for personal safety on the lowest ranks means that a whole range of jobs on deck and in the engine room are not carried out under the supervision of a qualified person who would work out in advance the schedule and work distribution in order to avoid all endangering factors. Those who work on board ships are usually aware of bad work organization, but they themselves can not improve it, and their voice very often is not heard far enough.

Since the 1980s there have been crew reductions on ships. The result of it is that in the periods of intensive work (putting to shore, loading/unloading of cargo or provisions, repairs and maintenance of the engine and the equipment) there are not enough people, so those who are there work too much and in an accelerated way. Some of them are very tired and therefore bound to overlook a threatening rope, a bar of a derrick or an uncovered opening of a cargo hold. Others working off-hand under pressure from their superiors are easily subject to cuts, burns or falls. In these circumstances it is not rare to find an officer addressing a worker in a rude way and by acting so lowering the self-respect and reputation of their workers who therefore break the safety rules from pure spite.

It is difficult to control the regulations on safety at work from the outside. It is possible that all records, documents and equipment are in order, but still the level of safety is low. This happens for example if safety habits have not been developed or if interpersonal relations are bad. Safety habits are created by educating individuals to develop respect towards safety, towards taking care of themselves and to concentrate on the work situation. If in their interpersonal relationship they help each other very little, and there is a lot of spite and imputations, these regulations are not very well carried out even if this would be for their own benefit.

7. CONCLUSION

Safety is not a component which determines maritime occupation in the same way other components do, but rather a factor which has a special role of the important guideline in this occupation as a whole. When the safety is conceived as an indirect system of protection then it is congruous with other components of the occupation. Promoting and increasing of maritime skills, knowledge, dedication and spiritual strength, economic and social status of seafarers, as well as improving their attitude towards observing moral principles and legal regula-

tions, all these increase safety. The better seamen's skills and knowledge are, the greater effort and the higher their working motivations are, the more responsibly they act on moral and legal principles, the higher is the level of safety and there are fewer maritime accidents and injuries. It is unacceptable if safety is endangered by privileges or tactless attitude of managers which destroy the self-respect and reputation of seamen, or if the formal record of compliance with regulations is achieved by covering up the breaking of rules or improper behaviour, but also if the safety, in general, is based too much on legal constraint.

Safety also exists as a direct intervention in removing a danger, as a control of how orders and regulations are carried out, how work is done and how the equipment functions. Therefore safety is one of the most important bases of the authority of managers and officers. This authority must be appropriate and aimed at an effective and co-ordinated functioning of the ship's mechanism and at satisfying the reasonable interests of seamen. If the authority is not like that, if it is careless or irrational, this is bad for safety and even the best regulations can do nothing to improve the situation. The share safety has in the reinforcement of authority makes it a somewhat conservative factor which may obstruct the development of maritime occupation. The development of this occupation can only be achieved by improving the theory which is focused on all of its aspects. Only a theory as a system of general technological - sociological notions can direct maritime knowledge and surpass the limitations established by the structures of authority and interest.

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SAFETY AND ENVIRONMENTAL ASPECTS OF COMPUTERS BASED TRAINING (CBT) – INTERACTIVE PROGRAMS APPLICATION FOR STUDENTS AND ENGINE ROOM OFFICERS

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Abstract

This paper describes the new developments in CBT – interactive programs applications, specially designated for the familiarisation with individual equipment like boilers, fresh water generators, steering gear, anti-pollution plants (oily water separator, biological sewage treatment plant), fuel treatment plant, Diesel engine generators etc., specially taking into account the safety and environmental aspects

The experiences in CBT application, the benefits and advantages of use of interactive programs in the educational process of engine room officers in Gdynia Maritime Academy are equally presented in this paper. The paper includes the example of CBT – interactive program concerning steering gear installation where trainees have possibilities to develop operation skills, train and refresh emergency procedures (react to emergency situations). The example of CBT – interactive program describing the functioning of Sewage Treatment Plant is also presented.

The basic tasks for CBT – interactive programs in maritime education are equally described, taking into consideration the new methods and procedures for accident prevention.

1. Introduction

It is well known that one of the major factors of accident prevention on board is the perfect theoretical and practical knowledge possessed by engine room officers while operating engines and auxiliary equipment.

Today, quite all major maritime academies have introduced computers as a valuable asset for educational process and use computer based training (CBT) interactive programs.

Once teachers learn to use effective and well designed CBT programs, they begin quickly to create new ways of structuring training in order to accommodate the educational program to their actual needs.

The basic tasks for CBT – interactive programs are:

- familiarisation with individual auxiliary shipboard system or equipment
- developing operation skills
- train and refresh emergency procedures (react to emergency situation)
- combine simulations with multimedia techniques like diagrams, pictures, sound etc.
- English language skills
- preparation for pre-promotion assessment of competency

- intensified trainee's activity during educational process
- to make the assessment process of trainee more objective
- to make the learning process shorter with simultaneous increase in quality

2. Description of the CBT - interactive programs

Gdynia Maritime Academy has carried out considerable research in the field of computer based training, for five years now, using a set of interactive programs developed by UNITEST, a Gdańsk, Poland – based company.

The following CBT interactive programs are presently used in Gdynia Maritime Academy:

* Water pumps
* Hydrophore installation
* Fresh water generator
* Piston compressor
* Refrigerating plant
* Diesel engines
* Diesel engine generators
* Steering gear installation
* Oily water separator
* Biological sewage treatment plant
* Auxiliary steam boiler installation
* Marine Diesel engine monitoring systems
* Fuel treatment plant

The marine training software package's aim is to teach the basic principles of how to operate marine power plant equipment. The programmes offered are intended for training students and engine room officers. The educational package is based on the solutions being actually used on ships.

The above mentioned programs are interactive i.e. they enable the realistic presentation of the marine power plant equipment functioning and are equipped with control panels and system installation diagrams. The control panel contains switches, pressure gauges as well as control and alarm lamps. The control panel and the main switchboard was intentionally designed to be as close as possible to the real equipment design.

Some programmes offer the possibility to realise regulations of the system parameters.

All operations on the PC screen (valve opening, pump starting, for instance) are effectuated by mouse-clicking.

The automatic valves are controlled by control panel.

Graphic symbols which are used in programs are described in the legend.

Most of the programs are sound-generated.

An appropriate mathematical and logical model of an equipment or system ensures that the program will react during trainee's action exactly as it would react in reality. In case of faulty operations the program will react identically as it happens during normal operation.

Information about the action performed by the student is displayed in form of digital or analogue data, colour changes of pipes and sound effect as well.

Typical UNITEST CBT interactive programs /see examples on Fig.1 and 8 /contains the following parts:

- System description
- Operating instruction
- Test
- Simulator

System description

This part describes the application, working principles and main components of the installation, together with different kind of graphic presentation (pictures, photos, diagrams etc.). See example on Fig. 3. An example of an installation diagram legend of the steering gear has been presented on Fig. 2. By mouse-clicking of the appropriate field of the installation diagram, the name of the particular part appears.

The experience gained proves that it is extremely important to combine the schematic diagram with the real presentation of a determined part in the form of a photo. On Fig. 3 the steering gear directional valve description is presented. By mouse clicking on the "i" field, the location of the above mentioned directional valve in the diagram is indicated – please see Fig. 4.

Operating instruction

This program's part includes a "step by step" detailed description of the preparation for starting the plant, starting the plant, automatic and manual control functioning and stopping the plant procedure together with the application of the emergency procedures. This part presents also diagrams illustrating the consecutive phases of the plant operation.

Test

The test is intended to assess the knowledge gained by the trainee from the two first parts of the program. In this module, the trainee should indicate the correct answer to randomly selected ten questions – see Fig. 5. This enables the trainee to effectuate the test various times without having to answer the same questions. At the end of the test the trainee is given a certain mark indicating the rate of correct answers (each correct answer gives the trainee a result of ten points).

Simulator

In this section of the program, interactive software simulator is applied – see Fig. 6, 7, 9 and 10. The trainee, by mouse clicking must set the valves on the installation diagram in proper position and start the pump, the compressors etc. by operation of the switches and push- buttons on the panel. The trainee must follow the instructions given in the Operating Instruction. This enables the trainee to apply in practice the theoretical knowledge acquired according to the Operating Instruction. The trainee is confronted with real life reactions of the installation. Steering Gear Installation program enables not only the operation in normal exploitation conditions but also the operation in emergency mode. This simulator makes possible for the trainee to exercise manual emergency operation. It is also possible to simulate other emergency situations for e.g. the loss of oil in the tank. In this case, the trainee should react to this situation in a proper way (switch on the stand-by pump unit and switch off the malfunctioning operating unit).

Sewage Treatment Biological Plant enables also to train the procedure of manual operation in case of the automatic control break down.

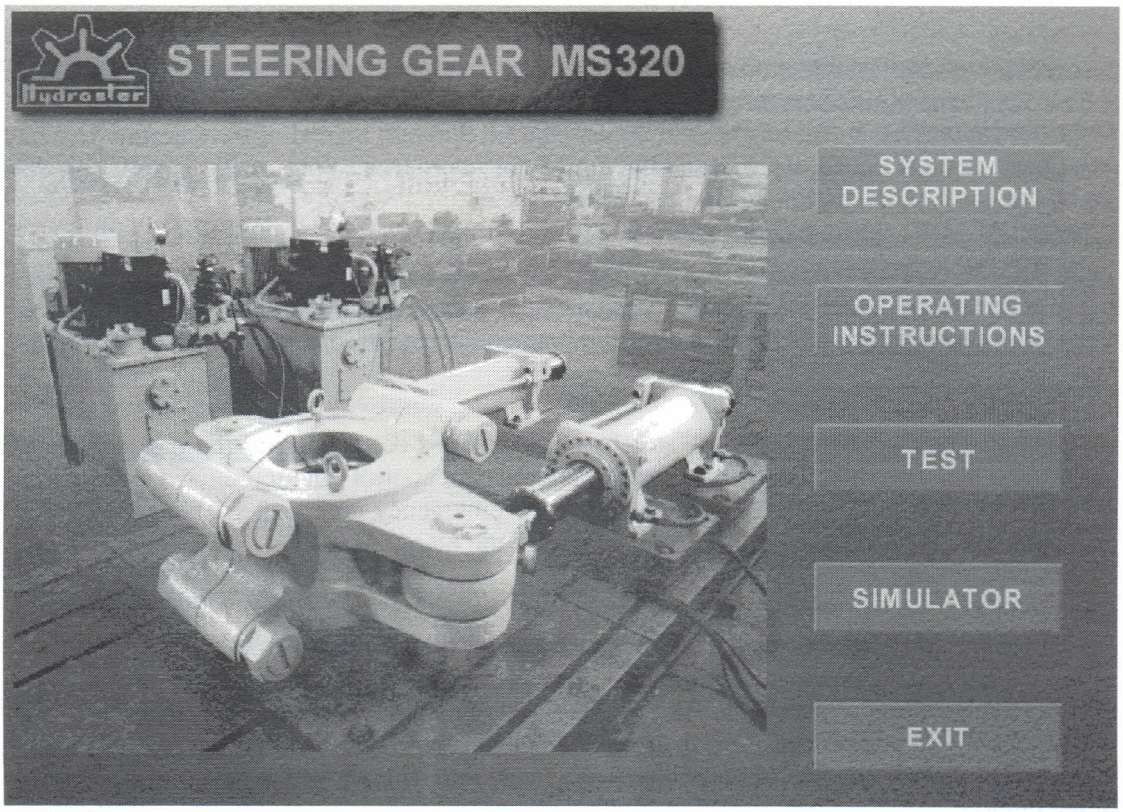

Fig. 1 Steering gear – interactive program – General view

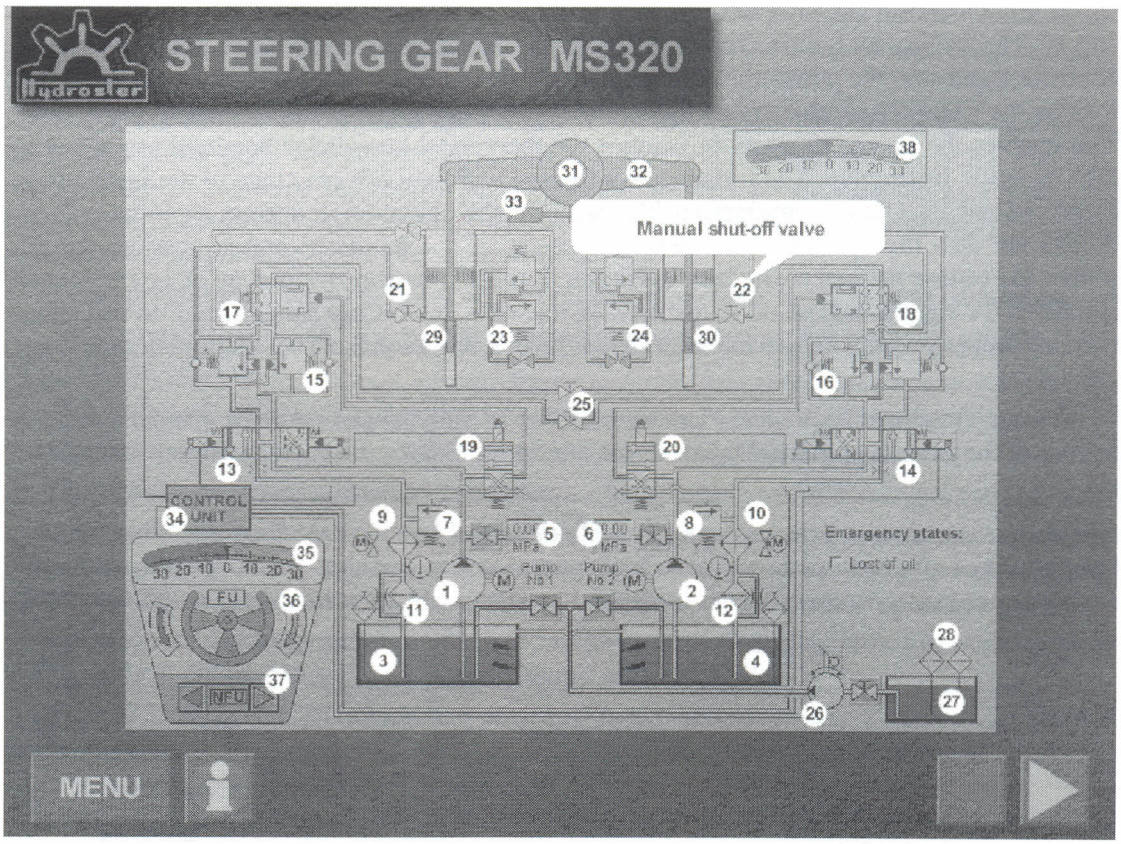

Fig. 2 Steering gear diagram with legend

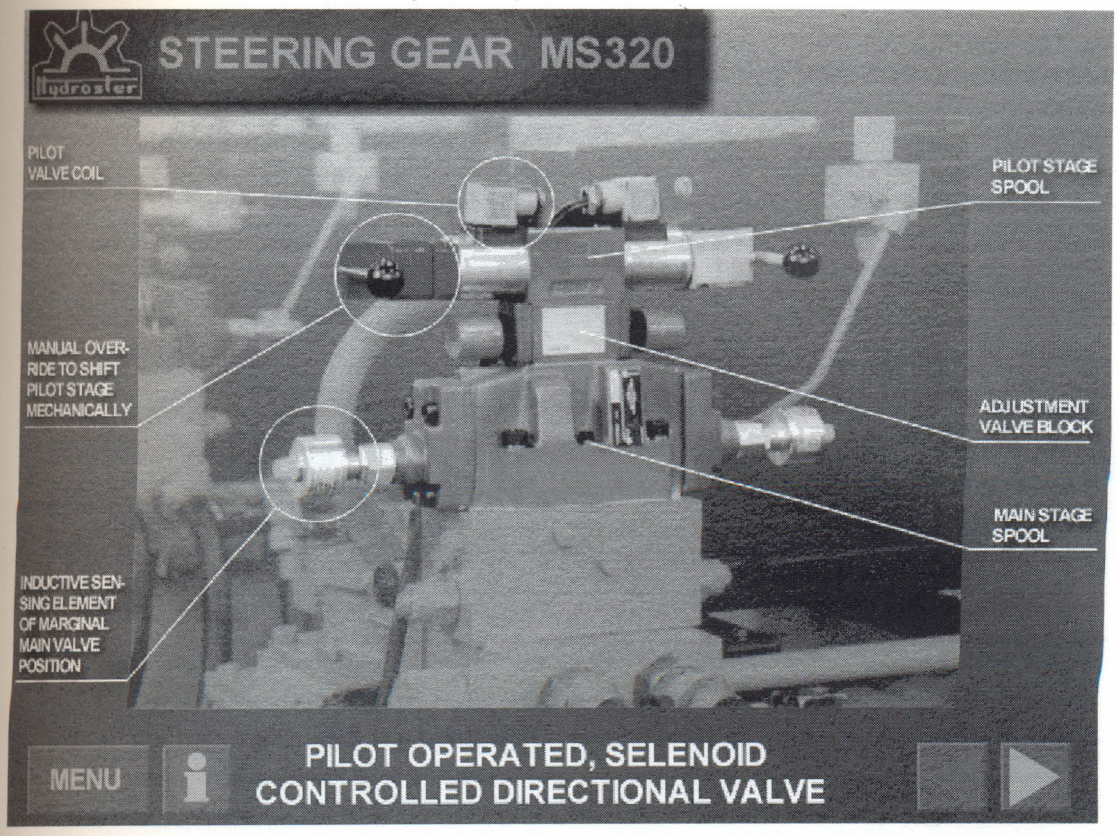

Fig. 3 Steering gear directional valve description

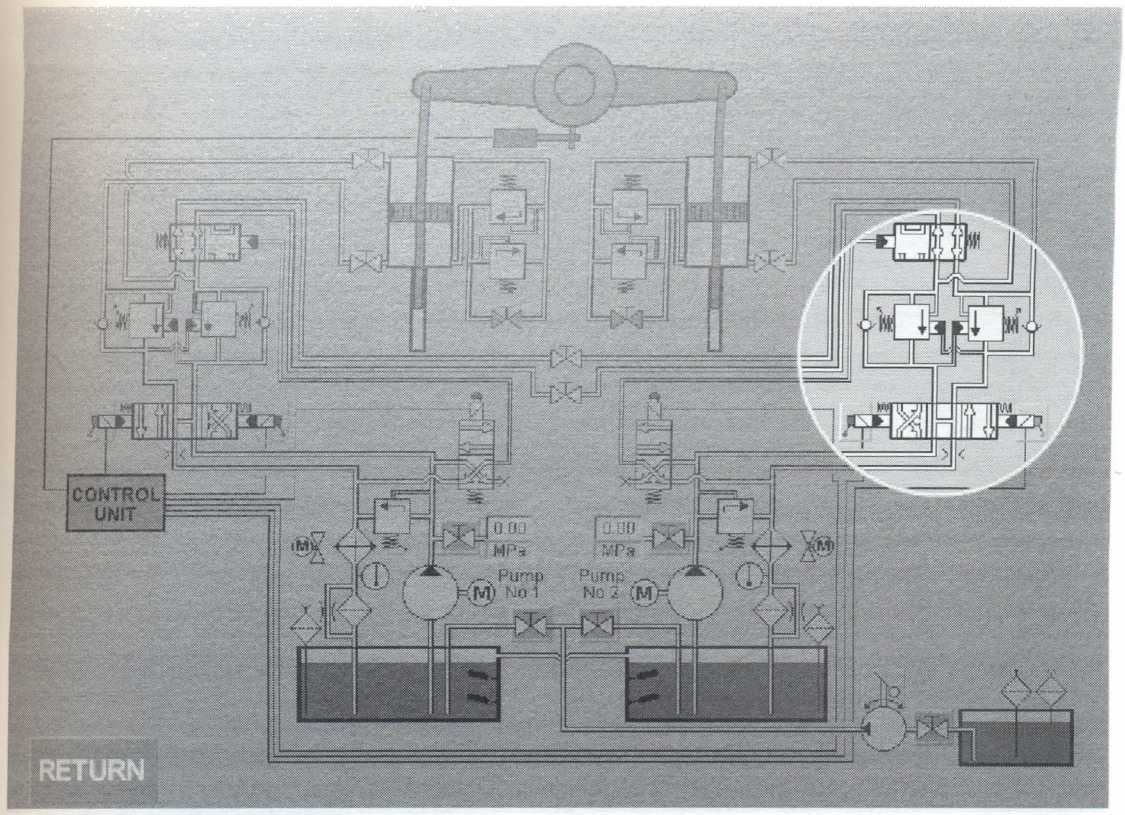

Fig. 4 Steering gear directional valve – location on the diagram

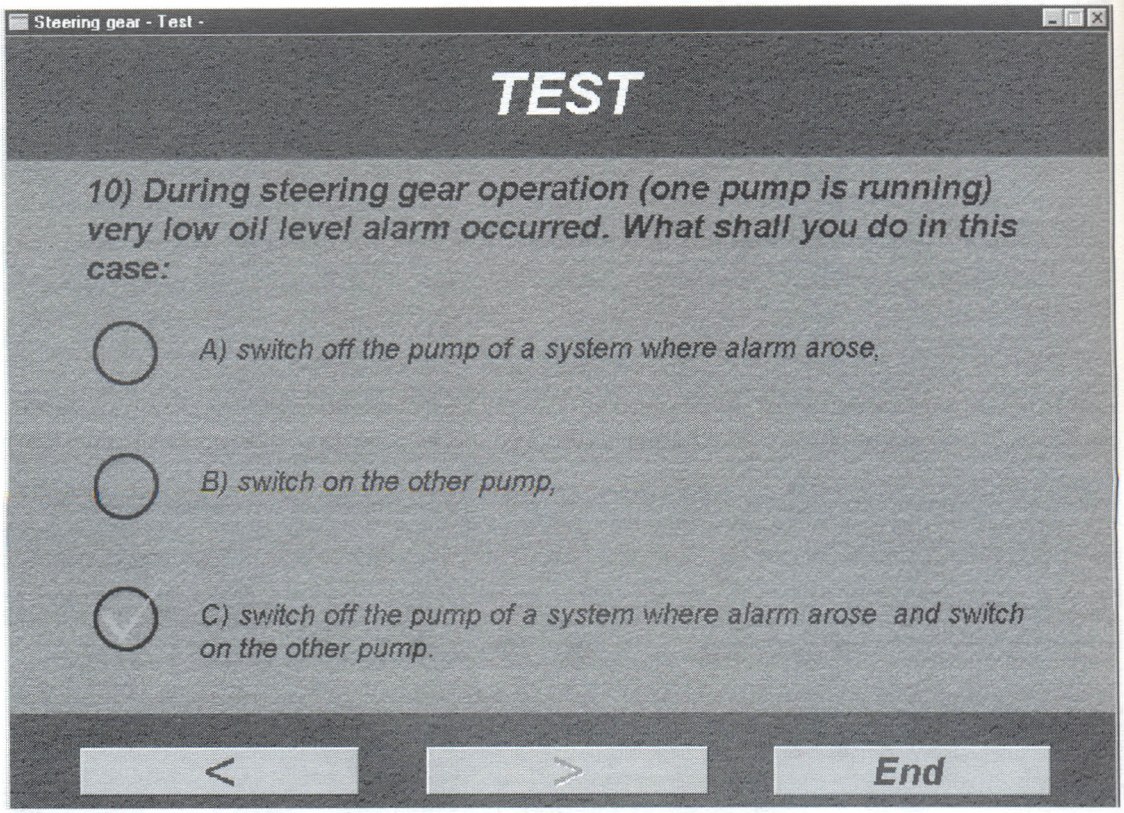

Fig. 5 Steering gear – example of test question

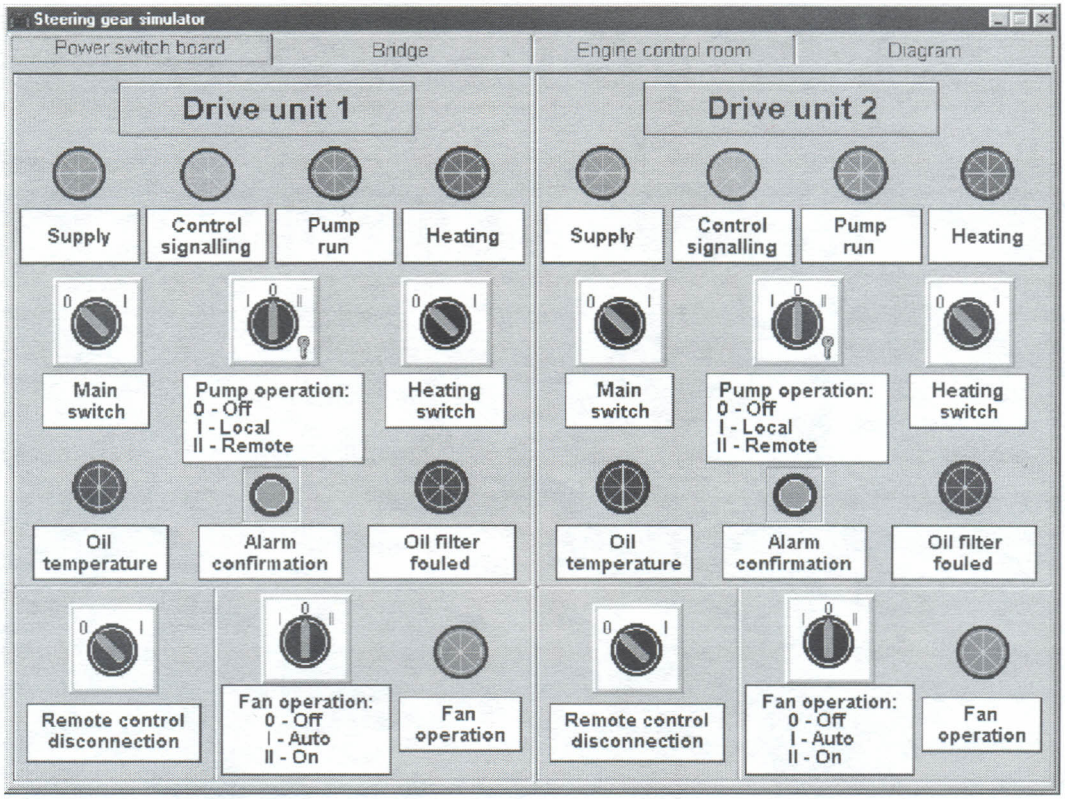

Fig. 6 Steering gear simulator – Power switch panel

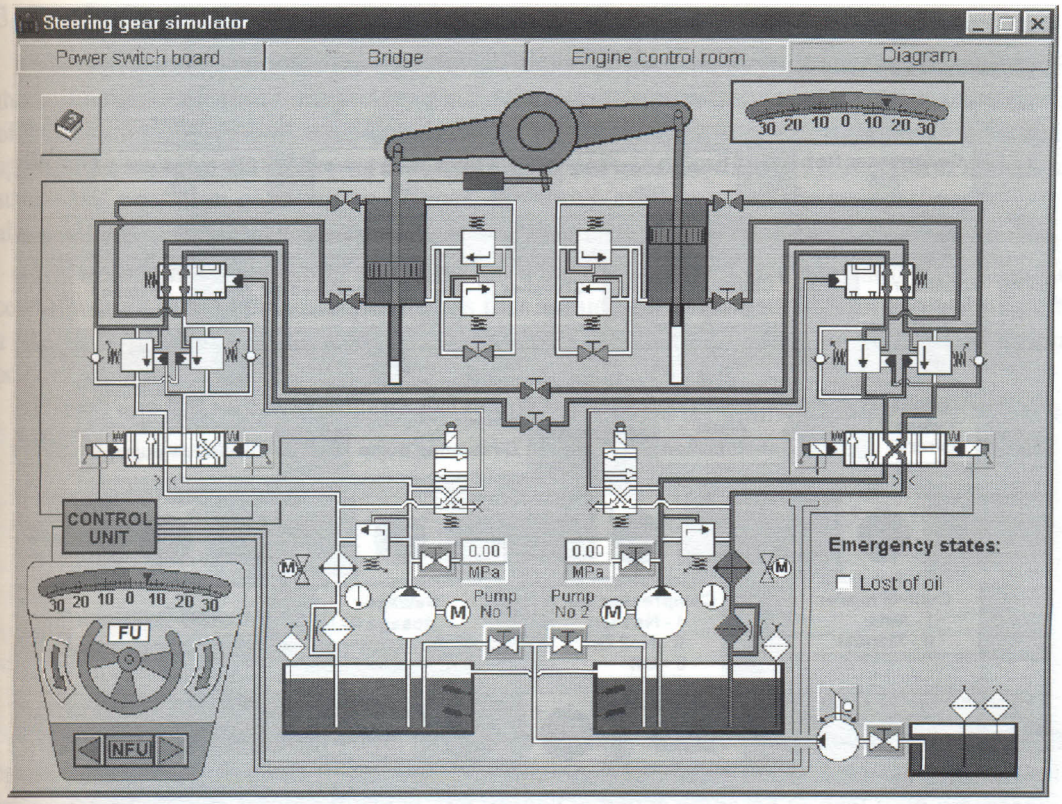

Fig. 7 Steering gear simulator – installation diagram

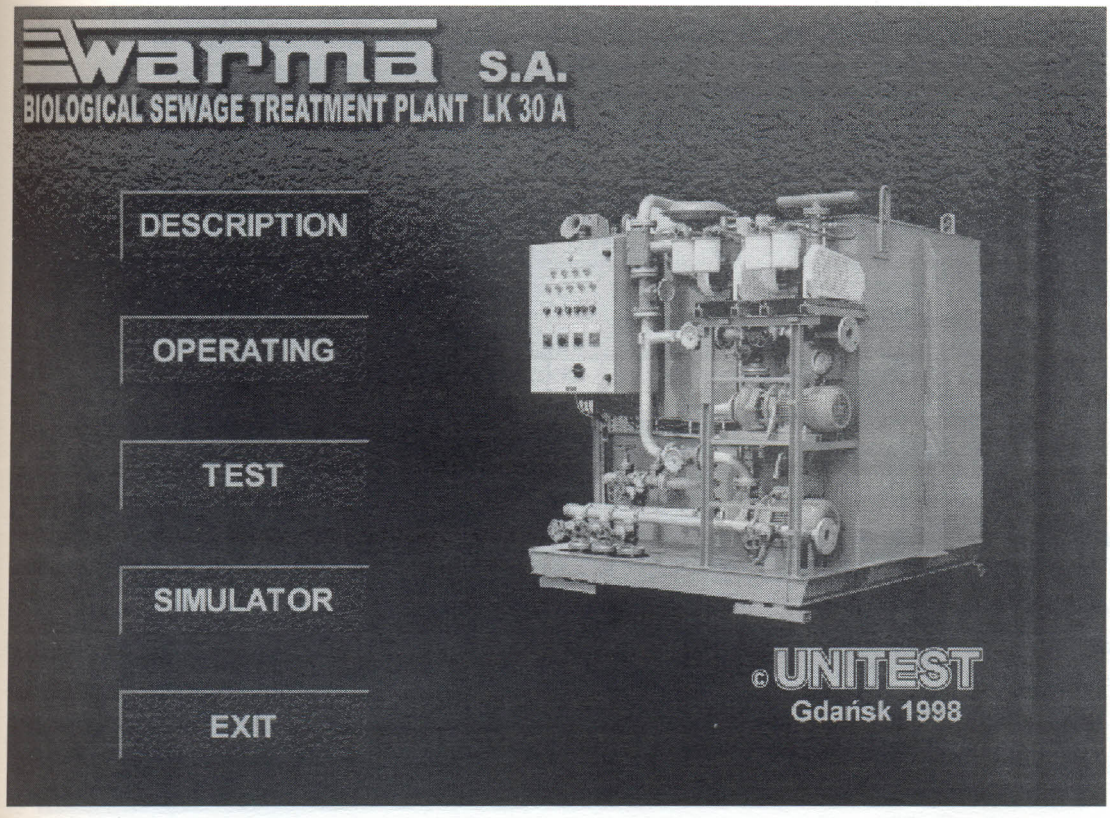

Fig. 8 Biological sewage treatment plant – general view

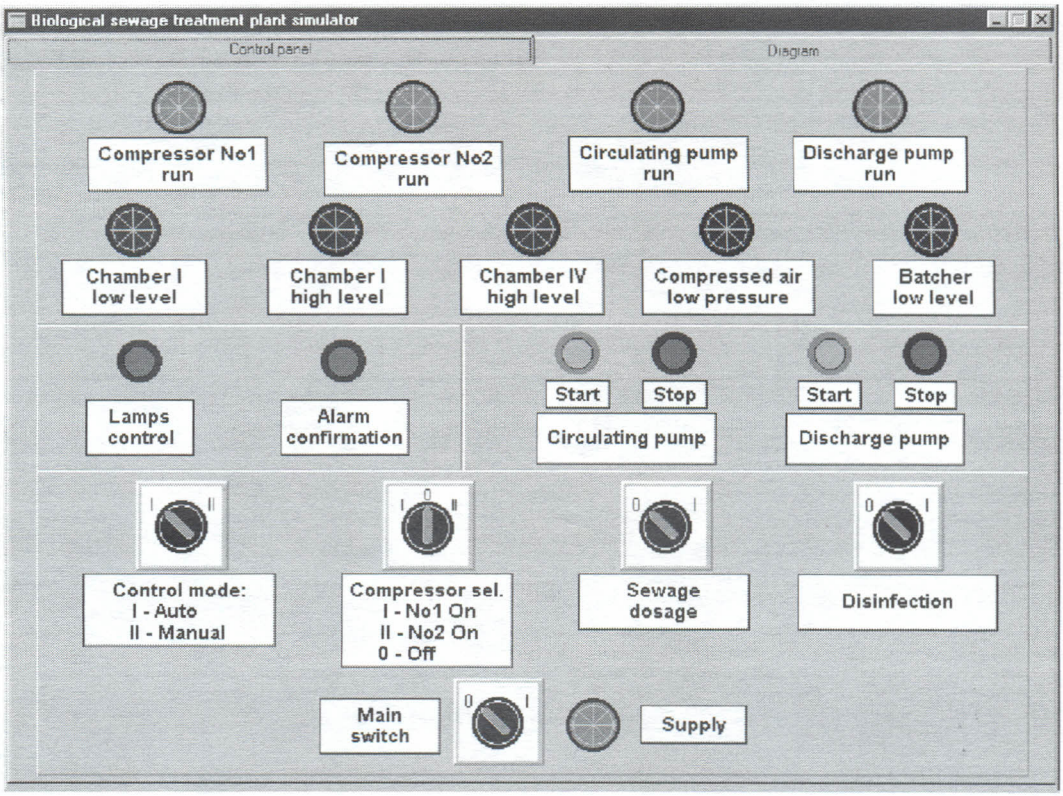

Fig. 9 Biological sewage treatment plant simulator – control panel

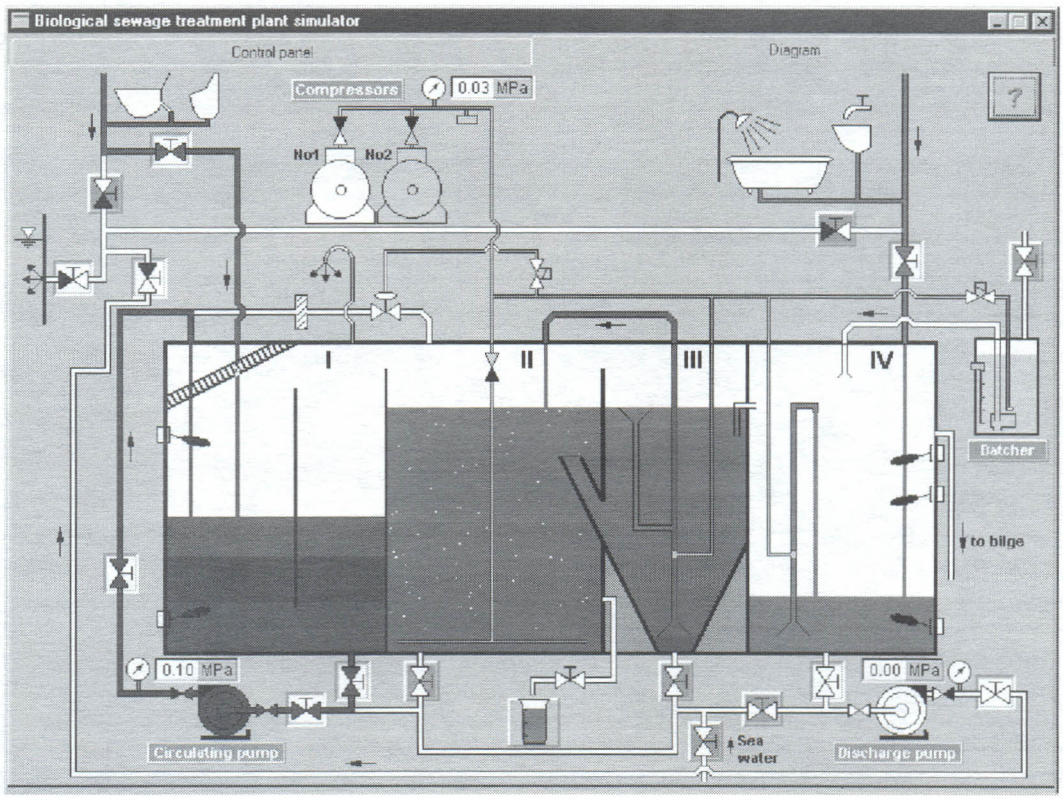

Fig. 10 Biological sewage treatment plant simulator – installation diagram

3. Conclusions

The vast experience with the utilisation of CBT – interactive programs shows clearly that these programs constitute a considerable development in the training process of engine room officers. As it has been indicated above, the CBT – interactive programs introduce a new, active approach to training that shortens the learning process and facilitates the reception and understanding of operation of maritime devices. Objective assessment of the trainees' progresses is also a quality of the use of CBT – interactive programs.

It is worthwhile mentioning that quite often the CBT – interactive programs have been successfully used in the educational schemes that include participants that return to training after a few years of professional activity, encountering problems to adapt to traditional training processes.

The list below presents the multiple CBT – interactive programs application possibilities:

- lectures
- exercises and seminars
- laboratory
- examination centres
- vocational training centres
- individual self-training
- application on-the job training

As it has been mentioned before, the trainee not only acquires the knowledge regarding the operation of the equipment in normal exploitation conditions, but is also familiarised with emergency situations. In consequence, the trainee is better prepared to deal with emergencies during operations on board. The emergency situations may be simulated and repeated as many times as it is necessary for the trainee to achieve proper preparedness.

In order to achieve the desired training results, the CBT – interactive programs have been constructed in such a way as to meet the following requirements:

- simplicity of utilisation
- available as single PC configuration
- developed for typical ship equipment and installation, taking into account the latest technical solutions.
- prepared in strict co-operation with equipment's manufacturer / program could be a part of Operator's Guide /
- possess an attached operation's guide
- low cost
- realism of simulated systems or equipment (inclusive of process peripheral such as panels with push buttons, switches, signalling and alarm lamps, gauges , levers etc.
- high descriptiveness
- interactive learning due to computer dialogue

The above listed requirements have been established as a result of close observation of the trainees' needs and capabilities.

To summarise, the use of CBT – interactive programs increases in a considerable way the preparedness to deal with emergencies. First, it is due to the increased familiarisation with the system's construction and principles of operation. Secondly, due to the use of an interactive simulator, it is possible to achieve proper trainee's reactions to emergency situations.

HUMAN ERROR IN ACCIDENTS AT SEA

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1. INTRODUCTION

The improvement of the technique and of the accommodations, of the naval officer's training hasn't been followed, on a global scale, by the anticipated decrease in the number of the accidents at sea, thus, it is estimated a percentage of 0.20–0.40 % annual losses from the whole commercial fleet of the world, these being represented by tragedies of significant proportions (the collision of PETR VASEV cargo vessel and the AMIRAL NAHIMOV passenger ship in the Temesskaya gulf on the 31st of August, 1986, when 425 passengers and seafarers died) or by disasters as far as the environment is concerned (the immersion of the TORREY CANYON – 1967, AMOCO CADIZ – 1978, EXXON VALDEZ oil tankers; the lost one polluted the Prince William Gulf from Alaska in 1989, one of the few places of the world that had remained till then unpolluted – and KHARK 5 that in 1989 as well, ESTONIA in 1994, just to mention several recent cases).

The causes that led to such losses of human lives as well as material goods are diverse. For example, from the total losses, ~27% of the ships run aground, 20% disappear, 15% burn, 10 % sink as a result of collisions, etc.

Beyond this apparent diversity, there is a major causative factor: 85–90% of the total accidents at sea, if not more than that, are due to the human risk factor.

In the following pages I will stop only on what is called "competent people's errors", that is, on some errors of psychological nature and on the way in which they manifest in spite of the existence of a corresponding volume of knowledge and operational specialized abilities.

As it is already known, the functional relations in a socio-technical ambient such as the seagoing ship, are very complex (see figure 1) which means that there are as many factors that influence one way or another the operator-technique-task system (operator means any person from the bridge deck to the engine compartment who has to carry out a task concerning the vessel's functionality)

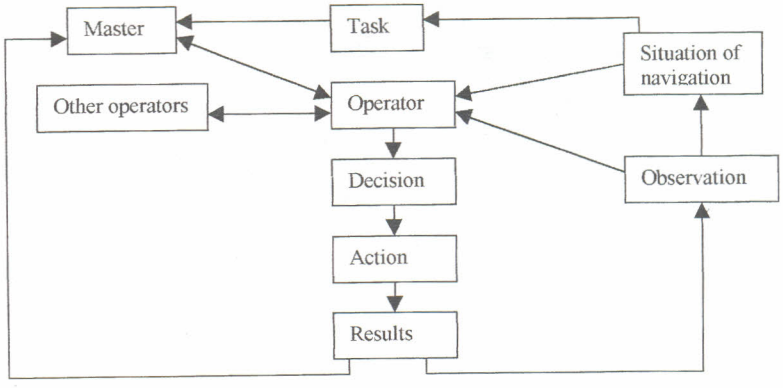

Figure 1 Functional relations in a socio-technical ambient

Some of these factors regard the communication psychology, others are ergonomically or organizational, ets.

In this study, the analysis will be focused on the variables that may intervene in the production of the accidents at sea that concern strictly the operators, namely:

1. the functionality of the individual psychic processes;
2. the complex personality features;
3. the current psycho-physical condition of the operator.

2. VARIABLES OF PERSONALITY AND HUMAN ERRORS IN ACCIDENTS AT SEA

2.1. The functionality of the individual psychic processes

The tasks of an operator may be classified, in principle, in the following main groups:

• **Stereotype tasks**. *These are well known by the operator who disposes of automated abilities* (skills) to solve them. The action is immediate and it is based on information that is analyzed at a lower level that is the sensory-perceptive level. For example, in the case of a slightly perceptible deviation of the ship, it may be returned to the correct course by means of manual control.

• ***Original (unique) special tasks***. *These tasks suppose a thinking process and the utilization* of some algorithms as well. In this sense, the tasks resolvable by means of skills are typical, the operators leaving the capacity of psychic reprogrammation, necessary to the transfer of information and action procedures from one type of situation to the other. The unquote consists both of a very reduced frequency of situations which does not eliminate the habit and also of a solicitation of originality, especially.

• **Problem tasks**. These are complex tasks for the solving of which the operator does not dispose of a schedule of actions or fairly regular rules. The solution may be found only by examining the phases of the decisional process (see figure 2) and by using different strategies: attempt and failure, multicriterial decisions, etc.

The correct, or better said, *the optimum solving of the tasks by the* operator-irrespective of their level of complexity-is impossible without the appropriate functionality of the psychic cognitive processes-whether sensorial, perceptive or logical, superior – or of the motivational-emotional nature, which will be discussed later. *A so-called negligence or inattention can be,* in fact, a deficient perception according to a certain category of stimuli or a disorder of one *mind operation* or another. An error can be caused either by the reduced functionality of the memory on short term (immediate) or by the obstruction of the segment of retrieve of some necessary information stored in the experience of the operator.

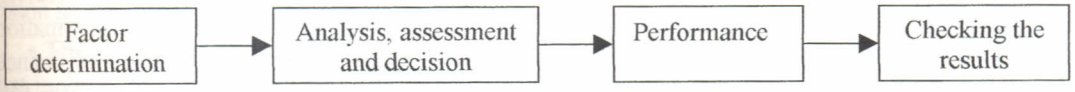

Figure 2 The phases of the decisional process

In this sense, the maladaptation to the navigation conditions represents a risk factor in the maritime navigation.

Some studies show that from the total number of the accidents at sea, 40% occur during the first ten hours from the departure. After a longer period of lying off, the seafarer is not always able to adapt to the rapid and complete pace of work.

So, leaving the port, he is predisposed to many errors, focusing less on the risks which may intervene in the navigation area.

In strictly individual cases, the adaptation may take even 3-4 days. In this period of readaptation, the activity of all psychophysical systems recovers and the perception, the attention, the orientation capacity in the actual circumstances improves.

2.2. The complex personality features

The carrying out of the unique tasks an especially of the problem tasks presupposes more profound and complex structures than those specifics to the psychic processes. It is not my intention to survey all the possible causal connections between the structures and the complex personality features on one hand, and the efficiency of the operator's action, on the other hand. I just want to underline several probable determinations that lead to errors in the operator-naval technique system.

Thus, some of the structures and complex personality features are:

• **The cognitive style**. This means the combination of the mind qualities with the level of functionality of its operations and with the system of values, opinions and attitudes of an individual and which gives some personal characteristics in the way of solving the problems, and in the development of the reasoning. If the cognitive style of an individual is brave, risky, abstract, complex, creative, conformist, dogmatic, cautious, etc., then the solution to the problem will have the same characteristics. Disorder – and eventually error – appears when a problem that would require a courageous solution is solved excessively prudently, when a complex problem is solved rather simply, etc.

• **The characteristics of the nervous system**. Manifested in temperament, may explain many of the operators' errors, superficially appreciated as negligence, inattention, so on. Due to these characteristics, the decision of the choleric is prompt but, probably deficient with regard to the comparative analysis of the consequences, as well as, in the case of succession or rapid change of the signals, much false identification is made. When the excitement is maximum, the choleric or the sanguine find their way out easier than in an understimulative situation when, apparently paradoxical, they make more mistakes. In his turn, the phlegmatic takes a very adequate but slow decision as far as the information revalution aspect is concerned. That is why the phlegmatic cannot be assigned with the subjective responsibility, because he may be in the theoretical and practical impossibility of having at least a minimum intention to prevent an accident.

• **The motivational perception**. The influence of the motivation upon the perception is so strong that we may speak about the motivation-perception structure or about motivated perception.

A state of motivational preparation may increase the perceptive efficiency or it may have negative effects such as false identifications, misrepresentations and transformations of perceived stimuli, etc. Furthermore, motivation is a factor of perception selectivity: the individuals tend to select the information they are interested in or they like and to ignore those they dislike, which produces, as we will see, numerous errors in the carrying out of the problem tasks.

Also, by virtue of the need of cognitive equilibrium, the individuals tend to "perceive" more than the place of information offers. These persons add to the perceived information everything that seems adequate in order to match the current interpretations and significance with the preceding ones, so that their system of knowledge elements to be more tolerable, uncontradictory and understandable. Or, this is done to the prejudice of the authenticity of knowledge, especially in navigation conditions, where the information is often contradictory, surprising, comparatively with the preceding knowledge, etc.

• **Motivation and success/failure**. People are different from each other in term of performances and of the motivation they have regarding the success/the failure respectively. Thus, the strongly motivated ones seek harder the success, they are more assiduous and combative, they set themselves much higher standards of performance they are very efficient in solving the problem tasks, but they may make mistakes in solving stereotype tasks.

An important implication in taking assessment of responsibility, for the management activity in general, is represented by the fact that these individuals underestimate the failure, con-

sider themselves less guilty – than they really are – There is even the risk that some structures of maladaptation to be formed in the functional relations' plan.

The operators with a predominant motivation to avoid failure intend not to make mistakes. They set themselves lower standards of activity, they carry out well the stereotype and unique tasks, but they act incorrectly as far as other tasks are concerned.

• **Emotional stability**. Understood as a capacity of the individual to resist to the influence of some strong emotional factors, is a central variable that defines the seafarer's efficiency, irrespective of his obligations. A seafarer, an operator with a deficient emotional stability (related with other factors of personality), in situations of over solicitation, manifests as lacking vigilance & concentration, mental confusion, hesitation and decisions, involving maximum effort and minimum results, trite thinking and stereotype.

And vice-versa, strong emotional stability bestows efficiency to thinking, lucidity, creativity, decisions involving minimum risk and effort and maximum results, etc.

• A complex factor that includes to a varying extent the factors mentioned above is the **level of the accepted/permitted risk**.

The objective situations a ship encounters – navigation risk areas, intense traffic, etc. – suppose a certain level of existent risk, a certain possibility that accidents might occur. According to the calculated and accepted risk by the masters (bridge officers), the corresponding safety measures are taken.

The higher the acceptance level is – when certain measures should be taken – the greater the probability of accidents.

The correct evaluation of the risk and its level of acceptance is a factor depending both on the psychological structure of the seafarer and on his professional experience. Thus, a large professional intormation, a vast management experience, rapid and profound thinking, a series of personality features (self possession, courage, lucidity, collaboration spirit, confidence in his own possibilities, rational prodence) contribute to the formation of a balanced personality of the master, able of taking adequate decisions.

• **The abusive utilization of the navigational radar** may be an effect of the lack of self-confession, of a predominant motivation of avoiding the failure, etc. It represents a risk factor especially by deciphering and incorrect interpretation of the signals. Thus, it is known that the error in azimuth diminishes from the center to the outskirts with c/a. 50% and the on in the distance determination doubles.

The error in azimuth in smaller for 0°, 90°, 180° and 270° and bigger for 45°, 135°, 225°, and 315°. Yet, generally, the biggest errors in the azimuth are in the lower part of the screen. The errors in distance are smaller along the horizontal direction (90° – 270°) and bigger along the vertical one (0° – 180°).

The correlation of the RL data with the visual observance ones (for immediate distances), with the data coming from other ships sailing in the area, or from other sources, makes the precision in determining the "target" to increase.

• **The prejudice that there is no danger within the known area** is also a complex factor that includes many variables of personality analyzed above. Thus, it is surprising that almost 10% of the accidents occur in well-known navigation areas.

