

1999

# The impact of the STCW 95 on the onboard training programs of shipping companies in China : meeting the challenge of change

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**WORLD MARITIME UNIVERSITY**  
Malmö, Sweden

**THE IMPACT OF THE STCW 95  
ON THE ONBOARD TRAINING PROGRAMS  
OF SHIPPING COMPANIES IN CHINA**

**- Meeting the challenge of change**

By

**SHEN GUOHUA**  
The People's Republic of China

A dissertation submitted to the World Maritime University in partial  
fulfilment of the requirements for the award of the degree of

**MASTER OF SCIENCE**

in

**MARITIME EDUCATION AND TRAINING  
(Nautical)**

1999

## DECLARATION

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

.....  
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## ACKNOWLEDGEMENTS

Having finished the dissertation, I feel deeply that my achievement could not be made without much help and support from professors and other staff such as librarians at WMU, friends in China as well as some visiting professors.

I hereby would especially like to express my deepest thanks to my Course Professor and Supervisor Peter Muirhead, who gave me great assistance and instruction in my study and research.

In addition, Associate Professor Hikima at WMU, Captain Yan Weiping, Deputy General Manager in COSCO Dalian, Captain Liu Shi, Deputy General Manager in Management Division of COSCO Headquarter and Senior Engineer He Dalu, Vice General Manager in COSCO Human Resource Training and Development Co. as well as Mr. Cao Chunjing, Manager of Seaman Division of COSCO Human Resource Training and Development Co. gave me great assistance in my collection of information. My acknowledgement also goes to them.

Finally, I must thank my wife Zhao Min and my beloved daughter Shen Tong wholeheartedly, who have given me a lot of support during my study at WMU.

## **ABSTRACT**

The dissertation is a study of Maritime Education and Training in shipping companies. It describes new requirements imposed on shipping companies by the STCW 95 and the national regulations related to the training of seafarers, and discusses at some length that more attention needs to be given to onboard training by Chinese shipowners. The assurance of seafarers' competency, especially operational skills and the English language skill, is not only the task of maritime institutes. On the contrary, shipping companies should carry out their obligations without any doubt.

The development of new technology such as computer technology, satellite communication technology and network (Internet) technology, and their applications in the shipping industry with the focus on the approach to onboard training are examined briefly.

An analysis of the current situation in Chinese shipping companies is made. Some weaknesses and shortcomings, both in training systems and in seafarers' competency, are identified.

On the basis of this study of the internal and external environment of Chinese shipping companies as well as reference to others, the principles and main aspects of onboard training in the improved training system for Chinese shipping companies are highlighted in order to meet the challenge of change. Finally, some recommendations are put forward to Chinese shipping companies.

**KEYWORDS: STCW, Shipping company, Onboard training and assessment, New technology, Training system, Improvement**

## TABLE OF CONTENTS

Declaration	ii
Acknowledgements	iii
Abstract	iv
Table of Contents	v
List of Tables	viii
List of Figures	viii
List of Abbreviations	ix
<b>1 Introduction</b>	<b>1</b>
1.1 Background	1
1.1.1 Enforcement of the STCW 95 and the ISM Code	1
1.1.2 The development of new technology in the shipping industry	2
1.1.3 Demand of the industry	2
1.2 Objectives	3
1.3 Methodology	4
1.4 Limitations	4
<b>2 Maritime training in shipping companies</b>	<b>5</b>
2.1 Company and Institutional Training – a comparison	6
2.1.1 Differences	6
2.1.2 Linkage to maritime institutes	8
2.2 Shore-based training in large shipping companies	9
2.2.1 Its necessity and basic approaches	9
2.2.2 General training aspects	11
2.2.3 Training needs	12
2.3 Onboard training	12
2.3.1 Advantages of onboard training	13
2.3.2 Objectives with different levels	15
2.3.3 Equipment and facilities	17
2.3.4 Training methods	18