It has been noticed that the better the area is known, the more frequent the seafarers – especially the younger ones – have the belief, the erroneous certainty that "nothing can happen to me here". In such situations, the concrete conditions, the modifications or the new elements are not taken into account anymore but the proceeding formed representation, how the area has been previously known. The seafarer does not consider anymore a real signal because this contravenes his subjective expectations. It is remarkable the fact that both "ADMIRAL NAHIMOV" and "EXXON VALDEZ" produced accidents in well-known navigation areas, their masters leaving the bridge (deck) after having given some advise to the bridge officers, just because "nothing could happen".

• Finally, of similar complexity as the previous factor, is the **along navigation**.

On the way back – especially when activities that require maximum solicitation have been carried out – the mentality according to which the "voyage is over" or "the tasks have been completed" may establish and the responsibility decreases. Thus, on the bridge deck few seafarers remain (along navigation), the watchkeeping (observance) is superficial, etc. (for instance the "PETR VASEV" case).

The brief survey of the complex variables of personality argues the fact that the errors of some operators cannot be explained just by the lack of some aptitudes of by a weak development of the others, but by the resort to complex structures of personality, with the value really determinative upon the performances.

2.3 The current psycho-physical condition of the operator

This category includes factors with a better-known influence, even quantified, on the operator's efficiency, thus:

• **Weariness and over-exertion**. The number of errors increases as the weariness is accumulated and stored (over-execution). Also, when tired, the tendency of giving up in front of the difficulties accentuates.

• **Tranquilizers** in excess may favor the errors, both locomotory and intellectual;

• **Stress** in not an obligatory presence anymore on the field of battle or in the activity of all operators, but probable enough.

It has been noticed that:

• In situation of stress, **decisions** are taken before all the alternatives are analyzed (because the attention is restricted).

• The preoccupation for looking for further **information decreases** and the resort to an analogical reasoning of a previous experience generates stress.

• Having at disposal a rather short time for taking a decision, and the **action of the stressing** factors being so rapid, the operator chooses an actionable alternative which eases the situation although for a short period of time.

• Due to the sam reasons, the operator seeks with frenzy a way out of this stressing situation and keeps on **changing the decision**, according to the new possibilities.

From the analysis of the three categories folows that the error in the operator-technique systems is multideterminated (see figure 3), because it is the results of the inter-contidioned action of more variable (features) of personality, hence the conclusion that the preventive actions are as complex.

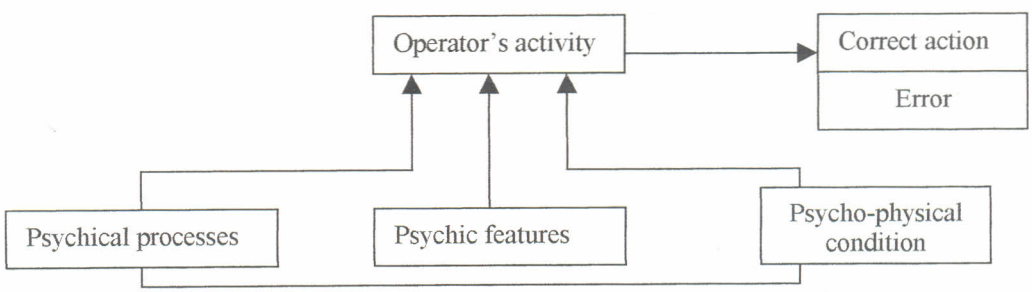

Figure 3 The multiple determination of errors in the operator-technique sistem

3. PSYCHOLOGICAL ERRORS IN DECISION TAKING

Psychological errors in the operator-technique system come from the mechanism of influence on the operator's efficiency by the personality variables mentioned above.

The most importnant – and also the least known – manifest in the problem tasks solving, thus:

• **Error of tolerance (acceptability)**. A modality of action in chosen just because it is easier to handle;

• **The effect of illusory-correlation**. If the operator had a similar problem in the past which was successfully solved using this method, then he has the illusion of a sufficiently typical connection. That is why, discovering that the new problem is similar with the previous solved one, the operators may use this method without a close examination of the new problem. Or, this sort of transfer is not always valid.

• **Conflicting inertia (knowledge conservatism)**. The operator takes a decision, but he is still receiving information that, objectively, would require the revision of the decision. However, he does not want to change his decision and ignores the new information, which is inconvenient for him (defending mechanism against the cognitive discordance)

• **Conflicting change**. The operator chooses the alternative that draws more his attention but not considering an essential parameter for the solving of the task.

• **Knowledge radicalilsm**. He gives a great importance to the new information, although they are not so important. The operator give up his previous decision and takes another one, etc. Or, it seems that an acceptable decision is more efficient than a perfect but temporary one, although, practically, it is not functional.

• **Hyper-vigilance error**. Is complex, partially including the preceding errors. Panic-stricken for one reason or another, the operation desperately searches for a solution, making use of minimal optional criteria, operates unimportant modifications, when radical ones would be necessary, decides according to what the majority wants and gives a great importance to the analogies with the past, etc. The operator wants by all means to show that he is taking action, this being self-amenable decisions.

• **Inadequate optimism**. The alternative that seems the most useful and appreciated as the easiest to complete;

• **Tendency error**. Appears when the operator is obliget to take action in emergency situations, when he has to eliminate the danger. All his attention is focused on the factor that alarms him, ignoring other factors, apparently insignificant or harmless, but very useful in the solving of the task.

• **Defensive ilusion**. Consists of the delay of decision, of the transfer of responsibility upon other people, or of construction of some imaginary reasoning which is meant to exonerate the operator from the possible negative consequences of his decision.

• **Over-determinate decision error**. The operator has the tendency to keep on looking for more information, because this strategy brings back his confidence. Yet, the price for the increase in confidence is the extension of the time for taking a decision and the decrease in precision.

4. DIRECTIONS OF ACTION FOR ERROR PREVENTION IN THE SOCIO-TECHNICAL SYSTEM

In principal, the directions of action for the prevention of errors in the socio-technical naval system are:

• The selection of the personnel using multiple psychological criteria and also considering the complex structures of personality. It is known that the selection and the distribution of the personnel in military specialites according the some psychological criteria represent consider-

able advantages. The cost of the pesonnel training reduces by 30-40% and the training time is shortened 20-30% without diminishing its efficiency. The possibility of breaking the technical systems because the operators reduce by 40-70% and, generally, the capacity of man of acquiring superior deferent levels of speciality can be estimated with a probability of 80%.

• Drills in specific conditions: it is admitted the fact that the precision of decisions increases along with the experience and in can be practiced; as an effect, the operator will adopt a vigilant behavior; he will search for relevant information, he will assimilate it in a controlled form and will estimate carefully the alternatives before taking a decision;

• The rational organization of work;

• The acquirement and the improvement of euristhic thinking, the operators' training in a perceptive that aims at complex fight and often chaning situations, with unlimited possibilities of training methodology improvement, represents not a universal panacea, but a realistic strategy; if not the only one.

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SAFETY, ATTITUDES OF PRACTITIONERS TO UPDATING COURSES AND THE ROLE OF CONTINUING MARINE EDUCATION IN AN ERA OF LIFELONG LEARNING

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Abstract

The willingness of practitioners to participate regularly in updating courses is crucial to maintaining and enhancing their professional knowledge, competencies and skills. In order to minimise the risk of professional incompetence being cited as the cause of marine accidents, suitable courses must be provided in a guise which practitioners are willing to attend, and as a prelude to devising and providing courses, it is essential to understand how maritime professionals perceive the role of updating courses. A review of the perceived updating needs of practitioners from a range of industries is also presented as a benchmark. Results of a recent survey of the perceived professional updating skills requirements of postgraduate alumni from Masters level courses in International Shipping and Logistics at the University of Plymouth are reported, in which risk management emerged as a common concern. Their perceptions of the attractions and barriers to attending suitable updating courses are discussed, along with other concerns which they raised in this context. Finally, the paper concludes with a review of the implications of the experience at Plymouth and elsewhere, for ensuring that as many maritime professionals as possible are attracted to courses which maintain and enhance their skills base, thus reducing the risk of future marine accidents due to professional incompetence.

Introduction

The willingness of practitioners to participate regularly in updating courses is crucial to maintaining and enhancing their professional knowledge, competencies and skills. In order to minimise the risk of professional incompetence being cited as the cause of marine accidents, suitable courses must be provided in a guise which practitioners are willing to attend, and as a prelude to devising and providing courses, it is essential to understand how maritime professionals perceive the role of updating courses.

Up to 80 per cent of all marine accidents have been attributed to human error (Donaldson, 1994,72), and in turn most marine pollution (Donaldson, 1994, xxv). Although it is "always idle to seek to change human nature... the answer to the problem lies in working with it and seeking to provide incentives and encouragement for the adoption of the highest standards at every level." While Donaldson showed how a safety culture affording safety issues a high priority in both the boardroom and the ship was the surest way forward, the need to "encourage and support" the best companies in managing their responsibilities implies a need for updating courses to support them. Managers need educating in new risk management procedures in

shipping, no longer based on sets of prescriptive rules, but rather on risk-based inspections which guide maintenance priorities, risk based classification rules and Formal Safety Assessment (Matthews, 1999). Under this approach, the costs and benefits of proposed legislative changes are systematically evaluated in order to balance safety and cost concerns.

This paper explores models showing how continuing professional development (CPD) has assisted practitioners in other professions, and reports on a survey of the attitudes of postgraduate alumni from Plymouth shipping courses towards updating short courses. The role of such courses in providing the encouragement and support for both individuals and organisations which is needed to nurture a safety culture is also considered. The needs for updating courses are reviewed, reflecting organisational changes promulgated by a dynamic global economy, external professional stimuli including the need for CPD, and many hidden benefits to participants, including benefits to course providers as evidenced by a "Teaching Company Scheme". The challenges of an era of lifelong learning, including its benefits as evidenced by the "Work Keys System", issues of how to promote such schemes, and the need to provide adequate recognition of CPD are discussed. The methodology and details of a survey of the attitudes of Plymouth postgraduate alumni towards updating courses are outlined, and the results are considered in relation to the expressed preferences of alumni in terms of course content, the reasons why such courses might attract them, and any barriers to attendance which they perceived. Finally, ways in which the gulf might be bridged between what is professionally desirable and the existing CPD activity of those surveyed are considered, as a possible ways forward towards propagating a marine safety culture.

Continuing professional development in related professions

The impacts of external global economic, legal and technological stimuli which may occasion change in maritime organisations, with all their attendant risks of operational failures and even accidents during transitional implementation phases, are well known. One way to minimise such risks is to study and learn from useful models for implementing cultural changes in other organisations, elsewhere in the supply chain, which have been developed. Staff training plays a vital role in implementing organisational change, and attention to the behavioural elements of managing the dynamics of change in the supply chain is known to be crucial if an initiative is to succeed (Easton *et al*, 1998). For a new organisational culture to develop to match a new strategy, it is essential to be sensitive to and manage human resistance, and to enable people to develop and re-skill. Systems of working procedures need to be designed and adopted, different types of decisions may need to be made in different ways, new infrastructure involving new information systems may be required, and usually, ongoing services must continue to function whilst the new regimes are established, without any breaks in operations.

In order to begin to change an organisational culture, comprehensive change and development training programmes are needed, which commence with re-orientating key change leaders or change agents who will promote changes amongst their peers. As a priority, their group communication and presentational skills may need enhancing, in order to encourage them to lead discussions and feedback progress to senior staff. Change leaders need to be enabled to know when to intervene in the change process, implying that they may need training in organisational behaviour and the psychology of change. Eventually, as change leaders move into new positions, they will require broader leadership skills, and may also need to understand and be able to communicate with other skills groups who are also involved in the change process. Beyond the change leaders, all staff will require training in how to perform new tasks, and work with new personnel, and new performance and reward structures will need to be devised. Simulators and other advanced technologies may be able to fulfil some of the training functions where the costs of incorrect actions by operators may be catastrophic. At sea, where the risk of loss of life, or serious environmental or economic loss is very real, these approaches have proved invaluable.

In the engineering professions for example, external professional developments have forced substantial strides towards defining effective strategies for ensuring that successful continuing professional development (CPD) programmes are implemented (Senior, 1995). By promoting the ongoing maintenance and enhancement of professional standards, it is envisaged that the probabilities of professional incompetence being cited as the cause of operational failures should be minimised. In particular, the issues of attempting to establish a learning culture through the promotion of CPD are well defined. Problems of smaller organisations which lack the resources to promote such schemes, with the onus for competence acquisition becoming focused on individual employees, are overcome through public standard setting agencies which are required to ensure that standards are maintained. It is important to persuade individuals that CPD is not merely a response to change, but should be pro-active in driving the change process both within themselves and within their organisations. The promotion of CPD necessitates an appeal to both the professional responsibilities of individuals to seek to continuously update, and the provision of an attractive and flexible set of activities through which to do so. The issue of setting standards involves individuals managing their own CPD, but also recording their achievements and supporting the learning of others where possible. Activities that contribute to development are wide-ranging and can include making presentations and writing papers, attending professional meetings and seminars, attending formal courses or distance learning programmes, and self-study or special secondments. Although various accreditation processes for measuring the attainment of learning outcomes are possible, the issue of recognition, and hence providing sufficient motivation with which to encourage all professionals to participate, has been problematic. Especially where membership of a professional body is not integral to the right to practice in an occupation, it is essential that each employee feels that they can both define their own CPD activities and requirements, and also own the whole process, if it is ever to be really effective. The key to the success of a scheme depends on being able to motivate all professionals to participate and continuously upgrade themselves through participation in the scheme.

Hidden benefits, over and above the tangible increases in the competencies of course members or reduced accident risks to the organisations employing them may accrue to all stakeholders participating in the updating process, including academics or other providers of courses. Some experience relevant to specialist marine education has been reported in partnership schemes, including one between the local university and the Devonport Royal Naval Dockyard at Plymouth (Burns, 1996). Under this so-called Teaching Company Scheme (TCS), three stakeholders including the company, the individual and the university were defined. Benefits to the latter, although arguably less tangible than to the other two participants, were substantial. New teaching materials acquired included a rich source of case studies and tutorial examples, and the company also provided visiting lecturers and hands-on problem contexts within which to contextualise challenging student projects. TCS Associates were encouraged to register as postgraduate students on higher degree courses, with the courses themselves benefiting from being more closely structured around workplace requirements, where modules of study were readily repackageable into flexible formats available for other users including short courses. In addition, there was scope for Associates to register for doctoral research, thereby raising the profile of the department concerned. Involvement of academics in the scheme contributed to their staff development, in addition to providing experience to assist in other course developments at the university, financial benefits through equipment transfers, and welcome contributions to academic salaries. The TCS provided one scheme under which, although the number of Associates gaining direct training was finite, each partner gained substantial tangible benefits raising their operational competence, plus other less tangible benefits.

The "Work Keys System" was devised in the United States as a response to the realisation that "education and adult life, especially work, are consecutive rather than concurrent" (Ferguson, 1995). In a lifelong learning environment, it is understood that traditional educational programmes must adapt to prepare their participants more fully for the world of work, and also that new partnerships will be needed between industry and institutions of higher edu-

cation to cater for the ongoing educational needs of employees. Academic diplomas must cease to be viewed as entry-level gateways to employment, where a gap has developed between the occupational skills requirements and the outcomes of educational courses. In a new tripartite arrangement, academics must be able to develop flexible approaches to learning which match employees' specific needs; employers' roles in defining curricula are likely to increase, and learners need to know what is required of them. The Work Keys System was devised partly to encourage a common meaningful vocabulary between industry and academia. In this interaction, terms were redefined, where the term "reading" for example ceased to represent a literary exercise based on impressions and opinions, becoming rather an exercise in the use of information in a problem-solving setting. Following on from this dialogue, workforce skills could then be upgraded. Job profiling, a process in which the various skills and competencies demanded by a particular job are defined, was linked with assessments of the skills and abilities of potential incumbents of the role, before targets for their instruction were defined which would enable them to fulfil this role. In the process of recording participants' progress during training, information on the skill levels attained by individuals was reported. Reporting also included normative reports of group performance, and any additional information which linked the individual's choices, experience and reports of any help they might need in acquiring new skills to gain suitable employment. Using this System, as new skill requirements are defined by the workplace, so new sets of skills can be recognised and refined, and the potential demands on individuals seeking to acquire them can be communicated to workers. These skill sets include both generic and job-specific skills, but at any level, clear progression to the next level is evident for all that seek to attain them. For any individual in the scheme, learning becomes a lifelong process, maximising their ongoing operational competence, and minimising their accident potential.

Unless employees can be encouraged to participate in training, their risk potential may increase. The problem of promoting lifelong learning has been addressed through a tripartite strategy of co-operation between a university, individuals and a company (Otala, 1994). A "competence to develop" strategy was afforded by the link between the university and the company; "strategic capabilities" were provided by links between the university and the individual through lifelong learning, and "operational capabilities" were provided by links between individuals and the company. Lifelong learning can represent a form of human recycling in which the individual is reinvigorated, although in the times of increasing job uncertainty, public accreditation of company training schemes becomes essential. In order to establish the partnership between organisations and universities, they need to work jointly together to establish strategic training needs, and analyse the training and education requirements. Counselling may be required, as may collaboration with individuals, before decisions are taken regarding the channels with which to distribute the educational process. Networking also assists in helping industry to define its ongoing training requirements, before eventually developing effective educational services and finally finding acceptable means of accrediting them. Taken together, these approaches could promote lifelong learning through satisfying the development and updating requirements of all three parties involved.

The issue of defining a suitable framework for recognising lifelong learning has been debated and operationalised even at the most august universities (Hendry and Waltham, 1998). Traditional provision of short courses, which afforded technology transfer and hence development of a competitive advantage for businesses at Cambridge University has been supplemented by attempts to develop longer-term relationships with organisations. The process of developing rather than training employees involved them in managing their own learning, and devising a system for recognising such learning proved essential. It was necessary to develop flexible learning programmes which were not dependent on external academic qualifications, which were tailored to the needs and study patterns of particular individuals. A "Mastery of Best Practice" system, company-specific, recognised the need for individual development plans, where each employee set their own targets, prioritised their development needs and identified their learning opportunities. Individual learning needs were defined in relation to corpo-

rate strategic objectives, and the employee's role in relation to them, accompanied by company-wide competencies defined in precise developmental needs terms. Courses were supplemented by on-the-job training, self-study and discussions aimed at developing skills and attitudes. Although awards for achievement did not afford global academic accreditation, they did have meaning within the corporate environment, and could be supported by an academic institution. Those participating in such schemes created their own specialist knowledge, and academics merely facilitated such a process, enabling professionals to become part of the community of scholars, rather than mere erstwhile observers or visitors to a traditional short course. The commitment and ownership of individuals and companies to such personalised learning is surely of the type needed to minimise accident risks.

Methodology

In an attempt to devise an updating short course suitable for Masters Level alumni who had graduated from courses such as that offered in International Shipping and Logistics at the University of Plymouth, an international survey of the current perceived training requirements of former students was conducted. A questionnaire was mailed out to almost 300 alumni who had been registered on courses which had run since 1975, although the contact addresses of many of them were inevitably no longer current. The format of several of the questions asked was open-ended, enabling respondents to express answers in their own words, and this necessitated qualitative data analysis of these replies using quantitative content analysis (Millward, 1995). This process involved analysing the verbatim statements of respondents and "tagging" particular concepts, and then recording and reporting the frequency with which each concept was alluded to, with statistical analysis proving inappropriate beyond reporting these basic frequencies. By way of contrast, the format of questions addressing other issues, pertaining to the potential content and topics which might be covered in short courses, involved respondents in being requested to rate particular subject areas and topics within them as being of high, medium or low interest. Data reported here included the combined percentages of responses in the former two categories.

Survey

The survey requested details of :

- short courses attended by respondents in the last two years
- the main reasons why respondents had attended short courses
- the main reasons why respondents might wish to attend short courses provided by their old university
- professional bodies which respondents were members of, and any attendant CPD requirements
- their preferred location, duration, timing and mode of attendance at short courses
- ratings of the desirability of the potential subject matter and content of short courses which they would wish to attend, included under six broad headings, each subdivided in turn into 10-12 topics.

Preferred course content

In order to assess the topics of interest to potential attendees at short courses which might be provided, they were asked questions about actual courses which they had attended recently, and the characteristics of courses which they might seek to attend in future. Of the 31 alumni who responded to the survey, half had attended some form of short course in the previous two years, with an average attendance at one course per year each, and a wide range of course providers had been involved. The introduction of ISM codes was the major single theme of courses which they had attended, affecting some 40% of those who had been on courses. The

topic of auditing was the second major theme, covering 25% of courses attended, but otherwise the lists of course topics attended were very broad. Half of the courses which they attended had lasted 2 days, with the rest of between 1 and 5 days duration, and employers had funded attendance at two-thirds of the courses.

Details of the content of courses which potential attendees might be attracted to are shown in Tables 1 and 2, where the percentage of respondents who recorded topics as being of either high or moderate interest to them is shown. This information gives some indication of the concerns which they were feeling at the time of their response, with concerns related to risk predominating. In the financial section, concerns over a single European currency and falling interest rates may have influenced responses, but with both implying uncertainty over profit

Table 1. The percentage of respondents as least moderately interested in the topics shown.

1. International Financial Management for Shipping	% of respondents
Hedging techniques for currency risk management	88
Commercial risk in international shipping	71
Interest rate risk management	70
Hedging shipping market risk	67
Credit risk in shipping	61
Forwards, futures and options in currency risk management	59
Forward Freight Agreements	55
Currency risk management in liner shipping	50
Hedging bunker price risk	45
2. Business Systems and Operational Research	
Risk analysis in shipping and logistics	87
Techniques for structuring business problems	78
Updating of spreadsheet skills	69
Soft systems in shipping and logistics	65
Game theory and shipping business	65
Systems dynamics in shipping	64
Investigating shipping problems in developing countries	61
Techniques for routing and scheduling	61
Decision theory in shipping business	54
Modelling congested systems	44
Using mapping techniques to structure problems in logistics	43
3. Strategic marketing and management in shipping	
Strategic choice in shipping	82
Strategic evaluation in shipping	82
Strategic direction and strategy formulation	81
Information and control in international management	77
Market auditing / SWOT analysis	77
Human resources management in shipping	73
Strategic implementation and control	73
Planning, policies and strategies in shipping	68
Organisation and structures in shipping companies	59
Theory and practice of ship management	59

Table 2. The percentage of respondents as least moderately interested in the topics shown.

4. Issues in shipping law % of respondents	
General average	76
Marine Insurance	75
Arrest of ships and maritime liens	75
Limitation of liability	75
Ownership, registration and mortgaging of a ship	71
Admiralty Jurisdiction	71
Salvage	71
The ship within public international law	67
Port State Control	67
Safety conventions	66
Pollution conventions	66
5. International Logistics	
Global supply chains	61
The impact of policies of world trade organisations	60
Enterprise resource planning	57
Through and combined transport	57
Law of international "non-marine" transport.	56
Third party logistics	52
Logistics in developing countries	48
Insurance in international logistics	48
Structure and organisation of marketing channels	47
Multinational corporations vertical marketing systems	43
Logistics in Eastern Europe	43
6. International Physical Distribution	
Law and legislation in the handling and movement of goods	86
International trade communications systems	67
Commodity characteristics and classification	67
Hazardous and dangerous goods.	66
The law, technology and commerce of intermodalism	66
Developments in handling systems and unit loads	62
Materials handling management	58
Materials classification systems	52

margins they could potentially stimulate cost cutting measures with implications for accident risks. A concern to quantify such risks, in turn demanding an ability to structure complex problem contexts, and upgraded spreadsheet skills is also apparent, along with an interest in game theoretic computations of the payoffs associated with particular strategies. Logically, given these concerns, the need to be able to formulate, evaluate and make strategic marketing choices with which to be able to respond to these uncertain conditions is also a priority. Associated legal issues, including liens, insurance, general average and liability are merely extensions of the same basic concern to manage the initial sources of risk. Related to this are concerns over the legal elements of handling and moving goods, but other elements of international logistics are more limited concern in this particular context. This prime concern of managers to equip

themselves with the skills required to handle risk represents a genuine willingness to ensure that the conditions under which accidents can be minimised are likely to pertain. The responsibility of course planners is to harness this willingness and find the most effective means towards enabling managers to acquire and hone new skills as quickly as possible. Part of this process involves establishing the factors which will entice them to attend suitable courses.

Table 3. Some verbatim replies to why alumni wished to attend short courses.

What are the main reasons why you wish to attend short courses? The frequency of responses are shown in parentheses (3).
To keep up with recent developments (7)
To improve my know how (6)
To gain new professional knowledge (5)
A need for ongoing training and academic support to my professional career
I only have time to attend short courses to upgrade knowledge
Updating in management techniques and issues
To develop a higher professional standard
To catch up with innovations in the shipping industry
To get an update on the shipping environment, improve my knowledge of stocks, and broaden my views on shipping business
Direct added value to my employment
Corporate reorganisation and a new IT system created a need for training
Part of my graduate training includes a course preparing me for examinations of a professional body.

Perceived benefits of attending courses

Table 3 summarises some of the verbatim responses and qualitative content analysis of replies by alumni wanting to attend short courses. Although a desire to update knowledge featured as the prime concern, the desires to deepen and broaden their professional knowledge and understanding were also apparent. In some cases, all three were present for one individual, although these were not necessarily the causal reasons for seeking to attend courses. Cases were cited of organisational restructuring occasioning a need for new skills, a desire to add value or be more effective in their employment, or a desire for professional development or achieving the professional requirements of a professional body. These reasons for attending updating courses indicate that course providers must cater for a broad range of individual needs, creating a challenge to channel them into an effective and attractive format which is able to meet these needs.

One third of respondents were currently members of a professional body, of whom only one half were undertaking some form of CPD, with this activity including attendance on courses, giving lectures and seminars, research activities and private study. The gulf between the realities of the actual CPD activity of practitioners as surveyed here and desirable levels as indicated in the literature review, indicates a need for initiatives to raise awareness of both the importance of such activity, and the ways in which it might be conducted among professionals in marine studies.

Bearing in mind that this was a survey of alumni, and hence respondents were already familiar with activity at Plymouth, many were attracted by the desire to return to this particular learning environment in order to satisfy their current perceived study needs (Table 4). Of

Table 4. Content analysis of the reasons for wanting to attend short courses at Plymouth

What are the main reasons why you wish to attend short courses in Plymouth?	Frequency of responses.
The university has a good reputation in shipping	10
The university offers me an opportunity to acquire new knowledge through providing high quality courses	8
I am familiar with the university, and my earlier experiences were good	8
To revisit the university and renew old friendships	6
The university offers me good facilities	4
It is a pleasant location	4

over riding importance was the technical reputation of the university in shipping as an academic discipline, acknowledging a desire to receive high quality tuition. The same point was evident amongst those seeking to acquire new knowledge, who expressed a concern to participate in what they perceived to be a high quality learning environment. The issue of familiarity with the learning environment was expressed in two ways, including those whose earlier experiences had been good, and those who were more influenced by a social desire to revisit and renew old friendships. Finally, and of less moment, were perceptions of good facilities or a pleasant location within which to study. Taken overall, even for returning alumni, these perceptions indicate that the perceived technical competence of the institution was considered to be paramount, including issues relating to its subject reputation, and the quality of lecturers and facilities. Issues of personal familiarity were important but secondary, and perceptions of a pleasant location were alluded to by some respondents. Although knowledge of the attractions of courses to managers is an essential input to their design, it is also essential to know what the barriers are which might deter potential attendees, in order to ensure that participation is maximised.

Perceived barriers to attending short courses

Cost, including both travelling and other costs, was the most frequently stated barrier which might deter respondents from attending short courses in Plymouth (Table 5), concerning almost half of those surveyed. Second to this, the distance required to travel to the university was significant, although many had attended short courses overseas previously. An inability to take time away from the workplace was linked with the issue of cost for some respondents, in turn linked with issues of explicit course relevance for a couple of alumni. Taken overall, it is clear that not only has a course to be perceived as "essential" by potential clients, but the overall package, involving time away from the workplace, international travel and course

Table 5. Content analysis of barriers to attending short courses at Plymouth.

What are the main barriers to attending short courses in Plymouth?	Frequency of responses.
The cost of attending courses	15
The travelling distance to the university	12
Inability to take time away from my workplace	7
I can only attend if courses are absolutely relevant to my work situation	2 2
There are no barriers at all	1

fees must be viewed as representing good value for money for them to realistically consider attending. This again raises issues of a need to market courses clearly, and to ensure that once in the classroom, the maximum use is made of what precious contact time is available in order to raise its behavioural effectiveness in the workplace.

Conclusion

This paper examined the attitudes of one group of practising postgraduate alumni in shipping in order to explore their perceived requirements for updating short courses. In seeking to work with, rather than change their human nature, as advocated by Donaldson, this study explored the possible content of courses which they would wish to attend, and investigated some of the attractions and barriers to their attendance at suitable courses. Expressed topics of interest included elements of risk assessment and management, including financial considerations, methods for exploring complex problem contexts and quantifying risks, spreadsheet approaches to risk analysis, and issues of strategic marketing were also raised. The main barriers which might prevent managers from attending courses included time, distance and cost, each of which imply a need to develop either more flexible modes of delivery for CPD, or special incentives to encourage attendance on courses if practitioners' participation rates are to be increased. More flexible forms of CPD could include workplace staff development, which might affect the commitment and ownership of the change process by individual employees, or distance learning formats for courses, which could dilute their impact on developing social skills or attitudes which may reduce their behavioural effectiveness in accident reduction terms. If it is desirable that more shipping managers from a broader functional base attend formal courses regularly, then the ongoing monitoring and accreditation of practitioners in particular CPD activities, in turn stipulated as requisite conditions for the granting of ongoing certificates of professional competence is possible. However, by reducing the personal ownership of such activity by individuals, this approach may also reduce its impact on operational effectiveness. Alternatively, if the cost-effectiveness of attendance at courses could be demonstrated, financial incentives possibly in the form of grants to attendees or their employers awarded by national or supranational bodies might raise participation rates.

The impact of course attendance on the workplace effectiveness of individual managers and hence accident reduction rates has not been discussed here, but the general positive effects on morale and motivation are likely to have knock-on effects in reducing human errors due to low morale or outdated knowledge. If CPD in an era of lifelong learning could be regarded as proactive, leading the organisational development and change processes, its perceived attractiveness would also rise. Experience in other professions indicates that a dialogue is required involving academia, industry and individuals from late adolescence to retirement in redefining the nature and content of educational provision for the maritime industries. Teaching Company Schemes for aspiring managers have proved beneficial to all parties involved and customised workplace staff development schemes have also proved effective, although the issue of finding appropriate recording and recognition of training remains. There are considerable grounds for optimism concerning both the range of CPD schemes which could be devised and the willingness of individuals to participate in them, and their potential for accident reduction. However, the precise mechanisms required to mobilise the resources needed to translate these schemes into positive CPD activity, and the form of any sanctions applicable to those failing to comply must be defined before the benefits of reductions in operating losses are reaped. One part of the process of developing an effective maritime safety culture will surely involve individuals engaging in lifelong learning regimes, with regular participation in short courses forming a useful component.

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USE OF THE SHIP ELECTRICAL POWER STATION SIMULATORS FOR IMPROVING EMERGENCY PREPAREDNESS OF STUDENTS AND ENGINE ROOM OFFICERS

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Abstract

The main focus of the presented paper is concentrated on the use of physical and virtual models, of ship electrical power plant generally called simulators, for improving emergency preparedness of trainees, i.e. students and engine room officers.

The ship electrical power station plays a vital role in the operation process of the ship. An appropriate quality of the produced, sent and used electrical energy is the basic requirement for correct running of all ship technical systems, some of the IMO instruments, e.g. SOLAS convention call on regulations related to this matter.

Starting from these requirements, a short description of the used simulators has been given. Afterwards, the framework of learning program and training possibilities have been described. Taking into consideration the chosen examples, among other in appropriate distribution of active and reactive power between generating sets working in parallel and worsening the electrical energy quality caused by damage of harmonic filter co-operated with shaft generators, the consequences like emergency situations will be shown. Some conclusions and proposals for avoiding such dangers and, first of all, for paying attention to such situations during the educational process will be formulated.

1. INTRODUCTION

The ship electrical power station plays a vital role in the operations process of the ship and appropriate quality of the produced, sent and used electrical energy is the basic requirement of correct running of all ship technical systems [1]. Almost every failure of ship systems such as propulsion or navigation carries the risk of a ship disaster being at the same time a threat to human life and the environment.

The voltage and frequency deviations, distortions and voltage asymmetry may cause not only the treat to safe operation of ship technical system but also additional energy loss and the decrease of ship electrical equipment durability especially electrical machines and related apparatus, e.g. elements connected with lighting and signalling [1]. It is worth to stress that electrical motors installed in ship electrical system have to operate in unparalleled in land electrical engineering conditions. Generally, motors in the considered system are supplied with distorted asymmetric voltage of a considerably changing frequency and the rms value causes summing up the different additional energy loss.

Another problem is the necessity for free standing generating sets to work in parallel [1], [2]. For safety reasons, it is necessary to maintain power surplus as a rule; it is 20% power of a single generator while at regular sailing or greater when manoeuvring. That brings some economic consequences in the form of the specific fuel consumption increase by a diesel engine and the necessity of parallel work of generating sets. But the importance of proportionate load

distribution plays a vital role just during manoeuvring, in difficult weather and navigational conditions. The results of disproportionate load distribution between generating sets working in parallel is, first of all, an apparent overload of one of the generators when there is still some power margin left. As a result of current or active power overload of one of the generators when the others are not fully loaded the disconnecting system which switches off the less important loads starts operating (Meyer's system) and when the load increases the overloaded generator is switched of automatically by the main switch. In a situation when power surplus of the remaining generators does not suffice to take over the load of the turned off generator power supply disppears in the whole electrical power network, which can cause serious consequences connected with safe operation of a ship [1], [2].

2. IMO INSTRUMENTS RELATED TO VITAL ROLE OF ELECTRICAL EQUIPMENT

The wording "IMO instruments" [3], [4], [5], [6] covers conventions and protocols accepted by the Governments of the Parties, which ratified them. In short, the principal purpose of the instruments developed under the auspices of the United Nations International Maritime Organisation (IMO) is to develop regulations to enhance the safety of international shipping. Additional aims, i.e. pollution prevention and liability and compensation for maritime claims are also included in the IMO's list of responsibilities [4], [7]. Some of its most important mandatory legal instruments, essentially international treaties, are SOLAS [8] – International Convention for Safety of Life and Sea, MARPOL – International Convention for the Prevention of Ship Pollution, COLREGS – Convention on the International Regulations for Preventing Collisions at Sea, 1972 and STCW 1978 as amended in 1995 [1], [9], [10] – International Convention on Standards of Training, Certification and Watchkeeping for Seafarers.

Except for the above mentioned conventions there are other "IMO instruments" of different character – numerous protocols, resolutions, guidance and circulars, which should be considered and respected.

2.1. Electrical, Electronic and Control Engineering in STCW' 95

There are many electrical installations of items of electronic equipment so vital that the safety of life at sea would be at risk if those installations or items of equipment failed, especially:

- main and emergency generators and power distribution system
- engine room alarm and automatic control system
- main engine control system
- steam plant control system
- manual and automatic ship steering
- gyro compass and repeaters
- internal ship communication systems
- fire detecting and alarm systems
- windlass control systems

The new training and qualifications requirements based on STCW' 95 convention are taken into consideration and introduced in the above mentioned aspects in the related chapter III, [1], [4], [6], [10] under the function "Electrical, electronic and control engineering", at the operational and management level, respectively.

In appropriate tables of the cited IMO instrument, the competence, range of knowledge, understanding and proficiency, and also methods for demonstrating competence and finally criteria for evaluating competence are presented [1], [4].

2.2. Electrical installations in SOLAS

In SOLAS Consolidated Edition, 1997 [8] we can note a special attention paid to electrical installations.

Regulation 40 of Part D [8] refers to all electrical installations of the ship in normal operational and habitable conditions as well as under various emergency conditions. Additionally, safety of passengers, crew and ship from electrical hazards is mentioned.

The next Regulation 41 is devoted to main source of electrical poser and lighting systems. The capacity of configuration of main source is determined. Moreover, some detailed requirements concerning each of the generating sets under emergency situations, for instance "the remaining generating sets shall be capable of providing the electrical services necessary to start the main propulsion plant from a dead ship condition" (42.1.4) are formulated.

Also the requirements, when the emergency source of electrical power may be used for the purpose of starting from a dead ship condition are presented in the above mentioned paragraph. The paragraphs 42.2, 42.3 and 42.4 describe requirements for main and emergency electric lighting system, main switchboard and main busbars, where the total installed electrical power of the main generating sets in excess of 3MW, respectively.

The Regulation 42 determines emergency source of electrical power in passenger ships. This emergency source of electrical power is defined under the assumption that, "the electrical power available shall be sufficient to supply all those services that are essential for safety in an emergency, due regard being paid to such services as may have to be operated simultaneously" (42.2).

Afterwards, some detailed requirements referring to the given period of time (36 hours or half an hour) and given type of emergency source of electrical power (generator or accumulator battery) are formulated. Another subparagraph is devoted to supplementary emergency lighting for ro-ro passenger ship.

The Regulation 43, is similar to 42, and describes the requirements for emergency source of electrical power in cargo ships.

Due to safety reasons very important issues re included in Regulation 44, concerning starting arrangements for emergency generating sets. The last Regulation 45 in Part D of Chapter II-1 of SOLAS [8] in connected with precautions against shock, fire and other hazards of electrical origin. Summarizing, Part D referring to electrical installations of the ship describes constructional and operational conditions as well as formulates detailed requirements for this equipment, especially paying attention to emergency situations.

3. IMPROVING EMERGENCY PREPAREDNESS OF TRAINEES OF ENGINE ROOM DEPARTMENT REGARDING ELECTRICAL POWER STATION OPERATION

In accordance to STCW'95 amended convention, the group of accepted methods for demonstrating competence consist of, among others, "approved simulator training, where appropriate" and "approved laboratory equipment training" [1], [4].

The main focus of the presented paper, is concentrated on the use of physical and virtual models [6], [9], of ship electrical power plant generally called simulators, for improving emergency preparedness of trainees. Basing the curriculum on this equipment and specialized learning program the trainees have possibilities to upgrade their fundamental knowledge concerning the ship electrical power plant, develop operation skills and train on refresh their reactions to emergency situations.

3.1. Simulator of ship electrical power plant

3.1.1. Physical model

In the educational process of engineers, serving as the officers of marine engine rooms, a physical model of ship electrical power plant is used (Figure 1) [9]. This model consists of

three generating sets in which the diesel drive of synchronized generators has been replaced by adequately controlled DC motors, of different character adjustable load and main switch board. A presented configuration will be soon development by shaft generator inclusion.

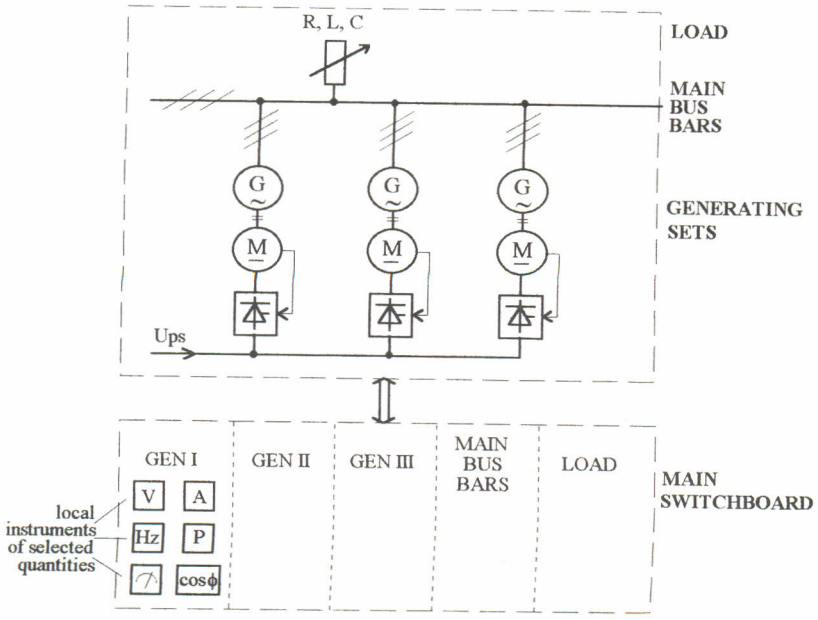

Fig 1. Physical model of ship electrical power plant

The elaborated model of ship electrical power plant is based in the first place on a realistic hardware layer since the purpose of classes is to familiarise students and course participants with the physical aspect of the phenomena connected with ship electrical power plant running.

3.1.2. Virtual model

In order to widen didactic functions and make students work more by themselves this model can be coupled with a virtual measuring system. According to one of the most frequently used definitions, taken from National Instruments [11]:

"Virtual Instrument is a layer of software and/or hardware added to a general-purpose computer in such a fashion that users can interact with the computer as though in were their own custom-designed traditional electronic instrument". Another version of the definition is: *"industry-standard computers equipped with the company's user-friendly application software, cost-effective hardware and driver software that together perform the functions of traditional instruments"*.

According to Hewlett-Packard conception [11], the capability of using graphical software and a personal computer for processing and displaying measurement results has been referred to as "virtual instrumentation".

This therm can be used to describe the following four areas [9], [11]:

- An Instrument System as a Virtual Instrument (VI)
- Software Graphical Panel as a VI
- Graphical Programming Technique as a VI
- Reconfigurable Building Blocks as a VI

More details about all the above mentioned areas describe "virtual instrument" may be found in [9], [11]. It is worth to note, that considered "virtual instrument" is in fact a very wide term, but finally main defined functions of VI software are: D/D conversion and data presentation.

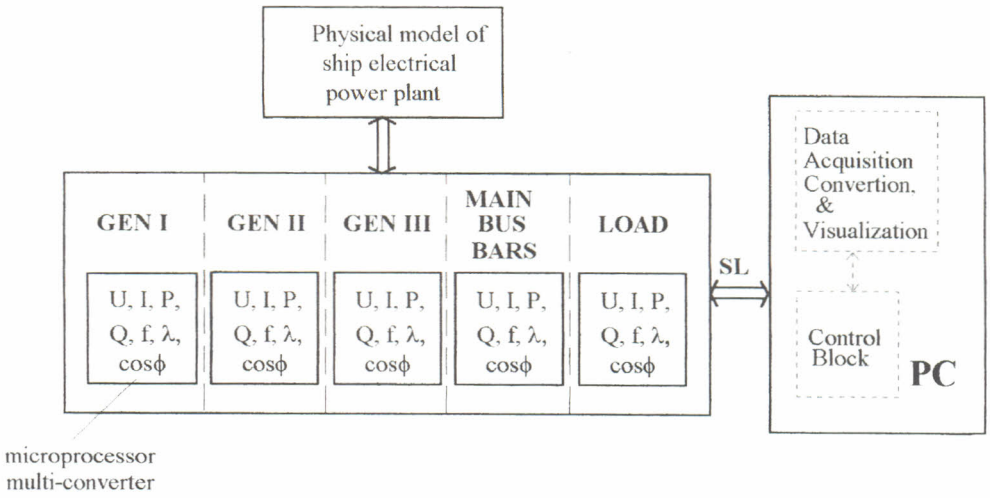

Fig. 2 Ship electrical power plant aided by virtual measurement system

In the Figure 2 hardware structure of virtual system [9] for measuring selected operational parameters of a ship electrical power plant that is voltages, current, power, frequency, cos φ and power factor with the use of original multi-functional measuring instruments [12] made by Department of Ship Electrical Power Engineering of Gdynia Maritime Academy is presented.

Measuring data are taken from multi-transducers installed in selected components of the electrical power engineering system. At present, software involving the virtual measuring system for didactic needs is being tested.

3.2 Learning program and training possibilities for improving emergency preparedness.

Learning program is based on the syllabus of studies for the specialization of "Ship Electroautomation" leading to engine room officers diplomas, particularly oriented at eletrical engineering matters and in Poland Called marine electricion officers. This syllabus covers 35 subjects amounting to 3890 hours at Academy and 9 months of sea practice. Full content of the syllabus was circulated at the 30th of STW Sub-committee session as the Appendix to the document "Education, training and certification of Marine Electrician Officers in Poland" [13]. The use of simulators is especially recommended for subjects: ship electrical equipment, ship electrical power generation and distribution, ship automatic control systems, marine propulsion systems and auxiliary machinery and technical operation and diagnostics of ship electrical equipment.

The simulators presented in part 3.1 of this paper give wide possibilities for improving emergency preparedness of trainees, in the context of SOLAS requirements [8] for ship electrical power station operation. The following functions of ship electrical power plant are accomplished during classes:

* Starting generating set
* Synchronization and parallel running of generating sets
* Frequency control and active load distribution of generating sets working in parallel
* Voltage control and reactive load distribution of generating sets working in parallel
* Checking main bus bars loads

Due to hardware layer a physical model of ship electrical power plant enables to train and refresh all manual operations related to the above mentioned functions. At the same time, a ship electrical power plant aided by measuring virtual system (software layer) gives new possibilities for diagnostics and supervising the electrical power station operation.

Built-in serial interfaces allow to send measuring data from transducers to the computer and controlling signals from the computer to transducers. Software tools installed in a computer offer a number of possibilities to use measuring results, often impossible to carry out in multi-transducers sets themselves [9]:

- analysis in output signals of measuring transducers in the virtual system enables to obtain more, practically any processed, measuring information in comparison to the conventional method,
- graphic presentation of the selected data in 2D or 3D on the screen, what enables to link causes and effects concerning operation of the specified elements of a ship electrical power plant,
- simple determination of the required energy quality rating produced and used in a ship electrical power engineering system,
- registration of the selected values according to the program determined by a system user and trend analysis of their changes in the function of given variables, among others in 2D or 3D.

All these properties may be extremely useful for improving emergency preparedness of trainees.

4. EXEMPLARY EMERGENCY SITUATIONS, THE CONSEQUENCES AND PREVENTIVE MEASURES

4.1. Improper distribution of active and reactive power between generating sets working in parallel.

In order to determine the correctness of active and reactive power distribution between generators we needed the indications specified by measuring instruments of the Main Switchboard. The best solution is a set which consists of kilowatt-meter and kvar-meter for each generator.

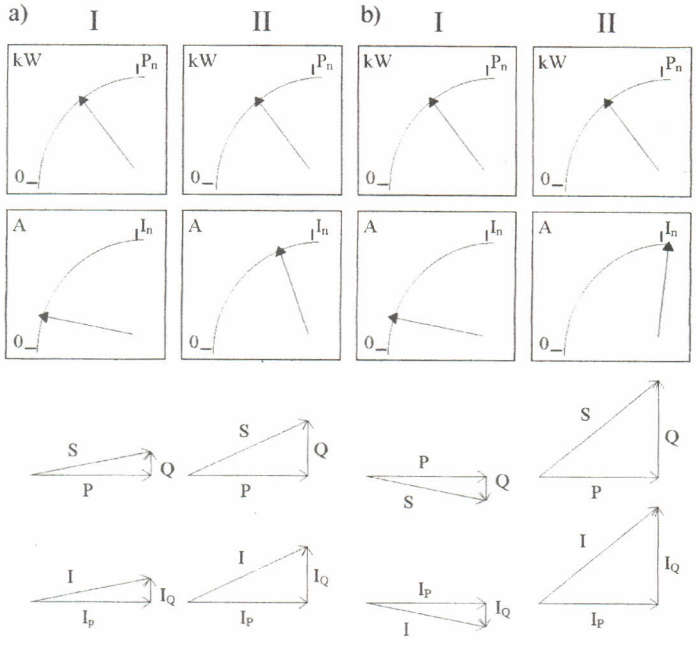

Fig. 3. Measuring instruments' indications and phasor diagrams for two generators working in parallel in the case of:
a) uniform active power distribution and unequal distributed reactive power
b) uniform active power distribution and extremely incorrect reactive power distribution (generator I gives up capacitive reactive power)

Monitoring of the generator's active and reactive loading can be carried out simultaneously. Also, we can use a single meter with the possibility to switch from active power measurement to reactive and vice versa.

In there is no kvar-meter the improper reactive power distribution between generators working parallely is difficult to spot.

In order to determine the reactive power distribution it is necessary to introduce parallely working generators into a state of proportional active power loading. It means that if there were two generators of equal rated power then we would get identical indications of kilowattmeters. The improper reactive power distribution would be revealed by different indications of ammeters measuring the apparent current but not the active one.

Exemplary measuring instruments' indications would be in the effect of such reactive power distribution as shown in Fig. 3 [2].

Fig. 3b illustrates extremely incorrect reactive power distribution. Ammeter of generator II indicates its overload at substantial margin of active power which could yet be applied to that generator. Moreover, the generator, being current-overloaded, will be switched off by the master switch of Mayer's protective system will operate, and that will happen without any real overload of electric power plant (i.e., at its apparent overload). Related characteristics U = f (Q) of corresponding cases presented in Figure 3, when the generators' characteristics do not coincide the reactive power distribution proceeds, for instance, in the way shown in Fig. 4.

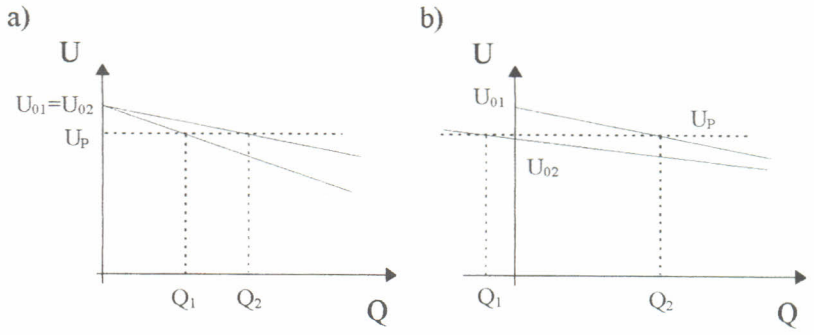

Fig. 4. Improper reactive power distribution between generators working in parallel, of the same rated power $S_{n1}=S_{n2}$, but at different external characteristics of them 2

Worthy of note is the fact, that in case a) we have equal generator idle run voltages $U_{01}=U_{02}$, but different droop of the characteristics U=f(Q). The difference in reactive power loading the generators is seen, $0<Q_1<Q_2$, at a given reactive power loading electrical power plant and working voltage U_0 identical for booth generators resulting from that. In case b) different generator idle run voltages and different droop of characteristic correspond. One of the generators gives the capacitive reactive power of $Q_1<0$ back to the electrical network, the other – the inductive reactive power of $Q_2>0$.

Reactive power distribution would be correct when at variable reactive power load in ship's electric network excitation currents of the generators change in the same way. Therefore external characteristics U = f(Q) of equal rated power generators have to coincide and to effect correct reactive power distribution this way.

In order improve this situation, generally, the crucial step is to draw external characteristics of booth generators to a common point, i.e. to level idle run voltage to the same value $U_{01} = U_{02}$ [2]. Proper active power distribution (set e.g. by hand) is a condition for correction to reactive power distribution especially when kVar-meter is not installed and ammeters indications of parallelly working generators are the only sources of data on improper reactive power distribution. The last step in reactive power correction is setting external characteristics droops

to be identical with the use of the related potentiometer for reactive power distribution control. The correction procedure is the same for different types of field regulators and it may be very easily adapted to the training program with the use of virtual model of ship electrical power plant.

4.2. Worsening of electrical energy quality caused by failure of harmonic filter co-operated with shaft generator

This case concerns the ship power station equipped with shaft generator and semiconductor converter with appropriate passive harmonic filter for limiting disturbance influence. In reality, one of the capacitors was damaged. In consequence, the asymmetry, distorted voltage waveform (Fig. 5) has been registered on the bus bars of the ship switchboard. This waveform was taken by analog oscilloscope during the normal, rut conditions of ship operation [14], [15].

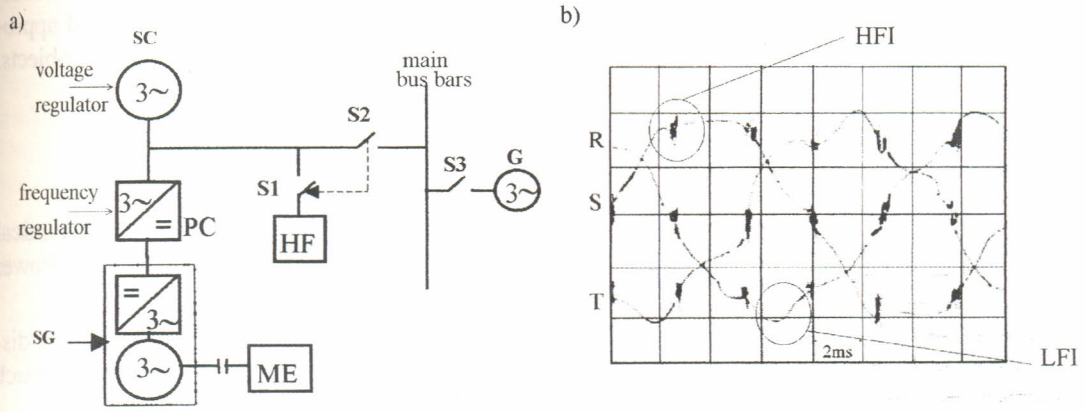

Fig. 5. Exemplary ship (product carrier) power network: a) simplified configuration b) exemplary three-phase voltage waveform on bus bars of ship switchboard: S1 – switches, SG – shaft generator, PC – power converter, SG – synchronous generator, ME – main engine, HF – harmonic filter, SC – synchronous compensator

Considered voltage oscillograms enable to distinguish both kinds of interferences, which independently influence devices and systems supplied by ship electrical power network. Low-frequency interferences (LFI), resulting from harmonic filter failure and high-frequency interferences (HFI), caused by commutation processes. Registered causes of failures concerned, among others, total hazard (accidental) switching-off of satellite communication system (GMDSS), having a vital role for safe ship operation. The failures were reported by radio to the appropriate technical services in different ports, where damages of the system were not confirmed and detected. The reason for this situation was the fact, that in the port ship electrical power system is fed only by classical generating sets and then shaft generator is out of work. Under those conditions correct diagnosis in the considered range is practically impossible and previously reported to repair devices under new conditions of supplying work correctly. The cited event is not an exception by consequences of these situations have a negative influence on watchkeeping as well as treating safety of life at sea as a wide problem.

Preventive measure for such situations would be an application of specialized electrical power analyser [14], [16] for monitoring harmonic as well high-frequency interferences, independently from each phase. This problem seems to be important because of the rapid saturation by highly advanced electronic systems for new-built ships as well as for modernization needs concerning the existing ships, e.g. based on microprocessor controllers. A general observation may be formulated, that in many situations we can not forecast future failures, especially in the context of electrical installations operation.

CONCLUDING REMARKS

One of the most important factors determining the emergency preparedness of trainees in the course of educational process is the use of simulators. Some IMO instruments, for instance STCW'95 and SOLAS conventions had a new impact on the related undertakings. The introduction of simulators into the education of engine room officers has had a number of significant positive consequences:

- The necessary time to complete an engine room officer's education has been reduced,
- The cost of education has been decreased,
- New spheres of education have become possible, in particular, advanced training,
- The standard and quality of education have been increased.

Exemplary applications of emergency situations presented in the paper occur very often in ship practice and they are extremely difficult to train and analyse on a real object. So, simulation technique gives us the possibility to train multi-variant emergency situations and appropriate reactions under these conditions, impossible or very difficult to educate on real objects.

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THE ROLE OF HUMAN FACTORS IN MARITIME CASUALTY INVESTIGATION: PAST, PRESENT AND FUTURE

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Introduction

Accidents at sea have occurred since man first set sail. The nature of shipping has changed substantially since then, progressing from boats and sailing ships to steam ships and modern day highly specialized ships (e.g., ro-ro ferries, car carriers). The physical environment, however, has not changed and ships still encounter frequently changing atmospheric and oceanographic conditions.

After an accident, there is an inclination to swiftly attribute it to a simple main cause, in a struggle to find an outlet for grief or dismay, and/or to find someone in particular to blame. Accidents at sea, however, are rarely intentional (i.e., the master and the crew do not aspire to have an accident) and therefore accident investigations need to move away from a blame seeking culture.

The human factors discipline attempts to apply the natural laws of human behaviour to the human element operating within the working environment. The aim is to maximize safety, efficiency and comfort by designing equipment and layout of workplaces to the physical and psychological capabilities of the operator. It is also a concept that focuses on how people work and cope (Stanton 1994).

The Evolution of Human Error Research in Accidents at Sea

Statistics on accidents at sea have been collected since the last century. It has now become generally accepted that more than 80% of all accidents at sea are caused by human error. The origin of this statement can be traced back to the late 1970's (Gray 1978) and has been discussed elsewhere in detail (Barnett 1989). These early studies suggest that researchers tried to find solutions to human factors' problems by employing the same methodology used for problems resulting from situational factors. Consequently the human element in casualty reports was examined in detail and the most significant group labelled 'human error'. Initially little further analysis, other than stating this all-encompassing category, was carried out. It soon, however, became apparent that to introduce accident reducing measures would require a deeper analysis of the factors that induced 'human error'.

Human Factors on the Ship's Bridge and a Look Beyond Human Error

The working environment of the ship's bridge can be broadly divided into two components, the organisational framework and the physical environment of the ship's bridge and associated situational/ navigational activities.

The organisational framework is directly influenced by international conventions or resolutions adopted by the International Maritime Organization (IMO). Its primary role is to develop and adopt regulations to improve safety of international shipping and prevent pollution from ships.

The physical environment can roughly be divided into settings inside and outside the ship's bridge. Settings inside the ship include the physical layout of the bridge, design of hardware and related information processing. The exterior environment includes the atmospheric and oceanographic conditions and natural hazards that the ship may encounter during its passage.

The concept of navigation has remained largely the same since the introduction of steam ships. The navigating officer's main responsibility is still to determine the position of the ship and avoid collisions. His working environment is further characterised by longer than average working periods (often weeks or months), unconventional working hours and days, and regular and extensive operations during the hours of darkness. Additionally navigation periods of intense activity may be interspersed by periods of relative inactivity.

The individual navigating officer has clearly little direct control over his working environment (shown in figure 1). An error made by an officer resulting in an accident should therefore not be regarded in isolation, but in relation to other factors influencing the navigational system.

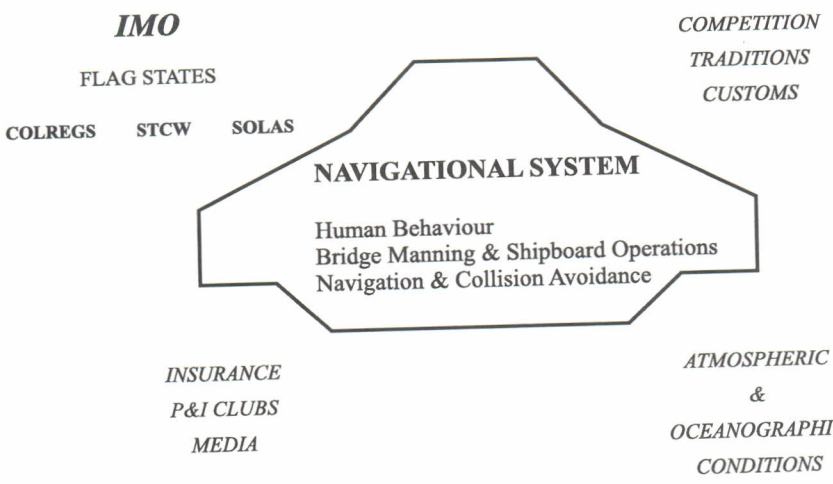

Figure 1 Major factors influencing the human element on the ship's bridge

The relationship between human factors, human errors and causes of accidents at sea is complex and often difficult to appreciate. Human error is likely to be present in the working environment on the ship's bridge, even if it would be operated legally unmanned. The error here would shift to originate completely outside the bridge environment (e.g., design of equipment). To reduce future accidents the shipping industry must move away from focusing on error reducing measures alone, to employing recognised human factor's techniques to design the working environment of the ship's bridge so that it helps the navigating officer to avoid accidents.

Managing Safety at Sea

Traditionally the shipping industry has relied to a certain degree on the operation of market forces to manage safety at sea. For instance, it was noted in the early mid 1830's that the system of marine insurance protected the shipowners from excessive loss. This allowed them to take less care in the construction of ships, less efficiency in their equipment and less security for their adequate management at sea (House of Commons 1836).

The introduction of steam ships resulted in a growing concern within maritime governments for safety at sea due to the increasing number of collisions which seemed to have resulted from the lack of common rules for overtaking, crossing and meeting end-on (Gray 1867).

This led to the introduction of the first international collision regulations adopted in 1863 (The Merchant Shipping Act Amendment Act 1862). Other safety related regulations imposed by the maritime governments are, for example, Plimsoll Lines (Merchant Shipping Act 1876) and the International Convention for the Safety of Life at Sea (SOLAS) first introduced in 1914 as a result to the sinking of the *Titanic* in 1912.

The management of the theory and practice of safety at sea must not only focus on the introduction and implementation of international rules and regulations. The underlying principles must be specific, functional relationships must be determined and sufficient research carried out to quantify various components in terms that will allow them to be properly incorporated into a safety strategy (Goss 1989). This requires a more scientific approach and involves identifying the effects of safety measures, quantifying them in physical terms and evaluating them in economic terms.

It is, as yet, difficult to identify the effects of safety or evaluate them in economic terms. Nevertheless, it is suggested that attempting to quantify components that may affect safe navigation is reasonable. Safety at sea is often considered in broad terms, i.e., accidents to all ships are included. The results are likely to provide general answers, i.e., what happened. Knowing what happened is mostly sufficient to propose universal changes in regulations or technology with view to reduce the number of accidents at sea (e.g., SOLAS).

IMO has recognised that a common approach and cooperation between States will aid remedial action. To promote a common approach to the safety investigation of accidents at sea, it recently adopted a code for the investigation of accidents and incidents at sea (IMO 1997). This Code provides guidelines to assist investigators in cooperating in accident investigations. Guidelines for investigating human factors have also been proposed, including a list of topics which should be considered by investigators, and procedures for recording and reporting the results (IMO 1998, Marine Accident Investigators International Forum 1999).

Human Factors in casualty investigation

After the event, an accident at sea may be investigated by several different organisations (e.g., Coastal State, Flag State, P&I Club, etc). This usually takes the form of describing the course of events and identifying the main causes of a particular accident. Rasmussen (1990) suggests that the identification of accident causes depends on the aim of the analysis, i.e., whether the aim is to:

- Explain the course of the events
- Allocate responsibility and blame
- Identify possible system improvements

As previously noted, in the aftermath of an accident at sea, there is a tendency to look for someone to blame. As a result the investigation often focuses on specific errors and perhaps overlooks situations or problem areas that may have provided pathways to the accident.

For example, the grounding of the *Exxon Valdez* (National Transportation Safety Board 1989) attracted worldwide attention from the media which primarily focused on the master of the ship. The fully laden U.S. tankship *Exxon Valdez* grounded on Bligh Reef in Prince William Sound, Alaska on March 24, 1989 resulting in the largest oil spill in U.S. history. The official report published by the National Transportation Safety Board (NTSB) argued, among others, that the intoxication of the master was a major factor in causing the accident. This notion was based essentially on the results of speech analysis. The report and the ensuing media attention is likely to have ensured that in the public mind ten years later, the blame remains with the master (Faith 1998).

It is not intended here to argue the merits of the technique of speech analysis for the determination of possible intoxication, nor to criticize a very comprehensive and thorough report, but to examine factors affecting the human element that perhaps received less attention. There

is, for example, another possible explanation to the master's speech patterns, i.e., that it resulted from a deep emotional shock caused by the grounding itself. Particularly as the master was not onboard the bridge at the time immediately before the grounding.

Consequently, his performance is likely to have had a lesser, **direct** effect, on the outcome of the events. This fact does not exonerate his behaviour, but draws attention to other factors which may also be relevant, e.g., why did he feel sufficiently confident to leave the third mate in charge? It should be noted that the third mate had served 6 trips on the *Exxon Valdez* with this master and one trip with a relief master. He had also served previously about two years as third mate on five other Exxon vessels.

Other data extracted from the *Exxon Valdez* report shows that the Vessel Traffic Centre (VTC) agreed to the diversion from the traffic lanes to avoid ice which eventually led to the grounding on Bligh Reef. This was an accepted practice as evidenced by the tankers *Arco Juneau* and the *Brooklyn,* which deviated around the ice, the evening before and the same morning, respectively.

Examination of the interaction of the human element and the steering control system of the ship is considered essential from a human factor's point of view. The *Exxon Valdez* was equipped with a centralized multi computer integrated steering control system. Four steering modes were available: (1) Helm, or hand steering (2) Gyro, or automatic pilot (3) NAV mode and (4) Rate-of-turn mode.

The role of human factors in the main events leading to the grounding is summarised in Table 1. The summary shows that the total time from when the master left the bridge until the grounding was only approximately 20-25 minutes.

A simple human factor's analysis of the summary indicates that there are at least two possible reasons for the third mate's inability to bring the vessel safely around the ice: (1) he began the swing to the starboard too late, or (2) that the autopilot was still engaged and therefore the helmsman's application of the helm did not engage the rudder.

The NTSB report states that carrying out the proposed manoeuvre involved careful navigation and frequent position fixing. The master had made well over 100 trips through the Prince William Sound which may have resulted in a certain degree of complacency and over confidence. He may not have realised that the third mate did not have sufficient experience to carry out the proposed manoeuvre on his own. On the other hand, the master also expected the third mate to hand over the watch to the second mate. It must also be noted that according to Exxon company regulations, the master or chief mate should have been in charge of the watch, when the vessel was navigating through confined or busy waters.

Examining the above scenario from a human factor's point of view, the following should be considered:

(1) Design of User interface - The course recorder suggests that the steering may have remained in gyro mode. The steering could easily be switched between gyro and helm without providing appropriate feedback (e.g., sound). The report does not state clearly the extent of sleep deprivation, but it is accepted that fatigue can result in substantial decline in performance (Neville et. al. 1994). Thus if the third mate was fatigued, he was more likely to make a mistake, i.e., not note consciously whether the autopilot had swithed to manual helm as intended.

(2) Manning - The *Exxon Valdez* operated with a reduced crew complement approved by the Coast Guard. The minimum crew requirements had been established for the Valdez-Panamanian trade but the vessel was now operating regularly between Valdez and ports in California. This trade was more demanding due to more frequent port calls, and it is possible that a re-evaluation of the manning requirements would have been useful in reducing the risk of fatigue.

		Comments
(1)	The master asked the helmsman to steer 180° and engage the automatic pilot. The helmsman pressed the gyro button to engage the automatic pilot.	*Why did the master leave it on automatic? How long did he intend to steer it on automatic?* **Time 23.39**
(2)	When the helmsman was relieved he advised the third mate that the vessel was steering on automatic pilot.	
(3)	The third mate acknowledged this but did not expect this as the vessel was not normally operated in automatic mode when navigating in traffic lanes. He did not discuss this with the master.	*Why didn't 3M query the decision to operate the vessel on automatic?* **Time 23.50**
(4)	The third mate decided not to call the second mate as scheduled but decided to remain on watch until the vessel was clear of ice.	*Was 3M over confident? Was it typical?*
	The master asked the mate whether he felt 'comfortable' to continue on his own to which the mate replied that he did.	*Master accepted 3M's response*
(5)	The third mate then went to the steering stand and pushed the hand steering button. The helmsman claims he observed the indicator illuminated showing it was engaged. The helmsman offered two different versions (1) he was unable to recall whether it was in automatic when he arrived on the bridge and (2) that it was in gyro mode and when he was going to push the hand steering button the third made pushed the button as well.	*Conflicting information on whether the manual helm was engaged. When in auto mode the steering wheel is electrically disconnected during gyro mode and may be turned without affecting the steering or causing any alarms to sound!* **Time 23.55**
(6)	The third mate ordered the helmsman to put the rudder to right 10° - he did not recall watching the rudder angle indicator to ensure that the rudder was actually applied.	*3M did not confirm visually the rudder angle*
(7)	He phoned the master to inform he had started to turn the vessel. He was standing with his back to the rudder indicator. The master asked whether the second mate had arrived on the bridge. He was informed that the second mate had not been called.	*3M was unable to confirm visually the rudder angle.*
(8)	The third mate then went to the port radar to check ranges and noticed that the vessel had not moved to the right and the heading had not changed.	
(9)	The third mate then ordered rudder increase to right 20° and then hard right rudder.	
(10)	He then called the master and said 'I think we are in serious trouble'.	**Time 00.05**

Table 1 Summary of the events leading to the grounding of the Exxon Valdez

(3) Onboard supervision and management - Traditionally training has focused mainly on navigation and other shipboard skills and to a lesser degree on formal training in managing people, understanding human factors, fatigue management, evaluating other crew members' experience/skills or managing reduced crew complements.

Marine Human Factors Classification

After the accident, the first priority is generally to develop measures that will ensure that a similar accident cannot occur again. To this end the accident is generally viewed singularly, i.e., what recommendations for system improvements can be proposed based on the investigation of a single accident such as the grounding of *Exxon Valdez*.

Research is needed to provide information to improve management of the theory and practice of safety at sea. Accidents grouped together provide a broader base for analysing common denominators and perhaps trends and the effectiveness of preventative measures over a period of time. The more detailed an investigation, the more useful data it can provide. The type of information available from a singular accident report was outlined in the above example.

Analysis of accident groups is generally based on final reports which may have several disadvantages:

- The report is edited and relevant data may not be included
- Data may be missing, perhaps because its importance was not realised during the inves tigation
- Lack of consistency, e.g., time of accident, number of people onboard the bridge, etc. may not have been recorded in each individual report

Traditionally analysis of accident groups has been based on some form of causal groupings. Based on such groupings used by other researchers, the actions of the second mate in the collision between *Galaxy* and *Alam Tenggiri* could be grouped under causes shown in Table 2.

The Malaysian cargo vessel *Alam Tenggiri* collided with the fishing vessel *Galaxy* early in the morning of 6 September 1996 off high Peak Island, Queensland, Australia. The *Alam Tenggiri* was overtaking the *Galaxy* on a similar course and had the duty to stay clear of the fishing vessel. The report shows that they were probably converging at an angle of about 20°.

The report concludes that the 2nd Mate on *Alam Tenggiri* did not make full and effective appraisal of the situation and the risk of collision. The ship was equipped with radar, ARPA and a separate look-out as required by the COLREGS (Rule 5). Knowing that the 2nd Mate did not appraise the situation and risk of collision correctly does not explain why he failed to avoid the collision. The report shows also that he was well aware of the other vessel approximately 80 minutes before impact.

Published Reference	Causal Groups
Quinn P.T. & Scott S.M., (1982), The Human Element in Shipping Casualties, 2T 550/551/552, The Tavistock Institute of Human Relations, London	*Rule Violation/Use of equipment*
Tuovinen P., Kostilainen V. & Hämäläinen A., (1984), Studies on Ship Casualties in the Baltic Sea 1979-1981, Baltic Sea Environment Proceedings No 11, Helsinki Commission	*Human Factors and Actions*
Wagenaar W.A. & Groeneweg J., (1987), Accidents at sea: Multiple Causes and Impossible Consequences, International Journal of Man-Machine Studies, **27**, 587 598	*Cognitive and Situational System*
Wagenaar W.A., Groeneweg J., Hudson P.T.W. & Reason J., (1993), Promoting Safety in the Oil Industry, Ergonomics Society, 7.1-7.24	*Navigational/Situational*

Table 2 Causal groupings of 2nd Mate's actions

Table 2 shows clearly that existing causal groupings provide data of limited practical value, particularly for recognising the role of the human element. Existing causal groupings and classification frameworks are useful for identifying and categorising what happened, i.e., the origin and type of decision or task that led to the accident. From a practical point of view, to improve proposed measures to prevent further accidents, where it happened is considered a stepping stone to further examining why it happened. Where it happened shows the situation or problem area associated with the mistake e.g., the second mate did not assess the situation correctly.

In an attempt to overcome the limitations of existing accident report analysis and other research into safety at sea, an alternative approach for research was considered. The study focused on situations on the ship's bridge WHERE problems occurred, i.e., situations which may have provided pathways that resulted in a grounding or collision. Data was collected primarily from the following sources: (1) 98 published accident reports (from seven different countries) and (2) 105 Marine Incident Reporting System (MARS) reports.

The basis of the study was to combine the theories of examining causal factors and task analysis into a method which would show situations and problem areas. These situations were termed 'catalysts' and defined as factors in a chain of events that may provide a pathway for an accident to occur. More than one 'catalyst' can therefore be assigned to each accident.

The 'catalysts' were derived through carefully noting problem areas rather than being based directly on the reporter's conclusions. They were first extracted directly from the accident reports and then listed under an appropriate sub heading. The 'catalysts' were grouped initially under 17 sub headings eventually grouped under 6 main headings as shown in table 3.

The MARS reports were initially grouped into three navigation related categories, i.e. crossing, overtaking and communications. 'Catalysts' were then extracted using the above method. As far as can be ascertained the MARS reports have not been analysed in this manner before.

Applying this marine human factors classification scheme to the grounding of the *Exxon Valdez* suggested two principal 'catalysts' (shown in Table 4):

Problem Area/Situation	**'Catalyst'**
It was possible to turn the wheel when in auto mode with no effect on steering and no alarm	*User interface*
The master left 3rd Mate alone in charge of the watch	*Did not fully assess the situation*

Table 4 'Catalysts' extracted from the *Exxon Valdez* Report

Further examination of the 98 accident reports show that there were 5 other incidents where the design of the user-interface of the steering control system had been a problem area (e.g., the autopilot changeover could be operated by the helmsman without knowledge of the pilot or the autopilot did not sound an alarm when the turn was not carried out when operated in NAV mode).

A HUMAN PERFORMANCE

1. Assumptions

A1 Assumed other vessel's intentions

2. Error of Judgment

A2 No collision had both ship's maintained course and speed
A3 Mistook position/land marks
A4 Incorrect change of course/Passing too close
A5 Failed to assess course and manoeuvre of other vessel
A6 Did not fully assess the situation

3. TSS (MARS reports only)

A7 Incorrect heading

B ENGINEERING/DESIGN

4. Automatic steering/Auto pilot

B1 Auto Pilot /Gyro Error
B2 Autopilot response affected by external conditions

5. Bridge/Ship layout

B3 Restricted view forward
B4 Position of equipment - Bridge Layout

6. Manuals/Documentation

B5 Manuals in foreign language/Poor manuals
B6 Drawings not 'as fitted'
B7 Manuals only for individual components, not the complete system

7. Mechanical & Manoeuvring

B8 Total Black out
B9 Unexpected manoeuvring characteristics

8. Technology - Other

B10 Echo sounder not in use

9. User Interface

C BRIDGE PROCEDURES

10. Bridge Resource Management

C1 Poor communication between Bridge Team members
C2 Did not monitor other actions of other Bridge Team members
C3 Master's orders not complied with

11. Communications

C4 Agreed manoeuvre (VHF) before near miss or collision
C5 Did not exchange information with other vessel/Unable to contact other vessel
C6 VHF agreement resulted in incorrect manoeuvre/not agreeable advice
C7 VTS did not provide information/advised delay
C8 Poor VHF transmission
C9 Use of different VHF channels by different classes of ship
C10 Different language
C11 Same language
C12 Failed to impart urgency
C13 No sound signals

12. Charts/Passage Planning

C14 Poor passage planning
C15 Failure to use adequate charts/Did not appreciate warnings on chart

D SAFE MANNING

13. Bridge Manning

D1 W1 - Bridge Unmanned/No Look-out
D2 Fell asleep - more than one on the bridge
D3 W1 - Distraction caused by VHF
D4 Long Pilotage

E NAVIGATION CONTROL

14. No Radar Involved - Visual Look-out

E1 Difficult to distinguish external navigation aids
E2 Failed to see due to impaired vision forward
E3 Did not see other ship

15. Position Discrepancy

E4 Position not fixed accurately
E5 Relied on radar bearings, etc.
E6 Using GPS as sole position fixing method

16. Radar

E7 No radar parallel indexing used/incorrect use of radar parallel indexing
E8 Failed to plot course/speed of other vessel/made decisions based on initial data
E9 Blind sector
E10 Did not see other ship
E11 Other radar related
E12 Radar off

F OTHER

F1 Exhibiting inappropriate lights
F2 Operational demands
F3 Pilot did not act professionally (speed)
F4 Master did not as advised
F5 Other

Table 3 Authors' classification of 'catalysts' grouped under 6 main categories (A-F) and 16 sub headings. 'Catalysts' have further been identified and coded within their main category.

Problems relating to user interfaces have been indicated in previous studies but these have not shown which user-interfaces may have caused difficulties. A systematic approach focusing on problem areas can show 'trends' such as problems with steering control systems.

The marine human factors classification system outlined here, provides improve detail which shows that each 'catalyst' or group of 'catalysts' are likely to require a different approach to determine the most effective remedial action.

'Catalysts' involving the steering control system suggest a need to improve the design of the user interface and corresponding manuals. Additionally, some form of verification is required to show that each officer has received adequate training in the operation of the navigation aids on the specific ship.

The 'catalyst' *did not fully assess the situation* was grouped under the subcategory Error of Judgment which falls within the main group of Human Performance. These 'catalysts' are best addressed through education and training.

The marine human factors classification system outlined here can be used to analyse the human element in collisions and groundings. It focuses on problem areas and provides a method for collecting human factors data systematically. This paper shows the need for an alternative classification system focusing on human factors specifically on the ship's bridge. Accident investigations and voluntary incident reports can be useful for collecting data on human factors. However, other methods must also be employed, e.g., personal observations which can provide information that would be difficult to acquire using any other method, e.g., changes in behaviour due to unexpected delays. Therefore it is suggested employing several different data sources can be effective resulting in a better representation of human factors on the ship's bridge

The objective is not to try to eliminate the 'catalysts' but to be aware of how they affect the navigating officer. The aim is to encourage further research thus ensuring that the human element does not invalidate the intended effect of remedial actions (e.g., introducing new technology or rules/regulations).

The future of Human Factors in Maritime Casualty Investigation

The role of human factors in investigations of accidents at sea is gaining increasing attention from the shipping community and the IMO. It is expected that this will result in an increasing acceptance of the role of human factors in future management strategies for improving safety at sea. The introduction of a code for the investigation of accidents and incidents at sea is considered a major step forward in improving safety at sea.

The present lack of a standard human factor's terminology in the marine environment, limits the possibility of comparing different studies (e.g., establishing the effect of safety measures through the analysis of accident reports). It is unlikely that significant progress in understanding human factors will be made until the shipping community:

- Adopts a standard marine human factors classification system for the analysis of collisions and groundings. The above research shows that such a system can provide functional data thus improving our understanding of human factors on the ship's bridge.
- Develops a human factors training scheme for marine accident investigators.
- Makes a united effort to coordinate and share funding for human factors research within the international research community. The added benefit is a reduction of duplication and cost of studies.
- Encourages the investigation of all accidents, major or minor. All accidents must be investigated in depth and the complete reports made available to the public for research and training purposes.
- Works towards an agreement to fit all ships with voyage data recorders (VDR's). These have been used successfully in the aviation industry. In the event of an accident they pro-

vide unbiased technical data that can aid the evaluation of human factors data collected through interviews.

- Encourages Voluntary Incident Reporting (e.g., MARS). The information provided can be categorised according to the proposed marine human factors classification system and thus increase the available knowledge base of human factors in the working environment.

Conclusion

This paper discusses human factors on the ship's bridge and their role in investigating accidents at sea. Two accidents, the grounding of the *Exxon Valdez* and the collision between the *Alam Tenggiri* and the *Galaxy* were discussed briefly. It was suggested that the human factor's discipline provides a useful tool for analysing accidents specifically relating to the working environment of the ship's bridge.

A marine human factors classification system was proposed moving away from a blame seeking culture to examining problem areas affecting the navigating officer during navigation. The application of this classification system and identification of 'catalysts' provides improved practical data, which will assist in the analysis of future accidents. It is expected that this results in better methods for measuring the effectiveness of measures introduced to reduce accidents at sea.

It must be recognised that there is more than one definitive strategy to preventing collisions and groundings at sea. There is not expected to be a single best recommendation, nor a single dominant dimension to focus on. The key to preventing collisions and groundings is to understand the theory of the individual components and focus on their interaction within the entire navigational system on the ship's bridge.

The marine human factors classification system outlined in this paper presents data in form of 'catalysts' that can be used to, for example, determine future research areas, assist in designing ships' bridges and provide useful data for establishing human factors training within the shipping industry.

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MARINE CASUALTY ANALYSIS USING SHIP-HANDLING SIMULATOR

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Abstract

It is said that more than 80% of the cause for marine casualty are human according to the accident analysis. In this paper, we discuss the relation between the causes of accident and human error. Human error that cause the marine casualties are divided into following two categories;

Category 1: Operator cannot accomplish the standard function

Category 2: Operator accomplishes the standard function

In the case of first category, the doze, drunk, mental and physical fatigue and the lack skill are corresponded. Usually, the human error being treated as the causes of accidents are not divided into the categories mentioned above, the causes of accidents in two categories are treated as human error in a lump. For the prevention of accidents, the countermeasures for each category are differ from each other. The countermeasures for the prevention of accidents based on the category 1 are education and enforcement. But when the operator who belong to category 2 occur the accident, the countermeasures corresponding to category 1 are not proper. Because he have sufficient ability and normal condition, it is not reasonable way to educate and enforce for getting the standard skill. There must be more rational countermeasures for preventing the accident in category 2.

It is important to clear the causes of accident which is occurred relating to the category 2. But the research is usually very difficult because of operator acting the normal handling. As a result, proper countermeasures are not applied. Generally speaking, most of causes of vehicle accidents such as aircraft, vessel and car are judged human error. In case of vehicle accidents, most of operator are pursued his responsibility because operator decide the final action which was direct causes of the accident, in spit of his action based on the normal decision which are commonly made by standard operators.

In this paper, the accidents in category 2 are discussed in order to clarify the methods how to recognize the structure of this accident and the methods of researching the causes and countermeasures.

1. The relation between the accidents and human error

When the standard operator mad the action which are the same as actions made by standard able operators, and then the accidents occurred. Is it the proper to judge his action human error? If we accept it human error, can we point him that he did not his responsibility? From the view point of preventing accidents, it is easy to estimate that the other standard able operator will do same action in the face of the same situations and occur the accident. In order the prevent the same accidents, it is necessary to find the condition in which standard able human acts normal handling without accidents.

The human's action would be the same under the same condition because of education and enforcement. In order to discuss the relation between the accidents and human error, we assume that the human mentioned above is having the standard ability and giving conditions

are ship's characteristic, rules of road, traffic condition and natural environment. The relations among the condition, accident and the human error corresponding to category 2 are discussed. 4 kinds of relation are proposed as follows;

Case 1.

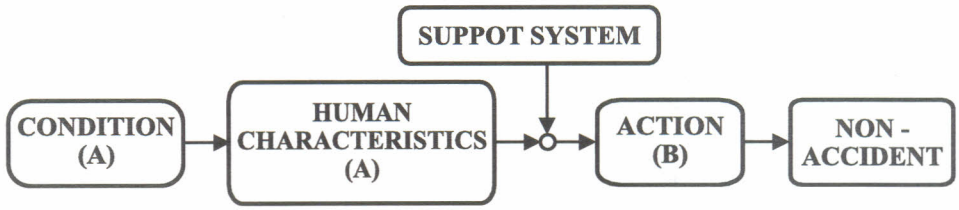
The accident is occurred caused by human's action type A which is induced by condition type A. The human characteristics (A) generates the action (A) caused by condition (A). The accidents caused by human error in category 2 are belonging to this case.

Case 2.

In this case, the human characteristics is changed from type A to type B by something to be improved. Therefore this human characteristics generates the action (B) corresponding to the condition (A). The accident dose not occurred because of human's action type B.

Case 3.

In this case, the human characteristics is still type (A). The action is (B) by the effect of support system and the accident will not occur in spite of condition (A) and human characteristics (A).



Case 4.

The accident dose not occurred because of human's action (B). Though the human characteristics is (A), Human action is changed from (A) to (B) because of condition changing from (A) to (B).

From this concept, the accidents will be prevented by changing from Case 1 to Case 2 of Case 3 or Case 4. In order to change the human action from (A) to (B), Three patterns can be considered. First one is to improve the human characteristics by special training and education.

These countermeasures correspond to Case 2. Second one is not to change the human characteristics. The action would be changed by support system which improve the human characteristics virtually. New control apparatus for handling is one of these support systems. These countermeasures correspond to Case 3. In case of Case 4, the condition is changed by applying new traffic rule and new types of ship etc.

In order to prevent the accidents in category 2, the countermeasures mentioned above are proper methods. The concrete methods depend on the causes of accidents. So it is important to clarify the causes of accidents. In the following section of this paper, one of example of accidents analysis that were carried out for studying the causes of accidents using ship handling simulator are described.

2. Collision between Yuyo-maru and Pacific Ares

In 9th of Nov. in 1974, Yuyo-maru proceeded to north bound in Nakanose fairway in Tokyo bay in Japan, Visibility was 2.0 miles. Yuyo-maru was LPG tanker, 43,724 GT, 227 m in length and 35.8 m in width. Nakanose strait is one way fairway. Pacific Ares proceeded to west bound from Kisarazu harbor. Pacific Ares was iron matrial carrier, 10,875 GT, 154 m in length and 22.2 m in width. The pilot on Pacific Ares (being abbreviated as P.A.) left ship after mentioned that Yuyo-maru (being abbreviated as Y. maru) coming from port side through Nakanose fairway. Master of Y-maru recognized P.A. at the distance 2 miles and started to decelerated her speed at the point of 1389 m on this side of encountering point. P.A. proceeded without avoiding action until the collision. They made collision at the encountering position. Fig. 1 shows the process of two ships situation. By this accident all of person on P.A. were died and 5 person on Y. maru were died. This accidents made people a extreme shock. Fig. 2 shows the news paper informing this accident. After collision was occurred, Y. maru and P.A. went up in flames. Y. maru was going up in flames for 20 days. Finally, she was towed to the out of Tokyo Bay and sank by bombing.

3. Simulator studies

In this section, the contents of simulator studies to analyze the causes of accident are shown. In order to simulate the accident condition and the ship's characteristics, we examined the following documents and data proposed by Japan Maritime Court.

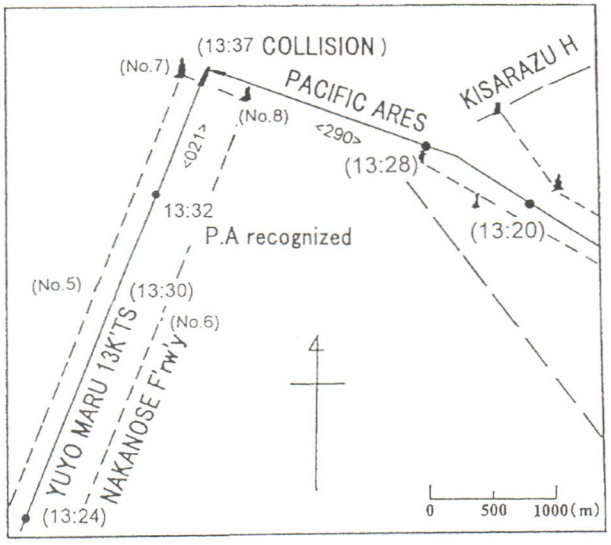
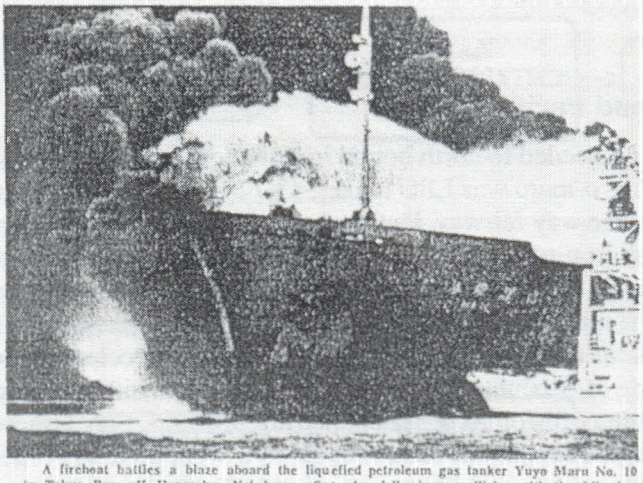


Fig. 1 The process of collision between Y. maru and P.A.

—6 Dead, 28 Missing in Fire—

LPG Tanker, Freighter Collide in Tokyo Bay



A fireboat battles a blaze aboard the liquefied petroleum gas tanker Yuyo Maru No. 10 in Tokyo Bay off Honmoku, Yokohama, Saturday following a collision with the Liberian freighter Pacific Ares.

YOKOHAMA—All 29 crewmen aboard a Liberian freighter were feared to have been killed in a fire triggered by a collision Saturday afternoon with a capacity-loaded Japanese liquefied petroleum gas (LPG) tanker in Tokyo Bay.

Six persons were found dead. They were five crewmen of the freighter and one crewman of the LPG tanker, police said. Twenty-eight others were reported missing as of late Saturday night.

Seven of the survivors suffered burns.

According to reports, all the crew members of the Liberian freighter are Chinese. It is captained by Lo Yao Nan, 47.

The 43,723-ton tanker Yuyo Maru No. 10, owned by Yuyo Kaiun Co., Tokyo, and the 16,-000-ton freighter Pacific Ares collided near the No. 7 buoy in the Nakanose fairway about 10 kilometers east of Honmoku, Yokohama, at about 1:40 p.m.

Both vessels were set ablaze.

At 4:39 p.m., an explosion crashed into the starboard bow of the Yuyo Maru No. 10.

The collision triggered a fire near the bow of the tanker and the freighter caught fire, too.

Then the crew members of the tanker abandoned their ship.

The captain and boats wain left the ship after all the rest of the crew left the ship.

Yoshikatsu Torii, 21, a deckhand of the tanker who was hospitalized in Yokohama, said that while he was resting on the afterdeck, there was a booming sound and a blaze shot up from the bow immediately afterward.

He immediately jumped overboard and swam in a sea covered with naphtha for about two hours until he was rescued by a patrol boat, the

Fig. 2 Newspaper informing the collision accidents

3.1 Estimation of ship's maneuvering characteristics

The characteristics of Y. maru and P.A. were estimated based on the following data and simulated using mathematical model which could estimate the ship's motion with high accuracy.

(1) The results of trial test.

(2) The table of principal dimensions

(3) The numerical estimation for speed control

(4) Others

3.2 Realization of the condition and the process

The environment of accident situation were examined using following data and realized with high accuracy and realistically by ship handling simulator in Tokyo Univ. of Mercantile Marine.

(1) Arrangement of sea buoy

(2) visibility

(3) Both ship's initial position course and speeds

(4) Others

3.3 Contents of simulator studies

In this studies, as the behavior of operator on P.A. could not be know, the behavior of master on Y. maru and discussed. The objects of simulator studies are the action of master on Y.

maru and the motion characteristics of Y. maru. In order to clarify the causes of accident, the effects of following factors are examined.

(1) Timing to start the avoiding action.

(2) Methods for avoiding collision.

(3) Rules of road.

(4) Ship's maneuvering characteristics.

4. Analysis

4.1 Collision avoiding timing

The time to start the avoiding action is very important factor which decide the accomplishment of the collision avoidance or not. Master of Y. maru recognized P.A. at about 2,700 m on this side of encountering point and start avoiding action at 1,389 m. The time to be considered for discussing the effect on the collision avoiding can be set position between the point of 2,700 m and the point of 1, 389 m on this side of encountering point.

(1) Start to maneuver at the point of 1,389 m

Initial position of Y. maru was 1389 m on this side of encountering point where master of Y. maru start to the avoiding action. This point is called A.T. in following sentence. 4 skilled masters started to maneuver in Nakanose fairway and made action to avoid collision at the time when he considered to have to do. The contents of avoiding action were restricted as only speed control that was applied for avoiding collision by master on Y. maru.

Fig. 3 shows the time history of engine control mode. Every master began the decelerating to avoid collision immediately just after the maneuvering was started. As the results of avoiding actions, all of their objective could not accomplished and collision occurred in every case.

(2) Start to maneuver at the point of 2,700 m

Assumed position was corresponding to the position where master of Y. maru recognized P.A.. This point is called A.T. in following sentence. 4 skilled master also handled and started to maneuver in Nakanose fairway and made action to avoid collision at the time when he considered to have to do. The contents of avoiding action were restricted as only speed control that was applied for avoiding collision by master on Y. maru.

Fig. 4 shows the time history of engine control mode. In this case, all of them did not start to handle the avoiding action immediately. They kept her motion for a moment. Each master started to decelerate her speed at the time when he consider the necessity to avoid collision by himself, they were not the same timing. When they navigate out of fairway, the make to avoiding action earlier in this encountering situation. It is the particular handling characteristics in fairway that they didn't make avoiding action earlier. Anyway, all of masters in this simulator studies avoided the collision. But the distance at the closest point of approach was very small.

4.2 Collision avoiding methods

In the previous section, the contents of avoiding action was applied only speed control that was applied for avoiding collision by master on Y. maru. Now we cannot estimate why master on Y. maru did not use the changing her course by steering the rudder for avoiding the collision. We tried to confirm the effectiveness of the changing her course. Two cases were applied, one was to avoid using rudder control, the other was to avoid ruder and speed control.

(1) Applying the rudder control to avoid collision

4 skilled masters started to maneuver from position of 1389 m on this side of encountering point in Nakanose fairway and made action to avoid collision at the time when he considered to have to do. The contents of avoiding action were restricted as only heading control.

The distance at the closest point of approach (DCPA) caused by heading control for avoiding collision were examined based on the numerical simulation. The results of simulation are shown in Fig. 5. The contents of avoiding maneuver is to carry out the parallel shift maneuver shown in

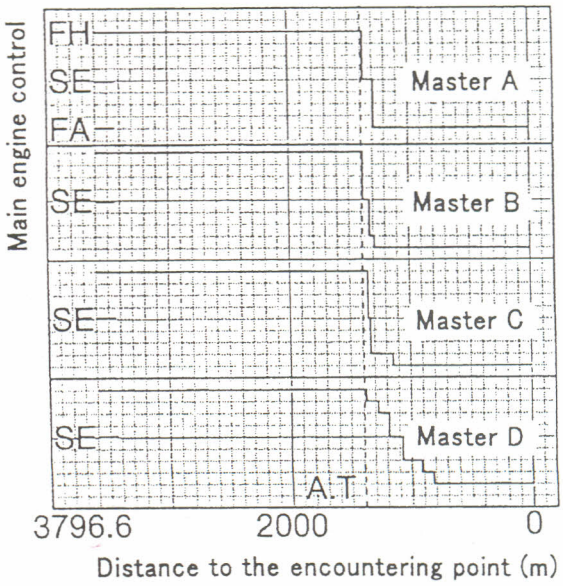


Fig. 3 The time history of engine control started from A.T.

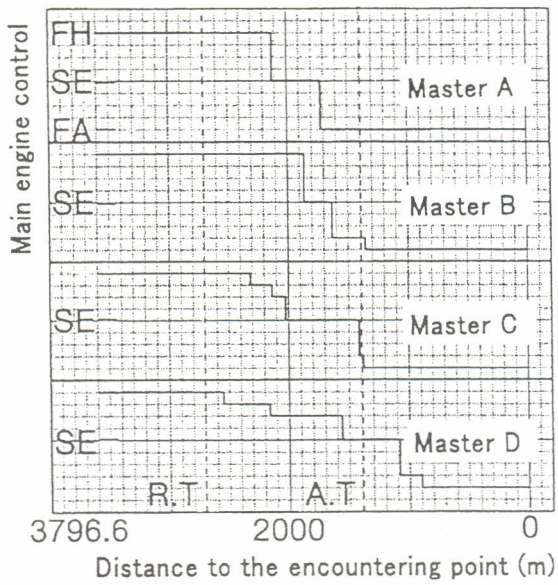


Fig. 4 The time history of engine control started from R.T.

Fig. 6 because of navigating in the fairway. The DCPA is 320 m when avoiding action is started at the point of A.T.. The relation between the starting point and DCPA are shown in Fig. 5.

Table 1 shows the DCPA which are obtained by simulator studies. All of masters could avoid the collision.

(2) Applying the rudder and speed control to avoid collision

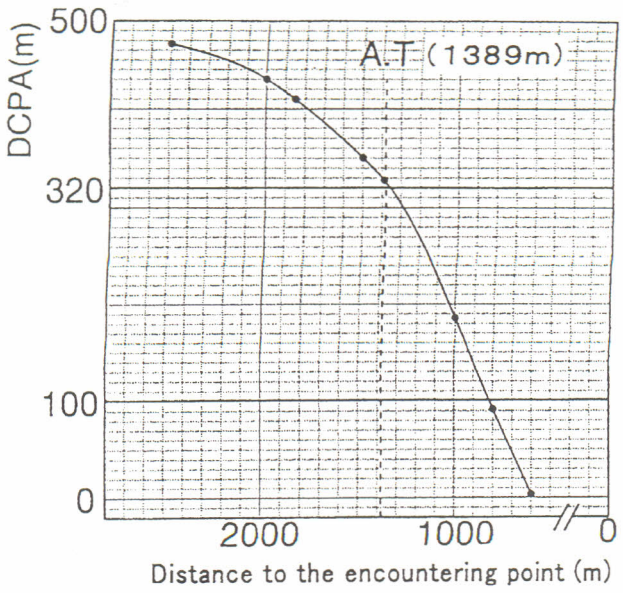


Fig. 5 The relation between DCPA and starting point using heading control.

4 skilled masters also started to maneuver from position of 1389 m on this side of encountering point in Nakanose fairway and made action to avoid collision at the time when he considered to have to do. The contents of avoiding action were not restricted. All of masters could avoid the collision.

Table 1 shows DCPA as the results of simulator studies in this sections. The DCPA in case of avoiding collision using speed control only from A.T. were 0.0. m; collision occurred. The DCPA in case of avoiding collision using heading control only or heading and speed control from A.T were over 129.0 m; collision was not occured.

By the results of this section, it is said that the heading control is effective measures to avoid collision. But most of master cannot apply this characteristics effectively in fairway. Three of masters who operated in simulator studies obtained DCPA under 200 m.

Table 1 DCPA concerning the control methods

	D C P A (m)		
	Speed	Heading	Speed/Heading
A	0.0	340.9	356.0
B	0.0	174.3	154.5
C	0.0	172.2	188.5
D	0.0	164.0	129.0

4.3 Compulsory navigation in fairway

The master on Y. maru made the action to avoid collision by speed control, did not by other control. We estimate that his action was affected by navigating in the fairway, the human characteristics of operation in the difference area were examined. The same encountering situation was assumed in the open water area. 4 skilled masters also started to maneuver from position

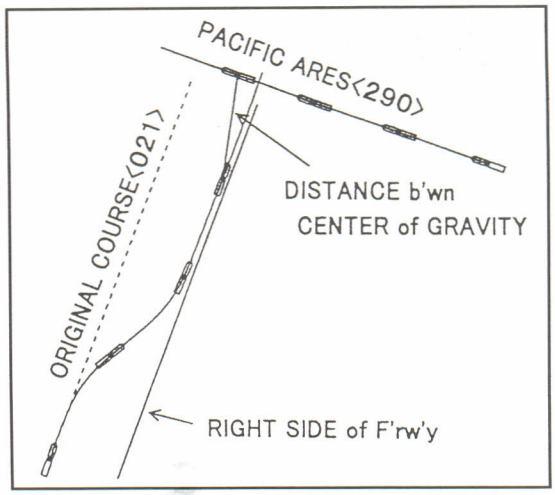


Fig. 6 The contents of avoiding action using heading control.

of 2700 m on this side of encountering point and made action to avoid collision at the time when he considered to have to do. The contents of avoiding action are not restricted. All of masters could avoid the collision. Fig. 7 shows the position where each master started the action to avoid the collision. All of master started the action earlier than in the fairway and they used only heading control. In the case of navigation in fairway, half of masters controlled using speed and rudder.

From the results of these simulator studies, standard human operator navigating in the fairway has the tendency to delay the avoiding action and to apply the control by decelerating the ship's speed comparing to the navigation in the open water area.

4.4 Maneuverability

The timing for starting avoiding collision strongly relate to the ship maneuvering characteristics such as decelerating and altering course. Y. maru was a big tanker that is commonly to change the motion very slowly. We tried to discuss the effect of difference of maneuverability. The container ship was applied to discuss the difference between Y. maru and another ships that has better maneuvering characteristics.