<b>3</b>	<b>Impact of conventions and regulations (related to seafarers' training) on shipping companies</b>	<b>19</b>
3.1	International requirements	19
3.1.1	STCW 95	19
3.1.2	ISM Code	22
3.1.3	International Memorandums of PSC related to training	23
3.1.4	Others	25
3.2	Chinese National requirements	28
<b>4</b>	<b>A review of current situation of the companies in China</b>	<b>30</b>
4.1	The role of the major shipping companies	30
4.2	An analysis of current training systems	31
4.2.1	Structure of training system	31
4.2.2	Regulations related to training	32
4.2.3	Organisation of training	33
4.3	An analysis of current seafarers' competence	33
4.3.1	Professional knowledge and understanding	34
4.3.2	Practical (Operational) skills	35
4.3.3	English language	37
4.3.4	Management ability for senior officers	39
4.4	Measures for implementation of STCW 95 in shipping companies	40
4.4.1	Preparation for implementation of STCW 95	40
4.4.2	Training practice	41
<b>5</b>	<b>Change to training, new approach for Chinese shipowners</b>	<b>43</b>
5.1	Impact of new technology on operation practices	43
5.1.1	Brief introduction to new technology in shipping industry	43
5.1.2	Applications of new technology in MET	51
5.2	Factors influencing a training system	53
5.2.1	Internal environment and situation	53
5.2.2	External environment	55
5.3	The use of experience of others	56
5.3.1	The Norwegian approach	56
5.3.2	The Japanese approach	59
5.3.3	Others	63
5.4	Improved training system for Chinese shipowners	64
5.4.1	The principles and organisation	64
5.4.2	Identification of essential aspects for onboard training	68
5.4.3	Onboard training resources	71
5.4.4	Methodology and effective implementation	74
5.4.5	Assessment, evaluation and recording for onboard training	76
5.5	Limitations and constraints	78

<b>6</b>	<b>Conclusions and Recommendations</b>	<b>79</b>
6.1	Conclusions	79
6.2	Recommendations	81
	<b>Bibliography</b>	<b>82</b>
	<b>Appendices</b>	<b>88</b>
	Appendix 1 Evolution of Intel Microprocessors	88
	Appendix 2 Norwegian Onboard Training Programmes	89
	Appendix 3 Japanese “K” Line Training Programmes	91
	Appendix 4 Seagull AS: CBT Training Programmes	92
	Appendix 5 Videotel Training Packages	96



## LIST OF TABLES

Table 2.1	Training Comparisons	7
Table 4.1	Assessment Results (deck department)	39
Table 5.1	Three-month Onboard Training Program	60
Table 5.2	Training Items for Each Group	71

## LIST OF FIGURES

Figure 2.1	Shipowners and Reliability	6
Figure 2.2	Linkage Between a Institute and a Company	9
Figure 2.3	The Concept of Experience	13
Figure 4.1	1991-1997 Seaborne Cargo Transport Turnover in China	30
Figure 4.2	Basic Structure Relating to Seafarers' Training	32
Figure 4.3	Statistics of Incidents in a Shipping Company	34
Figure 4.4	A Breakdown of Human Factors	38
Figure 5.1	Internal and External Factors	54
Figure 5.2	Baseline for an Improved Training System	57
Figure 5.3	Sectors Affecting a Seafarers' Training	66
Figure 5.4	A Flowchart of Training Procedures	67
Figure 5.5	Hierarchy of Training Standards	69

## LIST OF ABBREVIATIONS

APRO	Ability Profile
ARPA	Automatic Radar Plotting Aid
BRM	Bridge Resource Management
CAL	Computer Assisted Learning
CBA	Computer-Based Assessment
CBT	Computer-Based Training
CD-ROM	Compact Disk - Read Only Memory
CFR	Code of Federal Regulations
COLREG	Collision Regulations
COSCO	China Ocean Shipping Company
DGPS	Differential Global Positioning System
DTV	Digital TV
ECDIS	Electronic Chart Display and Information System
ECS	Electronic Chart System
EC	European Commission
ENIAC	Electronic Numerical Integrator and Computer
FSA	Formal Safety Assessment
GB	Gigabyte
GEO	Geo-stationary orbit satellite
GLONSS	Global Navigation Satellite System
GMDSS	Global Maritime Distress and Safety System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GPS-SPS	Global Positioning System Standard Positioning Service
IBS	Integrated Bridge System
ICO	Intermediate Circular Orbit (here it is the name of a company)
ICS	International Chamber of Shipping
ICT	Information and Communication Technology
IGS	Inert Gas System
ILO	International Labour Organization
INS	Integrated Navigation System
IMO	International Maritime Organization
INMARSAT	International Mobile Satellite Communications Global Mobile Satellite Communications
ISDN	Integrated Service Data Network
ISF	International Shipping Federation
ISI	Information Society Initiative
ISM	International Ship Management (Code)

ISMA	International Ship Managers' Association
IT	Information Technology
LAN	Local Area Network
LEOS	Low Earth Orbit Satellite
LESO	Land Earth Station Operator
MARCOM	Maritime Communication
MARPOL	International Convention for the Prevention of Pollution from ships 73/78
MET	Maritime Education and Training
MIS	Management Information System
MOU	Memorandum Of Understanding
MPP	Most Probable Position
OMBO	One Man Bridge Operation
OOW	Officer of the Watch
OS	Ordinary Sailor
OSM	Oil Spill Management
PPRO	Performance Profile
PSC	Port State Control
PSCO	Port State Control Officer
RPM	Revolutions Per Minute
SAR	Search And Rescue
SATCOM	Satellite Communication
SCC	Ship Control Centre
SETS	Seafarers Evaluation and Training Systems
SIRC	Seafarers International Research Centre (Cardiff University)
SMCP	Standard Marine Communications Phrases
SMS	Safety Management System
SOLAS	International Convention for the Safety of Life at Sea 1974
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 78/95
SWOT	Strength, Weakness, Opportunity and Threat
TEU	Twenty Equivalent Unit
UNCTAD	United Nations Conference on Trade and Development
USCG	United States Coast Guard
VDR	Voyage Data Recording
VHF	Very High Frequency
VR	Virtual Reality
VTMIS	Vessel Traffic Management and Information Service
VTS	Vessel Traffic Service
WWRNS	World Wide Radionavigation System
WWW	World Wide Web

# **CHAPTER 1**

## **Introduction**

### **1.1 Background**

#### **1.1.1 Enforcement of the STCW 95 and the ISM Code**

The revised STCW 78 (STCW 95) entered into force in February 1997, and the transitional arrangement of enforcement has already passed the first date of August 1<sup>st</sup> 1998. Final compliance date is set for February 1<sup>st</sup> 2002. The statutory requirements imposed by the Convention have had a strong impact on the whole maritime education and training (MET) system across the world. The obligations and responsibilities of shipping companies have been identified in the Convention, relating to recruiting and training seafarers. To enforce the seafarers' training, especially onboard training, shipping companies need to review and improve their training systems.

On August 1<sup>st</sup> 1998, the ISM Code, which directly addresses the company, fully entered into force. Bulk carriers, oil tankers, chemical tankers, gas carriers, passenger ships and high-speed craft (including both passenger and cargo) of 500 gross tonnage and upwards are bound legally. In three years' time, namely 2002, other types of vessels will also be bound by the Code. Shipowners and operators cannot avoid operating their fleet and manning ships carefully and properly. Safe management of fleet needs not only the necessary procedures but also even more competent personnel both ashore and on board. Therefore, recruiting and training seafarers in shipping companies requires more attention than before.