Assumed position was corresponding to the position where master of Y. maru recognized P.A.. 4 skilled master also handled and started to maneuver in Nakanose fairway and made action to avoid collision at the time when he considered to have to do. The contents of avoiding action were restricted as only speed control that was applied for avoiding collision by master on Y. maru. In this case, all of them did not start to handle the avoiding action immediately. They kept her motion for a moment. Each master started to decelerate her speed at the time when he consider the need to avoid collision by himself, they were not the same timing. Anyway, all of masters in this simulator studies avoided the collision.

Fig. 8 shows the relation between the DCPA and starting point for decelerating her speed concerning Y. maru and container ship respectively. The starting position of container ship were closer than one of Y. maru. In spite of closer point, DCPA were bigger than DCPA of Y. maru.

Furthermore, by numerical simulation based on the maneuvering characteristics of container ship, it is possible to avoid collision when the speed control is started from A.T.

From above discussion, the maneuvering characteristics was strongly effected in this accidents.

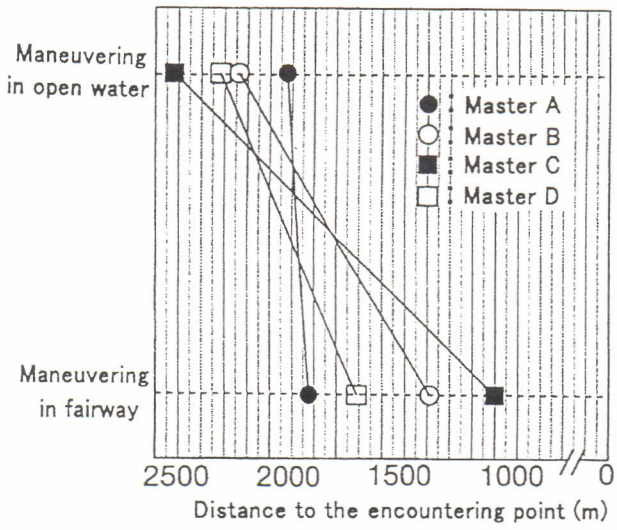


Fig. 7 The starting point of avoiding action in the fairway and open water

5. Discussion

5.1 Collision between Y. maru and P.A.

The water area near the exit of the fairway is complicated place because of the switching two traffic rules. The ship proceeding in the fairway must keep her track in the fairway and can proceed without avoiding the ship which cross the fairway. The ship intending to cross the fairway have to avoid the ship proceeding in the fairway. When two ships encounter at the water area near the exit of the fairway, what is the best way to avoid collision? In the case discussed in this paper, the master on Y. maru recognized that P.A. was the ship crossing the fairway and expected that P.A. would avoid Y. maru. The operator on P.A. was died, we cannot know what he thought this situation.

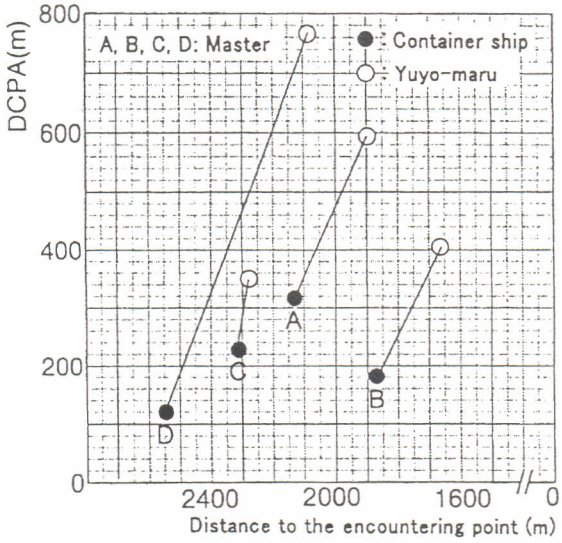


Fig. 8 The relation between DCPA and starting point of avoiding action concerning Yuyo maru and container ship.

In this section, we discuss the human characteristics who is operator on the ship proceeding in the fairway that is master of Y. maru. By the results of simulator studies, following characteristics are obtained:

(1) The avoiding action of the operator on the ship proceeding in the fairway tend to delay for the ship crossing the fairway.

(2) The avoiding action of the operator on the ship proceeding in the fairway tend to make mainly speed control

After this accident, Japanese Coast Guard set the sea buoy on the extended line of Kisarazu fairway and the ships coming from Kisarazu fairway are required to proceed the north of new buoy. This countermeasures are intend that ships coming from both direction will not encounter at the water area near the exit of Nakanose fairway. By this countermeasures, the accident like this case have not been occurred.

5.2 Countermeasures for preventing the accidents.

We discussed the relation between the accidents and human error in section 1 in this paper. The accident discussing in this paper was judged caused by human error. Most of skilled masters handled the same action as the master on Y. maru. The same accidents will occurr in case of not making effective countermeasures. The causes of this accident should be judged as category 2 in section 1. From this results, it is well known that the same situation are often appeared at the area near the exit of fairway such as Nakanose fairway.

When we discuss the content of countermeasure for this accidents, the countermeasure by Japanese Coast Guard is proper one because of no accidents like the accidents of Y. maru having not occurred.

It is always said that the causes of accident and countermeasures to preventing accidents that belong to Category 2 are found difficult. The causes and measures of accidents in Category 2 are discussed referring the Y. maru accidents. The countermeasures by J.C.G, setting new buoy are corresponded to the Case 4. The master with standard skill maneuvers in Nakanose fairway safely without any support system because of changing the traffic rule, the condition have been changed.

Meanwhile, the handing by excellent skilled operator such as pilot did not make the accidents, this situation correspond to Case. 2. The support system which inform the proper time to start this avoiding action and the proper way of avoiding correspond to Case 3.

The accidents do not occurr by single error or event, they are always occurred by several events that happen continuously like chains. As the causes of accidents are clarified respectively, the methods to remove the causes are found out. It is not necessary to remove the all of causes, it is important to cut the error chains. The best method for selecting the measure depends on the kind of accidents and efficiency.

The concept concerning the structure of accident by human error in Category 2 is necessary and useful.

Conclusion

The relation between the accidents and Human error are very important. Human error causing the accidents are divided into 2 categories shown in section 1. The human error in category 2 are mainly discussed because the countermeasures for Category 1 are simple because this causes are the lack of normal human abilities. In the case of category 1, the education must be done.

The process of accidents belonging to category 2 proposed are necessary to discuss the relation among the condition, human characteristics, human action and accidents, In order to prevent the accidents caused by human error in category 2, the understanding the process is very important. Three concept for preventing accidents are proposed. The necessity and effectiveness of this concept is confirmed through analyzing the big accidents occurred in Japan.

The ship handling simulator is very useful for analyzing the causes of marine casualty and human characteristics. Through the simulator studies, the countermeasures can be suggested.

Many accidents that were judged as the results of human error have been occurred all over the world. Some of them were better to be understood it belong to category 2. In this case, the countermeasure pointing the loss of human ability are not complete ways. This measure means that the same accidents will occur again by the same error by standards operators. To say again, in these cases, the countermeasures that are indicated at section 1 in this paper are necessary. The unsuitable measures have been made in many cases until now.

USING COMPUTER MEDIATED COMMUNICATIONS FOR LONGLIFE LEARNING

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Abstract

Computer Mediated Communications and Distance Learning (CMC/CMDL), and particularly asynchronous learning through the Internet, are becoming major vehicles for fulfilling the needs of Longlife Learning (LLL).

With the inception of computer technology in the 1980s and developments in communications technology in the 1990s, the potential for improving the quality and effectiveness of distance learning has grown.

This has resulted in the development of a variety of learning technologies and the incorporation of a number of new elements into distance learning: video films, multimedia courseware, and live lessons delivered to remote classrooms. Until the mid 1990s, the integration of such educational technologies was only partly successful, for methodological reasons, and due to considerations of cost and accessibility.

Today, we are at the threshold of a new era in which technological learning solutions are developing into effective applications. The Internet has become an essential communications platform and has new capabilities that can be utilized for distance learning. Various new models of education are described and discussed in this paper.

Throughout the world, the post-secondary learning market has become one of today's growing markets, both in developed nations and in developing ones. Increasing competition, the need to keep up-to-date professionally, along with a rising standard of living and more leisure time, have combined to make studying an ongoing process – lifelong learning (LLL).

The studying population has not only grown larger; it is becoming older, on average, and has additional obligations - mainly work and family. As a result, there is an increasing demand for a flexible learning framework, one that does not tie the learner down to a specific time or place. Differences between individuals also require an adaptable pace and mode of study, suited to personal abilities and distinct learning styles. The adult learning market is becoming increasingly competitive and full of opportunities, both for existing institutions and for new entrants.

Hanna (1998) claims that: "throughout the industrial era, the system has focused upon serving the educational needs of youth to prepare for a lifetime of work. Today it is clear that the future will involve a lifetime of learning in order to work."

Emerging trends in the $670 billion world wide education market indicate growth of the higher education and corporate training . The total scope of the learning market in the US in 1995 was estimated at $262 billion, of which $189 billion (72%) was devoted to higher education, and $60 billion (23%) to corporate training.

Traditional studies

Traditional university studies offer an impressive array of advantages, both in theory and in practice. When these advantages are realized in the classroom - in an encounter between an instructor who is also a first-rate scholar and bright students – an optimal learning situation can be obtained.

However, traditional learning can no longer satisfy all learning needs, for the following reasons:

(1) High quality learning depends, to a large extent, on finding a sufficient number of lecturers;

(2) (2) Studies in public research universities are expensive; thus, accessibility is usually limited and subject to budget cuts and restrictions;

(3) (3) Traditional learning is limited to a particular place (the classroom on campus, which is also expensive to set up), a specific time, and a uniform pace.

Traditional Distance Learning

Distance learning provides answers to the problems of availability (accessibility and cost) and the demand for flexibility (time, place and pace) of learning.

For 150 years, correspondence education has been used to deliver instruction to students. The materials for the courses were printed and mailed to the students in outlying areas which would return assignments via the same method. In 1840, England started the earliest distance tutoring courses by teaching shorthand. Since World War I, distance education spread rapidly and is in one form or another all over the world. As media and technology advanced, education incorporated media into distance education: newspapers, radio, television, telephones, satellite transmission, and electronic publishing.

Many educators were critical of distance learning in early years because of the expense of technology, lack of student-teacher interaction, and questions over the quality of student learning. The most recent research, however, suggests that new technology has provided advances that enable students to learn as well with distance education as they might in traditional educational settings. Students and teachers can interact in new and crucial ways to facilitate learning. In fact, distance learning has advantages over traditional instructional methods.

The method of distance education delivery is usually dependent on the cost of delivery and the students receiving the instruction. One study suggests that no matter how distance education is delivered—low-tech, high-tech, interactive, or not interactive—students learn equally well (Beller, 1997). Although, outcomes on tests may show little difference in knowledge gained, adaptation to learning styles and attitudes toward learning do vary among individuals based on their learning mode.

Adult learners tend to need less interaction to remain motivated and challenged to learn. With the age of electronic games and videos, the younger learners seem to learn more efficiently—at a higher rate of speed—using the high-tech interactive methods of teaching distance education.

The oldest and simplest form of distance education are correspondence courses. Whether or not traditional correspondence courses are two-way communication is debatable, but students do have the opportunity to write or call the instructor.

Computer Mediated Communications (CMC)

With the inception of computer technology in the 1980s and developments in communications technology in the 1990s, the potential for improving the quality and effectiveness of distance learning has grown. This has resulted in the development of a variety of learning technologies and the incorporation of a number of new elements into distance learning: video films, multimedia courseware, and live lessons delivered to remote classrooms.

CMC involves using a computer to send course materials, tests, lecture notes, and messages to individuals. This technology uses the current telephone systems to connect computers together via a network or individual modem. Computer conferencing, electronic mail, and electronic bulletin boards are part of this approach. The network can be computers that are linked, whether they are in one room, one building, between buildings, between campuses, or accessible via modems all over the world. The Internet has become an essential communications platform in the world and is still growing.

There are more than 35 million users of the Internet, 22 million users in North America, the number of Internet sites has risen from 27000 to 110 000 in six months, new users being added at a rate of 12 000 a day, and only advertising on the Internet will reach $ 5 billion by the year 2000 (whatever the numbers, they are obsolete, given the current rates of growth). All this is a surprise. Internet has been around for almost 30 years but wasn't taken seriously the business until quite recently. Then, a few years ago, without anyone planning or decreeing it, a very simple set of browser and server protocols emerged as universal Internet standards. Suddenly, and basically without warning, the Internet became a plausible and economical solution to the huge problem that has plagued business since 1960s; integrating increasingly heterogeneous IT systems between and within organisations. The Web now offers providers and seekers of information around globe easy access to one another that proprietary systems cannot match - but can easily benefit from

The World Wide Web system is promising some benefits to support learning on the Internet, such as:

- Hyperlinks - since there is no batch processing and links point directly to the information source, the information is up-to-date as possible;
- Support for multimedia - efficient presentation is made using only images and other multimedia elements (voice, video, etc)
- Ease of use through very simple navigation mechanisms (clicking the keywords) built into WWW clients, as such the application is highly appropriate for widespread usage.
- Support for almost all computer platforms and operating systems
- Interactivity - a user does not only search for information and click the keywords, but has the possibility to enter some input as well
- Interoperability - WWW servers not only have links to other servers but can also run external scripts (programs) and consequently enables access (through gateways) to large databases.
- Built in security mechanisms - with the emerging Secure HTTP standards (and some other proposals), standardised security mechanisms are integrated into WWW servers and clients.

Continuous improvement in Internet capabilities - both in terms of applications and transmission rates – is transforming it into a vehicle for the delivery of an ultimate learning environment for distance learning in the 21st century.

Using CMC on Internet one could determine two different approaches : asynchronous and synchronous learning.

Asynchronous learning

Asynchronous Learning Networks (ALNs) are on-line learning venues that emphasize people-to-people communication combined with traditional and/or information-technology-delivered learning tools. The terms The purpose of ALNs is to enable people to learn anywhere and at anytime without the constraints of time and space. ALNs are useful in many educational arenas including on-campus education, off-campus education, and continuing education. Principle technologies involved in asynchronous learning are:

Conferencing

To provide asynchronous interaction between people, computer conferencing is widely used. Computer communication ranges from the use of email, listservs, newsgroups to threaded conferencing systems. The latter type of communication is particularly useful for organizing discussions around topics. A wide variety of computer conferencing systems are available; most have similar features, i.e., posting and replying to messages. Often, conferencing systems will provide the capabilities of editing and moving messages, posting multimedia, notifying participants of new message postings and organizing discussions.

On-line Materials

Currently most on-line materials are in the form of Web pages, often linked to discussion groups and places to try out examples. The enormous advantage of creating on-line materials is that it makes the materials easy to reuse and modify. For example, an on-line course typically employs a standard set of Web pages that an instructor can easily modify. In these materials it is straightforward to link to explanations in other courses (for remediation, for example) or link to authoritative sources on-line. All materials in an on-line course do not have to be on-line. Printed materials, including books and journal articles, are also perfectly suitable and can form a basis for assignment and submission of problems and discussions on-line.

Computer-based Training (CBT)

While CBT modules have not yet become widely used in ALN, it is expected that adoption of CBT modules will become commonplace as technology progresses. The generation of simulations that explicate difficult to understand points will help augment on-line reading materials. Simulations of the way machines work to visualizations complex systems can provide powerful demonstrations to assist in learning.

New student – teacher relations

Asynchronous courses require more students to be enrolled in order to sustain robust group interactions since the students can be at different points in the course at the same time. This model requires different sorts of group exercises, ones that do not require the students to be at the same place in the course at the same time. Moore and Kearsley note that learner-learner interactions are a relatively new element in distance education [9], and so we must think in new ways about the course interactions we wish students to engage in. These group interactions can take the form of informal discussions, topical or other structured discussions, building projects or papers online, peer editing, brainstorming, and case study analysis, for example.

In collaborative learning, instruction is learner-centered rather than teacher-centered and knowledge is viewed as a social construct, facilitated by peer interaction, evaluation and cooperation. Therefore, the role of the teacher changes from transferring knowledge to students (the "sage on the stage") to being a facilitator in the students construction of their own knowledge (the "guide on the side"). Some examples of collaborative learning activities are seminar-style presentations and discussions, debates, group projects, simulation and role-playing exercises, and collaborative composition of essays, exam questions, stories or research plans. This new conception of learning shifts away the focus from the teacher-student interaction to the role of peer relationships in educational success.

Models of higher educations

Hana describes and analyzes several models of higher education:

- Extended traditional universities
- For-profit adult-centered universities
- Distance education/technology-based universities

- Corporate universities
- University/industry strategic alliances
- Degree/certification competency-based universities
- Global multinational universities

For extended traditional university operates as the parennt organization, serving as a sponsor for programs conducted for this "alternative or nontraditional" constituency or clientele. Such programs do not threaten the basic academic organization of the university, but they do serve a different market, one that is primarily external. Most efforts of extended traditional universities have centered on marketing and delivering existing on-campus courses and programs to adult audiences. For profit adult centered universities change their programs and are focused on educational market. Programs are almost always career focused offering courses that enable students to either enter a technical career or to advance to new management responsibilities. The distance education/technology-based universities are all organized around a technology-based approach to learning that seeks to minimize the physical separation of the learner from the instructor or from other learners. They also tend to be more adult and workforce oriented, although the large national universities enroll substantial number of traditional college-age students largely due to the incapability of traditional universities, especially in countries with rapidly growing populations.

During the 1980's a number of corporations established umbrella organizations to provide for the corporation's comprehensive human resource development, education and training needs. Their reasons for developing comprehensive training and educational programs included the need to develop basic educational competencies in the workforce, acculturate employees into the company, improve cooperation, communication and competencies of individual employees and teams of employees, and improve recruitment, advancement, and retention incentives.

Partnerships marry universities and for-profit organizations in ways that force contact and interaction between very different cultures, goals, and operating principles and assumptions. One potential benefit of this interaction is the opportunity for both organizations to acquire much needed information and knowledge from the other, and also to change some of the unexamined practices that may be inhibiting the organization from developing a successful strategy in a changed marketplace.

Organizations are also emerging to take advantage of recent changes in the labor market brought about by the increasing pace of change, especially in technology areas. With learning a requirement to stay current, and with workers changing both careers and employers more often than ever before, individuals need to certify and re-certify their competencies on a regular basis. In the professions, this has become a requirement known as mandatory continuing professional education.

The marketplace for learning is becoming global. With new technologies, neither language nor distance is a barrier to access, although cultural norms and patterns are among the formidable obstacles to learning across political and cultural boundaries. There are no problems for a university to become global, and indeed there are few universities that offer their courses in more than one country.

Computer mediated communications and lifelong learning in the maritime environment

To find opinions about possible use of the computer mediated communications for lifelong learning we have prepared a survey between students and seafarers. The survey has been divided in four parts. First part is used to define the bias of the participants, second to evaluate different tools and types of lectures, third to state the usage possibilities of new technologies in learning, and the last to convey the application of the computer mediated communications in the process of learning in the maritime environment.

First part had three questions, defining the bias in the knowledge and usage of the Internet and multimedia. The 79,17% of all participants are aware of the concept of Internet (93,75% of the students and 50% of the seafarers) , and 66,67% have any kind of the experience in Internet usage (50% of the seafarers, and 75% of the students). It is interesting that the multimedia have used only 62,50% of the participated population (68,75% of the students and 50% of the seafarers).

It has to be noted that the although the concept of the Internet is not in full known by all the participants, the utmost part of the population is aware of technology, and as will be shown later predict the principal use in the learning process.

In the second part the participants had to rate the classic lectures, video, CD-rom lecturing, Internet and interactive lectures with the grades from 1 to 5. The results are shown in the table 1.

	Total		Students		Seafarers	
	Avg	Std. dev	Avg	Std. dev	Avg	Std. dev
Classic lectures	3,86	0,83	3,93	0,68	3,62	1,06
Video	3,77	0,82	3,75	0,85	3,62	0,74
CDRom	3,59	0,72	3,62	0,71	3,62	0,74
Internet	3,86	0,84	4	0,73	3,75	1,03
Interactive lectures	3,86	0,92	3,82	0,98	4,12	0,83

Table 1. Rating the learning technologies

From the table it is evident that, although the total average grades for classic lectures, Internet and Interactive lectures are equal, the students have rated Internet with best grades, and seafarers have rated Interactive lectures as the best way of presenting the topics in the lectures. It is interesting that the students grade classic lectures with better grades and smaller standard deviation than the seafarers, where the standard deviation is spread over one grade.

It is also interesting that 66,67%, of the population (75% of the seafarers) think that the classic lectures are more advantageous than computer mediated learning. Both students and seafarers in 95% think that in the future the computer mediated communications will be main means for learning.

91 % of the population demands any kind of connection (online or via e-mail) with the teacher for support.

The results show that even if the subjects do not know the principles of the computer mediated communications participants in the survey think that the future of the learning in the maritime environment resides in the wide usage of the computers. As expected the seafarer population is a little bit conservative but not in decisive way. By the presupposition of the participants the massive usage of the computers and networks for the teaching in maritime environment will be in a period between 5 and 7 years.

Conclusion

The global marketplace and new technologies are contributing to the rapid globalization of higher education. Today's business environment draws its professional work force from all corners of the globe. This paper has presented various learning technologies used in the new concepts of computer mediated communications and distance learning. The new learning solutions are presented, especially ones using Internet as primary medium

The barriers to accessing learning opportunities are falling dramatically because of improved learning technologies. The number of providers of and approaches to education and training will continue to grow dramatically as access improves and as demand for lifelong learning increases globally. Universities of all types will increasingly focus on responsiveness to learner needs and desires such as convenience, timing, engagement, application of knowledge to the workplace, and learning by doing.

In the maritime environment as shown by the study reviewed in this article, the expectation is, that the massive use of the computers and communication networks will be dominant in the period from 5 to 7 years. The role of the teacher will be changed, giving him a different , much more responsible role. The teacher student relationship will be changed from teacher oriented to student oriented. Students and teachers have to interact in new and crucial ways to facilitate learning.

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Interesting examples of combinations of synchronous and asynchronous learning can be found at

MIT [http://www-caes.mit.edu//],

Stanford University [http://stanford-online.stanford.edu//],

Rensselaer Polytechnic Institute (RPI) [http://www.rpi.edu//],

The New Jersey Institute of Technology (NJIT) [http://eies.njit.edu/~hiltz//]

"California State University Institute: Higher Education's Entrepreneurs." California State University Web Address: [http://www.co.calstate.edu/CSUI/info/summary.html]

Washington State University. Web Address: [http://www.wsu.edu/vwsu/]

University of Phoenix. Web Address: [http://www.uophx.edu/uop/_campus.htm]

TRAINING ON THE RADAR NAVIGATION SIMULATORS AS AN IMPROVEMENT IN EMERGENCY PREPARDNESS OF SHIP'S OFFICERS

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STCW'95 Convention introduced the necessity of crew member's training and assessment on a simulator devices. Unfortunately, in or opinion, training and assessment on simulators is compulsory only during Radar Observation and Plotting and ARPA Courses. In the case of other courses, training and assessment in simulated suitable conditions are only recommended of permitted.

STCW'95 Convention requires, that any simulator used for mandatory simulator-based training and assessment of competence required under the Convention or for and demonstration of continued proficiency so required, shall (Section A – I/2):

- be suitable for the selected objectives and training tasks and be capable of satisfying the specific assessment objectives;
- be capable of simulating the operating capabilities of shipboard equipment concerned, to the level of physical realism appropriate to training of assessment objectives, and include the capabilities, initiations and possible errors of such equipment;
- have sufficient behavioural realism to allow a trainee to acquire and a candidate to exhibit the skills appropriate to the training and assessment objectives;
- provide a controlled operating environment, capable of producing a variety of conditions, which may include emergency, hazardous or unusual situations relevant to the training and assessment objectives;
- provide an interface through which a trainee can interact with the equipment, the simulated environment and, as appropriate, the instructor; and
- present an instructor, and assessor the ability to control, monitor and record exercises for the effective debriefing of trainees and effective assessment of the performance of candidates.

In conducting mandatory simulator-based training or in assessing on a simulator the ability of candidates to demonstrate their levels of competency, instructors or assessors shall insure that:

- the exercise objectives and tasks, level of difficulties, and assessments criteria are stated clearly and explicitly and are valid and available to the trainees and candidates, who have sufficient planning time before the exercise or assessment starts;
- trainees and candidates have adequate familiarisation time on the simulator and with its equipment before training or assessment exercise commenced;
- guidance given and exercise or assessment stimuli are appropriate to the selected tasks and exercise or assessment objectives and to the level of trainees or candidate experience;
- simulator exercises are designed and tested so as to ensure their suitability for the specified training or assessment objectives;
- exercises are effectively monitored, supported as appropriate by audio and visual observation of trainee or candidate activity and pre-and post – exercise evaluation report;
- trainees or candidates are effectively debriefed to ensure that training or assessment objectives have been met and that operational skills demonstrated are on the acceptable standards.

The required additional operational standards are presented in section A-I/12, but only for the mandatory ARPA and Radar simulator. Recommended guidance regarding the use in training and assessment of the two above mentioned simulators and of other following simulators:

- navigation and watchkeeping;
- ship handling and manoeuvring;
- cargo handling and stowage;
- radiocommunication; and
- main and auxiliary machinery operation contains Section B-I/12 of STCW'95 Convention.

According to the above analysis of STCW'95 requrirements and recommendations we can say that for the first time the subject of training and assessment on simulator is regulated. Mentioned Convention is based on the standards implemented in the other means of transport /mainly in aerospace/ recognised that simulator training, parallel to the practical on board training, is the main method of education to gain the experience by trainee.

According to our experience /both of us have few years of simulator and several sea practice, including service on the training vessels/ two described ways of practical training are complementary to each other. On board sea training allows to verify and to improve in conditions the practical professional knowledge but is time consuming and not effective.

It is difficult for each one candidate for the watchkeeping officer certificate to have on board training on the ships of different type, size and with the different manoeuvring characteristics.

On board the ship it is difficult to acquire enough experience in emergency, hazardous, or unusual situation procedures. Up to now only theoretical knowledge, about the above procedures, has been taught during the education process in the Academies or on specialised and on the upgrading courses. Emergency procedures for some dangerous situation are brought to perfection during ship's drills. These drills are covering only few emergency situations and their main target is to exercise crew members in their functions contained in the Muster List or Contingency Plans to attain better proficiency.

There is neither time, nor possibility to check, what would be, if... Correctness of all the above activities is a matter of estimation by ships masters or by Port State and Flag Sate inspections. There is a subject to discuss qualifications and experience in the above described procedures of masters, inspectors and lecturers of maritime academies. Very often even with long practical experience the basis of the emergency procedures in dangerous, hazardous or unusual situations they know, mainly theoretically, from lectures in maritime schools, or from courses. Evidence of sea courts, of causes of sea incidents show, effective is the presented above training system. Simulators with the proper software and duly equipped makes possibilities for training and assessment of seafarers without above mentioned limitations. The basic advantage of simulators is ensuring by them the following possibilites:

- realisation practical exercises on any ship of one's choice, in any part of the sea, in any hydro-meteorological conditions, depending only on software possibility of the device;
- creating any really dangerous, hazardous or unusual situations know from practice;
- repeating the presented above situation many times for any trainee to collect statistic data about preservation and principles of different seafarers decision in the same dangerous, hazardous and unusual situations;
- a compiled, basis of the statistic data, more effective emergency procedures and principles of decisions in the above mentioned situations; and
- testing of correctness and usefulness of the newly created procedures;

We would like to emphasise, that kind and reality of the situations arranged on a simulator are depend on the software and equipment. The above subject is described in the STCW'95 Convention in section A-I/12 where it is stressed that simulator must secure physical realism,

demonstrate limitations and possible errors of equipment and may simulate emergency, hazardous and unusual situations relevant to the training and assessment objectives.

One of the simulators owned by Gdynia Maritime Academia is four bridge radar-navigational simulator NMS-90 equipped with the operational software Mark III. All bridges are equipped with all necessary aids to navigation and all systems required or recommended by SOLAS Convention and IMO Resolutions for large ships. With those devices our simulator is creating a real model of navigation bridges. Radar display units are equipped with radar plotters unable to make classical radar plotting. Real VHF radiotelephones work in the closed circuites without aerials. One of the bridges is even equipped with a classical steering wheel. Instructor's console has a shore base VHF station and devices for registration realised exercises in the hardware in the computer (with the play-back function) and in the printer and X-Y plotter.

In the simulator's library are stored.

- about 15 completely programmed coastal areas like: Dover, Malacca, Singapore, Gibraltar Straits, German and Gdańsk Bays, areas of port in New York, Southampton, Bremen and Bremenhaven, Emden, Gdańsk, Gdynia, etc. (coastal areas include coastal lines, depths, aids to navigation including buoys, lighthouses local radionavigation systems, currents, tides jetties and bollards in the ports.)
- models of vessels prepared by DMI

The following courses are conducted a simulator:

- ARPA
- Radar Observation and Plotting;
- Radar Simulator;
- Bridge Resource
- Co-operation between ferries proceeding on the fixed routes and SAR centres; and
- VTS operators

and practical exercises in keeping navigation watches for cadets and watchkeeping officer /operational level/ and in manoeuvring and emergency procedures for masters and chief mates /management level/.

Programmes of all courses and practical exercises contain procedures in emergency, hazardous and unusual situations relevant to the course or exercise objectives.

The table below presents types of situations included in particular programmes for the courses and exercises:

1. Radar Observation and Plotting Course

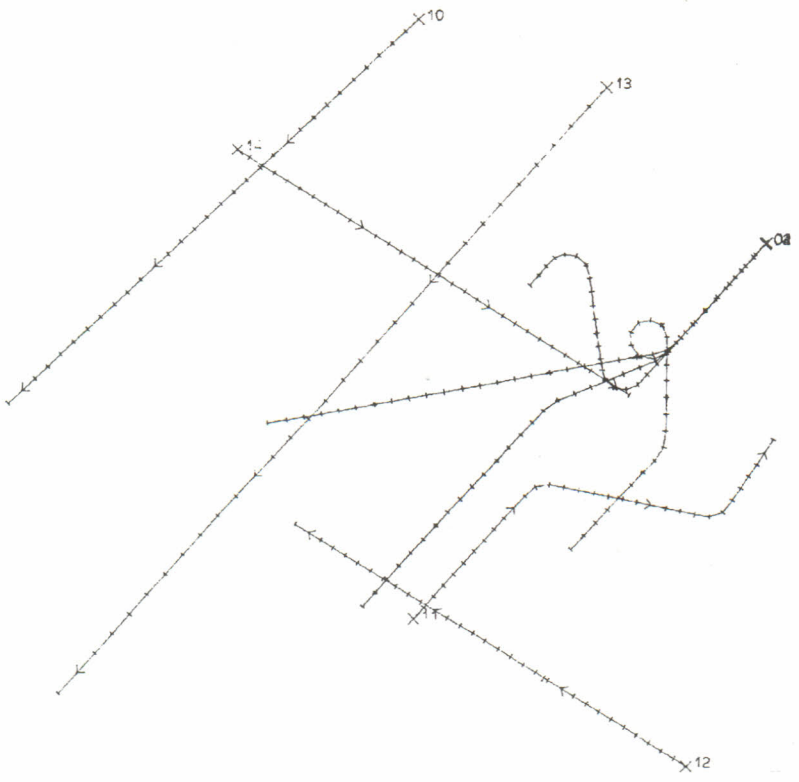
1.1 *main malfunctions of radar equipment, possibility of detection of default units and* influence of these malfunction on operational possibilities of ship's radar;

1.2 false echoes – their detection and influence on radar operational parameters;

1.3 practical complexive exercises in navigation in restricted visibility in the rear areas;

1.4 action should be taken after hearing apparently forward of her beam the fog signal of another vessel, or which cannot avoid a close-quarters situation with another vessel forward of her beam;

1.5 manoeuvring if a close-quarters situations are presented in the drawings 1,2,3,4 and 5. In all situations four own ships are in the same starting positions proceeding the same courses and at the same speed. The cadets working as watchkeeping officers on the bridges of the above mentioned own ships have the same navigation situations on the radar screen. The drawings are presented as samples of different estimation of the situation and possibilities to manoeuvre done by cadets with the same level of educations and practical experience.



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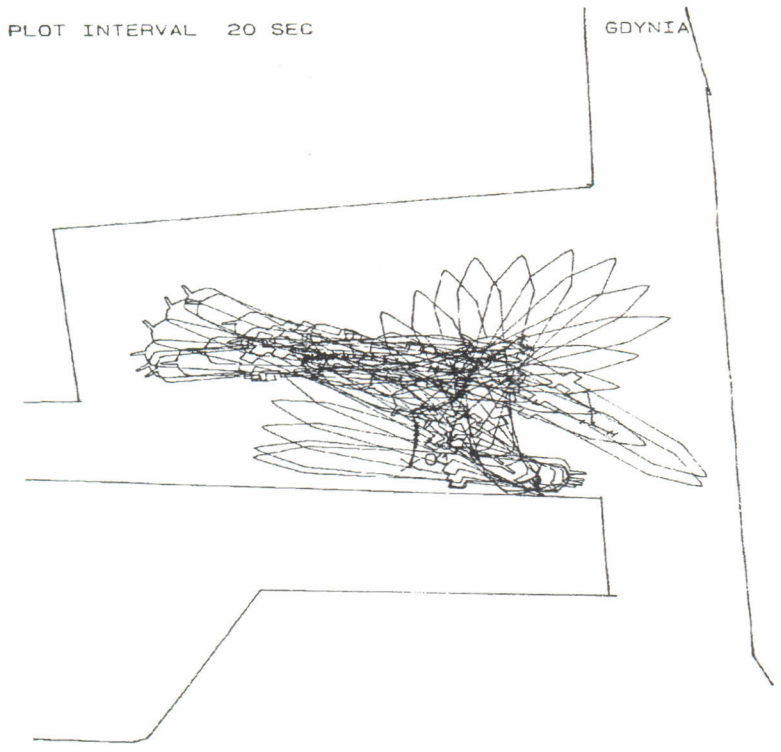

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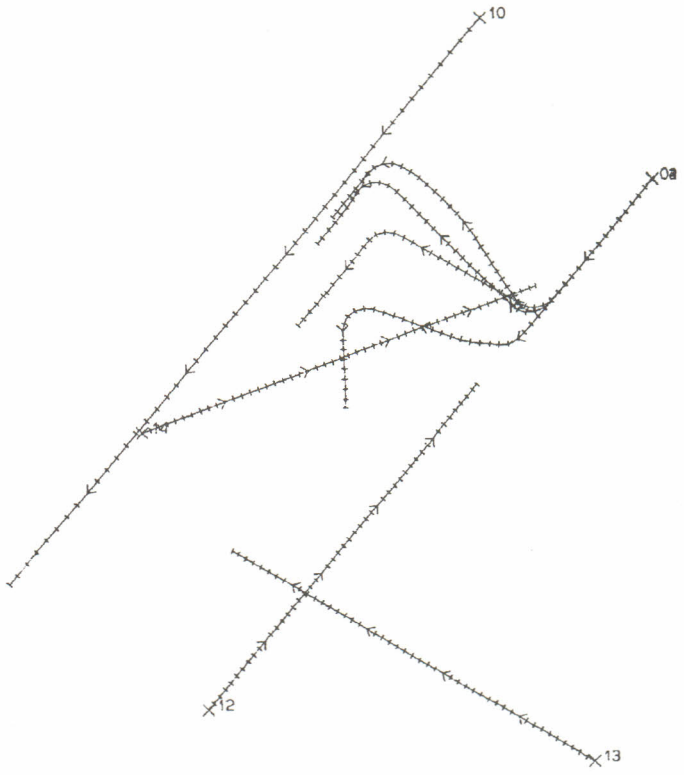

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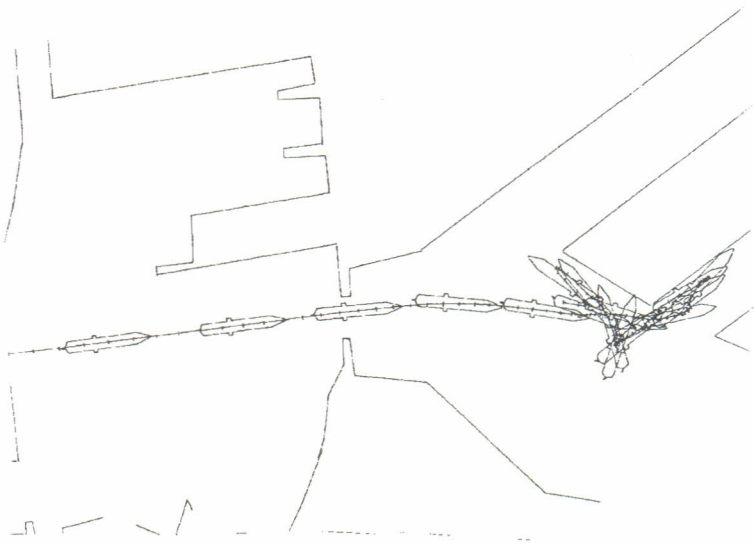

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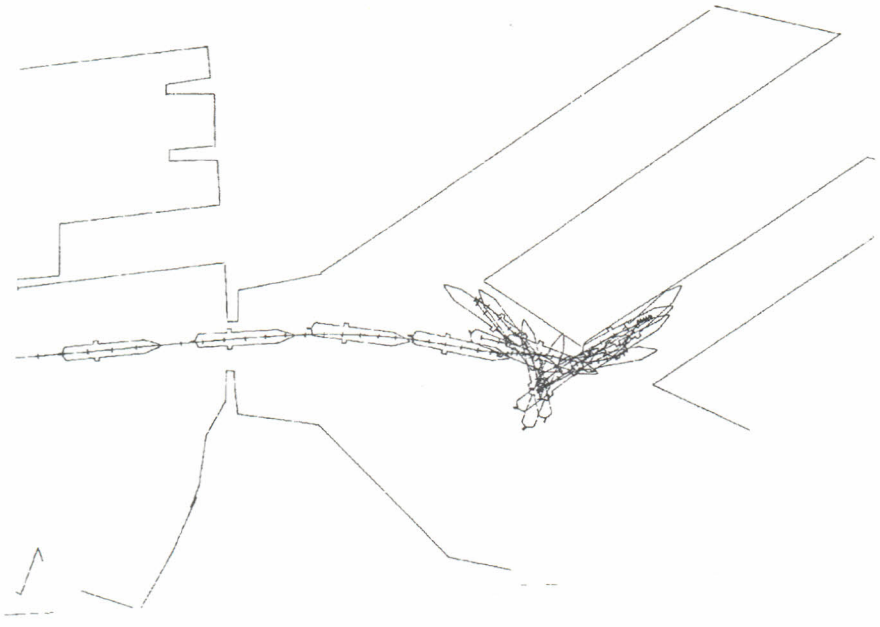


Drawing 5.

2. ARPA courses

2.1 main malfunctions and limits of different types of ARPAs, method of testing;

2.2 manoeuvring using information displayed on ARPA when a close-quarters situation is developing; and

2.3 use of ARPA with electronic charts in SAR operations, acc. to MERSAR requirements.

3. Radar Simulation Course

3.1 navigation in restricted visibility inside the port areas, in the rivers, in the restricted areas and in the areas with dense traffic flow;

3.2 port and anchor manoeuvres in restricted visibility;

3.3 behaviour when a close-quarters situation is developing /"manoeuvre of the last minute"/; and

3.4 navigation in the restricted visibility with temporary inefficient radar of with radar with seriously limited operational performance standards;

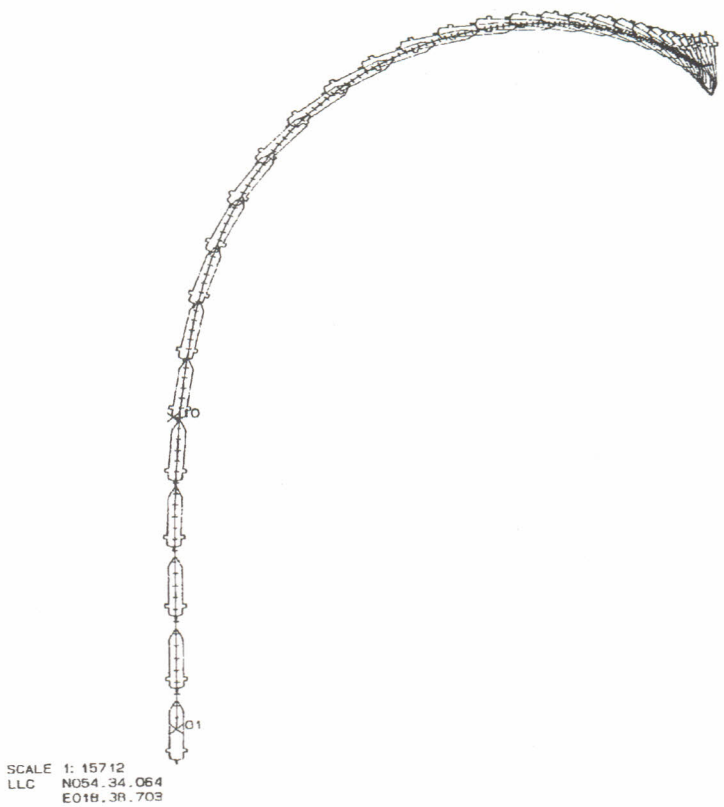
3.5 navigation in coastal area with not up-dated charts and navigation publications.

The samples of the exercises of manoeuvring in the port areas are presented in the drawing no 6 and 7.

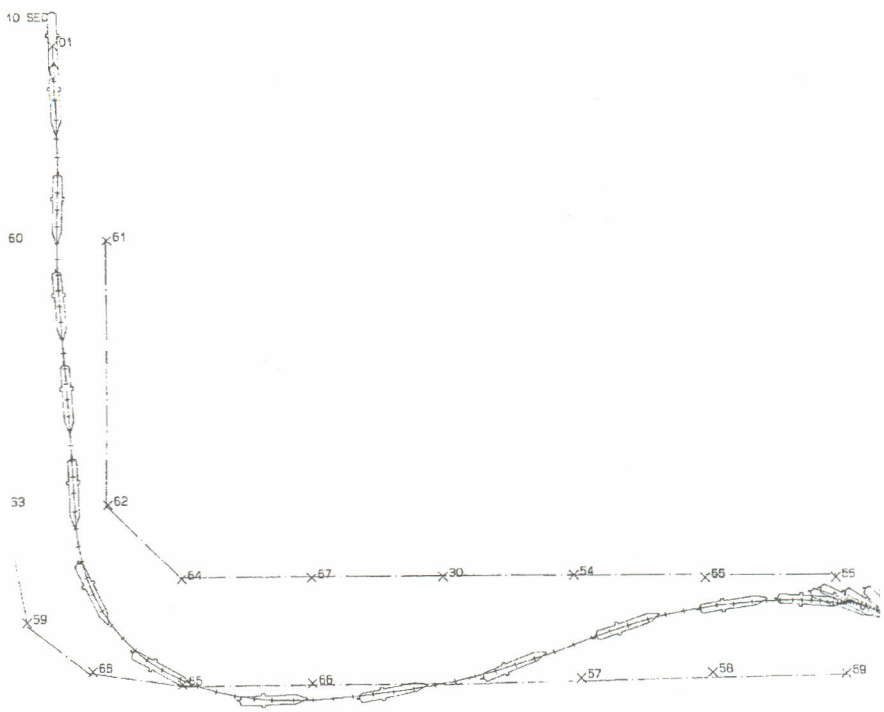
4. Bridge Resource Management Course

4.1 situations, when wachkeeping officer should call master on the bridge;

4.2 actions should be taken by master called to the bridge;



Drawing 6.



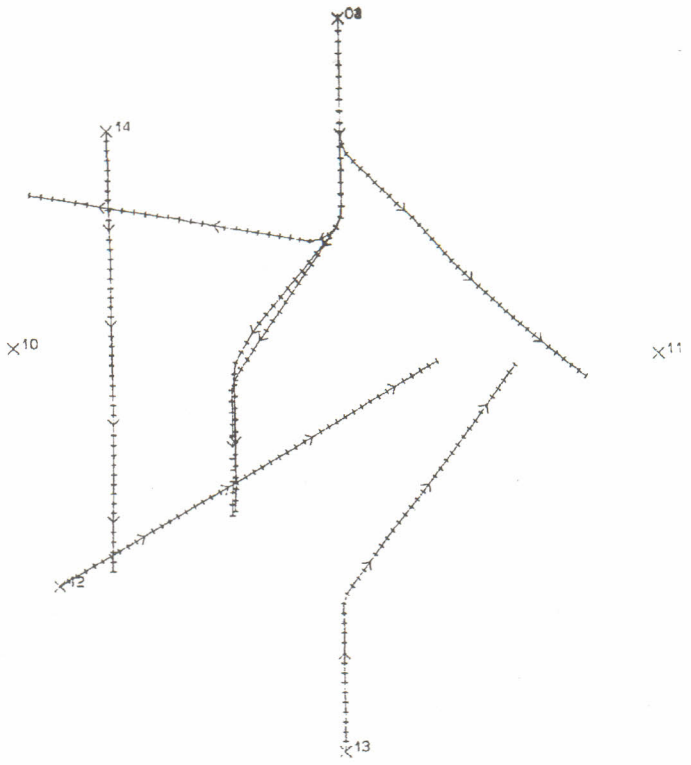
Drawing 7.

4.3 bridge procedures in emergency situations:

- after black-out, main engine or steering gear damage,
- MOB, grounding, fire, SAR action,
- receiving May Day signal by VHF or on radar screen (SAR transponder signal),
- damage to navigational equipment e.g. – radar, radionavigation receiver etc. when sailing in reduced visibility

5. Co-operation between ferries proceeding on fix routes and SAR centres

Practical exercises on this courses conducted on a simulator have special prepared scenario. Four school bridges simulated four different vessels; one of them obligatory is a ferry boat, second one may be a rescue vessel, two last are different – sometimes large crude oil tanker in loading or ballast conditions and small coaster. Watches on the bridges are provided by masters and chief officers from ferries (two persons on each bridge). In the event of the use of rescue vessel, master and chief mate from real rescue ship work as a crew on that bridge. The operator from MRCC works in the front of instructor's panel. He has the same equipment and possibilities like in MRCC centre. At the beginning of the exercise all ships keep normal navigation watch. Merchant vessels are sailing in the coastal areas, rescue ship is alongside in the port. Rapidly distress call has been received by VHF. Normally May Day signal is sent from a small yacht knowing only its dead reckoning position. Later the crew of the yacht inform, that they have to leave the vessel in small /four person/ life raft. The distress signal shall be heard by merchant ships but not by rescue vessel and MRCC operator. It means that one of the ships should send distress signal ashore. According to the scenario the ferry boat should be the first in the position of accident, and the rescue vessel as the last one. It means that the master of ferry boat has to take function of the commander on scene and organise the SAR action, keeping the voice communication with MRCC centre. Knowing actual hydrometeorological condition he has to calculate reference position, search area and acquire other merchant vessels and finally to plan schema of search for all acquired vessels. Nominated commander has to send by VHF actual reports to MRCC operator; which allow him to control if search and rescue action is realised properly and to give advice if it is necessary. Particular ships arrive at the search area in different time, their manoeuvring possibilities are also different, it means planning of search and rescue is rather difficult. Due to the above mentioned differences it is impossible to implement presented in the MERSAR scheme of search for 3 or 4 ships. It is not possible to use aeroplane and rescue helicopter, survivors can be rescued only by vessels. According to experience, after realisation of the exercises conducted, very often ships could not find survivors, when the scheme of search had been planned according to MERSAR recommendations. There is necessity to state once more reference position, taking into account drift of the life raft during the time when the first search action was conducted, and new searc area. In this time the rescue vessel arrives at the search area an her master takes over the Commander function on scene. This exercise is conducted on the area around the Gdańsk Bay. Exercises are provided for the masters of the ferries running in this area and for the MRCC Gdynia operators – responsible for SAR operations in the Polish waters. The Ferry boat is sailing from Karlskorona in Sweden to the passenger terminal in Gdynia; the large crude oil tanker is proceeding in loading condition to the oil terminal in Gdańsk or in ballast condition from that terminal to Great Belt; the small coaster or rescue vessel is proceeding from the west parallel to the Polish coast; the container vessel with displacement 26000 MT is proceeding from Gdynia to Great Belt. The yacht is sailing north of the Hel Peninsula. Experience scenario of the exercise is shown in drawing 8. Position 50 means the yacht position during second call when the crew were leaving the yacht drawing no 8.



Drawing 8.

OS 1 – small coastal vessel proceeding from west parallel to Polish coastline.

OS 2 – container vessel sailing from Gdynia to Great Belt.

OS 3 – 150000 MT oil tanker in ballast condition proceeding from Gdańsk to Great Belt.

OS 4 – passenger ferry boat sailing from Karlskorona to Gdynia.