The GMDSS has been just fully implemented from February 1<sup>st</sup> 1999. Correct operation of the system needs seafarers' practical skills. Other new requirements in SOLAS and MARPOL Conventions are in place.

In Chapter 3, the above-mentioned requirements on shipping companies as well as others including national requirements that are related to seafarers' training are identified.

### **1.1.2 The development of new technology in the shipping industry**

New technology, especially information technology (IT) in the shipping industry, has developed so fast that ship operation and management, based on the new technology, are changing the face of the industry, while changes in maritime education and training are concerned with people's perspectives, methods and tools. The opportunities and challenge brought about by the new technology are facing all shipping companies. The traditional Chinese shipping industry needs to think about rising rapidly with the aid of new technology. The first part of Chapter 5 states briefly the applications of new technology.

### **1.1.3 Demand of the industry**

MET system consists of two major stages: one is in maritime institutions, the other is in shipping companies. One cannot educate and train competent seafarers totally in an institution. On the contrary, the skills they have gained in an institute need to be assessed at the workplace, on board ships. On the other hand, the trend of reduction of manning ships demands more knowledgeable and skilful seafarers. The further training during their in-service on board therefore has to be conducted systematically.

The competitiveness in the shipping industry today has been increasingly intense. In essence, this is the competitiveness of people of talent, level of management and the use of new technology.

According to research by SIRC that is under the EC project 'Maritime Communication' (MARCOM), the most frequently applied criteria for recruitment of officers in the majority of shipping companies are 'abilities/training', followed by 'tradition' and then 'language skills'. This indicates that seafarers' training is now becoming a paramount factor to managers in companies who will take training of

seafarers more and more seriously. Many research results show that about 80% of marine accidents were attributed to human factors. Highly qualified seafarers mean safer ships, and a safer ship is an essential element for lower cost. So there are no reasons for shipping companies not to pay attention to seafarers' training. Chapter 2 describes general aspects of MET in a shipping company.

China is a developing country. The supply of seafarers for developed and industrialised countries is one of the practical issues. However, many seafarers are not at higher level of standards in operation of modern ships, nor skilled in English language. Their competency needs to be developed and improved so as to meet the requirements of the labour supply and safe operation on board ships. To improve this situation is a very important and urgent task for Chinese shipping companies. Chapter 4 reviews and analyses the current situation in Chinese shipping companies, including training system and seafarers' competency.

In summary, the main reasons for the author to choose the topic are the legal aspect, development of new technology, demand of the industry, and a gap between the industry requirements and the current situation in China.

## **1.2 Objectives**

Training in shipping companies, mainly on board training, is a hot issue that should be considered carefully in order to fully implement STCW 95. The objectives of this dissertation are to try to answer those questions: What situations are shipping companies facing? How can shipowners be encouraged to embrace improved onboard training regimes? What are the main factors that have an impact on the training? How to conduct training on board in order to acquire better results? The last part of Chapter 5 gives an outline to improve training system based on the following specific objectives:

1. To clarify responsibilities of shipowners in seafarer training, according to the international conventions and codes, as well as national regulations.
2. To identify impact of new technology on seafarers' training.
3. To examine the current measures for implementation of international

conventions and codes.

4. To identify the major training requirements for Chinese seafarers.
5. To develop solutions to achieve high standards of onboard training.
6. To make proposals and recommendations to improve training and assessment in shipping companies, especially onboard training.

### **1.3 Methodology**

The author made a literature search of the topic with the focus on identification of the development of new technology in the shipping industry, current MET methods for onboard training and assessment, and responsibilities of the company. He examined some relevant books, journals, conference-proceedings, handouts and lecture-notes, newspapers etc. as well as the Internet sources. The investigation was carried out by asking for some first hand materials and information, and interviewing professors, visiting professors and some staff in shipping companies to get their opinions on the seafarers' training. Reference of some training systems of shipping companies in other countries was taken for improvement of the Chinese training system. The handouts and lecture-notes related to the topic were used. E-mail and fax communication was a supplementary way to get some ideas from some world leading shipping companies. In addition, observation of others during the field study trips and the author's own experience were also used in creation of the new training system. In order to make some points clear, some references selected as support information are listed in appendixes. Based on the study of information, the conclusion and suggestions are drawn.

### **1.4 Limitations**

From the author's own background, the details in the dissertation are related to the deck department on board ships and the engine department is little discussed. Other limitations included the each of availability of useful information, and the restricted scope and time. As well, the author's mother-language is not English. There may be some unclear statements in the dissertation. So it is difficult to avoid omissions and limitations.

## **CHAPTER 2**

### **Maritime Training in Shipping Companies**

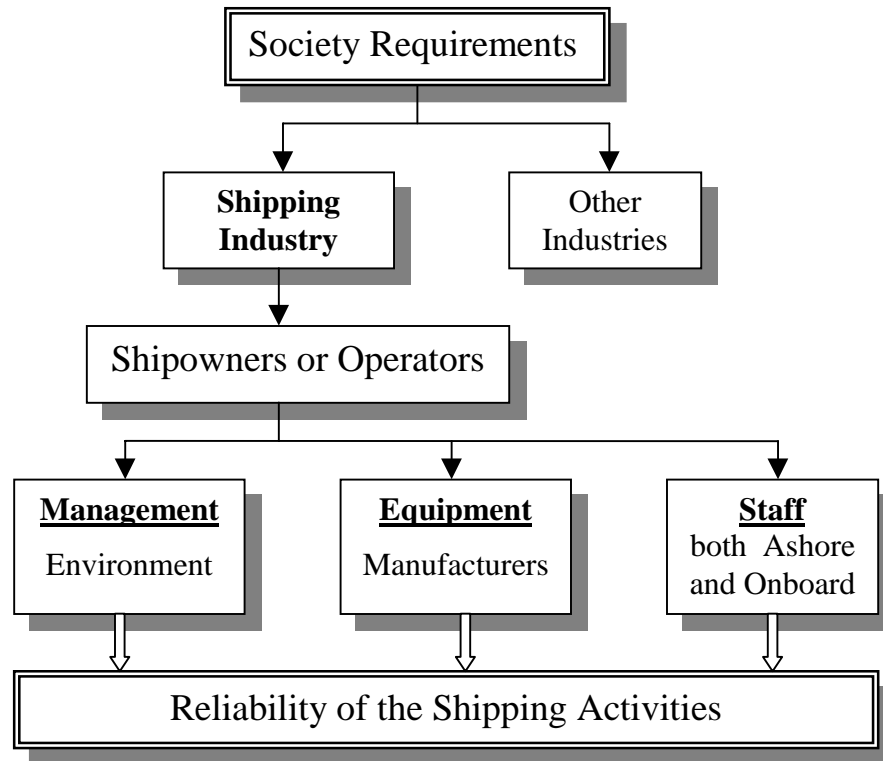
When people mention maritime education and training, they always think of something in maritime academies or institutes. Of course what they think of is not wrong. However, maritime training has been conducted in shipping companies for a long time. Maybe, it started at the very beginning of marine transportation with onboard training, but there were few people who realised this at the time. It was the onboard training that allowed seafarers in the ancient times to have the skills or techniques of navigation at sea in their hand. The master of a ship at that time was equal to a manager in a shipping company of today. And this kind of training still happens on board.

Looking back at maritime accidents in the past, one may find that many of them were caused by incompetent seafarers or human errors, not cadets who had just graduated from maritime institutes. The cadets need to be more fully trained on board, and then they could become competent seafarers. If the environment changes, such as new ships or new technology used in modern equipment, on being promoted to a higher position onboard, they still need further training. Otherwise, they could encounter difficulties in dealing with some problems that affect the safety at sea, prevention of pollution or safety of life. So maritime training in companies is a very important issue. It should be met face on, so as to take it from possible chaos to structured operation.