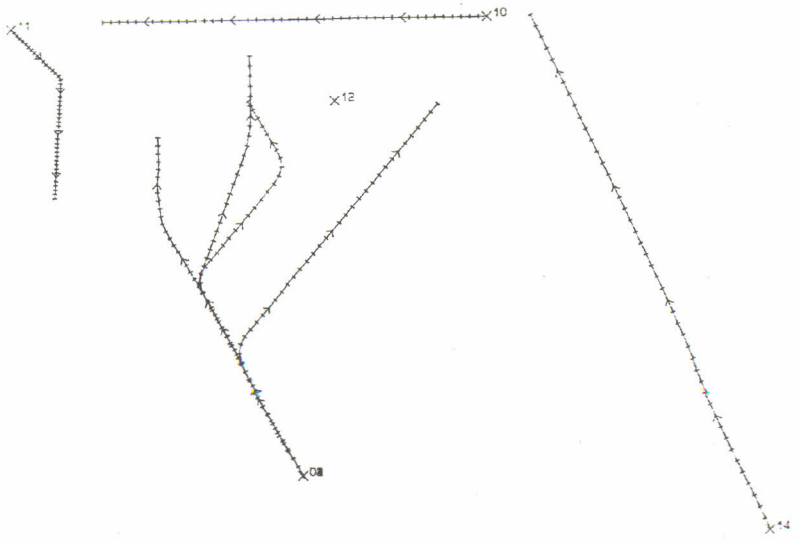
6. VTS Operator Course

6.1 emergency procedures during outside imminence:
- potential collision, grounding or pollution,
- collision,
- grounding,
- fire on board (vessel inside VTS area),
- MOB,
- accident with crew member involved on board the ship – necessity to organise medical first aid,

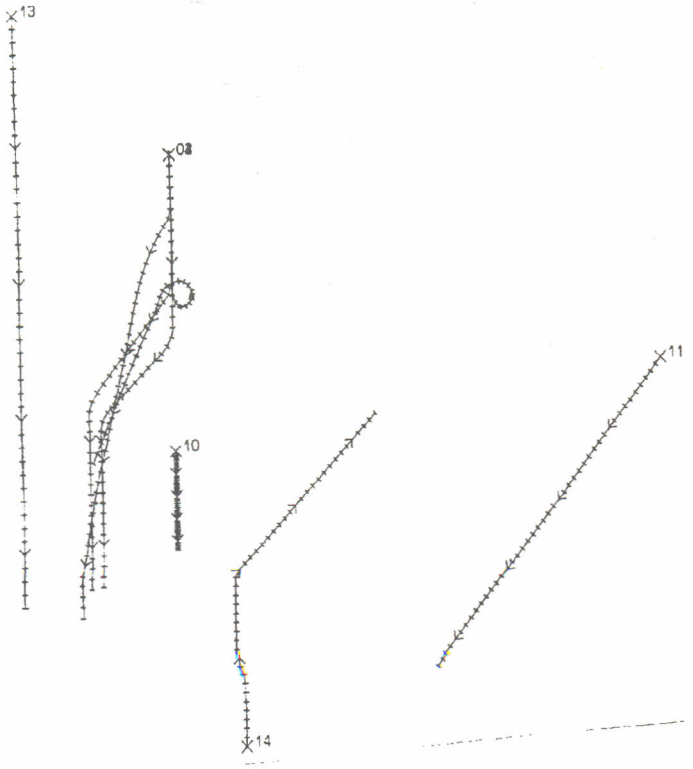
6.2 emergency procedures when CALREG regulations are not followed,

6.3 emergency procedures in inner emergency situations:
- radar damage,
- computer damage (lost of tracking target),
- damage or malfunction of radiotelephone VHF,
- fire in the VTS centre,
- unauthorised person inside VTS centre,
- missing communication between VTS centre and MRCC centre after receiving distress call,
- missing communication between VTS centre and medical service after receiving medical help requirement;

7. Practical exercise in keeping navigational watch for cadets and watchkeeping officers (operational level):



Drawing 9.



Drawing 10.

From the presented above composition of emergency situation exercises for different level training it can be seen that we create situations on our simulator which are really difficult, or impossible to be created on board the ship. We are always interested to check the behaviour of trainees in those situations and effectiveness and correction of action taken by them. The results of the exercises are followed by discussion and indication of mistakes and deficiency or cause of lack of effectiveness of action taken by trainee and finally recommended procedures are presented. When it is necessary emergency procedure is repeated and trainee are following all recommendations.

Our intention is to apply all available possibilities on our simulator to improve effectiveness of students and officers training and finally to improve safety at sea. The described above unusual, hazardous and emergency situations are most difficult in sea practice and should be trained on simulators as much as possible.

7.1. watch in reduced visibility in coastal waters, in dense traffic flow and in traffic separation schemes,
7.2 discovering of malfunctions and errors of navigational equipment (radar, echosounder, log, gyro, radionavigation receivers),
7.3 situation when master should be called to the bridge,
7.4 procedures after receiving information about fire on board, water inside ship, MOB,
7.5 received warming, security and distress calls given by voice on VHF and action taken after that
7.6 activities after main engine damage, black out, steering gear damage, and
7.7 VHF communication in emergency situations

Exercises are conducted in four hours watches between 08 – 12, 12 – 16, 16 – 20. All watch procedures are compulsory (charts works, log book etc.) including taking over the watch procedures. At 2000 hrs ships are dropping their anchors until next day up to 0800 hrs. The first watch pick up the anchor and continue the voyage. There are two persons on watch on each bridge, one is working as watchkeeping officer the other one as A/B. After two hours the functions are changed. Partially the emergency situations arise from the movement of the ships (collision, grounding), partially are arranged by the instructor. Each cadet should pass without any faults five four - hour watches. As a routine durign the first watch they are living port in the Bay of Gdañsk. Next watches are conducted in the following areas:

– Great Belt,
– Bay of German,
– approach to Emden or to Bremerhaven,
– The Dover Strait,
– The Malacca or The Singapore Strait,
– The Tokyo Bay or approaching to New York;

As a rule during each watch there are at least two emergency situations; to evaluate correction of activities and documentation is taken into consideration.

8. Practical exercises in manoeuvring and emergency procedures for masters and chief officers (management level)

8.1 practical checking of effectiveness of stopping manoeuvres for different types and sizes of ships in emergency situations:
8.2 practical checking of effectiveness of MOB manoeuvres for different types and sizes of vessels;
8.3 last moment manoeuvres,
8.4 procedures in emergency situations like fire, grounding, MOB, abandon ship, main engine damage, black out, steering gear damage,
8.5 communication on VHF in emergency, and
8.6 detection of navigation equipment damage

The sample exercises in practical checking of the effectiveness of stopping manoeuvres of the large crude oil tanker in loaded condition are presented in drawing no 9 and 10.

DESIGN AND IMPLEMENTATION OF STCW AND ISO QUALITY STANDARDS

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ABSTRACT

Marine Egineering Faculty of Gdynia Maritime Academy has gained national and international /IQNet/ certificates for quality assurance system in education and training. The system and its documentation perform STCW requirements /including ISM Code implications/, national demands for higher education and other references, too. The system covers all levels and kinds of education and training, provided by faculty. All works /e.g. internal trainings, the preparation of documentation/ were carried out by faculty staff; a few lecturers have taken additional external trainings as internal auditor and lead auditor - they are also carrying audits in both industry and services. Additionally, invaluable publications and experiences of WMU were very helpful in final translation of STCW and educational processes into ISO 9001 scheme. Also recommendations of ISO 9004-2 /services/, 10013 /quality manual/ and 10005 /quality plans/ were taken into account; the quality planning of the didactic process was the most important tool for quality assurance in whole education process. Documentation /continuously revised, 4th edition now/ consists of only 38 pages of quality manual, and set of procedures with instructions /only up to 30/; all are to be used as guidelines by lecturers and technical staff for all means of quality management /planning, control, assurance and improvement/. Development of the system is maintained by using results of audits /internal and external/, taking preventive and corrective actions, sustaining the gains and involving the whole faculty staff. Progress is monitored and stimulated by periodical /every two-three month/ management review of the system to ensure its continuing suitability and effectiveness /according to STCW and ISO 9004-4+AC1 recommendations/.

Key words: STCW 78/95, quality standards, quality assurance, education.

1. THE CHARACTERISTICS OF THE FACULTY

Marine Engineering Faculty of Gdynia Maritime Academy is one of the four faculties at this academy and educates on the "Mechanics and machinery building" with speciality on:

- exploitation of ship power plants,
- technology of renovation of shipboard and harbour equipment,
- engineering of exploitation of industrial installations ,
- engineering and management of renovation of shipboard equipment.

Functioning for 78 years, the faculty educates ships' engineer officers and engineers /of aforementioned specialities/ for ship-repair industry, industrial installation exploiters /especially needed in small business/ etc. It provides studies for BSc and MSc degrees - stationary, evening and extramural. This wide range of specialities and kinds of studies attracts candidates from all over Poland - interested in working either on the sea or on the land.

2. REQUIREMENTS AND RECOMMENDATIONS TAKEN INTO CONSIDERATION

Preparation of the project of quality system, its documentation and implementation took a year and a half, from December 1996 /Rector's issue of the proper order, the approval of tasks schedule, announcement of the first edition of quality policy by Dean and appointment of author as the Management representative, responsible for quality system/ to certifying audit on 27-29th April 1998.

The works were carried out in order to meet requirements of the STCW 78/95 Convention [1], which in Annex, Chapter I, Reg. I/8 and in STCW Code A, Section A-I/8 demands that the institutes educating seafarers have a quality system. Reg. I/8 demands, that "Each party shall also ensure that an evaluation is periodically undertaken in accordance with the provisions of section A-I/8 of STCW Code by qualified persons who are not themselves involved in the activities concerned"[1, p.28].

The model ISO 9001 was chosen, due to the fact that the faculty also designs the curriculum of the particular studies. Polish quality requirements were taken into account as well, for instance:

- educational demands for kinds of studies [2],
- planned accreditation requirements of kinds of studies [3].

To adopt the ISO 9001 Standard to the service process carried out /education and training/ guidance for services ISO 9004-2 was used and, besides, to the preparation of the required documentation - ISO 10013 Standard /quality manual/, ISO 10005 Standard /quality planning/ and EN 45013 Standard /personnel certification/ were also helpful. Apart from that, to adjust the ISO 9001's terms to the language describing processes carried out, such applications as HEQC [4] and DNV [5] were taken into account.

The system of quality assessment in education, which is now being prepared in Poland[3], was also useful to establish criteria and tools for quality planning in the faculty.

Finally, all details were verified according to recommendations and patterns:

- STCW 78/95 Convention, Code B, Section B-I/8:Guidance regarding quality standards [1],
- published by WMU clarifications, supporting implementation, application and enforcement of the revised convention [6],
- invaluable patterns presented by WMU: WMU's quality mission and goals [7] or quality planning by WMU's professors [8],
- Quality standards model for administration of national certification [9], where ISO 9000 standards were recommended for implementation of STCW's quality standards in education, similar as was recommended on Regional Seminar and Workshop on implementation of the revised STCW Convention, organized by IMO in Gdynia from 22 to 26 July 1996.

3. PROJECT AND ITS IMPLEMENTATION COMPLETED

As early as in 1996, educational and methodical materials, which were later used in the work on the project, had been prepared by the author's internal Academy research project No 115/1996-1997: "Project of quality assurance system according to ISO 9001 Standard requirements for education and training of engineer officers - with consideration the new IMO requirements". All tasks were accepted by Rector and Dean - because the project was very important to conformance with STCW 78/95 requirements in future by faculty. Lack of experiences in Poland with application of ISO 9001 Standard for education makes project very difficult and innovative.

Academy covers costs of external training for four lecturers of the faculty: one as lead auditor of quality systems /author - designated as the Managenent representative, responsible for

establishing, implementation and maintance of quality system/ and three lecturers as assistants of lead auditor; they carried out all internal trainings as own faculty's experts about quality asurance. They also lead preparation of documentation by faculty staff. One technician was employed additionally only - for current technical matters /typing, standards and documentation collecting, trainings coordination, drafts flow etc./.

In the beginning of 1997 basic trainings of the staff of the faculty and those who have classes as subcontractors for the faculty /mathematics, physics, social sciences, training ships section etc/ was carried out. Basic trainings - at the same time for faculty staff together with subcontrators of educational services, about 150 persons total - enabled the initial preparation of all the participants in all processes covered by quality system. Before trainings supporting training materials were handed together with the handbook, published by author in Academy - in 1996 - for that purpose /devoted also for students for subject "Quality Management"/.

In the second quarter of 1997 the next trainings of chosen persons /professors, assistants and technicians - 25 persons/ was carried out on the subject "Quality system documentation". All trainees got proper training materials as well and especially prepared project of "procedures' procedure"/later simplified and included as instruction in item 4.5 of ISO 9001 Standard: Document and data control/. Besides, trainees got the questionnaire to assign to particular points 4.1-420 of ISO 9001 Standard of:

- processes carried out in faculty,
- specification of resposibilities and authorities /for above/,
- proposed names of procedures and instructions,
- existing documented procedures, regulations, standards, documents and forms for records.

The material prepared by trainees was essential source to prepare first draft of procedures which were discussed during trainings /lectures and classes/ by the participants. They wrote - as next step of training and , simultanously, preparation of documentation - first edition of procedures and adequate parts of quality manual /one-page-extract from each procedure/. Finally - each procedure was:

- prepared by author carrying duties covered by this document,
- evaluated by other person with similar tasks,
- verified by faculty's internal experts,
- and approved by Dean.

This method of preparation, evaluation and verification of documentation /each one edition/ involved most of faculty staff in understanding, implementing and maintaining of the system.

At the same time all existing elements of quality system /besides processes and procedures/ were identified by faculty management, e.g.:

- faculty material resources, equipment and fixtures /including labs, simulators, workshops etc./,
- faculty's and subcontractors' human resourses /science degrees, sea certificates and experience, training and certification of simulators' instructors, skills etc./.

The collected data were used for preparation of lists of needs and the plan of development of faculty /material investments, aditional trainings for lecturers, science progress of assistants, sea practices for personnel etc./.

Quality policy was redefined and documented /second time/ by Dean - in the way proper to the faculty possibilities, tasks, goals and the STCW 78/95 requirements. Faculty staff was introduced /by trainings/ into the quality policy to ensure, that this policy is understood, implemented and maintained at all levels of faculty: management, departments, lecturers, technicians, administration and students.

Very important was the publishing /on faculty's boards and in Academy's periodic "Akademicki Kurier Morski"/ of documents - from Rector's order to copies of certificates -

and current information about progress of works. Public pressing supported motivation of participants who were frequently reading information about their effects. Motivation by "public awarding" was key, and only, method of inspiration of faculty staff. Also Faculty's Council and Academy's Senate got quarterly reports about progress and difficulties; it supported "activity loop" of faculty staff as well. Continuous influence /"all and everywhere are talking about successes of faculty's staff "/ on attitudes was a fundamental tool for motivation of faculty staff.

The assumptions of the quality manual /content arrangement, scope, etc./ were also prepared. Helpful here was the analysis of particular processes /recruitment, admission, didactic, workshop training, sea training, communication with postgraduates and their employers etc./, which allowed to adopt ISO 9001 requirements to provided processes. For example, item 4.3. of ISO 9001 Standard /Contract review/ was adopted - with recommendations of Section I/8 of B Code of STCW 78/95 - in three separate procedures:

- professional preorientation / as "marketing"/: informations for potential applicants, meetings in secondary schools, "open days" in faculty, public relations etc.,
- requirements review: investigation of new demands / IMO's, government's, owners' etc./ for preparation of input data for designing and modernization of syllabus / 4.4. Design control/ - together with results of research of opinion of employers about postgraduates and opinion of postgraduates about passed studies / according to item 4.19. Servicing/,
- recruitment and admission, including health tests and initial sea training /two weeks/.

To increase the interest of youth with sea carrier, as recommended on the 30th session of STW Sub-Committee /held 25 to 29 January 1999/, the book titled "Sea salt" was edited.

Apart from the preparation of documentation other training was carried out: for internal auditors /15 persons: professors, assistants, lecturers and technicians/, chosen by faculty management. Before the courses participants had got training materials

Many trainings were also done to introduce staff to providing records, required in quality system.

Further changes in the procedures allowed to prepare documentation adequate to the needs of the faculty. The third issue of all procedures / up to 30 examples with instructions - procedures are listed below in Annex/ and quality manual /consists of only 38 pages/ were edited before certifying audit /April 1998/. The fourth edition with additional /over 70/ changes under supervision was completed up to annual external audit / March 1999/.

The faculty received essential help from Polish Centre of Certification and Testing / PCBC - government body for certification of quality systems in Poland/, which enabled to do 10 various courses for faculty's experts. This investment allowed to avoid expenses on external consultants and carry out trainings of staff by faculty's own experts. Besides, the experts - trained in this way - are also lecturers for subjects "Quality management" and "Safety management", combining theory with practice. During the trainings many publications of PCBC and Polish Forum ISO 9000 were used; the faculty is the member of the latter.

Special contribution to the improvement of documentation made auditors from PCBC during audits: initial and certifying. Through numerous, detailed questions they indicated needs and problems which were to be solved. This also helped to improve basic terminology:customer, subcontractor, quality of process, quality of effect etc. Auditors' questions, recorded at once, helped to prepare the programmes of improving of quality system and further trainings, e.g. additional weekly training for internal auditors. The results of certifying audit / 3 nonconformities and many fruitable auditors' observations/ helped to prepare timetable of detailed tasks to be done before next /annual/ audit, carried out on 27-29 March 1999 - with new auditors' observations, especially those concerning supervision of documentation and records providing.

4. CHANGES OF THE STAFF'S ATTITUDES - MOST IMPORTANT GAIN

Educational processes carried over at the faculty require that the faculty function with regards not only to the formal discipline of work /as in industry/ but to academic and moral responsibility and authority as well. Therefore such instruments as in industry cannot be fully effective in educational institution. Hence special attention was paid to ways of influence on attitudes components /intelectual, emotional and behavioural/ of each person - in its particular groups: professors, assistants, lecturers, technicians and administration. Each of these groups has its own ambitions, self-evaluation and needs. Because of that, influence varies and is specific to each group. Yet classes were carried over without distinction between social position or status; professors participated in trainings together with other members of the staff, which allowed to use their authority to stimulate the change of others' attitudes as well. Thus:

1. To change intelectual component of attitudes: trainings in different kinds of classes adopted to participants and their level of ability of abstract thinking /lectures, seminars/ were carried over with the use of different tools: metaplans, brainstorming , questionnaires etc.. Helpful here were training materials, illustrations and manuals supporting understanding, interpretation and comparison of standards /ISO 9001 and STCW 78/95/ with faculty's practice.
2. To change emotional component of attitudes: preferred values and emotions were stimulated through indicating and drawing attention to higher values. Needed here was the change of disposition from that of the "neutral observer"and "reviewer" to that of the "participant" identifying with faculty's mission and goals. Publications about successes of participants and "public pressing" /mentioned above/ were helpful also for involving staff into implementation of the project.
3. To change behaviour: grading /and awarding at once!/ the successive phases of activity of participants of trainings:

- listening only - appreciation of participant's presence and attention,
- asking, commenting, assessing /as "observer"/ - appreciation of interest,
- explaining to others, commenting, trying to show the knowledge on the subject- oral awards,
- evaluation of others' projects /"reviewer"/, participating in their own project - giving next tasks,
- comments on the official projects, evaluation or verification of projects - signing projects as author or evaluator,
- preparing and carrying of internal audits, making petitions for changes - awarded by Dean.

All trainings were carried over with regards to procedure rules, and recorded. Especially important was the participation of faculty management / dean, two deputies of dean. each chief of department with depury for technical matters/ in assessments of effects of trainings, in preparation and verification of the project and implementation of the quality system.

The quality of education depends on the features of lecturers, e.g. on their authority. It cannot be traditional hierarchical authority only, based on formal regulations and extorting subordination. A student is being prepared now for functional /not hierarchical/ thinking , while the authority has the tasks to fulfil. So the authority has also tasks, not privilages only; answers questions, not only asks them; sets the patterns, not only gives examples. In this way, a student transforms from submissiveness to identification and imitation of patterns and, as a result, a student internalizes values, beliefs, attitudes, standards and practices by identification with patterns and by imitation of attitude. It helps to educate the youth in democracy, teaches them to harmonize freedom with social responsibility, in accordance with STCW 78/95 demands [1, Table A-VI/1-4, p.120: Specific of minimum standard of competence in personal safety and social responsibilities].

In this way, the institution based on authorities need not be authoritarian and is not reproducing authoritarian personality; therefore assessment of lecturers /including professors also/ is carried out by students now by special questionnaire.

Changes of attitudes were possible owing to the commitment of professors, assistants, lecturers and technicians to prepare procedures, evaluate documents and carry out internal audits. For instance - quality plans concerning preparation of all kinds of classes were successfully introduced by all lecturers: from professors to assistants. The documentation of classes /"Lecturer's file"/ also is provided as a standard tool for planning, control, supervision and records now.

Nevertheless, as certifying audit showed, changes of attitudes demand consolidation and bringing into general use, and the programme of a corrective and preventive actions states that the staff's discipline should be in progress.

5. DEVELOPMENT OF THE QUALITY SYSTEM

Continuous improvement of quality within faculty is an important profit, bringing by implemented and certified quality system. Quality loop which is driven by internal feed-backs makes system as continuously producing tasks for improvement of quality. Most of procedures have links between each other and it sets in motion all elements of the system: organization, resources, processes and procedures. Development of the system is maintained by:

- using results of audits of the whole system, taking into account standards and requirements, documentation and practice with records; internal audits carried over twice a year, system reviewed partially by faculty's management every two-three month,
- carrying of corrective and preventive actions by faculty staff,
- continuously involving of whole faculty staff for tasks, also by sustaining the gains and appreciation,
- using methods and tools for quality improvement, recommended in ISO 9004-4 + AC1 [10] and ISO 9001:2000, where item 8.4.3 will require: "The organization shall establish processes for the continual improvement of the quality management system. These processes shall include those methods and measures suitable for the product and/or service." [11].

Below are drafted preliminary proposals of subjects and tasks concerning the development of the system:

- links between faculty's quality system and updating of library's volumes,
- links between system and science researches provided by faculty staff /sytem covers education and training only/,
- covering by quality planning other processess that constitute the operating practice where specific procedures apply /sea trainings , diploma seminars and exam, etc. /,
- covering by system "Students' science circles" in faculty also; existing "Science quality circle" /"Quality Team"/ is preparing a procedure for them now,
- development of tools for investigation of demands, needs and satisfaction of postgraduates, Administration, employers and owners /according to draft of ISO 9001: 2000, now also being taken into consideration/,
- validation of new processes, equipment and personnel,
- adding also proposals for development of the system into effects of internal audits,
- covering by system all safety demands in faculty /BSI 8800 Standard / and environment protection /ISO 14001 Standard for Environmental Management System/ - development of the quality system as "Integrated Management System",
- indicating the quantitive goals of quality for lower levels of faculty's structutre: department, unit of subjects, labs, workshops,

- growth of applications of statistical techniques for: system effectiveness, trends in processes, customers satisfaction and conformity of effects with requirements.
- including in system of counting of quality costs /budgeting of faculty is expected/.

As drafted above, faculty staff has done first steps only on the long and long way, called quality loop.

Experiences with designing, implementation, maintaince and improvement of the system are incorporated into Academy's research program now. The Academy's project:"Methods of implementation of quality assurance system according to PN-ISO 9001 Standard in higher education" is now also approved as government project - Grant No 1 H002 009 16 for 1999-2001 years.

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ANNEX

LIST OF PROCEDURES OF FACULTY'S QUALITY SYSTEM

P/4.1/1 Procedure for management review of the quality system

P/4.2/1 Procedure for quality planning of didactic process

P/4.3/1 Procedure for contacts with youth in secondary schools

P/4.3/2 Procedure for review of oficial demands and customer needs

P/4.3/3 Procedure for recruitment and admission of students

P/4.4/1 Procedure for designing and updating of syllabus

P/4.5/1 Procedure for document and data control

P/4.6/1 Procedure for management of subcontractors of didactic services

P/4.6/2 Procedure for purchasing of equipment for educational processes
P/4.7/1 Procedure for admission of partly educated
P/4.8/1 Procedure for student identification and traceability
P/4.9/1 Procedure for didactic proces control
P/4.9/2 Procedure for sea trainings control
P/4.10/1Procedure for assessment and examination
P/4/11/1Procedure for supervision of equipment
P/4.12/1Procedure for supervision of status of student's progress
P/4.13/1Procedure for student nonconforming with requirements
P/4.14/1Procedure for corrective and preventive actions
P/4.15/1Procedure for dyploma exam and final settlement of student
P/4.16/1Procedure for control of quality records
P/4.17/1Procedure for internal quality audit
P/4.18/1Procedure for training and development of faculty staff
P/4.19/1Procedure for contacts with postgraduates and employers
P/4/20/1Procedure for identifying and applying of statistical techniques.

IMPACT OF THE AMENDED STCW CONVENTION ON MARITIME EDUCATION AND TRAINING

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Transport and Communications of the Republic of Croatia

1. Human factor in casualties

Since some experts claim that up to 80% of accidents at sea are caused by human element, this is the subject which needs most attention in efforts to achieve safer ships and cleaner seas. Also, statistical evidence shows that people making mistakes cause most accidents at sea.

The causes of people making mistakes, or what has been called human errors, are numerous: poor qualifications, inadequate training, fatigue, stress, linguistic difficulties, cultural differences, negligence... Each of identified common issues relating to the human factor must be taken into account in order to prevent accidents at sea caused by people making mistakes, because only by eliminating causes of mistakes the mistakes themselves can be prevented. The fact that up to 80% of all accidents at sea are caused by human related errors only emphasises the importance of efforts concentrated on preventing avoidable mistakes caused by human factor.

Many reports, casualty analysis and researches undertaken to determine common issues of accidents and casualties at sea also indicate that a number of common causes of accidents, serious and very serious casualties are related to the human aspect of the world-wide shipping. The table below shows the report which has identified a number of common causes of maritime accidents mostly relating to the human errors.

The table 1 shows that all items from the second column (common issues raised) are either directly related to the issues regarded as human error or to the issues which may be related to the human factor. In other words any policy to combat the causes of human error will break the chain of events leading to an accident, serious casualty or very serious casualty at sea.

Casualty category	Common issues raised
Collision	· Fatigue · Duty system of pilots · Bridge resource management · Management of the ship · Working relationship pilot/bridge team · Hours of darkness/adverse weather
Contact	
Stranding / grounding	
Fire or explosion	· Welding/cutting operations in vicinity of spaces containing flammable gases · Human element aspects
Other	· Tank venting operations

Table 1: Identified common causes of maritime accidents[1]

[1] *The report of the correspondence group on casualty analysis submitted to the IMO Sub-Committee on Flag State Implementation.*

All the figures and evaluations shown in the previous section justify and emphasise once again a high priority for all measures aimed at reducing the risk of human factor in casualties at sea.

2. The revision of the 1978 STCW Convention

The one of the most important measures aimed at reducing the risk of human error is to insure high standards for training and qualification of all seafarers. This measure must take account of the nature of today's world-wide shipping. Lack of awareness that the standards for training, education and certification must be global issue will not reduce accidents and make seas safer and cleaner because the manpower demand and supply is also a global issue.

The only possible answer which represents the global framework for standardisation of training and education of seafarers world-wide is international legislation and the only possible organization which is authorised to deal with such global maritime issues is International Maritime Organization.

In 1978 International Maritime Organization convened a conference which resulted in the adoption of the first International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) which entered into force in 1984. The STCW Convention is the most important international treaty dealing with global standards of maritime education and training. The importance of the STCW 1978 Convention is emphasised by the fact that until 1st April 1999 it has been accepted by 133 countries whose combined merchant fleets represent 98.04% of the world tonnage[2].

The said Convention was often criticized for not setting high enough standards. Over the years it became out of date and there was a need for fundamental review of education and training standards. The problem was even and bigger because some regional organizations (European Commission) have recognised the urgency of the said issue and were planning to introduce new training standards at regional level. Although it was clear that the said organization(s) have recognised the importance of the problem, introducing the new standards at a regional level for the such global issue as the training and education, may only result in more problems related to the uniform application and enforcement of international standards. The analysis and evaluation of the manpower demand/supply situation in the shipping industry only confirms that education and training standards are issues which must be solved on a global level. Namely, the international supply of seafarers very often, and today it may be said always, exceeds regional level.

In 1995 major changes were made to the 1978 Convention. The Conference of Parties to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 which ended on 7 July 1995, adopted amendments. The said 1995 amendments represent a complete rewriting of the Convention.

The high priority of the comprehensive review of the 1978 STCW Convention was given by the Maritime Safety Committee which resulted in amendments entered into force on 1 February 1997 using the tacit acceptance[3].

The Convention itself has not only a great importance for the training and education of the seafarers in the years to come. The amendments to the 1978 STCW Convention are opening a completely new page in the work of the IMO. Namely for the first time IMO has been given authority and responsibility for ensuring that the requirements of any of its conventions were met. This new regulation[4] may be seen as a recognition of the importance of the revised standards on maritime education and training (MET).

[2] *Source: IMO web site (www.imo.org).*

[3] *An IMO provisions which enables that an amendment to the convention enters into force on a specified date unless it is rejected by one- third of Contracting Parties or by Contracting Parties whose combined fleets represent 50% of world tonnage.*

[4] *Regulation I/7 of the 1978 STCW Convention as amended: communication of information.*

IMO has been very often criticized of being very slow in responding to emergencies. The first measure being taken to reduce the time for implementation of the new regulations was tacit acceptance procedure. Despite everything response which was undertaken after disaster of ro-ro passenger ferry, the *Estonia*, with the loss of nearly 900 lives, shows that the Organization becomes more and more capable to implement new regulations which will not be out of date by the time they enter into force.

It is very significant that the said disaster of the *Estonia* in September 1994 has led, inter alias, to the new amendments of the 1978/95 STCW Convention relating to the training on passenger and ro-ro passenger ships[5]. The fact that these amendments were adopted[6] before the official report into the disaster was published emphasises once again the importance of the human element in preventing all accidents and casualties at sea.

The grounding of the *Sea Empress* and review of the pilotage training issues[7] within IMO only confirms that change of the regulations related to the human factor can prevent people making mistakes. The next step is enforcement of compliance with all international regulations, which must be main pillar of global maritime safety policy leading to the prevention of avoidable mistakes caused by human factor.

3. Principles of the 1978 STCW Convention as amended having impact on MET

The General Provisions in the Chapter I of the 1978 STCW convention as amended include regulations having direct impact on MET. It should be noted that there are numerous regulations from the STCW Convention and many sections and tables from STCW Code making significant changes in training and education process, but this section of the paper will pay more attention on certain number of principal provisions which are establishing completely new standards in the MET.

The provisions from Chapter I dealing with MET are as follows:

1. Regulation I/6: Training and assessment;
2. Regulation I/8: Quality standards.

Regulation I/6 does not bring anything new for the MET institutions having experience with the training, education and assessment of competence or examination of seafarers. The experience gained from the tasks pursuant to the Regulation I/7 of the Chapter I (Communication of information) can only confirm that statement. The Maritime Administration of the Republic of Croatia had only to make compilation of the programmes and educational systems already in place within maritime high schools and universities. The only new element in the process of education and training is mentioned in the last paragraph of the Section A-I/6 of the STCW Code. Namely for the first time quality standards are part of the requirements being imposed to the MET institutions by the international legislation. National requirements of all the Parties to the Convention must also comply with the said international provisions.

3.1 Quality standards

Croatian legislation[8] relating to the training and education of the seafarers has already in place provisions relating to the quality standards in MET institutions. Some MET institutions in the Republic of Croatia have internationally recognised quality systems in place. Their experi-

[5] *STCW 95 Amendment 1 (1997): Regulation V/2- Mandatory minimum requirements for the training and qualifications of masters, officers, ratings and other personnel on ro-ro passenger ships and Regulation V/3- Mandatory minimum requirements for the training and qualifications of masters, officers, ratings and other personnel on passenger ships other than ro-ro passenger ships of the 1978 STCW Convention as amended.*

[6] *68th session of the Maritime Safety Committee (May/June 1997)*

[7] *Resolution A.485(XII)*

[8] *Article 56 of the Regulation on Requirements for the Award of Ranks and Certification of Seafarers on Board Merchant Ships of the Republic of Croatia.*

ence shows that internationally recognised ISO Quality systems are the best solution for the requirements of the both international and national legislation relating to the quality standards in MET. Although neither 1978 STCW Convention as amended nor national legislation prescribes certain quality system, the best way to control and audit educational and training requirements would be through the uniform system of quality standards.

Also the cost of evaluation and development of the specific quality system may exceed the benefits of such system. From the administration's point of view it is very important to emphasise that the tools which are enabled by one uniform system may provide further more benefits in the process of assessment, certification and control than several different systems which ought to be evaluated and reviewed in order to ensure that their defined objectives are met.

Regulation I/8 of the STCW Convention and Section A-I/8 of the STCW Code regulates that administration of the certification system must be covered by the quality system. The problems which may arise during the process of implementation of the quality system within the administration are various. The common issue which was recognised by the most administrations is the external audit which is almost in all cases very serious constitutional problem.

Beside all the problems in the process of introduction of quality systems in MET institutions and administrations it should be noted that the terms[9] such as organizational structure, requirements for quality, safety, inspection, validation, quality management, quality control, quality assurance, traceability etc. if used in one uniform quality system may be very valuable assistance in achieving all requirements of the revised STCW Convention.

The national administration may become external auditor and representatives of the international organizations may evaluate both the quality systems of the administrations and quality systems of MET institutions in order to determine whether or not the full and complete effect is given to the applicable provisions of the Convention.

Conclusion

"...in the future I believe that we must concentrate on implementing those standards and, above all, on reducing human error. That is where challenge now lies. And that is where we must concentrate our efforts[10]."

This part of a message from the Secretary-General of IMO justifies, once again, a high priority in global maritime safety policy for all efforts aimed at reducing the risk of people making mistakes.

Summary

Since some reports claim that up to 80% of accidents at sea are caused by human element, this is the subject which needs most attention in efforts to achieve safer ships and cleaner seas. The international legislation is trying to place its emphasis on anticipation of events, rather than taking action after accidents have occurred.

The STCW was one of the efforts to prevent avoidable mistakes.In 1995 amendments were made to 1978 Convention as the result of major changes in shipping and ability of human element to deal with new working environment.

This paper deals with major changes of the amended STCW Convention and its impact on MET procedure with special reference to its implementation within Maritime Administration and MET institutions in the Republic of Croatia.

[9] *Source: Quality management and quality assurance – Vocabulary (ISO 8402:1994; EN ISO 8402: 1995)*

[10] *A message from the Secretary-General Mr. William A. O' Neil for IMO's 50th anniversary*

THE ASPECTS OF NEW MARPOL ANNEX OF PREVENTION OF AIR POLLUTION FROM SHIPS

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Abstract

The predominance of the flag state, can be balanced against the interests of states not having large fleets, but seeking protection from pollution by ships of their seas, their coasts and their atmosphere. There is a good reason for the existence of Port State Control and for an IMO subcommittee on flag state implementation. The reason is that many flag states do not live up to the obligation, stating that there should be a genuine link between that state and ships flying its flag. There is often no genuine link at all and flag state activities are left to commercial organizations with often detrimental effects to safety and the environment. In IMO there still is a link between the interests of shipping industry, governments and non-governmental organizations. Turning away from IMO will lead to increased unilateralism and the shipping community as a whole may be worse off. Keeping IMO the focal point of shipping debate requires compromise. The development of the rule making process in IMO is described for the new annex on air prevention of pollution from ships (Annex VI) to the MARPOL73/78.

1. INTRODUCTION

The development of the air pollution annex at IMO involved a process of learning and still does. When the Annex VI enters into force (2002.), this process will go on for some time. This relatively new field of legislation, at least for shipping, will require feedback from the practice of implementing and enforcing it. The process in IMO is not always a very systematic process, that starts from very clearly defined goals and objectives. It is a rational process in principle, in that it has natural checks and balances, but politics and emotions creep into it. Conflicting interests can influence the content of the rules themselves, but can also influence the process leading to these rules. The Annex VI will be examined more closely in this paper. It can be looked at from various aspects, from which some of them have been selected: process of its development; the technical content of its regulations; the legal process involved, including the conditions for entry into force; the choice of instrument to address air pollution from ships; and the interests of the various players involved.

2. THE PROCES

The process can be called slow: it started by the end of the 1980s and it may take another 4-5 years before the regulations enter into force. It will take a number of years before sufficient of countries, representing sufficient tonnage will have ratified and, thus will have fulfilled the necessary conditions for entry into force.

The process can be called recurrent: texts are developed and are apparently finalized, but at a following session of IMO one notices that the discussion is reopened, often even on the basis of oral statements, thus frustrating agreed procedure that comments shall be given in writing well before each session.

The process is certainly difficult: it is difficult to follow because of the fact that discussion on the contentious items is reopened all the time, so it is hard to know what was finally decided and what was not. This was particularly difficult for industry: for instance engine manufacturers would like to know what they to have to comply with, because shipowner will ask them to deliver engines that can meet the new standards.

It is no longer about discharges into the sea and the protection of the marine environment in a limited sense alone. It goes far beyond that it is also about interests that lie inland or even far inland according to some. The words "long range transboundary pollution" come to mind. The annex id also about ozone depleting substances and even touches upon issues as human health and ship safety where it speaks about fuel oil quality aspects. The attitude of some of the players involved can be described as reluctant: they do not know what they are letting themselves into and/or are not convinced of the compelling need for new regulations and there are vast differences of opinion as regard the necessity between a countries.

The process lacks appeal in the public eye. This is partly because the issues involved are not very spectacular, nor are their effects as visible as oil pollution. It may also be that the public are not really aware of the activities of IMO and, if they are, they perhaps perceive it as yet another bureaucratic organization producing "paper tigers". Nevertheless, the process is rational: there are sufficient checks and balances to assure that what is produced makes sense, at least to a majority.

At the same time, the process is political, i.e. political in the very broad sense that other interests than the protection of the marine environment and the atmosphere, often economical, enter into it. This is certainly not a prerogative of administrations. It has come to the non-governmental organizations (NGOs) are quite good at it and the same applies to large oil companies.

Now and then the process is also emotional. Feathers get ruffled, people feel bullied or railroaded, thus creating an atmosphere that strays from a process of well informed decisions. Once "getting even" enters into it, people stand to loose more than they gain. [1]

3. THE CONTENT OF THE ANNEX VI

It can be called contentious. The quarreling over the regulations is still going on and agreement has been reached about a final text. A large amount of time has been spent on the most contentious issues of all: the measures to reduce SO_x emissions, fuel oil quality and bunker delivery note.

The annex can be called incomplete. A number of issues are not covered by the annex. First and foremost of these is CO_2. Some countries have on several occasions pointed out that IMO someday may have to address this issue. The European Union is looking into the matter, but this is also a contentious issue between the member states. Some one hold the view that they cannot think of any meaningful measures to reduce CO_2 emissions from a ships. An inventory of all possible measures to reduce these emissions is being made and, at the same time, the cost effectiveness of such measures will be looked at. That will put one in a better position to come to a well informed decision.

The second element missing in the draft text is organic micro pollutants and particulate matter. A third element that may become very interesting is the restriction encompassed in regulation 13 on Nitrogen oxides (NO_x). Paragraph 1a reads [2]: "This regulation shall apply to each diesel engine etc...." This means that gas turbines are not covered by the annex. It is understanding that the emission of NO_x of gas turbine per kWh are much lower than those of diesel engines, in order of 1 g/kWh as compared to 10 g/kWh for high-speed diesel engines. Even if the regulation were to apply to gas turbine as well, they would meet the standard. The total load of air pollution coming from very fast ships, because even if emission per kWh are low, the sheer number of kWh may result in greater loads of air pollution than those of conventional ships. This is another feature of the regulatory work of IMO and, consequently, of many administrations and that is that it does not address total loads of pollution. Growth of the

merchant fleet and increased installed power may, therefore, defeat any efforts to reduce the total load on the environment. The only consolation is that lack of measures would have shown an even greater load.

The next qualification of the air pollution annex is that it is superfluous. The argument in this case is that the contributions of shipping are comparatively small and stay well under 10% of the total load. A further argument is that a lot of the emissions take place at the high seas where they will not harm anyway, and this is fallacy on both counts. The first argument can be rebutted by pointing out that breakdowns of industrial emissions or those from traffic could also show that some specific sector only contributes a very small portion. The rebuttal of the second count is twofold: quite a considerable portion of emissions take place close to land and once again the concept of total loads and long range air pollution.

The last qualification of the content of the annex is that it is immature. This is true in many respect: the annex does not cover all it should, the issue of control and enforcement has not been resolved satisfactorily and the standards are too lenient to achieve any real benefit for the environment. All of this may be true, but it is also true that one has to start somewhere. The whole process has been quite conductive to research and development and will continue to do so. A step by step approach has to be taken and one will learn from experience as one is learning from experience with the other annexes of MARPOL 73/ 78.

4. LEGAL APECTS

It will be comment on the way the annex will be incorporated in the structure of convention. The need to amend the convention itself is nicely circumvented by using yet another protocol. To elucidate this one only has to draw attention to Article 2(2) of MARPOL 73/78 which reads [3]: "harmful substance means any substance which, if introduce into the sea,.....etc.". Clearly the new annex VI does not address harmful substances that are introduce into the sea, although some may actually end up in the sea, but primarily into the atmosphere. Instead of amending the convention, a protocol is used, to which the new annex is annexed. The annex contains a new definition, for the purpose of the annex, of harmful substance which also covers "introduction into the atmosphere". It takes some understanding of the way IMO conduct its business to digest what is being done here. However, an even harder task is explaining this to somebody else. Anyone who cannot follow this will not be blamed.

5. THE ANNEX AS AN INSTRUMENT

The instrument can be qualified as typically IMO for the very simple reason the IMO does have not too many options when it comes to legally binding rules. The air pollution annex will be hooked up with MARPOL 73/78 in a pragmatic way. IMO, i.e. its member states, could have chosen to draw up a separate convention. IMO, of course, knows several kinds of voluntary arrangements and other non-binding instruments, such as MEPC and Assembly resolution, guidelines and circular letters. They have their merits, but as there is already a difference in the way various member states implement binding rules, this even more the case with the non-binding ones. Thus, a non-binding instrument may not help create a "level playing field" or should one say "equal opportunity". There are great differences in the way states consider themselves morally bound by resolutions.

The qualification "novel" can be accepted at face value. It is obvious that the MARPOL 73/78 convention could not accommodate a new annex in an easy and straightforward way. However, a way has been found to realize this. The novelty of the instrument lies also in the issues it covers. The new annex is perhaps also novel with respect to the degree to which certain players take an interest, for instance where it has a very direct bearing to the oil industry. Of course, one could also qualify the annex as novel, meaning that it is not worth the paper it is written on, but it seems it is not.

6. THE PLAYERS

There are the individual governments r groups of governments who may choose their position as a flag state, as a coastal state, as a port state or even as neither of the above, but simply being affected by air pollution from ships or other sources. To complicate matters, there are many states that are not monolithic. For instance, with respect to air pollution from ships, the Republic of Croatia taking a great interest in the position of Rijeka, is a port state. However, it also has a very long and vulnerable coastline and the critical load of its soil for acid depositions is rather low, which makes the Croatia consciousof its position as a coastal state. It tries to mean more as a flag state, or more precisely as a state in which shipping activities add to the national income. As IMO is very much an organization of flag states, it is obvious that the position of the other categories of states is comparatively weak.

There is the shipping industry, saying that one can regulate as much as one likes as long as one ensures that it does not distort competition. Also, this is true for all commercial parties involved, a great interest is taken in predictability. Industry does not look favorably upon investment decisions being overtaken by new regulations. This is of course the issue of the so-called "grandfather clause".

The oil industry is omnipresent and omnipotent. They certainly and very skillfully have influenced the process. Compared to the pitiful struggle to join forces of some groups of states, particularly in Europe, the oil industry appears to be evilly united. One would assume that as non-governmental organizations, they would only have access to the decision- making process through the NGOs represented in IMO such as the Oil Companies International Marine Forum (OCIMF), and this would not be a very strong position, because NGOs have no vote. The truth is different. In reality the interest of the oil industry and the interests of flag states are very closely linked. It is no longer a suprise to find a representative of an oil company in the delegation of country B, and it find the same person in the delegation of country C at the next session. The interest of the oil industry takes in the air pollution annex, partly based on a bunker industry being a sulfur outlet of the refineries. The industry would face very large investments if this outlet were to be blocked. This is one of the reason why it has proved so difficult to come to a worldwide standard for sulfur in fuel, which from the viewpoint of enforcement, would be the most attractive. To be quite fair, the oil industry has always used the argument that a low worldwide standard of 3% for sulfur would be a very expensive way to realize a very modest reduction in the SO_x emissions and even more so if SO_x deposition on land is considered.

The next group of players consists of the engine manufacturers. They are very keen to settle standards as soon as possible. The longer it takes to create stability by means of this standards, the more they risk being overtaken by unilateral standards in several countries. Even if new standards are settled soon, it remain to be seen if, for instance, the United States will impose more severe standards on ships calling at their ports.

A very mixed company are the NGOs as a players. OCIMF is in there and so is EUROMOT (engine manufacturers), but also Greenpeace, Friends of the Earth International (FoEI), World Wildlife Fund (WWF) and organization such as the International Association of Ports and Harbors (IAPH). The environmental groups often hold the view that the best available technology should applied, which in the case of sulfur would mean that the sulfur content in bunker could be 0%. They will always say that the compromises reached are not enough, keeping administrations alert and sometimes irritated.

7. CONDITIONS FOR ENTRY INTO FORCE

MARPOL 73/78 and its annexes have entered into force on the basis of article 15 of the convention. The conditions to be fulfilled are that [3]: "15 states the combined fleets of which constitute not less than 50% of the gross tonnage of the world's merchant shipping, have become parties to it". This mean that in environmental meters related to shipping, states with large fleets play a key role. One only has to look at the statistical Table I to appreciate that on

the basis of the conditions just mentioned there will be no entry into force of the air pollution annex unless at least a few of the large flag states become parties.

The compromise is inevitable if the annex is to enter into force. This compromise could either take the form of the large flag states expressing the intention to become parties and act upon that intention, or to accept more lenient conditions for entry into force, say 25% of tonnage instead of 50%, perhaps with some more countries than 15. If one accepts the link between tonnage and influence, then of course a disadvantage of the latter approach is that a minority could impose rules on the majority.

8. CONCLUSION

To strike a more fundamental note, one could wonder if the concept that still rules IMO, i.e. the predominance of the flag state, can be balanced against the interests of state not having large fleets, but seeking protection from pollution by ships of their seas, their coasts and their atmosphere. One could say that the concept of the flag state and the genuine link entailed in the UN convention of the law of the sea has been watered down substantially. There is a good reason for the existence of Port State Control and for an IMO subcommittee on flag state implementation. That reason is that many flag states do not live up to the obligation expressed in UNCLOS, stating that there should be a genuine link between that state and ships flying its flag. There is often no genuine link at all and flag state activities are left to commercial organizations with often detrimental effects to safety and the environment.

Table I World's tonnage - Lloyd's statistical table '97.

Country	Gross tonnage	Percentage
1. Panama	70 943 848	15,26
2. Liberia	59 199 369	12,73
3. Greece	29 336 748	6,31
4. Cyprus	24 652 546	5,30
5. Bahamas	23 229 554	5,01
6. Norway	20 898 265	4,49
7. Japan	18 628 046	4,01
8. Malta	17 645 115	3,79
9. China	16 129 991	3,47
10. Singapore	13 423 438	2,89
11. UK	3 637 702	0,78
12. Netherlands	2 876 522	0,59
World	490 662 091	

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USE OF SIMULATORS IN ACHIEVING AND IMPROVING EMERGENCY PREPAREDNESS

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Abstract

The author attempts to elucidate the basic principle of simulation technique, the type of simulators and the significance of micro-computer on simulation system. Indeed, the main point of this paper is going to be about the simulator training of emergency cases, in order to improve the ability of future seafarers on board ships.

In should be noted that the other important aspect of the instruction is concerned with the degree of realistic and the validation in visual presentation of simulators training.

In other words, the role of CGI (Computer Generated Imaginary) in simulation technique will be investigated in order to improve the quality of pictures which are presented to the trainees. The author intends to allocate a part of this paper for introducing the advantages of simulator training for having meritorious mariners.

Besides, the last segment is going to be devoted to describe the impact of simulators on port layout, and design study in accordance with the fast-time and the real-time simulation methods, by referring to the mathematical models.

Abbreviations

Colregs: International Convention of Collision Regulations, IMO.
GMDSS: Global Maritime Distress and Safety System.
IMO: International Maritime Organization.
ISM: International Safety Management, IMO.
OPA90: Oil Pollution Act of 1990 (USA).
SOLAS: International Convention for Safety of Life at Sea, IMO.
STCW95: International Convention of Standards of Training, Certification and watch-keeping, IMO of 1995.
USCG: United States Coast Guard.

Introduction

A lot of progresses have been accomplished in shipping activities, nevertheless the ship accidents, mishaps and catastrophes still being given rise at sea; so owing to that the marine simulators become a mandatory equipment for training deck officers. The main objective of the simulator system is to improve the skill of navigators in order to create safe way of navigating into harbours, narrow channels, waterways, and open seas.

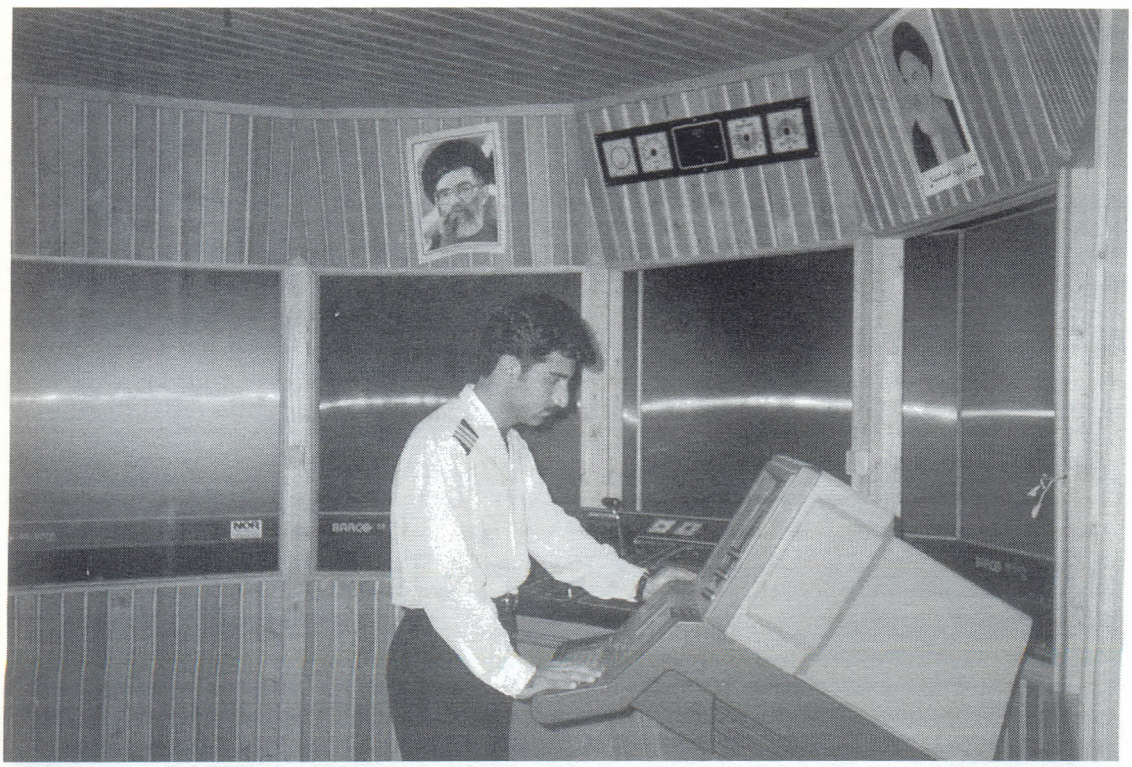
This article attempts to investigate the significance of simulation systems particularly marine simulators which are being used as vital training tool for ships' manoeuvrability, for

improving the ability of trainees, for advanced training in emergency cases, for port design and for further research.