Furthermore, from the whole society point of view, safety and environment protection in the shipping industry are addressed directly to shipowners or ship operators such as by the ISM and the STCW. This should ensure reliability of shipping activities through employment of qualified staff, reliable equipment and



better management, and in such a way give the society a satisfactory answer. See Figure 2.1. Of the above three elements, staff, including seafarers, is crucial one.



**Figure 2.1:** Shipowners and Reliability

But what differences are there between training in shipping companies and training in maritime institutes? Can these be harmonised? What is the focal point of maritime training in companies, particular for on-board training? This chapter discusses these issues.

## **2.1 Company and Institutional Training - a comparison**

### **2.1.1 Differences**

Maritime training in shipping companies may be broken down into two categories: one is shore-based training, the other is on-board training. They have their own characteristics, which are as follows:

- a. The focus is on the task. It can be explained that training items or courses are specially designed to meet the requirements of the fleet and seafarers' needs.
- b. Course programs are short but effective. For example, when the company buys newly built ships, seafarers who will be assigned to work on board the ships need to be trained in ship-handling or equipment operation.
- c. Training is flexible. Training may take place on shore or on board a ship, depending on a specific course. Trainees can select the time set aside for training in certain period.
- d. Instructors may be selected from senior officers on board, staff in the company or professional persons in the maritime field.

The differences compared with maritime institutes are identified in following table.

**Table 2.1: Training Comparisons**

<b>Items compared</b>	<b>In shipping companies</b>	<b>In maritime institutes</b>
1. training approach	Flexibility: shore-based and onboard, self-study, close to real environment	Class-teaching and laboratory
2. training principle	Special knowledge and skills, safety concerned.	Basic knowledge and normal skills
3. training contents	Relates to role onboard, short courses	shipping concerned, general ability
4. training organisation	Periodical and based on the scheme of development of company	Long-term, fixed courses, Some short courses for regular training
5. instructors or supervisors	Staff or senior officers on-board with much experience, sometimes lecturers from institutes, depending on the courses	Technicians, lecturers or professors
6. trainees and their needs	Seafarers, different levels, initiative	Students or cadets at the same level, passive
7. effectiveness and efficiency	Training at workplace, closest to on board role and hands-on, prompt use	Training at simulated environment, the programs for future use

Obviously, many advantages of training in shipping companies can be found from the above table.

### **2.1.2 Linkage to maritime institutes**

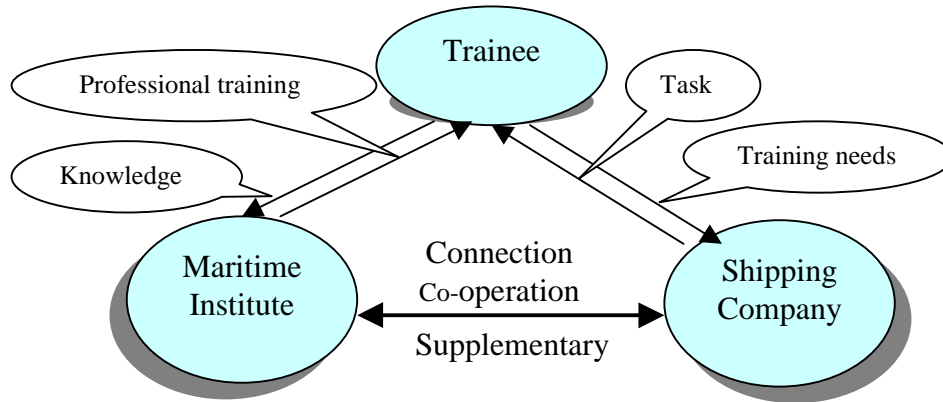
As the author mentioned in Chapter 1, a MET system has two major parts: one is in maritime institutes and another is in shipping companies. These two parts can form an integral system. Eliminating either of them will cause the MET system not to be integral. Being a seafarer, he/she does not only learn something in a college, but must also learn something on the job. As a result, he/she could become a competent seafarer. So the linkage between two kinds of training shows its importance to trainees.

A good linkage should be made from trainees' needs or in considering trainees' level. It means that the body of trainees is the central part of the training system, thus either an institute or a shipping company should take trainees as a basic element to develop training programs.

Figure 2.1 indicates that an institute gives a trainee (here a student) a professional training and then awards him/her a diploma or degree. A student's needs are the basic knowledge and skills, and a certificate of competency. After graduation, the student is recruited to work on board a ship in a shipping company. The shipping company assigns him/her a post on board, either as an officer or a rating. But he is not competent for the job during the beginning period of time in general. So further training needs to continue.

From an institute's point of view, the program should be capable of meeting the requirements of the position on board. The institute needs to understand more about shipping companies, ship-operation practice and seamanship, etc. while a shipping company can design training programs according to a trainee's level (knowledge basis and skills mastered) and requirements of the job. In this case, refreshment should be brought into line to avoid unnecessary overlap. So these two organisations are two facets of one thing, in that they should connect and co-operate

with each other, and supplement or modify their training programs. Trainees will become competent, and the aim of safer ships and cleaner oceans will be realised.



**Figure 2.2:** Linkage Between a Institute and a Company

## 2.2 Shore-based training in large shipping companies

A large shipping company may be defined as a company that usually owns more than 10 vessels and employs over several hundred seafarers. In that case, the number of seafarers is the basis for discussing training.

### 2.2.1 Its necessity and basic approaches

Shore-based training in a shipping company, like a maritime institute, is to gather seafarers by groups and then teach them certain skills or knowledge that will be used when they go back to work on ships.

Years ago, the hierarchy of the organisational structure on board was experience based. Now the hierarchy on board is mainly technical based. Senior officers should update their knowledge so as to keep abreast of modern ships.

With the development of new technology, the level of ships' automation is higher and higher, and the equipment onboard ships is more advanced. The integrated Navigation System (INS), for instance, has become a popular configuration on modern vessels. The techniques and knowledge for seafarers to operate such a ship consequently become more and more complicated. One-man-

bridge-operation (OMBO) is not strange to seafarers, though it is still in hot argument. Therefore, seafarers have to learn some new things so as to work on board better to improve their ability for safe navigation.

On the other hand, managers in shipping companies do not have the safety of ship as their final goal. What they really want to gain is high revenue. From the board of directors to ordinary staff, a “sound circle” has been formed. Maybe, this is the driving force for shipping companies behind the training. Seafarers, particularly senior officers, are just a link of the circle. But how can they manage to assist a company to achieve its goal? The answer should be that they need to understand the company’s policy, follow the instructions, organise other seafarers on board and use all resources on board as well as they can.

Thirdly, some international conventions or codes as well as national regulations require shipping companies to make sure all seafarers working in their companies are trained properly and qualified. (See Chapter 3)

Lastly, cost-derived forces make shipping companies man ships with multinational crews. However, seafarers from different countries have different cultures that influence their behaviour in working and daily life, including language communication. With regard to the special environment on board ships, their behaviour may affect the safety aspect by misunderstanding each other. On the other hand, although the standards in the STCW Convention are required to be achieved, their operational practice, in fact, is still different or at different levels. The shipping companies, consequently, cannot avoid training crew in safety, even behaviour standards if necessary. Not only should they be trained before seagoing, but they should be continuously trained on board also.

Shore-based training may be conducted in several ways. Self-study and studying in a training centre of a shipping company are often used, which apply to different situations and programmes respectively, theoretical and simulations are main subjects. But these two ways have their own advantages and disadvantages. For example, self-study can save costs, but the result is not so good as hands-on training, which is difficult. Studying in a training centre may mean spending more money on

teaching, accommodation and travelling but the result will be better than that of self-study, and easier to get better management and no limitations whenever companies want to conduct training.