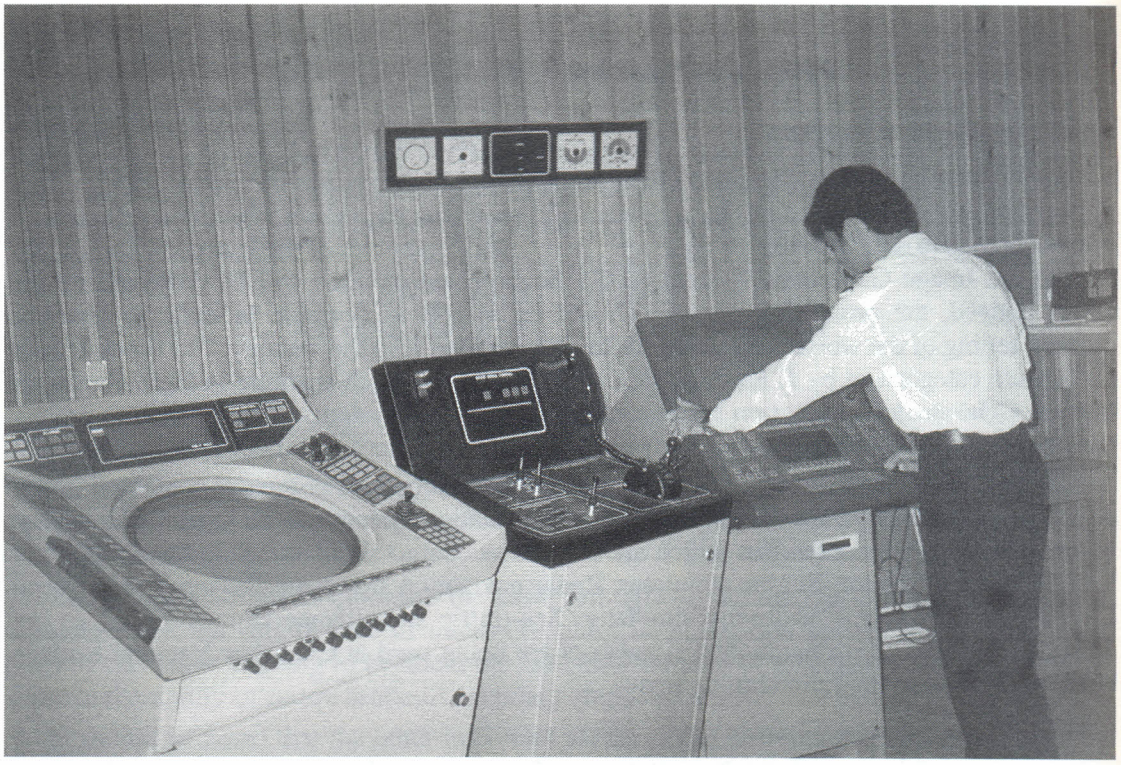
Basic Simulator Elements

Marine simulator is an advanced electronic device which consists of control panel, visual display system, a network of microcomputers and an instructor station. The main principle of this tool is to give data, mathematical model, to the main computer of the instructor station, so, through the Image Generating System (IGS) the expected pictures will be projected on the screen. Indeed, the presenting pictures should be as real as possible in order to lead the trainees' felling of the worse case scenarios to be coincided with the veracity. The types of simulator were categorized by J. Perdok, head of maritime Research Institute in Netherlands, as follows: • The shadow projection system. • The model board system. • The light-point projection system. • Computer Generated Image (CGI) system. • Micro simulator system.

The one which is more attractive from the above mentioned is computer generated image or image generating system (IGS). This type of simulation system can be used for all brands of real-time simulation exercises which are as follows: Cargo simulator, Ship handling simulator, Oil spill simulator, Engine simulator, Radar navigation simulator, Ballast control simulator, Flight simulator, Car-driving simulator, Sea-traffic surveillance simulator, and so on. Some types of the above mentioned simulators are being used at Chabahar Nautical College which are shown in the following figures:



Shiphandling Simulator



Own Ship of the Radar Simulator

Engine Simulator

Gone are the days that large ships were navigating without propeller and propulsion system, which were equipped with the ordinary equipment under minimum safety of life at sea. Nowadays, because of modern technologies and computerise systems in shipping, the manoeuvrability of new ships became more complex. In other words, new hull design causes to change ships' dynamic behaviours, so, owing to that the ships may be controlled in different ways by new regulations. Accordingly, the use of simulator training course is recommended by IMO, which course can be implemented by all institutes and maritime research centres.

A number of microcomputers are linked inside a simulator in order to give very high flexibility and very high capability of the instrument, by using the required mathematical models various training and emergency cases can be simulated through this economy tool.

Simulator training

Training through the simulators can be carried out in the following two methods; On the one hand, to train the junior officers or senior cadets for learning: how to operate the simulator, how to use the new equipment, how to behave with the collision cases under the Colregs, how to control the ship as independent officer on watch, and how to...?

On the other hand, to instruct chip masters, pilots, senior officers and other senior mariners who are interested to improve their skill, ability and manoeuvring of different types of ship, in this group, the assessment of trainees is carried out by asking some questions; for instance, why did you take such action? why did you apply this rule? why did you stop engine? why did you...? A good practice for those who have long sea experiences is arranged by producing different emergency situations with direct communication system; surely some questions may be asked about the ISM code, STCW95, OPA90, etc.

The importance of simulators inside a system approach to training must be specified through this article. Again, the quality of training can be improved by having a group of qualified instructors with proficient sea-service experiences. The effectiveness of simulator training is mostly related to the instructors' activities, and is not concern to the other components (computer programs) of the simulators, which must be discussed to a great extent.

In other words, the following are stated by Dr. M.L. Barnett as main characteristic of simulators which are substantial in training effectiveness: • Versatility and upgrade ability of the device. • User-friendliness of the device for the trainee. • User-friendliness of the device for the instructor, including ability to set up initial conditions easily and inject malfunctions etc. • Flexibility of the device, i.e. that it can be altered to provide different levels of training by adding of removing cues as necessary. • Monitoring recording, playback and freeze/fast forward features of computer-based simulators. These contribute to improve feedback to the student.

Here, the author reiterates that the contribution of qualified lecturers with sufficient sea experiences can be implemented as a one team for simulator training which is an important factor in this field. In order to improve the training quality of future Captains or senior officers, the instructors have to comply with the required sea times under the IMO regulations. It is therefore suggested that the instructors or examiners have to join on board the ship for a period of not less than one voyage per a couple of years.

As a result of they become familiar with the technological improvement in shipping activities in order to grow the trainees' preparedness. Through the simulator training the instructors can do further research to prepare suitable programs for increasing the ability of trainees during manoeuvring in the emergency conditions. For instance, an advanced meeting can be held by a team of lecturers before trainee's operation to be started, afterwards and assessment meeting can be arranged throughout the trainee's performance up to the end of his/her achievement.

By all means, simulator-based training offers an effectual, and in some emergency cases is the merely safe training method. Indeed, the training should be as real as possible in order to upgrade the quality of ships' officers for having safe ships, safe routes and safe environment.

By analysing the worse case scenario and applying the advanced technologies in the simulation systems, the simulators training courses can be replaced by cadets' sea service.

Although, it can not be felt as a real sea practices, nevertheless it is emphasised that an impressive simulator training can be achieved by having more or less real presentation. On account of the augmentation of the trainees' feelings about the presenting situation, they assume that the exhibiting operations are carried out at sea. The USCG currently grants remission of required sea time in some ratio of sea time of training time for successful completion of specified simulator-based training courses.[1]

Of course, the remission can't be applied for promoting 2nd mates, Chief mates or Masters; it is a good proposal for cadets only, thus a certificate may be issued similar to the other required sea certificates. However, it can not be implemented in coming few years, it takes time to consider all aspect of training standards and planing for future activities with a view to reducing the cost of training at sea. In reality, through a ship handling simulator, a newly qualified 3rd officer can encounter with many different emergency cases which may have not been experienced by a ship Master at sea.

Port design and layout on simulator

The main points of using visual simulator are mainly related to port design, port layout, location of navigational aids and further projects. Although, for the port design the type of projecting the visual scene on the screen may be used, but the two most suitable systems for port layout or basic design are the model board approach and the use of computer generated imagery (CGI) technique. Indeed, the optimum answer for port operation can be achieved and modified by CGI method which is inexpensive method in comparison with model board approach.

By having many runs in the simulator systems, the effect of different port deign, minimising dredging work, serious failures due to the human error or environmental conditions, and manoeuvrability of a ship in predicted port, can be analysed. It should be noted that the port work may be carried out in various ship's status and different environmental conditions by changing the inputs, mathematical models, through the main computer system. So, by running simulation system in port design, the optimum manoeuvring operations can be implemented, before the actual construction of the port to be initiated.

The safety of crew, ship, cargo, and environment against pollution is particular importance of training and port design schedule. In this regard Dr. I. McCallum stated that the accent on this study is to find out what conditions of wind and tidal stream will together constitute on unacceptable risk to safe navigation. It means that the resultant of different extraneous forces may give rise to experience many various emergency cases in a route. The pilots, tug masters, shipmasters and port operational managers can become familiarise with the existing port, with the modification of port arrangement, with navigating in narrow channel, and with the new equipment by using simulation systems.

Besides, by operating this serviceable device, the skill, ability and manoeuvring dexterity of pilots, tug masters, ship officers and skippers will be ameliorated in the emergency situations.

Conclusion

Owing to the advanced techniques and computerise system in shipping, the way of employing seafarers has been changed which made to replace educated and qualified seafarers instead of illiterate sailors. Nowadays, for reducing the number of ship accidents, some certificates are oblige to be achieved, for instance radar certificate, GMDSS certificate, navigational equipment certificate, IMO standards certificate, and so on which can be performed by the simulation techniques.

However, due to the significance of simulators as training aid which are being used for instructing future watchkeepers, hence, all maritime colleges or Institutes ought to be occupied

with a set of multi-purpose simulator with a wide range of application. Consequently, the ability of mariners, safety of ships, safety of crew, and safety of environment against pollution is to be supported and improved by operating simulation technique. Furthermore, many research can be carried out on port design, by using mathematical models through fast time or real time simulation methods.

Overall, the seafarers' preparedness is impressed with their intelligence, interest, and ability of ship manoeuvring through the advanced simulation technique, it can be improved by having many exercises on the related simulator system. So, as consequence of the above research, the best training method in order to improve seafarers' practical activities, can be achieved by using methods before they go to sea.

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MANOEUVERING CHARACTERISTICS OF A VLCC USING MATHEMATICAL MODEL

Dsc. ***DUŠKO VRANIĆ****, Master Mariner*
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Msc. ***ROBERT MOHOVIĆ****, Master Mariner*

Abstract

The knowledge of ship manoeuvering characteristics is based upon the relevant theoretical knowledge and is a prerequisite for safe ship handling. Poor or insufficient theoretical knowledge, however, may result in a bas performance of a particular ship handling operation by the navigating officer. This can cause damage to own ship and other nearby ships, to cargo and can, likewise, imperil life at sea. In the extreme cases, it may also give rise to the loss of ships or cargo and to fatal losses to the ship's crew. Handling large ships requires additional knowledge and a higher predicting capability for which purpose manoeuvering diagrams within a VLCC mathematical model have been worked out analysed.

INTRODUCTION

Simulation in seamanship is not a novelty. The application of the electronic computer has made the appearance of new scientific disciplines possible whereas specific and almost unsolvable problems have been envisaged in a news way.

The creation of a mathematical model of a ship and the use of the electronic computer has enabled graphically detailed demonstrations of the ship and its movements that can easily be verified in practice. The basic demand of each model is that the system is described in sufficient detail and that the model's characteristics are compatible to the characteristics of the entire system.

The purpose of this paper is to present the main manoeuvering characteristics of the VLCC.

1. IMPORTANCE OF KNOWING THE MANOEUVERING CHARACTERISTICS OF SHIPS AND THE NECESSITY OF USING SIMULATORS IN EDUCATION

Knowing the manoeuvering characteristics of ships is one of the basic factors of ship safety during ship manoeuvering and navigation. Particular emphasis of this fact was stressed by the International Maritime Organization (IMO) with the adoption of resulution A.601(15) *Provision and Display of Manoeuvering Information on Board Ships.* According to this resolution the manoeuvering characteristics on board the ship must be shown in graphic detail so that the data can be used by shipmasters, deck officers and pilots. The addendum to this resolution presents the method of displaying manoeuvering information regarding the ship's manoeuverability and is made up of three parts, as follow:

- The *Pilot card* which is filled in by the shipmaster and serves to give the pilot upon his arrival on board basic information on the manoeuvering characteristics of the ship;
- The *Wheeelhouse poster* which must be placed permanently on the navigating bridge and must contain specific and detailed information describing the manoeuvering characteristics of the ship;

- The *Manoeuvering bookler* must be accessible and must contain comphrehensive details on the ship's manoeuvering characteristics and other important data.

Data on manoeuvering characteristics displayed in this way certainly expand the degree of safety during ship manoeuvering since they render information to all persons included in the manoeuvering procedures in a very approachable way. Another point of great importance is that this manner of displaying the basic manoeuvering features of ships is unified and this essentially reduces the problems of understanding the meanings of particular elements regardless of the origin of the crew on board or the part of the world in which the manoeuvering takes place. This substantially contributes to the general safety of the ship during manoeuvering.

For the purpose of raising the degree of safety during ship manoeuverings, in addition to the previously mentioned resolution, the basic manoeuvering characteristics of ships and the parameters of these characteristics are the subject of international unification that the International Maritime Organization (IMO) has effected with the adoption of resolution A.7511(18) *Interim Standards for Ships Manoeuverability.*

The manoeuvering characteristics of ships are a subject of study by ship designers who endeavor to attain the best possible manoeuvering characteristic that will facilitate the ship's manoeuverability and at the same time enhance its safety. However, besides being knowledgeable about the ship's basic manoeuvering characteristics it is also necessary to be familiar with all the other factors that have an effect on safe manoeuvering, such as the effect of the wind and the sea current. Most of these effects can only be accurately acknowledged on a definite ship coupled with practical experience, yet knowledge of the source of these effects and previous exercising of manoeuvering on specialized simulators can be of great help in getting to know the manoeuvering characteristics of definite types of ships under different navigating conditions.

For the purpose of preparing shipmasters and deck officers for successful manoeuvering of the ship under actual conditons, the International Maritime Organization has through Convention STCW 78/95 rendered special attention to this segment of education of shipmasters and deck officers. In part A of the Convention within chapter A-II that deals with the training programs for the basic professions of shipmaster and deck officer, a particularly extensive program is linked to ship manoeuvering. In addition to the obligatory section A, the Convention in part B (B-V/a) also foresees a section that refers to the domain of manoeuvering the ship. The said section foresees special training under the title *The Training Course for Master and Chief Officer of Large Ships and Ships with Unusual Manoeuvering Characteristics.* It is necessary to add hereto special training under *Ship Simulator and Bridge Teamwork,* which is likewise partially linked to manoeuverability characteristics of various types of ships.

From our account so far, the many courses that the International Maritime Organization has taken to achieve as great as possible safety both during navigation and manoeuvering are apparent. Thereby an increase in the general degree of safety at sea is achieved and it has a preventive effect and decreases the risks of polluting of the maritime environment that might occur in accidents caused by faulty manoeuvering.

In the domain of ship manoeuverability education, at the current level of development, the use of sophisticated simulators on which one can in graphic detail get to know the manoeuvering characteristics of different typeds of ships and their behavior during navigation and manoeuvering under different atmospheric conditions and different states of ship load. Simulators enable analysis of the manoeuvering characteristics by means of execution of various manoeuvers such as *head reach, turning circle, zig-zag manoeuver, spiral manoeuver, pull out manoeuver,* etc. Although practical experience on various types of ships is also of great importance, the previous exercises on simulators facilitate the interpreting and familiarizing with the manoeuvering characteristics of a concrete ship in exploitation and is a major advantage for anticipating the expected behavior of a ship in reality.

Simulators can be used quite successfully on a plan of training students who are preparing for the vocation of deck officer, and subsequently shipmaster, but likewise for training of already experienced mariners with a lack of experience on a certain type or size of ship.

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Simulators can be used quite successfully on a plan of training students who are preparing for the vocation of deck officer, and subsequently shipmaster, but likewise for training of already experienced mariners with a lack of experience on a certain type or size of ship.

Teachers of the science of navigation (nautics) at the Maritime College in Rijeka confirm the truth of this assertion from direct practice since they have been using simulators in training students and experienced nautical personnel for a number of years.

In student education the practicing on simulators is their first contact with ship manoeuvering and it represents an experience of inestimable value to them. But in addition to this aspect simulators can impressively and in graphic detail explain certain theoretical concepts, the knowledge and understanding of which is indispensable. However, working with students on simulators gives rise to a problem that must by all means be overcome. Namely, some students experience their work on simulators as if playing a video game. It is therefore the teacher's duty to create an atmosphere as realistic as possible and to elucidate to the students the earnestness and responsibility involved in manoeuvering a real ship in real life.

The teachers at the Maritime College in Rijeka also have very interesting practical acquaintance in the training of experienced shipmasters and deck officers, and even pilots. This school has for many years been conducting remedial education of ship personnel on simulators within the framework of training courses such as ARPA and RO, and more recently in courses like *Ship Simulator and Bridge Teamwork* and *The Training Course for Master and Chief Officer of Large Ships with Unusual Manoeuvering Characteristics.* In a group analysis by teachers who hold these courses, it has been observed that experienced officers, and masters also, sometimes undertake wrong steps and make faulty estimations when practicing manoeuvers on ships of the size and characteristics with which they had no previous actual experience. Mistakes occur particularly because of overdue undertaking of action when manoeuvering with large vessels and this causes collisions, running aground of crashing against the wharf. This work therefore displays the manoeuvering characteristics of a VLCC ship. It is very interesting to note that this group of participants has a much more serious approach to working on simulators. Besides, even though this is a group of men and a profession of a rather traditionalistic hue, they usually strongly support this method of remedial education and consider it necessary.

Using sophisticated simulators much can be done on the plane of education of shipmasters, deck officers and certainly of pilots, too. Furthermore it is possible to use such simulators for various research work. In the continuation of this work the basic manoeuvering characteristics of a VLCC ship will be displayed. These ships surely fall into the types with unusual manoeuvering characteristics and in light of the cargoes that they carry they are very susceptible from the aspect of the marine environment. In this sense knowledge about their manoeuvering characteristics in order to prevent eventual accidents is of utmost importance.

2. CHARACTERISTICS OF MODEL VLCC

The Mathematical model of ship analyzed in this paper has these characteristics:

Displacement of vessel	253,966 tons
Total length of vessel	330.7 meters
Maximum width of vessel	51.8 meters
Draft of vessel	20 meters
Maximum number of revolutions	80 per minute
Minimum number of revolutions	10 per minute

Revolutions during manoeuvering of vessel:

Full speed ahead	65 revolutions per minute
Half speed ahead	40 revolutions per minute
Slow speed ahead	25 revolutions per minute
Dead slow ahead	15 revolutions per minute
Full speed astern	-65 revolutions per minute
Half speed astern	-40 revolutions per minute
Slow speed astern	-25 revolutions per minute

Dead slow astern	-15 revolutions per minute
Maximum headway speed ahead	16.2 knots
Maximum headway speed astern	10 knots
Velocity of revolution of helm	1.4 degrees per second
Maximum deviation of helm	40 degrees

3. HEAD REACH OF VESSEL

The head reach of a vessel is the distance that the vessel covers from the moment of engine room's receiving order to "stop", to the moment when the vessel has stopped in the course of headway full speed astern.

The diagrams shown in figures 1 (Time lines of ship's head reach) and 2 (Head reach test) were designed for headway at full speed ahead at 16.2 knots and 80 revolutions of the propeller per minute and headway at full speed astern at 74 revolutions of propeller per minute.

The stoppage path is 2.45 nautical miles, and the time necessary for the vessel to stop is 20 minutes and 50 seconds.

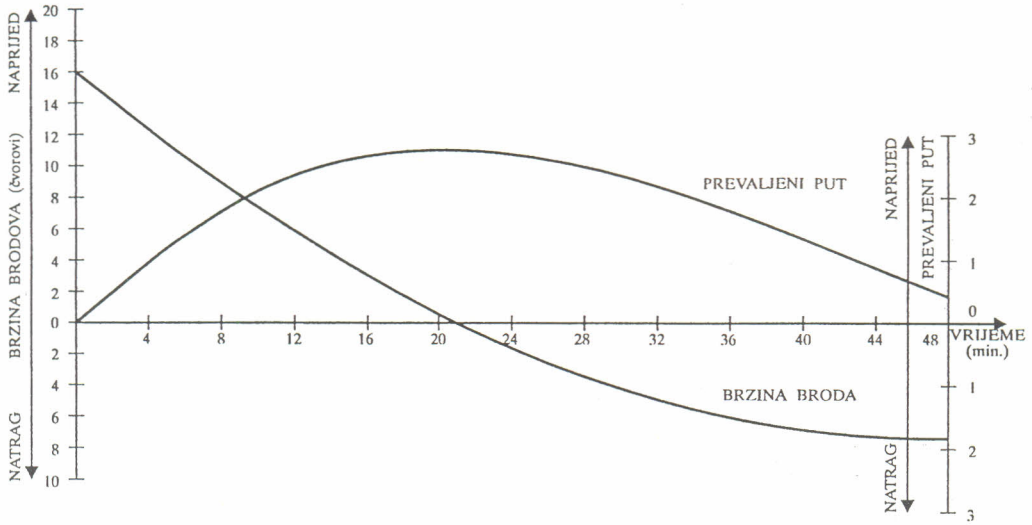

Figure 1. Time lines of ship's head reach

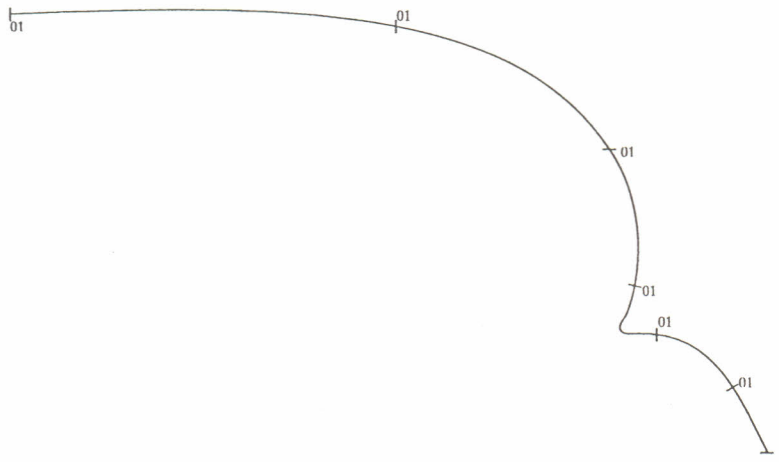

Figure 2. Test of ship's head reach

4. THE TURNING CIRCLE AND ITS DURATION

The turning circle is the circle that a vessel circumscribes navigating at a constant speed against a specific angle of the helm.

4.1. The turning angle and its duration against a 15 degree deviation of the helm

The diagrams shown in figures 3 (Lines for turning starboard) and 4 (Test for turning starboard) were designed for headway at full speed ahead of 16.2 knots with a helm deviation of 15 degrees. The initial course of the vessel was 90 degrees. The plotting interval is 30 seconds.

The initial number of revolutions of the propeller of 80 per minute was 73 by the end of the turning circle.

The speed of vessel is reduced to 7 knots and the time necessary for a 180-degree change of course is 7 minutes and 27 seconds.

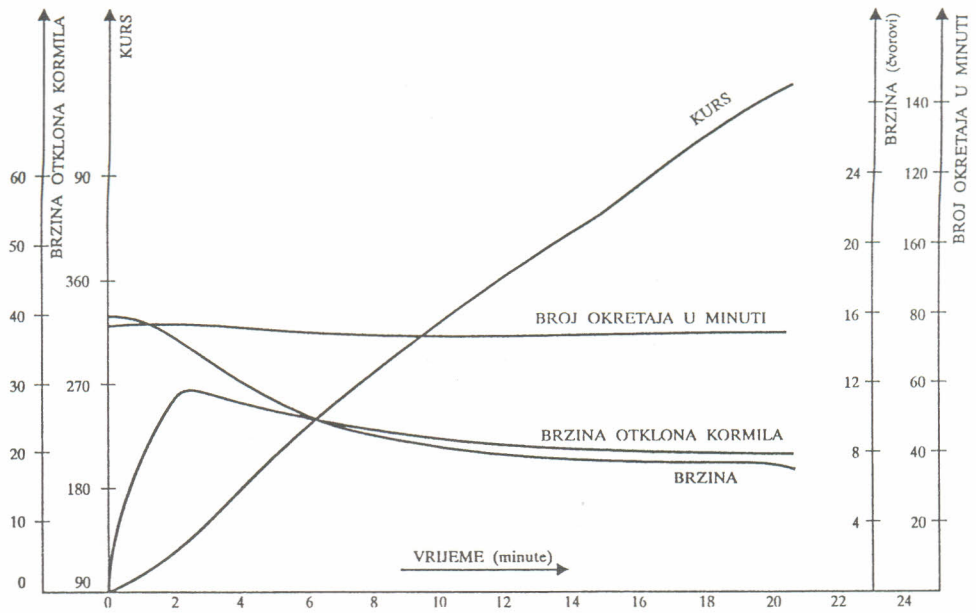

Figure 3. Lines for turning circle to starboard (deviation of helm 15°)

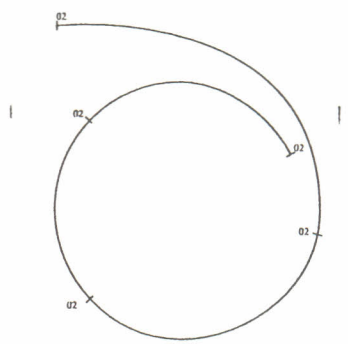

Figure 4. Test of turning circle to starboard (deviation of helm 15°)

4.2. Turning circle and its duration against a helm deviation of 35 degrees

The diagrams in figures 5 (Lines for turning circle to starboard) and 6 (Test of turning circle to starboard) were designed for headway at full speed ahead of 16.2 knots with a helm deviation of 35 degrees. The ship's initial course is 90 degrees. The plotting interval is 30 seconds.

By the end of the turning circle the initial number of 80 revolutions of the propeller is reduced to 71 per minute.

The vessel's initial speed of 16.2 knots is reduced to 4.9 knots, and the time necessary for a 180-degree change of course is 5 minutes and 39 seconds.

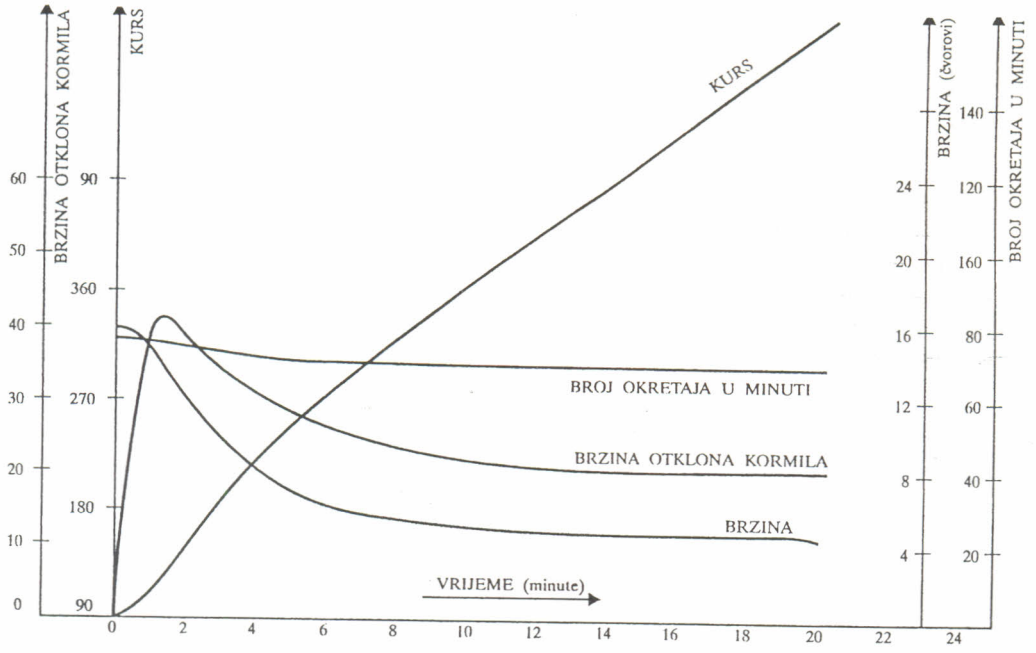

Figure 5. Lines for turning circle to starboard (helm deviation 35°)

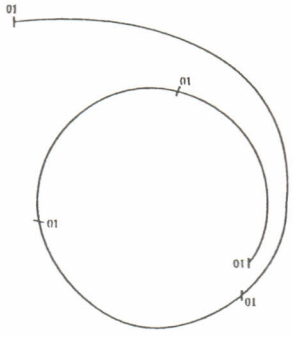

Figure 6. Test of turning circle to starboard (helm deviation 35°)

4.3. Turning circle and its duration in shallow water

It is interesting to find out how shallow water effects the turning circle. Therefore we designed the diagrams shown in figures 7 (Time lines for turning circle to starboard in shallow water - helm deviation 35 degrees) and 8 (Test of turning circle to starboard in shallow water - helm deviation 35 degrees). The diagrams were made for headway at full speed ahead of 16.2 knots with a helm deviation of 35 degrees. Ship's draft is 20 meters; sea depth is 26 meters. Plotting interval is 30 seconds.

The initial number of propeller revolutions of 80 per minute is reduced to 74 by the end of the turning circle.

The initial speed of 16.2 knots is reduced to 8 knots, whereas the time necessary for a 180-degree change of course is 6 minutes and 43 seconds.

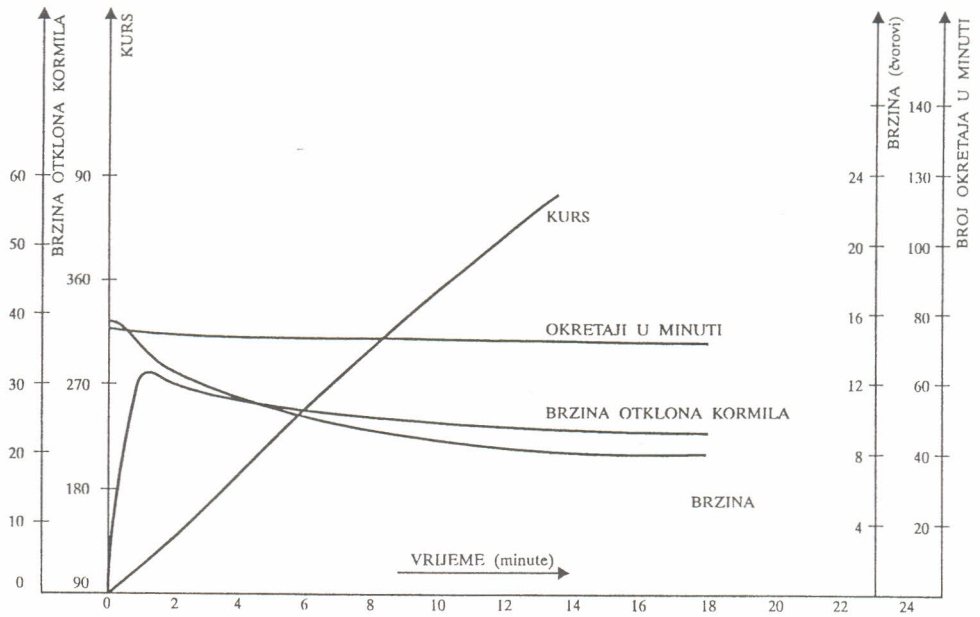

Figure 7. Time lines for starboard turning circle in shallow water (helm deviation 35°)

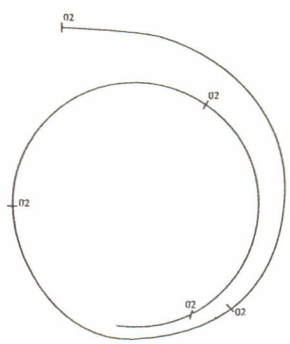

Figure 8. Test of starboard turning circle (helm deviation 35°)

CONCLUSION

Today we see the building of vessels of huge dimensions; dimensions that not long ago seemed to be incredulous. A big draft and large inertia have an essential effect on the manoeuvering of such gigantic vessels. Therefore such ships cannot come to a quick stop nor can they make a turn in a relatively brief span of time. For commanding such vessels, greater possibility of anticipation is required. In order to safely navigate a vessel from the port of departure to the port of destination, the deck officers must be well acquainted with the manoeuvering characteristics of their vessels. The diagrams of the VLCC manoeuvering characteristics have been made and analyzed with this purpose in mind.

WORK RELATED DEATHS AT SEA

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The Hong Kong Polytechnic University

ABSTRACT

Seafaring has long been recognised as one of the more dangerous occupations as it presents workplace hazards in a combination rarely encountered in other occupations. Available recent studies on occupational health and safety of seafarers have concentrated on nationally manned fleets mostly operated out of North-European countries.

Recent studies on the supply and demand of seafarers have pointed to the fact that international shipping relies pre-dominantly on ships manned with seafarers from mostly Asian nations.

This study examines the records of the Singapore Marine Department of fatalities on board Singapore ships.

In the ten year period covered (1986-1995), a total of 373 deaths were identified which fulfilled the inclusion criteria. The victims came from 26 different countries, with Singapore resident seafarers forming only the fourth largest group. The biggest number of deaths was attributed to maritime disasters, followed by deaths due to illness, of which the biggest share was formed by heart related illnesses. The third biggest cause of death were occupational accidents and personnel working on deck constituted the biggest group of victims. Most occupational accidents were caused by lack of procedures or negligent working practices.

KEYWORDS: occupational accidents, seafarers, merchant ships, fatalities, Maritime disasters, total losses

INTRODUCTION

The occupation of merchant seafarers is a dangerous one exposing them to hazards in a rarely encountered combination. Among these specific risks are exposure to extreme weather conditions, dangerous enclosed spaces, noisy mechanical equipment or toxic cargoes. When travelling all over the world, seafarers may be exposed to unusual or rare diseases caused by infectious agents unknown in their countries of residence. All of these hazards might be even more increased through the lack of direct access to medical assistance while at sea or in remote ports.

A recent study into the supply and demand of seafarers world-wide estimated that approximately 1,030,000 seafarers are employed on merchant cargo ships world-wide. The study also highlighted that the majority of modern day seafarers originate from non-industrialised countries, mainly East and Southeast Asia.

Available recent studies investigating the risks for, and mortality and morbidity of, seafarers concentrate on industrialised countries (Larsson and Lindquist, 1992; Brandt et al., 1994; Moen, 1991) thus examining pre-dominantly nacionally manned fleets with often particular characteristics of trade or employement or types of ships involved. Little is known about the causes and circumstances of deaths at sea on merchant ships from other countries, manned by multinational crews.

The study presented in this paper investigates patterns of fatalities in an internationally manned fleet with a view to establish differences to other fleets.

MATERIALS AND METHODS

The Republic of Singapore has a long tradition in operating a shipping register, which over time evolved from being perceived as an open register to a quality register with a well established maritime administration. As a Commonwealth member, Singapore has reporting system for deaths on board ships, which is similar to that of other Commonwealth nations and is largely modelled on the British system prior to the introduction of the *Merchant Shipping Act* (1979).

Singapore shipmaster are obliged to report any birth or death occurring on board a Singapore ship to the Marine Department, failure to do so would result in a maximum fine of Sin$ 2,000 (Singapore *Merchant Shipping Act, Sect. 91, Ch. 179*).

The reports and statements submitted by the shipmaster are reviewed by a Marine Superintendent, who decides upon the necessity to hold a marine enquiry or carry out an investigation.

The study covers deaths of seafarers signed on Singapore flag seagoing ships. A seafarer was defined as a person gainfully employed on board a merchant ship, having been signed on the ships' articles. This definition excludes passengers or accompanying family members but includes company superintendents. Not included were deaths on non-merchant ships, such as dredgers, harbour craft and fishing craft.

The categorisation of cases was based on the evidence as found in the case files and comprised mainly extracts from ships' logbooks; ship masters' statements; statements from various crew members; communication with the shipowners or managing agents, often in the form of telex or telefax communication; death certificates or autopsy reports, if necessary accompanied by a translation; police statements and other case records; lawyers' statements; and occasionally correspondence with relatives.

No documents or files of marine inquiries or investigations were made available, since these are considered confidential under the Singapore Merchant Shipping Act. To ensure completeness, the records were compared with a print-out of shipping accidents as recorded by the Institute of London Underwriters, which covered the years 1990-94; the annual casualty statistics as published by Lloyd's Register of Shipping , the on-line database of Lloyd's List, for the years 1991-95 and a book covering maritime disasters which is largely based on information compiled by Lloyd's Maritime Information Services Ltd.

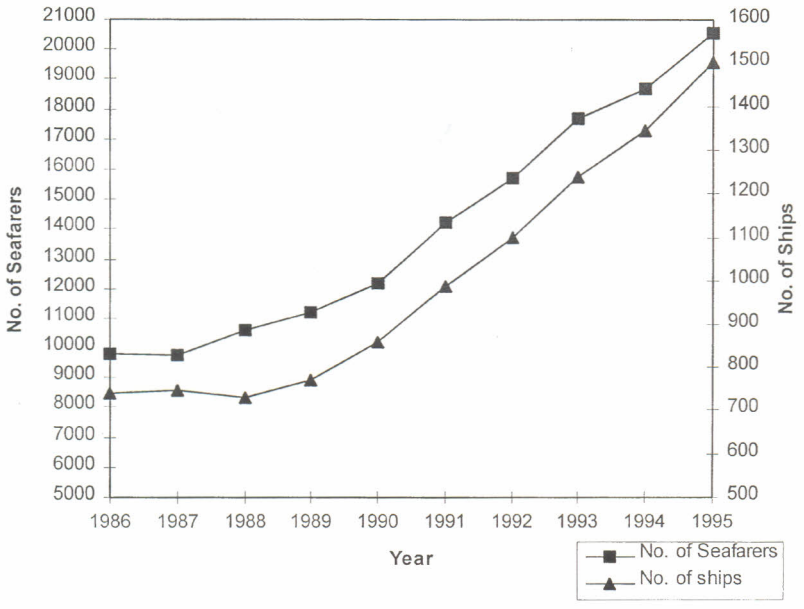

Figure 1: The Singapore Fleet and the Number of Singapore Seafarers (1986-1995)

source: annual reports Marine Department, personal communication

For the purpose of this study, deaths were categorised in 8 broad groups: maritime disasters; occupational accidents; deaths due to illnesses; individual persons missing at sea for no apparent other reason; homicides; suicides; off-duty and finally unclear causes.

RESULTS

The Singapore Fleet and Seafarer employment:

Over the study period, the Singapore fleet expanded continually from 738 ships with 6,859,814 grt in 1986 to 1,501 ships with 13,498,279 grt in 1995. In line with this growth of fleet, the number of seafarers employed on Singapore ships rose from 9,785 in 1986 to 20,534 in 1995.

Figure 1 shows the development of the Singapore fleet in terms of numbers of ships registered and the employment of seafarers.

CAUSES OF DEATH

The Singapore Mercantile Marine Office (MMO) gave access to files concerning a total of 313 deaths on board ship. From the other sources mentioned above, another 4 accidents to the ship could be identified, which resulted in a further 60 deaths.

263 of the deceased were males, the gender of the remaining victims could not be established.

Figure 2 gives the distribution of causes of deaths. The majority of deaths is to attributed to maritime disasters, mostly vessels sinking or disappearing without trace.

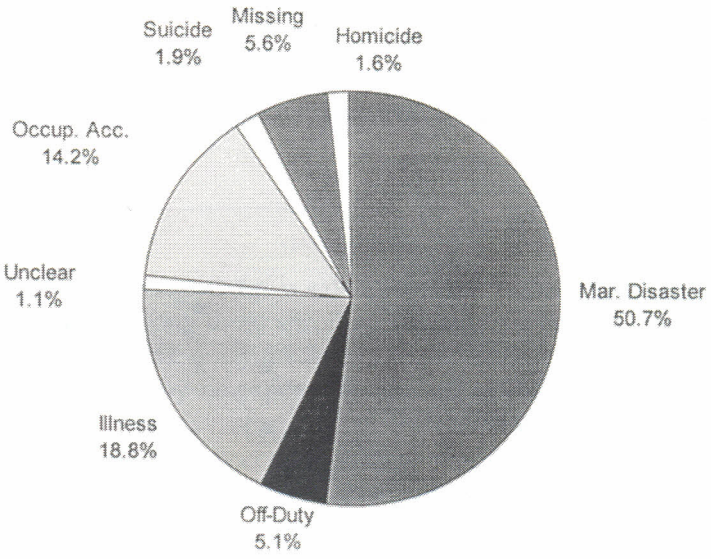

Figure 2: Causes of death

source: Author

LOCATION OF THE SHIP AT THE TIME OF DEATH

The location of the ship at the time of death is shown in table 1. Given the fact that 42.5% of all deaths were attributed to maritime disasters, it would not surprise that the majority of deaths occurred while the ship was at sea.

Table 1: Location of the ship at time of death

Cause of Death	Total	at sea	in port	on roadstead	River
Occupational Accident	53	23	22	6	2
Illness	70	33	29	8	2
Maritime Disaster	193	169	12	12	
Individual Person missing at Sea	21	17	0	4	
Homicide	6	0	6	0	
Suicide	7	4	2	1	
Off-duty Accident	19	2	12	4	1
Unclear Cause	4	1	2	1	
Total	373	249	85	36	3

Note: Roadstead: an area near a port or river estuary, where the ship lies at anchor or where the ship may drift waiting for a pilot or clearance to enter the port. The ship is thus neither in port nor at sea.

COUNTRIES OF ORIGIN OF THE VICTIMS

Singapore manning regulations are strict and detailed, but they stipulate no restrictions as regards the nationality or country of origin of the seafarer. The freedom of Singapore shipowners in sourcing their crews is reflected in the distribution of nationality of the deceased who came from 26 different countries. The Phillippines, Indonesia, India, Singapore, Burma and Korea were the main countries of residence. All other countries had under 10 victims. The nationality of 60 seafarers was unknown.

TYPE OF SHIP

Based on the ship's name and gross tonnage as recorded in the accident files, the type of ship was determined by referring to the annual Lloyd's Register of Ships books.

Table 2: Causes of death by type of ship

Type of Ship	Total	maritime disaster	illness	occupat. accid.	missing at sea	homi-cide	sui-cide	off-duty	un-clear
Oil Tanker	75	34	15	14	6	1	2	1	2
Bulk Carrier	64	30	13	9	2	4		6	
Ore-Bulk-Oil	3		1				1	1	
General Cargo	128	98	12	10	4		1	2	1
Container Ship	35	10	10	8	3		1	3	
Chem. Tanker	1		1						
LPG Tanker	6	2		1	2		1		
Tug	42	19	10	4	3	1	1	4	
Supply Vessel	10		3	4				2	1
Vehicle Carrier	8		4	3	1				
unknown	1		1						
Total	373	133	70	53	21	6	7	19	4

When assessing the risk of death in relation to type of ship, table 2 seemingly suggests that general cargo ships followed by tankers and bulk carriers pose the highest risk, as they report the highest numbers of death. A look at the annual fleet statistics as published by the Singapore Marine Department tells us, however, that the Singapore fleet is dominated by tugs, oil tankers and general cargo ships. Statistics on the number of seafarers employed on different types of ships would then allow a more informed assessment of risk of death. Unfortunately the Singapore Marine Department does not compile such statistics and it is therefore suggested that the number of ship-years at risk could be used as a denominator to compare the risk of fatality.

In figure 3 the relative risk of death due to maritime disasters is shown.

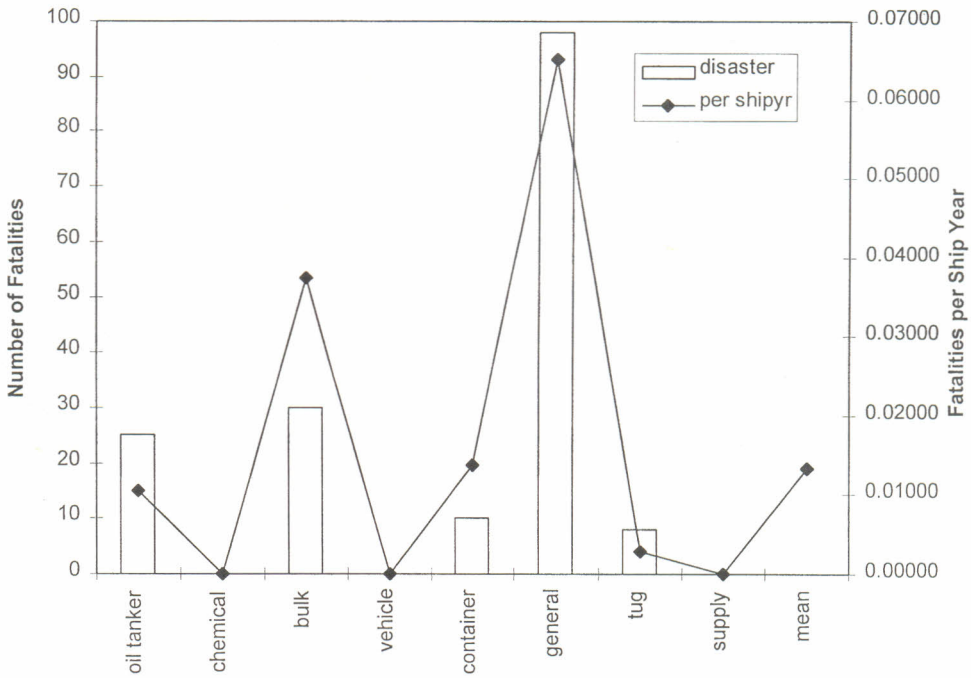

Figure 3: Risk of death due to maritime disasters

source; author

The risk of death due to a maritime disaster is much higher on general cargo ships and bulk carriers than the average, with container ships and oil tankers being close to the average rate of fatalities. For both general cargo ships and bulk carriers, the higher risk of death is mainly due to foundered or sunken ships.

The mean age of seafarers dying in a maritime disaster was 38.04 years (standard deviation: 8.03; median age: 37.0 years), the age was known for 110 of the 193 victims.

DEATHS FOLLOWING AN OCCUPATIONAL ACCIDENT

The second largest group of non-natural deaths is due to žoccupational accidents' with 53 reported deaths.

A more detailed review shows that there are several areas of particular danger, and the accidents were grouped according to the area of work on board the ship, where the accident happened. Six subgroups were formed:

- falls over board when working on deck or on the ship's side
- accidents in cargo holds
- accidents in the engine room
- accidents in tanks or enclosed spaces
- accidents while working on deck including mooring/ anchoring operations
- various causes

The deck department is the most dangerous workplace on board. Indeed only 13.2% of the victims were working in the engine department and no occupational accident resulting in a death occurred among the group of catering workers. Most victims are manual workers on deck (petty officers and ratings) and the highest numbers of death are attributable to falls over board or accidents during opening and closing of hatches, often involving a fall into the hold. When working on deck, in some cases basic rules of seamanship seem not to have been observed. Crew members were washed over board when trying to secure loose items on the foc'sle or were crushed by waves against bulkheads.

The single most important cause of occupational accidental deaths are accidents which happen in tanks or other enclosed spaces. All of these accidents in enclosed spaces took place on oil tankers and the case files point to serious deficiencies in procedures when preparing for entry or monitoring the workers in the tanks or enclosed space. In almost all cases no rescue equipment had been placed near-by, ready for immediate use.

The age of the victim was recorded in the case files in 52 out of the 53 occupational accident cases. Six victims were under 25 years, none under 18 years and another six victims were over 45 years. None of the victims was over 55 years of age.

The mean age of seafarers dying due to occupational accidents was 35.17 years (standard deviation: 8.32; median age: 35.50 years).

Table 3: Rank of victims of occupational accidents

	rank of seafarer														
cause of death	Master	Chief Off.	Deck Off.	Rad. Off.	Chief Eng.	Engineer	P.O. Deck	Deck Ratg.	Eng. Ratg.	Catering	Gen. Purp.	Deck Cad.	Eng. other	Cad.	Total
cargo hatches			2					7				1			10
fall over board		2	1				2	2				2			9
Various				1		1	2	1	1						6
deck/ mooring		5	1				2	3				2			13
tank/ enclosed space	1	1				1	2	1			1	2		1	10
engine room					1			1	2				1		5
Total	1	8	4	1	1	2	8	16	3	0	1	7	1	1	53

More than one third of the 45 seafarers for whom the time served on board was reported, suffered a fatal accident in the first three months on board and 75% died with up to 6 months service experience on board

The total time served at sea was only known for 27 of the 53 victims of an occupational accident. Nine victims had up to 5 years total sea experience, another 9 had between 5 and 10 years experience, one seafarer had been at sea for 10 to 15 years, 3 seafarers had 15 to 20 years sea time and 5 seafarers had over 20 years experience at sea.

This must be seen in the context of seafaring being an industry with a high fluctuation rate. When looking at all fatalities, the total time served at sea was known for 103 persons out of 373 fatalities. In the category 0 to 5 years sea time the age spread was from 18 to 50 years of age. The category 5 to 10 years seatime had an age spread from 25 to 55 years, 10 to 15 years sea time had an age spread from 30 to over 65 years, 15 to 20 years sea time had an age spread from 35 to 65 years and finally over 20 years reached from 40 to over 65 years of age.

The risk of death due to an occupational accident on different ship types is shown in figure 4.

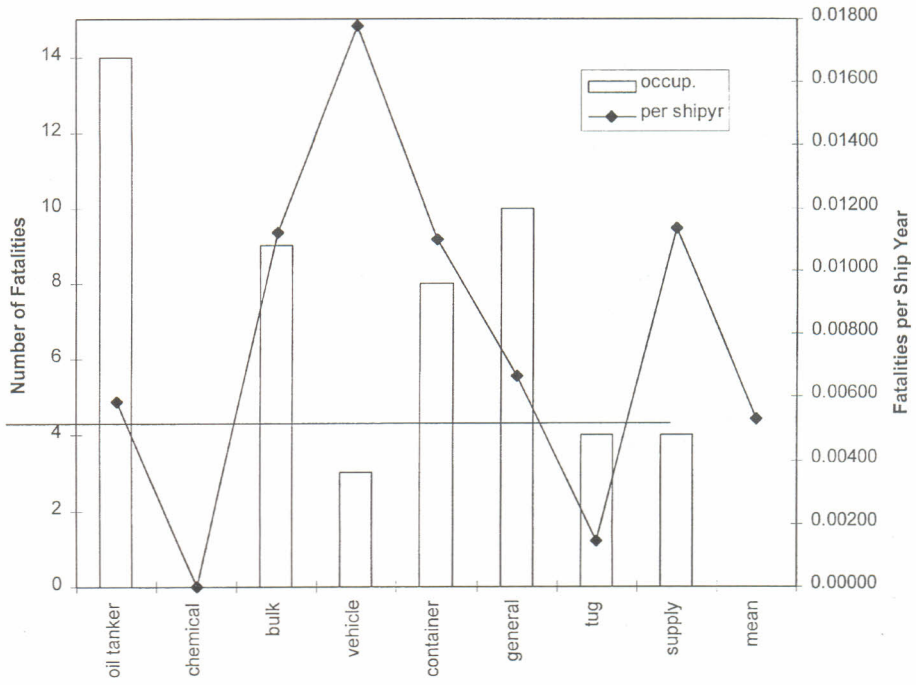

Figure 4: Risk of death due occupational accidents

Ship types with small numbers of ships per year are unduly sensitive to even smaller rates of casualties, thus the high risk on vehicle carriers must be assessed with care. However, bulk carriers and container ships pose an increased risk of an occupational accident to the seafarers, mainly due to falls over board and into the hold in the case of bulk carriers.

DROWNING AS A CAUSE OF DEATH

Altogether 197 seafarers (52.8%) drowned and in figure 5 the different causes of drowning are shown.

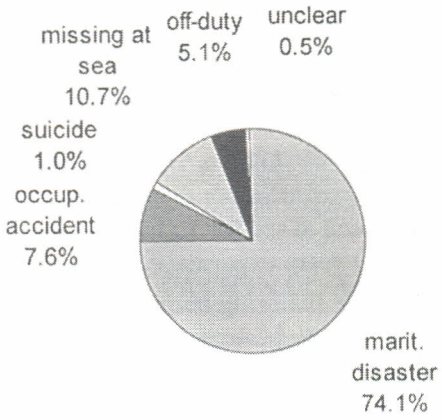

Figure 5: Cause of drowning

Drowning is the main cause of death following a maritime disaster and an occupational accident. Other important causes of drowning are 'missing at sea' and 'off-duty' accidents, often when returning to the ship.

DISCUSSION

This study examines reported non-natural deaths of merchant seafarers which occurred on board of Singapore merchant ships. Death is the ultimate consequence of an injury suffered but serious accidents do not always lead to immediate death. The availability of medical help, the position of the ship relative to the shore and of crew properly trained in first aid or advanced medical care may influence the outcome of a serious accident. The results of this study thus do not lend themselves to generalisations on the risks of the occupation as a seafarer. Other data on non-fatal illnesses, accidents and near misses must be taken into account in judging the risks to which modern day seafarers are exposed. For Singapore ships, such records are not available for review.

It is very difficult to judge the quality of reporting or the rate of under-reporting. The main reason for an under-reporting is probably the fact that Singapore laws make the results of marine inquiries confidential, even for research purposes. As mentioned before, other (additional) sources were consulted and four maritime disasters were identified, which led to the death of altogether 60 seafarers.

This study is clearly biased towards sudden deaths following an accident. An analysis of deaths due to natural causes (illnesses) was beyond the scope of this study.

Follow-up studies into serious accidents which may have led to prolonged hospital stays or death after signing-off the ship may have been desirable but cannot be carried out for Singapore flag ships. By law, Singapore ship owners have no restrictions in sourcing their crews. They can choose to employ seafarers from any country in the world, as long as the seafarer complies with the training requirements as stipulated by the then Marine Department and now Maritime and Port Authority (MPA). On the other hand, seafaring has been characterised as an occupation with a high fluctuation rate . In an internationally manned fleet such as Singapore, there is no register of seafarers employed on Singapore ships and seafarers employed by Singapore companies may alternate between Singapore and non-Singapore flag ships.

Additionally there are other reasons, why the study may not cover all work related fatalities among Singapore merchant seafarers. If for example the seafarer has been signed off for the very reason of an injury suffered, or an illness contracted while on board, and he dies shortly after being signed off, there would be no legal obligation for the master to report such a death. Indeed the ship master may not even be aware since the death may not have been communicated to him.

In general occupational accidents were not at all investigated by the MMO. As a rule the marine superintendent managing the case file accepted the statements by the ship's master and crew as sufficient. This can hardly be deemed to constitute an in-depth investigation of a fatal occupational accident carried out by Singapore investigators.

Even for several accidents involving the loss of the whole ship or other serious accidents to the ship leading to loss of life, no formal investigation has been carried out. However, two of the maritime disasters which led to the sinking of the ship and consequent loss of life, were investigated by the German *Seeamt Emden*. The German Marine Accident Investigation law calls for an investigation to be carried out, if the ship in question had been under the command of the holder of a German certificate of competency. The results are then published by the German Maritime Authorities.

The main aim of the Singapore MMO seemed to have been to ensure that the family of the deceased received the personal effects and any outstanding wages and to confirm that indeed death had occurred. This can more be likened to the function of a registrar of births and deaths than to a coroner's inquiry.

The case files thus cannot be used for detailed reviews and analysis of causes of accidents, but the study was able to demonstrate that seafarers working in the deck department are particularly at risk of an occupational accident and most accident victims are of a relatively senior rank (officer or petty officer).

In a recent study covering Polish seafarers, the two departments deck and engine had about an equal share of victims. Hansen reports increased standard mortality rates (SMR) for all age groups and departments compared with the Danish male population. But deck ratings and to a lesser extent engine ratings have about two times higher SMRs than deck or engine officers.

The case files also suggested that in several cases there were indications that poor working practices and lack or availability of preventive safety equipment may have led to these fatalities.

In particular the outcome of the cases of falling overboard while working at the ship's side or climbing Jacob's ladders, could perhaps have been mitigated if the seafarers had carried a self-inflating life-vest, used a safety harness or if a security guard had been placed on deck while work was carried out on the ship's side. The merits of these so-called 'single chamber life vests' have been discussed in a recent court decision in England .

Mooring operations have long been recognised as an activity involving a high degree of risk which may sometimes lead to serious and fatal accidents. In this study only one accident was identified which happened while berthing the ship when a mooring rope broke. Six seafarers died while working on deck in bad weather when they were crushed by waves against ships parts and suffered multiple injuries.

But the single most important cause of death was working in enclosed spaces, a particularly dangerous area on board ships, with oxygen depletion leading to suffocation. In this study 10 occupational accidental deaths were to be attributed to this cause. Hansen highlighted that oxygen contents of the enclosed spaces were not checked and safety lines were not rigged which delayed the rescue. Similar facts can be elucidated from the respective Singapore files. All cases of deaths in enclosed spaces happened on oil tankers, a section of the shipping industry which is particularly proud of its good safety record.

The mean age of the victims of occupational accidents (35.2 years) as well as those who perished in maritime disasters (38.0 years) is about the same as reported by Hansen for Danish seafarers (35.5 years) whereas Roberts reports a much higher mean age of 43 years for occupational deaths in the British fleet, which certainly reflects the higher mean age of British seafarers, a fact also mentioned by McConville and Glen(1997).

The mortality rate of confirmed suicides is lower than in other studies, but one must bear in mind that it is possible that any of the cases in the category 'individual persons missing at sea' may have been concealed suicides. It is at least debatable, if a seafarer distressed enough to take his own life was able to perform his duties and functions on board the ship properly in the time before death. This should give a new perspective to the discussion on human errors being the cause of 80% of all shipping accidents and it is argued that this area is one, that should also be addressed in the current, ongoing discussions on manning levels at the International Maritime Organisation. Proposals that 'social matters should not be addressed' (Lloyd's List, 1998) seem to be short sighted.

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VIRTUAL CLASSROOMS FOR MARITIME ENGLISH TEACHING IN THE NEW CENTURY

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Abstract

In this paper, theories on language teaching approach, method and techniques are examined. In addition, maritime English teaching in China is evaluated and the feasibility of the virtual classroom is considered.

Key words: approach, intranet, virtual classroom

I. Approach, Methods and Techniques in English Teaching

According to Anthony, an approach is a set of correlative assumptions dealing with the nature of language teaching and learning. Methods, on the other hand, are overall plans for the orderly presentation of language material, whereas technique is implementational, which actually takes place in a classroom (Anthony 1963). Approaches are based on different views of language. Generally speaking there are three major theories concerning the nature and function of language.

The traditional theory, the structural view on language is that language is a system of structurally related elements for the coding of meaning. The target of language learning is to master elements of such a system. Typically, the audiolingual method is based on this view.

The functional view regards language as a vehicle for the expression of functional meaning. It lays stress on the semantic and communicative dimension, leading to a specification and organization of language teaching content by categories of meaning and function rather than by elements of structure and grammar.

The third view is often referred to as the interactional view, which sees language as a medium for the realization of interpersonal relations and for the performance of social transactions between individuals. Language is a tool for the creation and maintenance of social relations. It focuses on the patterns of moves, acts, negotiation, and interaction found in conversational exchanges. The teaching content is specified and organized by patterns of exchange and interactions.

The approach and method of foreign language teaching in China are mainly of eclectic. However, whatever the views, approaches and methods, the intended end results are the same, ie, for the language learner to be able to use the target language. Quirk et al gave a two pronged analysis of language study: the study of the sounds and that of vocabulary, grammar and meaning (Quirk et al 1985). For a foreign language learner, this bipartite classification becomes quadruple: listening, speaking, reading and writing. Table A-II/1, Annex, of STCW95, for example, specifies that navigation officers should have "adequate knowledge of the English language to enable the officer to use charts and other nautical publications, to understand meteorological information and messages concerning ship's safety and operation, to communicate with other ships and coast stations and to perform the officer's duties also with a multi-lingual crew, including the ability to use and understand the Standard Marine Navigational Vocabulary as replaced by the IMO Standard Marine Communication Phrases."

II. Eveluation of China's Maritime English Teaching

There are more than ten maritime schools and institutions in China, all of which give a substantial proportions of their classroom hours to the teaching of English. In Dalian Maritime University, for example, there are 380 classroom hours for English, 280 for general English, 100 for subject English. Despite the efforts and time, the results are not entirely satisfactory. Every year, there is a proficiency English test for the third year students of the navigation program held by the Ministry of Communications, consisting of subject English (both oral and written) and general English. The passing rate is very low. Another example is that a fourth-year student, practicing on board a ship whose anchor happened to be dragging, was told by the first officer to warn the ships passing by over the VHF. To the latter's great annoyance, it took him a couple of minutes to think it out and then uttered it haltingly. Although this is quite an unusual case, it does show that, generally speaking, the students' maritime English competence, especially the communicative competence, is not in accordance with the language requirement specified by STCW 95.

Although factors contributing to this unsatisfactory result are many, the technique and facility factors play a significant part. Foreign language teaching has a recorded history of nearly 2000 years in China, starting from the Han Dynasty (206 BC–220 AD). In the Tang Dynasty (618 AD–907 AD) it flourished and Sanskrit was the major foreign language taught for the translation and teaching of Buddhist Scriptures. Since the 18th century English has been the major foreign language in China (except during the 1950s, when Russian was the major foreign language taught in almost all the secondary schools in China). Despite such a long history, the mode and medium of instruction remain virtually the same, that is, the classroom – teacher – textbook mode. Zheng Shu-tang in Shanghai Communications University sent out a questionnaire to 351 university English teachers in a survey of the use of teaching aids in 1997. The result is as follows:

	No answer	Never	Sometimes	Often
Video	209 (59.5%)	123 (35%)	10 (2.8%)	9 (2.6%)
OHP	198 (56.4%)	123(34.1%)	12 (3.9%)	18(5.1%)
Lang. Lab	156 (44.4%)	63 (17.9%)	49 (14.4%)	83 (23/6%)
Recorders	71 (20.2%)	25 (7.1%)	43 (12.3%)	212 (60.4%)
Blackboard	25 (7.1%)	5 (1.4%)	3 (0.9.%)	318 (90.6%)

According to Eggan, the integrated visual, audio and motional information can be registered much longer inn the sensory registers – information stores that hold exact copies of stimuli for a brief period of time. Visual information can stay only for 1 second, auditory 4 seconds (Eggan:1992), and a combination of the visual and audio information would stay for 6 second. If animation is added such information would stay much longer. However, the traditional classroom does not have equipment providing visual-audio-animation stimuli.

As to teachers, most English teachers have difficulty teaching subject English. Therefore, at DMU, as in most of China's maritime institutions of higher learning, general English is taught by English teachers while subject English is taught by subject teachers – those who teach navigation, marine engineering and so on – on the side. Since they were not trained as language teachers, they lack the methodology to teach language, and their English need improvement as well. The result is lack of learner interest and the resulting functional incompetence of some of the learners.

The textbooks are largely text based, teacher centered and reference book dependent, very difficult for self study. The coverage is narrow and difficult to update. For example, household words such as e-shop, e-cash and so on are not included in the newly revised College English.

III. Feasibility of the Virtual Classroom for Maritime English Teaching

It would be ideal for maritime English taught in a classroom providing access to all the real-time audio-visual-animated material available simulating the real situation, with the teacher well versed both in language skills and maritime knowledge – a rarity in China. Textbooks are in hypertext with audio-visual information as well. Such multi-functional, futuristic classrooms can be realized with the state of the art computer technology, and in the foreseeable future these cyberclassrooms will replace the traditional classrooms and language labs in foreign language teaching.

The virtual classroom consists the software and the hardware and the network in which the software is run. The software is interactive, multi-functional, multimedium and self-contained – it can teach, evaluate, answer questions and has hyperlinks. Such software requires wideband, high performance network for the transmission of real time audio-visual and animated signals. Currently, the Dalian Maritime University's intranet is capable of running such virtual classrooms. The LAN of the university is the ATM network capable of transmitting 100 MB per second. All the language classrooms and dorms are now interconnected via the fast Ethernet. The university's intranet is linked through an extranet to China's CERNET and the INTERNET. However, there is still a long way to go before the virtual classroom is established.

One of the major reasons is that the software is difficult to write. It needs concerted efforts, enough funds and it takes time as well. There are other difficulties such as the copy right problem. Despite all the difficulties, within ten years such virtual classrooms would become common and stand-alone PCs and Laptops can have virtual classrooms too.

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THE LOCATION OF THE LIFEBOATS IS IRRELEVANT IF YOU CAN'T TELL ME HOW TO GET THERE

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I am by no means an expert on maritime matters. I have been teaching maritime students for only three years while many of you have been doing so for many years after long careers at sea. That said, during the past three years I have made some observations and drawn some conclusions based on both my experience at the Fakulteta Pomorstvo in Promet in Portorož, Slovenia and on my experience as a teacher in the United States which may be helpful.

That it is necessary for seafarers to have a common language in order to insure the safe and efficient operation of ships on the sea lanes of the world and in its ports seems clear. That that language happens to be English rather than French or Spanish or Chinese is an accident of history. For the foreseeable future, then, English will be the language of the sea.

I am told by those who know better than I that the day is coming when proficiency in English will be a requirement for all who hope to work aboard ship, not only for captains, deck officers, and engine room officers but for the entire crew. At the risk of boring you with the obvious let me ask: What does 'proficiency in English' mean? Does it simply mean knowing the terminology; that the back of a ship is called 'the stern' and the front 'the bow' and that port is to the left and starboard is to the right? Or does it mean the ability to communicate to other seafarers effectively, articulately under any circumstances, no matter how confused or stressful those circumstances might be? Proficiency in maritime terminology without a corresponding competence in general English is relatively useless, especially in an emergency. That seems clear. So, how do we ensure that the sailors we are training not only know that the 'lifeboats' are on the 'stern' but also can tell us how to get there?

I suggest it is necessary to expose students to general English and maritime terminology in separate classes. In my first year at the Fakulteta in Portorož I taught maritime terminology and general English to first year maritime students. The combination of my lack of proficiency in maritime terminology and the variable competence of my students in general English made it a somewhat frustrating and unsatisfying experience. Success was uneven, at best. At the end of that first year my boss, Dušan Fabe, and I sat down together to reassess and plan for the next year. We decided to concentrate our efforts by using each of our strengths to best effect. During each of the last two years, all first year maritime students, both engineers and deck officers, have received 30 hours of exposure to general English in my classroom and 30 hours of exposure to maritime terminolgy in Mr. Fabe's classroom. Purely anecdotal evidence seems to indicate that this approach has increased students' proficiency in both areas.

Based on my three years experience at Fakulteta Pomorstvo in Promet, I would like to suggest a general approach to teaching English to future mariners. This approach presumes that students arrive at your school with, at least, a basic knowledge of English.

First, hire qualified native English speakers for conversation classes. When I use the word 'qualified' I am not necessarily talking about formal academic credentials. What are required are dynamic, articulate, personable individuals who can immerse students in a sea of English, talking to them, listening to them, drawing them into speaking, writing, joking in the language, playing with the language and so becoming comfortable with it. Sometimes this sort of individual comes with a teacher's certificate, oftentimes not. I am convinced that there is a pool of native English speakers–business people, retired people, advanced students, as well as for-

mally trained teachers–who would jump at the chance to spend a year or more exploring a new culture in exchange for sharing their knowledge of English.

Second, the mastery of language demands that students hear the language, write the language and speak the language – and the greatest of these is speak. It is my understanding that English is still taught in many institutions of higher learning using the traditional lecture format. From a lecture students can learn the fine points of grammar, can learn terminology, can learn about Shakespeare but they can not learn to speak English because they mostly hear it, occasionally write it, but rarely speak it. To increase the opportunites for students to use English, eliminate the lecture and its evil trappings. That means a) no more classes of thirty, forty, seventy students. Reduce class sizes to an absolute maximum of twenty (fifteen would be better). As classes grow larger than twenty the possibility that each student will participate meaningfully during each class period diminishes quickly. b) Eliminate two, three, and four hour blocks of instruction. It may be efficient to teach mathematics or technical subjects two or three or four hours at a time but it is not a good way to teach language. Replace those blocks of instruction with two, three, or four one hour class periods per week. Simply multiplying the number of exposures per week enhances learning of a language. c) Tie successful completion of the class to attendance at class and diminish the importance of the written final examination. Again, a student can miss a math class or two, borrow a fellow students notes, and be up to speed again in no time. Not so with a language class–if the class is based on using the language, as it should be. d) Make English a requirement in each year of study. I have anecdotal evidence that shows diminished competence in speaking the language after only one year without an English class devoted to conversation.

Third, we must find or develop an English proficiency test specific to maritime issues and concerns and make it absolutely clear to students entering Maritime Studies that they will be graduated only if they can pass this oral English proficiency test under stress conditions at the end of their course of study. We should give them a version of the test at the end of every year of study beginning with the first year and keep them apprised of their progress (or lack of it) so that they may take remedial action if it is necessary.

In conclusion let me say that if, indeed, proficiency in English is soon to be a pre-requisite for obtaining a berth aboard ship then we must re-think our approach to teaching language and start teaching our maritime students English as if their livelihoods depended upon it.

Summary

English is the language of the sea. Proficiency in English is (or will be) a requirement for all who hope to work aboard ship. However, proficiency in maritime terminology without a corresponding proficiency in general English is useless, especially in emergencies. In order to teach maritime English as opposed to simply maritime terminology it is important to expose students to general English and maritime terminology in separate classes (first year maritime students, both engineers and deck officers, at Fakulteta Primorska in Promet in Portorož receive two hours of exposure to general English and two hours to maritime terminology within the year). An approach: 1) hire qualified native English speakers for »conversation« classes. 2) Since the mastery of language requires the usage of language increase the opportunities for each student to use English in school by: a) reducing class size to an absolute maximum of 20; b) eliminating 2, 3, or 4 hour blocks of instruction and replacing them with 2, 3, or 4 one hour classes per week; c) making English a requirement in each year of study. 3) make it absolutely clear to students entering Maritime Studies that they will be graduated only if they can pass an English proficiency test under stress conditions and keep them apprised, from year to year, of their progress toward that goal so that they may take remedial action if it is necessary.

focused very narrowly on a single area of communication. They were indeed quite suitable to prepare the learners to get a job or to interact successfully in their workplaces.

Though, these programs with the limited set of needs specification could not help the learners to communicate in all real life situations, they established a starting pint for the linguists and syllabus designers to do needs analysis for a new movement called ESP (English for Special or Specific Purposes).

The History of ESP

ESP seems to be a relatively new term. This revolutionary movement is referred to as the global trend towards learner-centered education. Strevens (1978) states:

> "...within the context of this development, ESP can be seen as responding to the educational requirement to study the learner, to analysis his needs and aims, to define his contribution to the teaching/learning situation... to device means of helping him to learn not just that which has been defined by some externally imposed general syllabus." (p. 153)

The term (ESP), however gave label to a long-standing familiar problem. It's history dates back to at least half century ago, but many scholars mention 1966, 1967 or 1968 as the time during which ESP started and became to concern of ELT activities (Robinson 1980, Mackay & Mountford 1978). However, as a new term or 'label', it is still subject to various interpretations, some of which are examined below.

Strevens 1980 has a more comprehensive categorization of ESP taxonomics. He believes that ESP is devided into two major branches ^ESP courses and all other ESP courses. On the importance of ESP he believes:

> "... EST courses are usually distinct, because they require the incorporation within them of a greater content of "Scientific English". This in turn entails the learning of ways in which quantification of various kinds is expressed in English...." (p. 90)

He further adds that all ESP courses are either occupational or educational. By occupational ESP, it is meant English for airliners, fire fighters, etc. Occupational ESP according to Strevens, then, subdivides into pre - experience, post - experience and teachers conversion courses.

Within educational ESP, he distinguishes discipline based and school subject which are subdivided into pre - study, post - study, and independent, integrated courses respectively.

The following diagram taken from Strevens (1980), is a schematic representation of ESP taxonomy:

			Pre experience	
		Occupational	Post experience	
			Teachers conversion	
	EST			
ESP				
	Other			
				Pre study
			discipline based	post study
		Educational		
				independent
			school subject	integrated

Taxonomy of ESP

This classification of ESP has some paramount advantages, it makes a distinction between EST and all other courses which are classified under the title of EST. It also accounts for two main features which are closely related to ESP; namely time and age factors. However, these two factors are indirectly implied in Streven's classification. For, it is assumed that teaching a language to adults for special purposes often refers to a time constraint, during which adults take an intensive course both for occupational and educational purposes. On the other hand, it seems obvious that most of the learners are adults or near adults when they are in jobs, about to be employed or taking tertiary educational courses.

EST Development

The development of EST has been the concern of many scholars over the past few years. Specifically the increasing expansion of science and technology has called for numerous research into the area of EST.

It was believed that EST was a "type of English" used for students of science and technology. This was an argument upon which the notion of register was based. The underlying assumption of this notion according to Widdowson (1979) is as follows:

> "... since language in general varies in accordance with the functions it is required to fulfill, then it follows that a language in particular must consist of different and distinct varieties. Furthermore these varieties are defined in terms of their linguistic characteristics as sub-codes of particular language..." (p. 22)

Making distinction between form and function, text and discourse Widdowson argues that selection of certain lexical and syntactic features related to specialist topics and serve some of the language needs for which those selections are applied, but they do not take into account the other needs dealing with communicative function of language. This assumption leads to the notion that accounts for EST as a king of discourse, i.e. using English to realize the universal notions (semantic components), not as a kind of text which functions in terms of its formal properties.

To device EST programs, the following three generations are known in the field; lexicon analysis, Syntax analysis, and discourse analysis.

The followers of the first generation believe that the only difference between GE and EST is a group of related registers. They claim that to provide and EST program, after conducting a statistical survey on certain samples, a frequency count of lexicon is done. Then teaching materials are devised on the bases of frequency weight of the lexicon, but as Widdowson 1979 puts it:

> "... a register analysis takes samples of actual discourse and breaks them down into constituent linguistic elements... it accounts for samples of language as instances of linguistic usage but not as instances of communicative use..." (p. 38)

Then, a frequency list of lexical items in isolation can not help the syllabus designers to provide ESP programs for communicative purposes because, scientific words in a particular texts with high frequency do not always provide an adequate distinction between closely related subjects (Lee Cheong 1975). Two writers of the same subject may use a single item with different frequency level. Furthermore, in EST whose concepts and contents change rapidly, word frequencies do not remain stable. They change within a certain period of time. Posing these criticism, another school of thought appears and gives theoretical justifications for EST program development.

The followers of this (second) generations believe that the lexical specification is not enough for EST text development. They claim that the difference between GE and EST is a set of structures. For example, they say, in scientific prose passivization, normalization, and appo-

sition are the most frequent structures. They do frequency count of syntactic features of EST texts, and believe that after usage characteristic of EST is learned, it is easy to put it to use in certain communicative activities. But Widdowson (1979) argues:

> "... I do not believe that a knowledge of how English is used in EST communication can arise as a natural consequence form the learning of patterns and vocabulary... we need to set up conditions which will lead students to transition from usage to use." (p. 39)

Widdowson believes that both the analysis of lexicon and the analysis of syntax are žquantitative' approaches and suggests that a 'quantitative' approach would better fulfill the needs for communication in EST.

Both kinds of analysis give a quantitative indication of the frequency of lexical items and structures but since they are isolated from the context, they can neither indicate how they function in relation to each other, nor they can indicate any variability in their communicative value.

The followers of the second generation, concentrating on the forms of sentences, ignore the complexity of scientific prose. They tend to oversimplify the syntax of a language by limiting it to a set of manageable patterns, and do not consider that there are different ways of saying the same thing.

Brown (1987) asserts:

> "human beings universally have needs of drives that are more or less innate, yet their intensity is environmentally conditioned..." (p. 114)

Among the environmental conditions, motivation of the learners is a unique factor which is generally used for explaining the success of failure of various tasks. It is a kind of internal drive that encourages the learners to pursue a course of action.

Extrinsic motivation and intrinsic motivation are known as two main types of motivation. They are concerned with factors outside and inside the classroom respectively. Some degree of extrinsic motivation accompanied with some degree of intrinsic motivation, which includes class activities and materials, has a better effect on the learners' English proficiency.

After designing any syllabus, relevant materials are developed. In this procedure most experts of the field agree upon materials that are called "authentic", and relevant. Carver (1983) believes that authenticity of texts is intrinsic to an ESP course simply because of orientation towards purpose. Therefore, from the beginning one should consider that there is a very obvious difference between an ESP text and a general ELT course book. An ASP text should involve authenticity which refers to using materials taken from the 'real life' not produced specifically for foreign language learners Johnson (1980) believes that ESP course book should not be organized around general human interests, topic and situations. Rather, he adds, topics and situations are linked to the learners subject spacialism. (being relevant).

Subject spacialism, as the name implies, is the specificity at content. This means that learners learn language for educational and occupational benefits.

Naturally, authenticity and subject spacialism play a crucial role in ESP materials productions. In fact, two distinctive modes for employing authentic materials are suggested. The first mode grades the materials using an accessibility criterion. In this case, original texts are restricted and adopted to learner's competence considering the diversity of new information. In the second mode, original and authentic materials are used without change or restriction, and each task is manipulated through relevant authentic materials (Phillips and Shettelworth 1978).

However, it is argued that the closer and the more relevant the EST materials are to the field of the learners, the more successful and motivated they will be.

Morrow and Shocker (1978) claim:

> "... in this case the focus is not on process or model in terms of the student use of preidentified areas of a language, but rather it is on the content of the text itself. The rational for the choice of text has to do not with uses to which it can be put, but with the subject matter involved." (p. 249)

They further mention a very crucial and interesting point regarding the effect of novel content based text on the students motivation.

> "... the hope is that by choosing texts that are inherently interesting, the teacher will motivate students to involve themselves in."

In content based teaching, language is a means of communication in meaningful, purposeful and academic context. A real situation is created in which language is used about what the learners want to know, not to talk about language itself. What the learners need to know more about is the subject matter.

Another underlying principle is that content based ESP provides a substantive basis for language teaching and learning. Content can provide both a motivational and a cognitive basic for language learning. It provides a primary motivational ground for language learning insofar as it is interesting and of some value to the learner and therefore worth learning. Later, language provides an access to the content, and may become incidental to learning about the content.

Content also provides a cognitive basis for language learning in that it provides real meaning. In the absence of real meaning language structures and functions are likely learned as abstractions lacking conceptual or communicative value.

There are some other reasons for following content based approaches to language teaching instead of sticking on the language alone. The intrinsic characteristics of language variation is another reason. The learners in content based classes realize that learning certain specific content may be prerequisite to mastery of specific subject matter or to academic development in general. Lambert & Tucker (1972) believe that it content based classrooms, the students learn the academic content specified in the curriculum and at the same time develop significant levels of foreign language proficiency.

Widdowson (1979) discussing different issues in EST teaching also claims that:

> "... the closer English teacher's methodology can be made to approximate to that of science teaching, the more successful he will be in integrating the two areas of knowledge whose synthesis constitutes relevant English use." (p. 43)

It is quite clear that Widdowson is supporting content based materials to be taught in ESP classes, but as it is generally known, he believes that construction of texts which are written within the competence of students can maintain true communication. Widdowson's suggestion, though useful and content support, seems to ignore idiosyncrasies of original texts, and the motivation which is created by new texts.

Whereas some experts in the field are against teaching content based and new texts to ESP learners, it seems that a large group of experts, MacDonald & Sager (1975), Ray Williams (1977), Morrow & Shocker (1987), Ann Snow (1987), believe that new, interesting and content based texts which are selected through the consultation with content lecturers are more suitable materials than existing ones.

The first group of experts, claim that awareness of the content, psychologically helps the learners to understand the language better. They believe when the learners are familiar with the concepts in their L1, they can easily transfer their knowledge into L2. This implies that simple and familiar texts make the students better comprehend that language and accomplish communication that unfamiliar texts. On other hand, the second group of experts declare that very familiar texts aim to focus on the language, not the content which is the concern of ESP learners. From their point of view. The first group overlook the fact that language should be a means of expressing the content through which some degree of language proficiency is attained.

GENERAL REMARKS ON MARITIME ENGLISH SYLLABUS: CONTENTS AND STRUCTURE

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As the 21st century is approaching fast, let us look at the contents and structure of Maritime English syllabus. What will change in it? What will remain? What shall we scrap?

It should certainly concentrate on communication on board ships and between ships and shore stations and VTS centres and Search and Rescue centres to ensure safe passage of ships, quick transfer of passengers and goods. Thanks to new technology, the "old Morse Code" can be scrapped.

However, the syllabus should certainly contain terminology connected with he ship so the students my get familiar with the main parts of a vessel, then, at a more advanced level, they can be given a description of a vessel in more detail or they can be asked to prepare such a description themselves. Ship types and ship sizes as well as special duty ships should feature prominently in the Maritime English syllabus.

Another topic should be connected with the construction of ships and their equipment both on deck and in the engine-room.

Yet another topic should be included: different ways in which merchant ships can be operated and the whole range of documents involved in it.

A very important part is played by the people working on board ships, the crew and their functions in the deck department, engine-room department and catering department which can be quite big, particularly on board cruise ships and passenger vessels.

The main difference here is that the radio officer has disappeared from cargo vessels and the officers have to hold General Operator Certificate now. And again the communicative abilities of the crew have been underlined and this aspect has to be reflected in the syllabus. Here we have to mention that ship's crew nowadays are predominantly multi-lingual and may come from very different cultures so these aspects should also be taken into account. This is probably the main change which will dominate in the nearest future.

Maritime English syllabus should also contain terminology connected with the port and its approaches, marking of fairways, anchorages and roadsted (seamarks and landmarks), design and layout of quays and basins, piers, wharves and jetties, port facilities including the latest types of cranes (Portainers, Transtainers, gantry cranes, floating cranes etc.), services rendered by the port: pilots, Harbour Master's Office, ship's agents, stevedores, fuel and water supply, provisions, life-saving equipment, fire-fighting equipment and services at the terminals in the port (container terminals, ferry terminals, oil terminals etc.).

Vocabulary connected with the port should also include different types of cargo the port is handling and storing and different harbour regulations referring to it.

Here again, the people working in the harbour should be mentioned and their different functions and the language they use. We, as teachers, are trying hard to get our students master the English pronunciation to the RP level but is it the language they are likely to hear in the docks or on board ships nowadays or is it a local variety of English such as the Indian variety of English or Philippino English or Texan English?

All this is not happening in a void but in the real environment so the problems of preventing pollution should also be included and ways of combat, if it occurs in port waters or at sea. Marpol conventions should also be taken into consideration here.

These brief remarks do not exhaust all the topics and the development of technology in the future may be to our advantage. Already, the Internet has turned out to be a valuable source of information for both the students and the teachers. The students are more motivated to learn English if they can use it looking for materials on the Internet.

We can strive towards a uniform Maritime English syllabus in all nautical schools and academies but it has to be structured according to the local needs and it has to take into consideration the type of courses these educational establishments provide; whether they are Mate's courses or Master's courses or Engineer's courses or GMDSS courses.

In any of these courses the communication aspects should be underlined and the Standard Marine Communication Phrases implemented and checked orally in practice.

I hope the SMCP would be put on tape soon and will be available to the teachers and the students so that the teaching process would be easier and the acquisition far more pleasant. Perhaps it would be a good idea to record different sections of these phrases in different countries to get our students familiar with the different accents and varieties of English used all over the world.

SOME DICHOTOMIES IN MARITIME ENGLISH TEACHING

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Abstract

A dichotomy means a division into two parts, opposed yet related, counteractive and iteractive, independent but complementary, promoting and restricting each other. A correct understanding of some dichotomies in maritime English teaching (MET) may help to find solutions to the handling of some relationships concerning MET, and thus evelate its effectiveness. The dichotomies under discussion are: 1) maritime subjects in English and English in maritime contexts; 2) general English and maritime English; 3) knowledge impartation and skill training; 4) student-centredness and the teacher's leading role. The author intends to offer some tentative ideas so as to arouse the interest of his colleagues and counterparts who may come up with more valuable opinions, rather than make a subjective assertion of his own.

Introduction

A dichotomy is a division or separation into two parts which are sharply contrasted. Talking about a dichtomy, people tend of think of the two parts merely as opposites which are contradictory and conflicting by nature. This is, however, a superficial and one-sided understanding. As every coin has two sides, everything has two aspect. It's true that the two sides are opposites, front and back, obverse and reverse, but it is precisely the two opposites that constitute the unified whole. Neither of the two can claim to represent the whole. Therefore the essence ofe everything lies in the umity of opposites: one divides into two and two combine into one.

This paper present three dichotomies in maritime English teaching (MET). These dichtomies have always been existing in MET, whether recognized or not, and however treated, consciously or unconsciously, with or without priority and preference. An impartial analysis of the two sides of these dichotomies might help us understand the essence of MET and guard against the pitfalls of superficiality and one-sidedness.

1. Maritime English and maritime subjects taught in English

This dichotomy embodies the relationship between the language course and subject course. Maritime English is, as the term suggests, English used in maritime contexts, of English for Maritime studies. When referred to as the name of a course, it is obviously a language course. Maritime English is English after all. Though premodified by "maritime", "English" is the central word, and the language is the core or focus of attention of the course. The student's attainment of the language proficiency is its main objective. However, maritime English, like other branches or sub-branches of ESP, is intended for a particular group of learners, i.e., seafares or would-be seafarers, and based on their special needs and interests, i.e. working in the maritime sector or studyng for a maritime career. Therefore, it could be identified by analising the linguistic characteristics of the learner's specialised area of work or study, and it necessarily reflects, to a certain extent, the content of various maritime subjects.

A maritime subject is a branch of knowledge studied, which concerns ships or the sea. Owing to the international nature of the work in the maritime sector and undesirable commu-

nicative competence of the Chinese seafarers, it is much encouraged now in China that maritime subjects should be taught in English, so that the learners could get used to acquiring knowledge through the medium of English, and later when they enter upon a maritime career, will fing little difficulty in communicating in a multi-national environment and conforming to the international norms governing the maritime practice. As a subject course lays emphasis on the learner's obtaining the knowledge of the subject matter, the language itself is not the purpose of learning, but a medium of instruction. However, teaching maritime suvjects in English helps to create a very good English enviromment and benefits the learners in their language acquisition, as they can improve their linguistic skills unconsciously in the process of assimilating knowledge of the subject matter.

To sum up, Maritime English touches upon maritime situations in which English is used, but gives prominence to language learning; whereas maritime subjects taught in English uses English as a vehicle, and lays emphasis on conveying knowledge of the subject matter. The former may consolidate the learner's understanding of the maritime knowledge while the latter may facilitate the learner's language acquisition. The two are independent of each other with different objectives of their own, but they are mutually complementary with "byproducts" conducive to those of their opposites. In Shanghai Maritime University, courses of both types are offered in the third year of the undergraduate programs on the supposition that the first two years "study of "general English" has laid a solid foundation for taking more specialized courses to be conducted in English. The maritime English courses offered are *English for Navigation* and *English for Marine Engineereing.* The courses of this type play a role of transition betwen the course of general English and those of maritime subjects taught in English by reinforcing the linguistic skills the student has already acquired and simultaneously introducing the student to some technical terms and essential knowledge necessary for engaging in the maritime occupation. The courses of the latter type are *Marittime Safety Management, Ship Maneuvering, Rules for Preventing Collisions at Sea,* and *VHF Communication*, etx. Most of the teachers who have given the two types of courses hold that efforts should be made to offer more subject courses taught in English though the students still have difficulty in their comprehension now. The transitional role of the maritime English courses is felt at present, but it will diminish with the improvement of the general English level on the part of the student and the increase of the subject courses taught in English.

2. Maritime English and general English

In the area of English language teaching in China, there has been a tendency to give prominence to general English to the neglect of ESP with English for maritime transporation as one of its branches. The unified National College English Tests (CET) Band 4 and Band 6 are offered to students of all specializations ar the collegiate level twice every year. The results of the tests are not only used by the educational authorities to asses the teaching quality of various institutions, but also considired by employers as part of the qualifications of their recruitment candidates. Consequently the tests almost play a dominant role and produce a profound influence over the English teaching of the whole country. Nearly all the universites and colleges offer "college English" (general English) as a required course to their students in the first two academic years, and thus leave little room for the existence of ESP courses. Moreover, some influential linguists in China advocated that there should be no such division between general English and ESP, for English, as a tool, can serve all purposes. This viewpoint once added more difficulty to the already difficulty situation of ESP, maritime English being no exception.

Nevertheless, as China is vigorously developing market economy by deepening its reform and opening its "door" wider to the outside world, there has been a growing demand for business English, a branch of ESP in the recent years. The Nacional Examinantion Center and the University of Cambridge Local Examination Syndicate have jointly offered BEC (business English certificate) 1, BEC 2, and BEC 3 tests to candidates of all trades and professions with ages raging from 17 to 40. This has also contributed to the nationar drive for the study of busi-

ness English. As Hutchinson and Waters (1989: 7) said, 'the tradicional leisurely purpose-free stroll through the landscape of the English language seemed no longer appropriate in the harsher realities of the market place.' As a results, ESP has gradually established itself, and is gaining certain prestige, especially in the sector of non-formal education. The slow but steady rise of ESP has subtly elevated the position of maritime English in maritime institutions. Furthemore, the necessity for the serious implementation of the international convention STCW 78-95 has given remarkable impetus to its further development. Importance has recently been attached and attention given to maritime English teaching and training not only, by maritime universities and institutes, but also by the competent authorities concerned and the whole shipping circle.

With the position of maritime English secured, the next question is what should be the methodology of MET as compared with that of general English teaching.

Maritime English is not a matter of teaching a specialized variety of English. The fact that it is used for maritime purpose does not imply that it is a special form of English, different in kind from other forms. It's true that there are some terms and features which can be identified as typical of the maritime context, and which the learner is more likely to meet in the target maritime situation. But these differences do not overshadow the far larger area of common ground that underlies all English use. Though the content of learning may vary, there is no reason to suppose that the process of learning should be any different for the maritime English learner from that for the general English learner. In fach, there is, as Hutchinson and Waters (1989: 18) suggest, "no such thing as an ESP methodology".

If there is no or little methodological difference between the two, how should MET be conducted? As ESP was the outcome of the rapidly growing market, so maritime English came into being as a result of the expansion of the maritime industry. Needs account of the existence of MET, and the conductiong of MET should, in return, be based on the learner's needs. The MET teacher should be aware what the learner has to know in order to function effectively in the target maritime situation. For example, he might need to undersand radio weather messages, read admiralty charts, follow sailing directions, use navigational instruments, establish telegraphic communication, carry on ship's correspondence, write an accident report, etc. He might also need to know the linguistic features, whether semantic of structural, stylistic or functional, which are commonly used in the contexts identified. The teacher must also identify what the learner alredy knows so that he can decide what the learner lacks at the present stage of study. On the basis of the analysis of the learner's needs and lack, the MET course can be properly designed and tailored to the attainment of the identified goal. Of course it is also possible to specify the needs of the general English learner, such as the need to seek social status or simply to pass the examination, but they are not so definite, specific or clear-cut as those of the maritime English learner.

In short, the difference between maritime English and general English is theoretically nil in terms of the linguistic features and teaching methodology, but practically much with regard to the content and the learner needs. The common ground they share determines their interactive relationship while the disparity between them shapes their mutually complementary roles.

3. Knowledge impartation and skill training

The discussion of the relationship between knowledge impartation and skill training does not apply only to MET. It is, in fact, pertinent to language learning and teaching as a whole. However, since MET is more needs-oriented as mentioned above, it seems worhwhile to give some space to the exploration of this dichotomy in terms of learner needs.

Traditionally, foreign language learning is regarded in China as the mastery of a body of linguistic knowledge including phonology, syntax and lexicology, which can be divided into small blocks of manageable size, and logically, teaching involves the presentation of this body in a systematic and assimilable way. Clear presentation, lucid explanation and earnes corretion are seen as essential to the impartation of knowledge from the teacher to the learner. Form and

accuracy are given prominence. A good teacher is supposed to be both a knower and a giver. A learner is a passive taker, sometimes like a duck to be force-fed with those blocks of knowledge. Of course, this approach to language learning and teaching has its advantages. Bling grammar-couscions, the learners usually turn out to be good at analyzing language phenomena, detecting linguistic mistakes, understanding involved texts and producing grammatically correct sentences. But disadvantages manifest themselves when it come to using the language in real communicative settings. Most learners find themselves "deaf and mute" in front of native speakers of the language they have learned. They are so careful about grammar and so sensitive to mistakes that they dare not make utterances or write sentences without much consideration, and this often results in the breakdoown of the oral or written communication. The learners' speed of reading is comparatively low. In brief, this approach leads to the learner's imperfect acquisition of communicative competence.

The approach on the other side of the dichotomy is to treat language learning and teaching as a matter of skill training. Language proficiency is seen too reflect itself in the communicative use of such language skills as listening, speaking, reading and writing, and those skills are to be acquired by constant practice in authentic or queasi-authentic enviromment rather than by absorbing knowledge about the language. Stress is laid on function and fluency, and class activities are more task-based and meaning-oriented. The teacher is supposed to be an organizer and helper while the learner, an active participant. However, this approach is sometimes carried to an extreme by ignoring the learner's mistakes in order to preserve the authentic atmosphere and not to interrupt the proceeding task, and by underestimating and even neglecting the role of knowledge instruction. Consequently, fluency tends to be achieved at the expence of accuracy and knowledge. According to Widdowson (1990: 161), 'It turns out that learners do not very readily infer knowledge of the language system from their communicative activities'.

Maritime English is, a mentioned above, English used in maritime settings, between members on board the ship, between ship and ship, and between ship and shore. Owing to the multilingual and multi-cultural composition of the interlocutors, and the precarious and vicissitudinous nature of seafaring work, language proficiency is highly necessary for seafarers. Fluency and accuracy are equally important, especially when English is used in the situations of preventing accidents, dealing with emergencies and coping with casualties. A moment's hesitation or a slight error may cause great danger and loss. Therefore MET should view dual simultaneous focus on form and accuracy as well as meaning and fluency, i.e. a combination of the above two approaches, as exceedingly desirable. According to Lightbown and Spada (1993: 105), 'Classroom data from a number of studies offer support for the view that from-focused instruction and corrective feedback provided within the context of a communicative program are more effective in promoting second language learning than programs which are limited to an exclusive emphasis on accuracy on the one hand or an exclusive emphasis on fluency on the other'. When it comes to the correction of the learner's mistakes in the process of task-based activities, this dual focus could be achieved by encouraging the learners to manage the interction themselves and limiting the teacher's role to using camouflaged correction techniques to upgrade learner utterances.

In short, MET is a matter of both knowledge impartation and skill training, which interact with each other and facilitate learning with complementary force. Two extremes should be avoided, as neither has proved to be effective if used to the exclusion of the other. The integrative approach of dual focus is the happy medium fo the avoidance of such extremes.

Conclusion

Dichotomy is a relative concept. The absoluteness of notion may result in extremes in action. To avoid lapsing into lopsided fallacies, we must consider the two parts of a dichotomy as opposed yet related, counteractive and interactive, independent but complementary, promoting and restricting each other. A correct understanding of this may help to find solutions to

the handling of some relationships concerning MET, and thus heighten its effectiveness. The dichotomies in MET as presented above are certainly not exhaustive. The author intends to offer some tentative ideas so as to arouse the interest of his colleagues and counterparts who may come up with more valuable opinions rather than provide a complete list and make a subjective assertion.

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MARITIME ENGLISH VS. MOTHER TONGUE

DUŠAN FABE

My task which I am trying to achieve is,
by the power of the written word to make you hear,
to make you feel - it is, before all, to make you see.

/Joseph Conrad, The Nigger of the "Narcissus", 1897/

SUMMARY

The paper initially recalls the everlasting issue about the relationship between language and thought, their independence or identity. After that it confronts English and mother tongue (Slovene by observing their conceptual uniqueness). This is then reflected in the translation of the revised STCW Convention made by non-specialized translators. A few examples of specialist maritime terms and collocations are given. These show the common misconception of the original meaning, incomprehensibility or absence of the corresponding term. And finally the paper calls for partnership between linguists and subject specialists.

LANGUAGE AND THOUGHT

To begin with it seems important that we have a look at the function of language and thought which would lead us to a comparison between Maritime English and the mother tongue, in our case the Slovene language. Identifying linguistic differences or similarities between two languages has always proved to be highly complex because of the many variables involved. Structural closeness, no doubt, is an important factor, our task, however, is to concentrate on the semantic aspect.

The issue of the relationship of language and thought has attracted many philosophers, psychologists, anthropologists, semanticists and others. Currently there are still various different or opposing views on this matter. If we confine ourselves to the latest book on semantics by Saeed (1997), we see that he draws attention to two opposing views, called *linguistic relativity* and *cognitive science.* The former, if we may venture to paraphrase, means that language influences our thought, "lexicalized concepts impose restrictions on possible ways of thinking" or " that people's thoughts are determined by the categories available to them in their language".[1] The latter, on the other hand, claims that the way we think is independent from language, " there is evidence of thinking without language"[2], also defined as a non-linguistic mental process.

The two opposing views offer convincing arguments and we believe that they both reflect reality. We would argue that they should not exclude, but quite the contrary, dialectically complement each other. We are convinced that there is a dialectical interrelation between language and thought and they, therefore, should not be dealt with separately. Such conviction includes the assumption that language participates in creating our vision of the world which surrounds

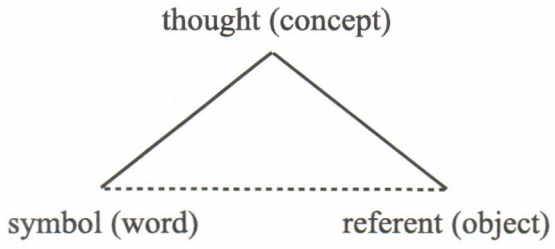
[1] Saeed p. 41

[2] Saeed p. 41

us, because language may become an automatic process and thus gradually change our concepts of reality, particularly when used by those who seldom experience it. Let us take an example of an ordinary sentence:

There is a *ship* coming alongside.

Do we undergo any conceptual experience of a particular ship before we see it or if we see it at all ? Considering the Ogden and Richards' semiotic triangle (1923):



Do we experience any associative bond between the symbol and thought? According to our experience we do not. We take it for granted that the symbol *ship* refers to an object which either floats or sails. As a result, such automatic use causes the shapes of the referred object to gradually either disappear from our minds or become vague. This paves the way for semantic changes. Once images from the real world are "transformed" into words or in terms of the above triangle, the *referent* becomes the *symbol*, then the process might take a reverse direction in which the *symbol* in the course of time does not necessarily refer back to the same *referent*. This process could be illustrated with a labeled bottle, in which we can pour water instead of wine, while the label remains the same.

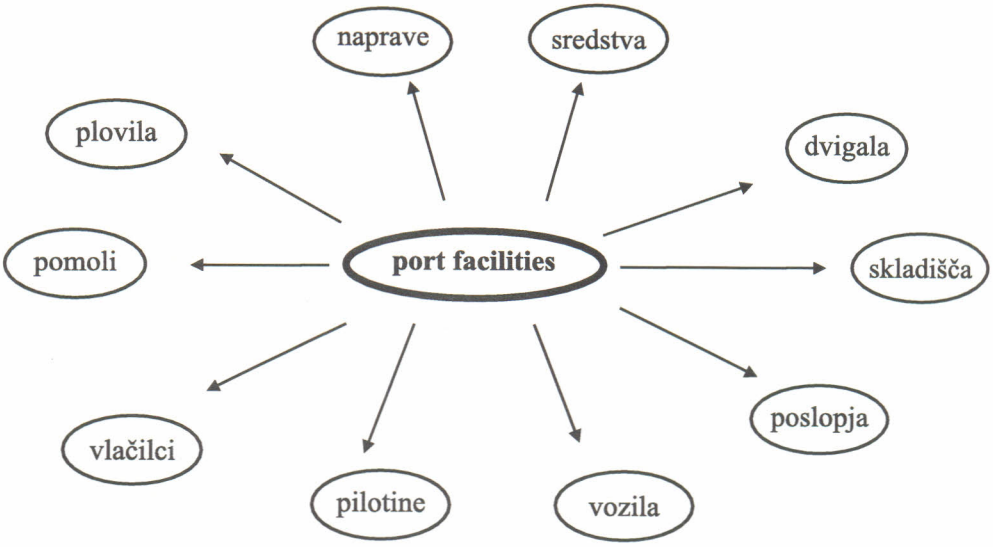
Linguists have proved that it is most difficult for the foreign language learner to learn those aspects of the language which do not exist in his mother tongue. If he encounters such an aspect, he experiences a strange, and sometimes, even unacceptable attitude to life. In other words, the native speakers of any language have, through their special language, developed a particular attitude to life of which they are sometimes not even aware themselves. Such language aspects cause the greatest problems for non-natives.

SEMANTIC PROBLEMS BETWEEN THE TWO LANGUAGES

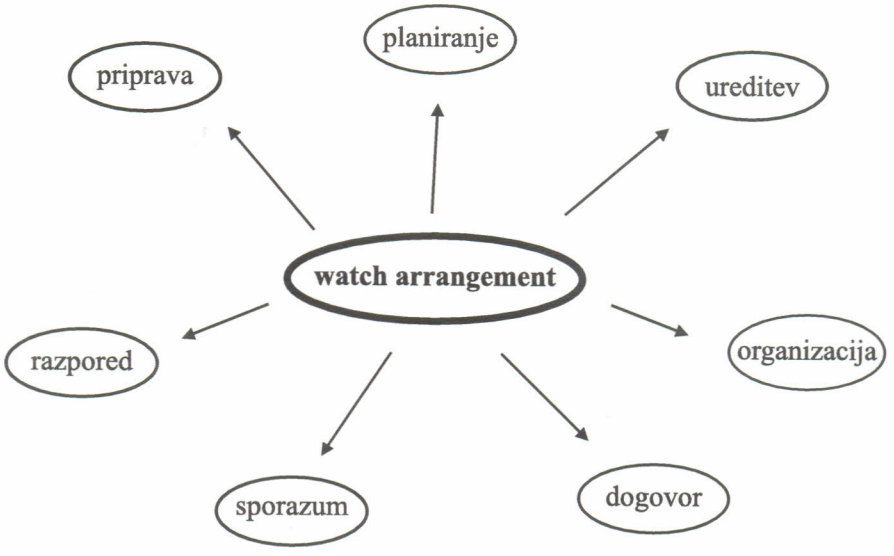
In view of what has been said, let us consider translations. When faced with translation in general all conceptual differences come forth. It is often believed that translation is one of the most complex tasks, since we have to consider numerous pragmatic and aesthetic aspects. If we look at maritime English as the source language, the collocation suggests that we have to deal with a technical subject related language. Hence, our basic concern should be the pragmatic aspect and we should aim to achieve the highest possible degree of accuracy which provides semantic equivalence between the source and the target language. This can be achieved only if the translator is aware of the fact that he cannot consider only language as such but must needs take into account the world outside of it, i.e. the maritime discipline.

The English language in general if compared with Slovene often uses "lexicalized concepts" covering larger semantic fields. A Slovenian translator encounters great difficulties when he has to deal with such "loose" lexemes. In order to identify concepts he needs a well defined context and sufficient knowledge of the subject matter. Apart from that he has a different perception of reality, due to different experience gained through his mother tongue. The evidence for such a claim can be found in various translations of English texts in which original meaning is thoroughly missed.

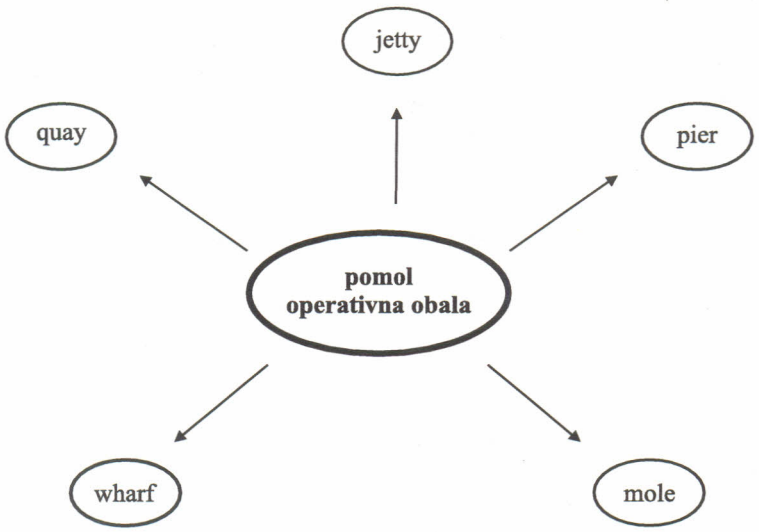
For example, there is no equivalent in Slovene to the collocation "port facilities". As we know the collocation refers to buildings, equipment and services provided in a port. Translators would usually translate it as "naprave" (gear or devices), "poslopja"(buildings) or "oprema"(equipment), by which they would always exclude something.



A similar example is the collocation *watch arrangement*. Here, however, there is a danger of falling into a trap. When the context signals us to use the equivalent "organizacija"(organization), "priprava" (preparation) or "planiranje"(planning), we certainly cannot use "razpored" (layout) or "sporazum"(agreement).



Another example shows that there are several English concrete nouns which define slightly different concepts. They, however, have only one or two counterparts in Slovene.



The Slovene native speaker who has been using only the term *pomol (pier)* in his mother tongue has difficulties in imagining the semantic difference between the terms quay, pier and jetty. It must be noted, however, that a non-expert English native speaker would probably feel embarrassment over the same thing.

Hopefully, the given arguments have convinced us that language has a creative aspect and that it plays an important role in the shaping of our vision of reality.

An expert review of the translation of the revised **STCW Convention** carried out in Slovenia in 1996 made 25 pages of various corrections, remarks and recommendations. We wish to note that the number of all observations made, if presented, would exceed the space available in the present paper. We therefore present only the most typical words and collocations in which the lack of semantic equivalence was established. These are classified into four basic categories:

1. Misconception of the original meaning due to some kind of misleading signal in the source word. The translation contains the largest number of examples to be classified in this first category:

source language	target language	back-translation	comment
gross tonnage	bruto teža	gross weight	Tonnage may mean either volume or weight. Here it refers to volume.
secure cargo	zavarovati tovor	protect cargo	Secure may also mean protect, but here it means fix.
trim	uravnoteženost	on even keel	Trim is the fore and aft inclination of the keel, but the translation was made under the influence of its other meaning, i.e. to make even or more level by cutting.
heavy lift	težko dvigalo	heavy crane	Lift is also a carrying device, but here it means heavy cargo.
stopping distance	zavorna pot	braking distance	ships have no brakes
beaching a ship	pristajanje na obali	berthing	Beaching means intentional running ashore and not berthing.
oil in bulk	velika količina nafte	great quantity of oil	Bulk generally means a large size or mass, but here it means that it is not packaged in barrels.
boiler uptake fires	požar pri dviganju kotlov	fires occurring when lifting boilers up	Uptake is confused with taking or lifting something up, but here it denotes the tube leading gases to the funnel.

2. False friends:

source language	target language	back-translation	comment
petroleum	petrolej	kerosene	Petroleum means crude oil obtained from under the ground.
fresh water	svježa voda	clean and cool water	Fresh water here means other than salt water.
inerting	vztrajnost	inertia	Inerting means providing continuous flow of inert gas through empties tanks to prevent fire.

3. Inexact equivalence where only part of the respective semantic field is covered in the target language:

source language	target language	back-translation	comment
on board ship	na krovu ladje	on the ship's deck	On board ship means on the ship and not just on the deck.
moored	privezana na bojo	moored at anchor	Moored means secured to a buoy or position ashore.
port facilities	pristaniške naprave	port gear	Port facilities cover a larger semantic field.
seaworthiness	vzgon	buoyancy	Buoyancy is just one of the necessary requirements for a ship to be seaworthy.
dry-docking	postavitev v suhi dock	placing into a dry dock	Dry-docking does not mean only placing into a dry-dock, but also undergoing repairs and maintenance there.
deadweight	spodriv	displacement	Deadweight is the difference between loaded and light displacement.

4. Omission of a lexeme in the target language either due to incomprehension of the source lexeme or its non-existence in the target language:

source language	comment
segregation	Segregation refers to cargo stowage. The lexeme appears in the source language next to "separation" and they refer to two different procedures. The lexeme segregation is omitted due to incomprehension of the technological procedure.
floating	There is no such equivalent lexeme in Slovene. The translator should have resorted to description. The only two lexemes close to it in Slovene are "plavati"(swim) or "pluti"(sail).
sling	Sling refers to cargo handling. There is no equivalent
bareboat charter	There is no "single lexeme" equivalent to "bareboat", which means to hire a ship without crew.
oil in bulk	"In bulk" is omitted. There is no Slovene equivalent for liquids "in bulk". The equivalent exists only for dry cargo "in bulk"(razsuti tovor).

CONCLUSION

In the previous chapter we have identified basic semantic problems when translating Maritime English to Slovene. We hope that our examples can in many respects be generalized and reach beyond particular English-Slovene comparison. We have seen that there are basically two causes which generated the said problems. First, the objective - dialectical interrelations

of language and thought, and the subjective - the lack of knowledge of the subject matter. We can hardly do anything to change the first, the function of individual languages and even less regarding the function of our mental processes, but what we can do is to encourage the relationship between language and the maritime discipline. Linguists, including LSP teachers, frequently claim: " We are only linguists and not subject specialists." This is certainly true, but their words sound more like: "Leave me alone, I want to teach language and don't want to get involved in the slippery field of the technical discipline." However, they should be aware of the fact that linguists do not teach language for its own sake. Language is a combination of form and meaning. There is always some relation between words and the things talked about. Language after all serves communication. We know that seamanship particularly cannot afford inaccuracy and those linguists who do not want to get involved in the subject matter will have to change their attitudes. In order to promote such changes a certain kind of partnership between linguists and maritime subject specialists will have to be established or even institutionalized. Thus, linguists, both translators and teachers, will have efficient and effective access to the complex maritime world. This will contribute to the prevention of accidents and bring benefit to the whole maritime industry.

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SEMANTICS & NAUTICAL VOCABULARY TEACHING
SEMANTICS & MARITIME STANDARD VOCABULARY TEACHING (MSVT)

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Abstract

This paper studies the aspects concerned with semantics & MSVT, which is an approach in ESP. It's intended to show that the extension of the scientific knowledge development on nautical vocabulary, combined with a widening of the gap between the general usage and the specific purposes. The extent to which semantics attitudes towards MSV is still explained by its basic function. No matter how the MSV is derived or transformed, excatly saying how it is extended or minimized from its original meaning, it is governed by the principles of semantics. Since the word is not a natural linguistics entity (France Palmer, 1985: 43), it should have a principle to come to a formation. In this paper I'm inclined to show that MSV is also a linguistics unit that has a specific meaning originated from its root. In conclusion, I have to say that the MSV is never beyond the scope of the semantics theory on "meanings" . The MSV learners are involved the L2 adult acquisition. In teaching process, the teacher should adopt a suitable input medium so as to make the MSV information to be received by adult learners effciently. Therefore, MSVT and semantics are interdependent.

Key words: semantics, MSVT, Acronym, ellipsis, abbreviation, acquisition.

As we know, semantics is the study of meaning. Although there is little general agreement about the aim and precise nature of semantics, interest in and importance attached to semantics is more and more evidently shown in recent years. Leonard Bloomfield said that the word is a minimum free form. In other words, word is a meaning unit, this makes it possible to classify words into seven meanings in terms of semantics by Leech, but when vocabulary teaching is in progress, there will occur the eighth meaning, that's cultural meaning. We know language is the center of culture, every speaker lives in a certain culture background. It's realistic that the eight meanings of words can't be expressed in one word. In teaching practice, each specific field of science or branch will employ certain specific vocabulary to denote its individual meaning concerning with certain special purpose.

I. Semantics & MSV Study

1. Semantics Study Goals

(1) The goal of semantics research is not only study the meaning and also similarities in meaning of language instead of differences. Semantics emphasizes in the general rules of all languages not the differences.

(2) It's also considered to be at the center of communication, emphasize language as a tool in communication and semantics is the center of communication. When you communicate you must know what people mean, so meaning is the center.

(3) As the center of the study of human mind, different people will clarify different thing. Through language the expression causes different way to arrange language expressing what's in our mind, different form of rule can be used in the expression. Therefore,

thought process, cognition, conceptulization, organization of words, organization of idea etc, are going on in our mind.

What mentioned above showed that: without vocabulary there would be no language, no thought. Because thinking comes before language, but we're using language to think. It depends on language meaning. That is to say semantics is now burgeoning into a discipline of great promise, so that MSVT is expected to be in principle among the goals of semantics.

2. Vocabulary Meaning

The meaning of vocabulary in English can be divided into two branches: the grammatical meaning and the lexical meaning. The word which is used to express grammatical meaning is called function word. There are ten parts of speech in English word's grammatical meaning. According to Leech, there're seven types of lexical meanings and meanings in the wider sense may embrace the following types:

(1) conceptual meaning
(2) connotative meaning
(3) stylistic meaning
(4) affective meaning
(5) reflected meaning
(6) collocative meaning
(7) thematic meaning (Leech, 1981:9-23)

Among this meaning, we have to understand the meaning of a word in context to define which meaning it is. This is because it's often confronted with more than one choice, more than one possibility. That's to say the meaning & reference should be defined clearly so as to give the English teacher a easy method in the teaching progress. In the narrow sense I want to emphasize the meaning of MSV.

3. MSV

MSV is an aspect of English for occupational purposes(EOP). Then the problem arises: Is MSV constituted with entirely new words that people who are not engaged in maritime work are not aware of? Of course not. According to Leech, MSV is the general vocabulary implicating maritime conceptual meaning, some of them are the extension from the original meaning of words but some of them are minimization of them. No matter how they are changeable, they're in the limitation of the semantics theory, i.e. MSV is a fruit derived from the mother trunk of general English.

(1) Extension

The extension is taken the conceptual meaning from the original words and to be used in the similar meaning of MSV. Take the general word "tank" for example. In general it means "a tracked vehicle, armour-plated and carrying a gun and automatic weapons, capable of rapid movement over difficult country." Comparing with it the meaning in MSV is "a container for fresh water or oil on board the ship." Here the meaning of "tank" and "container" have a logical link between them. The reason is that the shape of tank gives people the imagination about a tracked vehicle can be extended to a container. The meaning extention from general words are compared as follow:

General Meaning	MSV Meaning
Course: curriculum	The direction of navigational path taken
hold: something providing a grip for the fingers.	The space below in a ship where the cargo is stored.
Gooseneck: the neck of a goose	Something curving like a gooseneck on the top of the derrick.
Bridge: a structure over a wide water	A midships, forward as in some tugs, or after as in large tankers and container ships.
Over: above	Speak please !

(2) Pictograph

It's a theoretical construct which is intended to represent a concept that is part of the sense of morphemes and other constituents of nautical languages. By the concept in this connection I mean the mental ideas about a word is abstracted entities, for example: "vessel" in daily usage it refers to a container for liquids, in maritime usage, it refers to a "ship", that's because of its appearance telling the shape for a container for liquids, in the mental meaning is similar to a ship, contrarily, the nautical word "forecastle" is entirely borrowed from the word "fore" and "castle" for the structure of forecastle on board is like a real castle at the bow. While nautical word "catwalk" just has a reference for "a narrow and footway in daily usage."

Therefore, while the pictographical analysis employed in nautical vocabulary, it's helpful to get a vivid discription on a new word. Even if semantics used on explaining, nautical vocabulary is to be part of an empirical science, such an account must be made more substantial.

(3) Minimization

In MSV, many phrases and sentences are in short forms to facilitate the navigational operation. The main function in the marine usages are: acronym, ellipsis, abbrviation. Take the acronym for example: LOA-length overall. The NP can't be divided into 'length' and 'overall'. The two words must be combined to express one meaning: the whole length of a ship. Rather, I'll place it with the second acronym 'GMDSS' it means Global Maritime Distress & Safety System. If this NP is in separation form there is no meaning as the acronym, thus will come to the conclusion. As far as meaning is concerned, the word is not a single unit, nor it even a close-knit group of related unit of meaning. (Palmer, 1985:45) There must be another problem: one acronym has more than one meaning. If an acronym is in a sentence, it has only one sense.

e.g. My ETA 011300 LT.

'ETA' in MSV means estimated time of arriveal. 'LT'means local time. From the words combination, we find that the individual word can't stand for the meaning in this context only the phrase can be used combined together to constitute a phrase meaning and the meaning of each word is certainly minimized. There are many "Q" code abbrieviation in Morse Code before the satellite communication hadn't been put into use. After the satellite communication being used at sea, there have come other kinds of short forms. All these are good examples to tell the function of minimization for words meaning.

(4) Transformation

The shift of meaning in MSV is the case that word meaning from one definition to another, but they have the logical link to make the distinction from the original usage. We know language has chiefly the function of furnishing "a stable verbal support, so that inexact, nebulous, and fluctuating concepts may be recalled to the mind whenever required, without any prejudice to the elasticity of the concepts" (Ogdern, 1985:40)That's why some verbs used in MSV shift its original meaning.

MSV requires the verb with its special purpose. e.g. When it's used in the communication conversation on VHF, people often beginning with the sentence like "How do you read me ?" The verb 'read' here is not the original meaning in the dictionary: "to understand the meaning of by looking at them and assimilating them mentally ." But here 'read' means to understand the signal strength on VHF. The meaning transformation is from the cognition of the literal meaning to the comprehension of signal strength on VHF. That is: the speaker requires the listener understand something specific, the kernal meaning for 'read' is understood both in general usage and in specific purpose. The examples mentioned above make it clear that, the precondition for transformation is the logical value of the word. Why the verb 'read' can be used to express the effect of listening is based on the organic sensation. From what mentioned above, it goes to the conclusion: the naming relation between a word and its object is most transparent with proper names, the paradigm case of naming. Here there is a one-to-one correspondence between name and object: for example, the name The Parthenon refers to the object the Parthenon in Athens, the name Tom refers to the idividual who is given by this name. This relationship between word and object is called the relationship of reference, and there is

a long tradition of equating the problem of meaning with the problem of reference. According to this view, known as extensionalism because of its treatment of meaning in terms of the objects, called extensions, to which the items of the language refer, the meaning of a word can be explained in terms of the relation between that word and object or objects to which it refers. In the writer's opinion, within the semantics governing, the transformation of word's meaning should be equivalent to the logical value.

II. MSV Teaching process

1. The Obstacle In MSV Learning

(1) The Negative Shift For Learners' Own Language Knowledge

Most of the learners in MSVT have learned English in their college course. They know 'bridge' is a structure carrying a road railway or path over a wide water or gap. When they are input the new conceptual meaning on MSV, they will find the old concept about 'bridge' is an obstacle to hinder them to accept the new conceptual meaning. In this process, the learners try to use the 'semantics field' theory to make the judgement. The learners will get a useful information in a correct 'semantics field' to overcome the negative shift caused by the general English knowledge. Suppose the sentence "The captain ask you to the bridge" The judgement has two: a. You go to a place, which there is a structure over a wide water or a gap on land. b. You go to the place which is at midship. If the situation takes place on board, the place you go is "b", otherwise is "a".

Apart from the verb usage, some adverbs without objects to refer is confusing or causing misunderstanding in MSV. It must be dependent on its logical linking or semantics field to get the correct information.

e.g. Captain: Port Control(PC), I'm M/V DALI, delta, alpha, lima, india. How do you read me? Over.

PC : M/V DALI, delta, alpha, lima, india, I'm PC. I read you with signal strength five. Out.

The words "over" and "out" refer to nothing objective but abstractive. The learners may know they are used as adverbs or preppositions to denote the location or modify the action. But in MSV they are used in the VHF coversation terminology. From the coversation, it shows that the caller part must connect with the called part and require the reply. In this situation, "over"neans: Please Speak! And what dose "out" mean? When two parts have established communication on VHF, the coversation can be ceased. So the word "out" means: finish. The example expresses that: language is a tool in communication, and semantics is at the center of communication ." When you communicate you must know what people mean, meaning is the center." (Palmer, 1985:24)

Therefore, the learners should make themselves clear about the words meaning in specific context, they also should employ a useful study method to raise the effective on MSV. It is emphasized that if the leaners' psychological load is relative light, they can have a positive input result, otherwise they will be confused with it.

2. MSV Teaching Approaches

(1) Learner-centered Method

MSVT is that: the teacher applies the suitable method to make students obtain the new information by means of their general English language knowledge. Strevens said: "Understanding previous learning". (Strevens, 1985:21) In this situation, it's an important factor for a teacher to know the learners' English level. In the writer's opinion, a competent teacher should make his endeavour to get the information about the learners' condition, so as to utilize it in input process. It's an active process for language learning and it's not enough for a learner only to have the knowledge to be used in understanding objects, the learners must

learn to apply what they received in practice. Therefore, the implication of "active" should never be confused. The following are some strategies:

(i) Psychological Motion Behavior

This is to demand the observed actions of vocal organ and the four limbs caused by the signals given by the learners' brain.

(ii)Language Processing Behavior

This is to denote that the learners organize the information into a meaningful knowledge network. It's produced in brain not seen in the appearance. In the duration of MSVT, language processing behavior is the most important. If the teacher can't send the knowledge into the learners' network, all efforts are in vain. That's to say the teacher must teach the learners how to use acquisition ability to receive the new information on MSV. In a narrow sense, the knowledge about general English is the foundation to support the learners receiving the new concept on MSV.

(2) Involvement Method

In the process of MSVT, the teacher should creat a situation to attract learners involvement. The teacher stimulates the learners to acquire MSV and arouse their emotion to attend class and to input actively. Then a problem arises: Is the verb "read" used in communication at sea just like the general meaning "listen"? The teacher should encourage the learners to make a response. In this way the teacher will know the learners' difficulty in the output process and give them necessary guide. The profit of involvement is: to strengthen students' self-confidence and make them be aware of their potential English knowledge so as to remind a teacher altering the teaching plan for the purpose of getting the best teaching result.

(3) Creativity and Atmosphere Method

MSV is also a language vivid phenomena and demands a relative atmosphere. e.g. Making up the classroom as ship, the teacher's table as a bridge. Then a learner is appointed as a captain. He orders anyone to any post of the ship. In this way to practise the location name of the ship. Suppose the first sentence is: "Chief Officer, the Purser is waiting for you on the port quarter ." If the questioner knows what the port quarter means he will go to the left side of the classroom facing the teacher's table. This behavior can train the learners having the cooperative principle in class. The goal of the method is to stir the learners interest in MSV study.

(4) Predication Method

This method is used to lure the learners to guess the MSV meaning according their English level. The teacher never gives everything in class, but only guiding. The teaching process can provide the learners more chances to develop their ability in acquisiting new meaning on MSV originated from the general English words.

e.g. Make Ease!

This is a helm order given by a pilot to the officer who is working at the helm when the ship is entering or leaving a port. The teacher ask the learners to make the predication and encourage the learners to put themselves into the predication. In this circumstance, all the learners will participate the predication to reach the correct concept of the phrase. It gives the learners an impetus to learn the MSV continuously. The teacher can give the learners some explanation by the word's meaning "ease" , so as to lead the learners to the correct approach. After some unsuitable response, the teacher may give them the correct answer about it, that is "Keep the wheel upside in 180 degrees. It's verified that "ease" means relaxation in general usage, so that when the helm is in relaxation, it is in the state of 180 degrees. In this way, the MSV is derived its meaning from the general usage. Special purpose is relative, the inner linguistics link functions on purpose.

(5) Variety Method

Variety is a medium to flavour the class with onions. It's necessary to repeat some difficult vocabulary but make the various repetition, the following is a designed process:

The variety of language medium, such as video tape, tape, picture etc., to stimulate the learners making linking exercise about MSV, such as there is a picture of a moving ship at sea on the TV screen. It can arouse the learners to say: "the ship is riding the tide" , "the ship is on her home passage" , "the ship is proceeding to her destination" , "the ship is up and down with the high seas"... All these sentences can train the learners get a useful input about MSV,such as:ride the tide, home passage, high seas. What is high seas? The teacher can ask the learners whether they know the meaning of "high traffic" at maritime usage, just like high mean "jammed" on road. Here the general word "high" means the long swell or high waves. Of course, there are no new words in it but there are new meaning imposed on them.

(6) The Variety of Learners' Role

In class the teacher can make the learners in partners to ask them to simulate some roles at sea, or to make some sentences by some difficult words such as "manoeuvre" , the following is a short dialogue using the word "manoeuvre":

A: Third Officer, (TO) what are you doing when a ship is entering a harbour?

TO: I'm manoeuvring the ship, taking note of the pilot's helm orders, giving the telegraph order on the bridge.

Through the practice, the learners can receive some useful information about TO's work and also can get some useful information on MSV.

Conclusion

Since MSVT is an approach of ESP, the teaching principle just as Halliday said: "Metaphenomena-projections can be associated only with certain types of process, essentially saying the thinking and linking, plus in certain circumstance being. (Halliday, 1985:227)" The teaching practice shows that all approaches which is suitable to general English class teaching could be applied in MSVT class. But in MSVT the teacher should make a careful selection on emphasize that MSVT has its own regulations which are different from those in other ESP teaching. Just as saying that: MSVT is like playing a piano, both the teacher and the learners are playing with two hands. The final goal for it is: meaning of word is various but the semantics theory is stable, in MSVT the input and output only concerned with the specific purpose, which is the center for both teacher and the learners.

Reference Books:

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2. Richard Ogdern (1985): The Meaning of Meaning
   Harcourt Brace Jovanovich
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ON THE REQUIREMENTS OF A FUTURE COMMON CORE SYLLABUS FOR MARITIME ENGLISH

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Abstract

The paper deals with the linguistic feature of Maritime English and presents a survey of currently available textbooks and other teaching material (deck and marine engineering) with a view to provide some elements for the construction of a common core Maritime English syllabus. In this respect some view of possible further research are offered.

1. Introduction

Defining the purpose and scope of contents for the syllabus of any language for specific purposes is one of the most difficult tasks for course designers. The perennial questions arise again and again as to who and what to rely on in designing the syllabus. The question, however, is not whether 'one or the other' but rather that of extent to which the two are intertwined. Should we therefore trust, on the one hand, seemingly the most trustworthy - i.e. experienced authorities on the subject-matter such as teachers of Maritime English, most frequent users of Maritime English on board ship (ship masters and officers), VTS or VTIMS operators etc., or shall we base our decisions on the what is accessible to assessment, i.e. syllabuses, handbooks, textbooks etc. already available, some of these in the form of accepted, more or less recommendable, or even mandatory standards?

To make appropriate and valid decisions, a careful study of both approaches is necessary. In this paper an attempt is made first at delimiting the scope of English used for maritime purposes. The paper also provides a brief survey of Maritime English instruction as it is taught and learnt world-wide under a number of national and international syllabuses. This is closely related to an authors' view of the so called needs analysis (Robinson 1991). Finally a proposal is made of the necessity to set up the objectives and methods of undertaking an internationally-based research into Maritime English users' needs, the study of the scope of Maritime English syllabus and the role of general English within Maritime English.

2. Maritime English - nature, scope and limits

In terms of users' needs two terms and concepts should be given particular attention: *maritime communications* and *user-friendliness*. The former lexicalizes a well established notion in the maritime industry and is well known and highly exploited amongst both experts and laymen in the field. It is due to this fact that, for the purpose of this report, one should discuss this term within the framework of the basic notions belonging to the same lexical field related to maritime safety communications. Thus it will also be dealt with as referring to other members of the same lexical set (cf. *standard* vs. *restricted language; language for specific purpose, restricted language; maritime English,* and *IMO standard marine navigational 'vocabulary'*).

The language of maritime communications is a particular subset of any human language (English, in terms of international maritime communications, and for the purpose of this report) whose lexical component (vocabulary: lexical items, collocations, lexical sets, and phrases) and grammatical structure (syntactic and discourse features):

(a) are appropriate to the requirements and restrictions of specific communication situations in navigation, both at sea and in port,

(b) meet the communicative needs and linguistic capabilities of users (participants) in conveying and exchanging messages within outboard or inboard communications, and

(c) meet the communicative, pragmatic and semiotic setting of maritime discourse

The language of maritime communication therefore forms a part of the speaker's and/or receiver's linguistic and communicative competence enabling him/them to make a proper selection from his linguistic inventory to ensure maritime safety and effective interaction at any time in any maritime-related situation, irrespective of any disturbances in the communication channel.

The latter term, *user-friendliness*, is a relatively recent lexical development, a very productive and widely used neologism stemming out of the development of modern technology causing inadequacies and difficulties in the man-machine interrelations and interactions. When faced with new or other ships, the modern navigator, is often aware, for example, of the inadequacies of symbolic representations of various controls in the bridge equipment (cf. the so-called 'knobology' problem: e.g. press-buttons, keys, levers, knobs, on/off-switches, selector switches). This is particularly embarrassing for pilots when, after boarding a ship, they have to familiarise themselves instantaneously with the navigation and communications equipment, which often varies from ship to ship and from manufacturer to manufacturer.

Maritime English therefore represents a variety of English language (not a separate language), chosen and adopted by the general maritime community and, occasionally, expressly recommended for use by seafarers, to achieve effective communication in everyday life on board, ship-to-ship and ship-to-shore communication, and in performing other jobs and duties related to all aspects of maritime traffic and shipping.

Though Maritime English has been the subject of extensive discussion and, occasionally, in-depth analysis for many years now, it seems that no definition of Maritime English has been offered that could be both comprehensive and satisfactory for all the purposes and needs. But isn't it the fate, after all, of many fundamental concepts in any discipline or study!?

Maritime English is now frequently written in capital letters to designate that this concept has reached a high degree of lexicalization and thus become a well established term, Any analysis and definition of Maritime English must start from the notion of languages for specific purposes, which, as Widdowson (1998:3) rightly claims, is a form of English 'peculiar to the range of principles and procedures which define a particular profession'. He further adds that the 'S of ESP links language with purpose and establishes the association' with a particular discipline. In questioning the specificity of any ESP variety he notes that *all uses* of English, and this is also true of any other language, are specific. Therefore, the question is reverted: i.e. ESP, like Maritime English, is not a deviation form and ideal, sacred, unchangeable 'general' English (a view frequently shared by laymen). It is quite the opposite: we subdue our own, general language to the particular requirements of our communicational intent or purpose in a given surrounding at a particular time by choosing or shaping the surface language form to suit our purpose. Or, as Widdowson again puts it: 'I am being as specific as I can about the point I want to make'. Therefore, in a pragmatic sense, all language use is specific. But, what is so specific about it, then? Let us leave aside the specific, but relatively limited number of easily mastered lexical items called technical terms. Is the syntax of any maritime text, dialogue, or VHF communication any different from the syntax of other 'non-specific' texts? Of course, not. We can only talk about different frequencies of generally recognizable syntactic strucutres (e.g. questions, verb or noun phrases) in different texts under different circumstances obtaining in various contexts of situation. Furthermore, what is specific about Maritime English, or any ESP, is the peculiar distribution of certain lexical elements in collocations, the so called high collocational potential of a particular lexical item (general or specific) which we are all intuitively well aware of but which become only too obvious in the lists of collocates obtained by any tools of modern corpus linguistics. One final formal, and easily retractable, feature of

Maritime English is the high incidence of polysemy arising as a result of the use of some of the most frequent general English terms used in specific maritime environments. But, these again are the features shared by all kinds of ESP's.

What, then, is specific about Maritime English as compared to other ESP's? The only plausible answer that comes to mind is the vocabulary and a range of language structures offered by common (or general) English which the speaker or user of Maritime English selects from his communicative (linguistic) competence and assigns as being appropriate to the particular maritime context of situation in the process of communication. This leads us to discourse analysis and pragmatics as the two fields of applied linguistics that appear to be worthy of further studying. Therefore, discourse features and pragmatic information retrievable from recorded maritime dialogues or conversations, not only VHF but also on-board and on-shore conversations between speakers involved in everyday widely conceived maritime activities, as well as written texts of the various maritime-related registers (navigation, technology, marine engineering, law, shipping business, communication technology, etc.), need to be further studied. This involves identification of such features, their linguistic description (on the discourse and pragmatic level) and possibly normalisation on an international level, i.e. within IMLA. Finally, all these studies would be futile unless the provided for a possibility of making such elements of Maritime English available to the ease of learning and teaching, a feature not easily achievable in the case of restricted forms or standards of Maritime English such as SMNV, SeaSpeak or SMCP.

In creating the policy and setting standards for learning Maritime English world-wide, in order to cover the most different uses of Maritime English, for most different users of the same language, it is therefore necessary to start from the top, i.e. the widest and deepest knowledge or competence of English for maritime purposes, down to the lower steps on the scale of linguistic competence in English, i.e. those that F. Weeks (1997) calls:

- standard English (i.e. highest degree of competence in general English)
- 'standard English with 'belonging' English (standard/general English with some knowledge of maritime English),
- maritime business English
- technical English
- standard communication phrases (IMO SMCP)
- communications English specifically for use over voice radio,
- 'survival English' for shipboard use (as tested by ICS)1

It can be clearly seen that if a modern seafarer, or the *European graduated seafarer* as he is now often termed (cf. CAMET meetings), is to be granted an opportunity of reaching a bachelor of science degree (during pre-service, in-service, or after abandoning sea career), he should also meet very high requirements in his communicative competence and expertise in English. This, however, requires undertaking a thorough research in the needs of such a future seafarer along with a needs analysis (Hutchinson & Waters 1987) for the seafarers requiring various degrees of limited mastery of (Maritime) English as proposed above by Weeks (1997). The analysis should cover the needs analysis involving both vocational and academic maritime education and training of the future seafarer and subsequently assign various degrees of knowledge and competence requirements in English of the seafarers as one descends the scale of jobs and duties (see the English language requirements for seafarers carrying out duties on the operational and management levels in STCW 1995).

[1] The ordering here has been changed to suit the downwar principle of difficulty of learning

3. Maritime English syllabus and STCW Requirements

Seafaring is one of the oldest and by far one of the most international activities. This very traditional trade is governed by a well established common practice, customs, codes, rules and regulations. In it, every communication either written or oral is carried out in English. Therefore, the English language is considered a kind of *lingua franca* at sea. It is used on board among ever present multinational crews, but also in communications with other ships and shore based services. This peculiar language, which has about 20% -30 % of ESP character and the rest of it being general language, is usually referred to as Maritime English.

Since seafaring encompasses a wide range of activities as for instance: navigation, astronomy, business and economy, law, medicine, cargo work, seamanship, shipbuilding, but also technical sciences such as physics, chemistry, mathematics, mechanics, thermodynamics and many others, it is not easy to frame up the language field and strictly define its borderlines.

All standards for training certification and watch-keeping of seafarers have been contained in STCW and its subsequent Annexes and Codes. The knowledge and competence of the English language is no exception to this. Since the Convention terminology has sustained some changes with reference to the Code, it is first necessary to define some new terms[2] that did not exist in the previous basic text. Those define the meanings of *standard of competence, management level personnel and operational level personnel.* While the term *standards of competence* only generally defines the set performance criteria, the other two precisely tell us that the designed English language syllabuses have been tailored for deck management and operational level personnel.

In order to precisely understand the meaning of each term, the following STCW Code definitions have been used.

.1 "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 herein and incorporating prescribed standards or levels of knowledge, understanding and demonstrated skill;

.2 "Management level" means the level of responsibility associated with:

.2.1 serving as master, chief mate, chief engineer officer or second engineer officer on board a seagoing ship, and

.2.2 ensuring that all functions within the designated area of responsibility are properly performed;

.3 "Operational level" means the level of responsibility associated with:

3.1 serving as officer in charge of a navigational or engineering watch or as designated duty engineer for periodically unmanned machinery spaces or as radio operator on board a seagoing ship, and

.3.2 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;

The Table[3] below offers additional information, yet only presenting the guidelines for further elaboration of detailed English language syllabuses.

[2] STCW Code 1995.

[3] Table A-II/1 Part 6 of 11 parts

COMPETENCE, KNOWLEDGE UNDERSTANDING AND PROFICIENCY	METHODS FOR DEMONSTRATING COMPETENCE	CRITERIA FOR EVALUATING OMPETENCE
Use and understand the Standard Marine Navigational Vocabulary as replaced by the the English IMO Standard Marine Communication Phrases and use of English in written and oral form to understand meteorological information and messages concerning ship's safety and operation, to communicate with other ships and coast stations and to perform the officer's duties also with a multi-lingual crew.	English language of evidence Adequate knowledge of instruction language to enable the officer to use charts and other nautical publications, Communications are clear and understood	Examination and assessment of English language navigational obtained from publications practical relevant to the safety of the ship are correctly interpreted or drafted

3.1 Maritime English Books and Other Teaching Material

Following some incomplete results of MARCOM project a list of Maritime English books, teaching materials, video and audio cassettes will be available shortly. It reveals that as many as 87 monolingual and bilingual books are currently in use all over the world. The research has also shown that ME lecturers use some 20 different video tapes developed exclusively for that purpose and an assortment of almost 300 videos mainly of Videotel, London production. Some 9 CD–ROMs of which only two developed for ME purposes[4] also contribute to raising overall language learning standards. All major IMO editions are also found in CD versions, some of them being used as supplementary source of language information, mainly for very specific purposes. Some English language lecturers have recently started making use of internet sites of relevant importance. Eventually a number of specialised journals, magazines, charts, log books, shipboard cargo and safety documentation, company standing orders, notices to mariners, sailing directions etc. are normally in use.

Most of the books are dedicated to either ME for deck officers, and only a small number of them are designed for marine engineering officers. However, there are few books containing both deck and engineering texts. Among them descriptive and narrative texts largely prevail while dialogues are much rarer.

[4] Center for Technology (1997) CD-ROM of IMO SMCP Part IV / Chapter D, Passenger Care Cocks D, et alt. : Maritime English, Silja Line, Stockholm, Norway

The level of Maritime English books range from basic (Sarkis, R: 1986)[5] to low intermediate (Blakey: 1987,)[6] and upper intermediate (Katarzynska:1998)[7] . Irrespective of the levels, however, the majority of books designed for learning of Maritime English suffer from poorly designed, demotivated and uninventive exercises. This only proves that in some unprivileged countries a book is not a team work product.

There are five books well known among all ME lecturers. More experienced lecturers will remember the good old Seafaring in English[8] with well dramatised texts and rough Bosun's tape recorded voice. An old and slightly outdated, but a very good book was also the Wavelength[9]. Our younger colleagues, especially from some Mediterranean countries extensively make use of Blakey's English for Maritime Studies[10]. Two books in common use for communication purposes are the Seaspeak[11] and Anglosea[12].

Almost every seafaring nation has its author(s) and its book(s) or a selection of texts used by Maritime college attendants. Those are tailored to the best of author's knowledge which does not always mean that they fully cover the vocational contents, satisfy international requirements imposed on seafarers for an efficient exchange of information, conduct of safe procedures and in carrying out of on-board routine jobs and extraordinary duties, especially in the circumstances of ever present multi-national crews.

Interesting enough, some small nations like Slovenia[13] and Croatia[14] have a number of valuable books covering both deck and engine sections. On the other hand great nations as France and Italy have no adequate books of Maritime English. Germany[15], Poland[16], Spain[17] and China[18] fall among the group of countries with largest ME book production.

5 Rafat, S: An Integrated Basic Maritime English Course Based in the Findings of a Detailed Text Analysis of a Corpus of Maritime English Discourse, Second edition, 1986

6 Blakey, T.N. English for Maritime Studies, Second Edition, Prentice Hall International 1987

7 Katarzynska, B., Notes on Ships, Ports and Cargo , Gdansk, Pland, Wydawnictwo Morskie Gdansk, 1988

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11 Weeks, F F, Glover, A, Johnson, E and Strevens, P, (1988) *Seaspeak Training Manual*, London, UK: Pergamon Books Ltd., Soft cover book, 197 pages, tapes, English

12 Anglosea: VTS the English Channel, Module 2, Canadian Coast Guard College, Press, P.O. Box 4500 Sidney, Canada, ISBN 0-660-15803-5

13 Fabe, Dušan (1995) *Shipping Business for Nautical Students*, Portorož: VPPS., Soft cover book, 139 pages, Slovenian/English
Fabe, Dušan, (1997) *English for Maritime Engineers*, Portorož: Fakulteta za pomorstvo in promet, Soft cover book, 229 pages, Slovenian/English

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Luzer, J.: *Cargo Notes on Mate's Receipt*, ICR, Rijeka 1992, English/Luzer, J. : Cargo Notes on Mate's Receipt, ICR, Rijeka 1992, English/ Croatian phrase book, 56 pages.
Luzer, J. Spinčić A.: *An Outline of English Grammar for Seafarers*, Pomorski fakultet 1994, Croatia, Texts in Croatian/ English. Soft cover book, 274 pages, key to the exercise
Sacchi, Milka, *An English Course*, Rijeka, Croatia: Nautical School Bakar. Soft cover book, 101 pages, English
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Spinčić, A. (1996): *English Textbook for Marine Engineers I*, Rijeka: Pomorski fakultet, Soft cover book, 128 pages, Text in English with a Croatian/ English, Vocabulary at the end .
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Sušanj J. Luzer J: *Navtex*, Croatian/English, Zagreb:Školska knjiga /Sveučilište u Rijeci, Soft cover book, 110 pages, Croatian/English, Vocabulary at the end .

[15] Fischer, C, and Trenkner, P (1990) *English in Search and Rescue.*

(Rostock, Germany: Hochschule fur Seefahrt Warnemunde/ Wustrow, Soft cover book, 30 pages, tapes, German/English

Trenkner, P, et., al.,(1986,1987, 1989) *Englisch fur Schiffsoffiziere*, Rostock, Germany: Ingenieurhochschule fur Seefahrt Warnemunde/Wustrow, Rostock, Soft cover book series of six booklets totaling 314 pages, German/English

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Helga Jänicke-P. Trenkner: Medico at sea, Hochschule für Seefahrt, Warnemünde-Wustrow, Rostock 1990.

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[17] *Ingles Comercial Maritimo*, (Colegio de Oficales de la Marina Mercante)

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Since all seafarers perform the same kind of duties, share the same or similar social environment and they all have to comply with the same international regulations, it is a must that some serious incentive be made towards the unification of the learning objectives and to a high congruence level of English language teaching issues. Prospective books, videos, audio cassettes, CDs should become a common heritage of all maritime nations. The books should include the same core syllabuses, cover all levels, be accompanied by all available supporting aids and tools, have professionally designed exercise (not necessarily by the author himself but with his assistance), and last but not the least be attractive (e.g. Headway). This process should be dynamic and follow all language and technological requirements.

4. Research Proposals for Marine Engineering English

The current situation of sources for the study of Marine Engineering English compared to those for Maritime English (for Deck Officers) is rather unfavourable for the former. This means that an incomparably fewer number of books, teaching materials video and audio cassettes, and CD are available on market. Being aware of an increasingly important role played by engineers on board modern ships nowadays, it is necessary to direct further research to lexical and language studies in both written and oral communications. Those would include:

a) Minimum lexical requirements for an efficient engine room operation. Those should incorporate knowledge of standard technical terms related to machinery, equipment and accessories, abbreviations, the terminology describing conditions, wear rates assessment, on requesting spares etc.

b) A limited number of verbs to denote engine room activities covering machinery operation, condition ascertaining, maintenance, repair work and safety.

c) The formation of compound nouns.

d) Most productive suffixes and prefixes.

e) The study of language elements used in engineering discourse.

The research should lead to a common core teaching material of Maritime English for Marine Engineers. It should partly follow the approach exhibited by Yagi Takeshi's Marine Engineering Practical English Conversation, Kaibundo. That very rare book that offers an insight to Marine Engineering occurrences through dialogues is a valuable example of a collection of very versatile and useful dialogues. Unfortunately, it has no exercises at all.

It is no doubt that written communication presents an almost totally neglected area. Since the common practice imposed by shipping companies, as well as some international regulations, such as ISM Code, have turned marine engineers into paperwork handlers, some future research should concentrate on designing a Standard Marine Engineering Phrase Book that would encompass common phrases used in all kinds of forms and covering the fields of major engineering responsibilities, such as monitoring, maintenance an operation.

Finally, major diesel engine producers should be enhanced to produce CDs for on line training use. Those are user-friendly tools for ME students. A first trial has been done by B&W.

5. Concluding remarks on the needs analysis and future research into Maritime English

Needs analysis for seafarers' knowledge and competence in Maritime English will have to pursue two direction in the future:

– strict needs related to safety of navigation (deck & engineering)

– the much wider needs of the 'European graduated seafarer'

As far as the former is concerned, there is no doubt that the existing standards on maritime English as laid down in the IMO Standard Marine Communications Phrases (1997), as well as

in other current recommendations on the use of such standards, are of such a nature as to ensure, in combination with other factors of navigational safety, efficient communication at sea. These standards have been subject to continuous improvement and upgrading, building first on the earliest ITU recommendations on radiocommunications, encompassing later the basic concepts and terminology of the Collision Regulations, and integrating finally the requirements of a number of IMO conventions and other documents laying down, mainly implicitly, and in the case of the 1995 STCW Convention also explicitly, the standards on the form and use of maritime English for the safety of navigation. However, for a better analysis of this, restricted type of mMaritime English legitimate recording of maritime communications and the study of post-accident transcripts will be required. Thus, an internationally accessible corpus of maritime VHF communication, both in transcripts and voice form, should be made available, not only for pedagogical but also for research purposes.

A possible syllabus for the European graduated seafarer will further require the creation and permanent maintenance of an on-line global maritime corpus in the form of a computer-based maritime language and lexical database, under the guidance of the International Maritime Lecturers' Association (IMLA). This would enable comparable research into all aspects of maritime language communications. Continuation of the MARCOM project and IMLA workshops seem to be an appropriate place for discussing the achievements and advances in such a project.

Hovewer, since real communications often considerably differ from the recommended standards in SMNV and SMCP, further research should be undertaken into the nature of maritime English with respect to the changing speech communities both on board (e.g. multi-purpose crews) and on shore. This should include discourse analysis and the study of pragmatic values of maritime communication not only of VHF communication standards but also of all sorts of maritime-realted communication in the widest sense of the word.

Therefore the research into the needs of a graduated seafarer should combine the knowledge of general English and its interaction with English for specific purposes, which in turn is only possible by a pragmatic study of maritime conversation and discourse/texts (not only safety-oriented) to cover all aspects of maritime activities.

For this purpose legitimate recording of maritime communications and the study of post-accident transcripts will be required (cf. Pritchard 1998). Also, the creation and permanent maintenance of an on-line global maritime corpus in the form of a computer-based maritime language and lexical database, under the guidance of the International Maritime Lecturers' Association (IMLA), may be most useful. This would enable comparable research into all aspects of maritime language communications. IMLA workshops seem to be an appropriate place for discussing the achievements and advances in such a project.

Experience shared by most teachers of Maritime English has shown that there is a direct link and interdependence between the competence in general English and in Maritime English and that most successful communicators at sea are those persons whose competence in general English is the highest. This makes the requirement for a future study of the role of general English in the overall syllabus in maritime communications even more plausible. Not only user's needs but also contents and methodology of teaching should be studied further in order to arrive at a common core mixture of general and ESP (Maritime) English for future seafarers at all levels of STCW competence, shipboard, company or adminstrative responsibility, This is the assignment which most of us will be aready to pursue. We are confident that Maritime English teachers will be ready to take part in such projects and that they will be willing to serve as first assessors of their results.

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– PADECC –

The submission of abstract of papers addressing the following major topics is invited:

Preventing accidents: cognitive, communicative and legal issues (topics for a joint session with WOME 10)

- human factor - preventing human error, stress control, panic, crisis management
- recent research in cognitive science - human thought and restrictions on communicative competence
- public communication in emergencies - dealing with the media
- human behaviour in emergency and stress situations - human erorr analysis
- risk and hazard assesment - management of risk
- communicating under stress - psychological and linguistic aspects
- multi-national crews - consequences of language and socio-cultural interference
- impact of new international legislation (STCW, SOLAS, MARPOL, SMNV/SMCP) and rule-making process (FSA)
- the maritime education and training perspective

Dealing with emergencies

- safety and environmental aspects of novel ship types and transport technologies
- new methods and procedures of accident prevention (tehnical, legal, environmental aspects)
- organisational, technical and legal aspects - surveyors' views
- use of simulators in achieving and improving emergency preparedness
- rescue and salvage units and support shore personnel - education, training, preparedness, efficiency
- role of maritime education and training

Coping with casualties

- maritime casualty investigation - present status and future trends
- legal and procedural aspects of casualty investigation
- technical and forensic aspects of casualty investigation
- handling the consequences - lessons to be learnt, near miss reporting
- maritime accidents - case studies as teaching method
- role of maritime education and training
- training inspectors in casualty inspection work

– WOME 10 –

The submission of abstracts of papers addressing the following topics is invited:

Preventing accidents: cognitive, communicative and legal issues - some repercussions for maritime English (topics for a joint session with PADECC)

- human factor - preventing human error, stress control, panic prevention, crisis management
- recent research in cognitive science - human thought and restrictions on communicative competence (with particular reference to emergencies)
- public communication in emergencies - dealing with the media
- human behaviour in emergency and stress situations – human error analysis
- communicating under stress - psychological and linguistic aspects
- multi-national crews - consequences of interference between mother tongue and (maritime) English
- impact of new international legislation (STCW, SOLAS, MARPOL, SMNV/SMCP) and rule-making process (FSA)
- communicative competence (with particular reference to emergencies)

Preventing accidents, dealing with emergencies, coping with casualties: can language help?

- linguistic features of communication in emergencies and maritime casualties
- communicative/linguistic apsects of maritime casualty investigations
- standardised versus true forms of maritime English in distress and emergency communications
- IMO Standrad Marine Navigational Vocabularty (SMNY) and Standard Marine Communication Phrases (SMCP) in dealing with emergencies and accidents: user-friendliness view
- Search and Rescue communications – theory versus experience

Maritime English syllabus for 21st century

- role of maritime English in Maritime Education and Training (MET)
- maritime English syllabus: contents and structure
- future role of technology in maritime English
- multi-cutural and multi-lingual speech community on board – ensuring effective communication
- restricted English (SMNV/SMCP) - IMO standards/recommendations and national maritime English curricula
- crisis management: on-board communication/communication with passengers

Maritime English - a global methodology

- recent developments in the methodology of foreign language teaching
- lessons from maritime accidents and their impact on maritime English instruction (SMNV, SMCP) - lexical, structural and discourse aspect
- case studies as an important source of maritime English instruction
- teaching SMNV/SMCP: IMO model course, IMLA learner's course or national course manuals?