With large shipping companies, the number of crew is larger, and seafarers' training often happens. The better way to conduct training is to set up a specific division to manage it and train seafarers in turn by stages, but in proper groups.

So the shore-based training method in shipping companies is no different from that in maritime institutes. The important thing for shipping companies is to make a course plan for instructors or lecturers, whether in a training centre or not.

### **2.2.2 General training aspects**

What seafarers need to be trained in depends on their posts on board ship and the strategy of the company's training policy as well. So the training should reflect the future's vision and requirements of the shipping industry. Precious (1997) holds that tomorrow's skills required for seafarers are identified by four aspects:

- technology which will of course impact on ship design that gives crew the benefit of a safer operating system, and more sophisticated equipment,
- manning on board that needs higher skill-level but less complements,
- industry regulations that impose on seafarers such as STCW and ISM Code,
- and a role of the individual that makes up our industry.

In general, training items can be divided into the following groups:

a. Technical group

New technology used in navigation and machinery equipment,  
Operational requirements related to safety and pollution prevention,  
Familiarisation, variable types of ships run by the company,  
Basic safety,  
Professional development.

b. Management group

Teamwork skills of mixed manned ships and human resource management,  
Company's policy, procedures in Safety Management System (SMS),  
Maritime IT,  
Cost management,  
*Note:* in each group, there are different requirements for different levels.

### **2.2.3 Training needs**

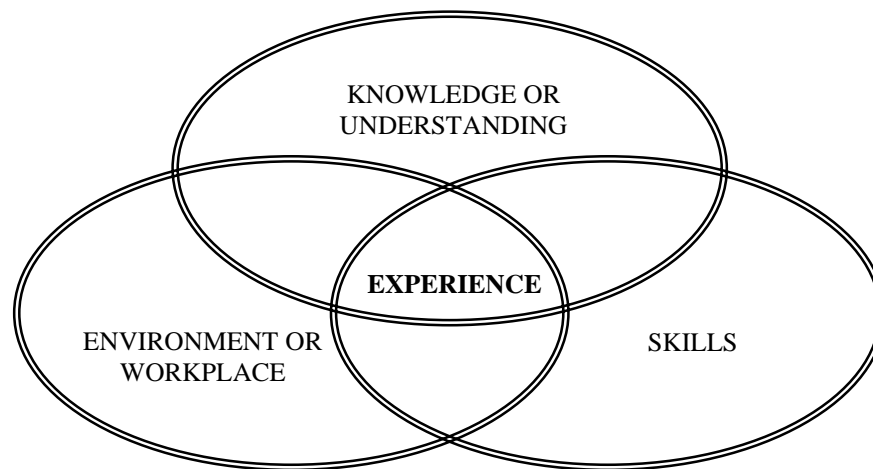
Identification of training needs is prerequisite for training arrangements. But one should give a clear description of a job before assessing seafarers. Training needs for seafarers, therefore, as mentioned in Section 2.2.1 of this paper, come from the job requirement on board ships. In other words, training is needed when a seafarer's knowledge and skills are lower than what are required by the job, and they will be improved to the required level through normal training. Both knowledge and skills can be acquired either on shore or on board. But experience is a special training need, which one can only achieve by on-the-job training, especially for the seafaring profession. From this point of view, training is an eternal topic in the shipping industry.

### **2.3 Onboard training**

There is no doubt that on-board training is apparently tailored training in shipping companies and it is the most practical and effective. It can enable seafarers' knowledge to be transformed into effective skills besides learning by practice. In the broad sense, on-board training is currently not necessarily concerned with specific tasks on board. It may be any training related to professional development that takes place on board, such as training in computer operations and new technology learning.

There are many factors that affect onboard training. Among them, trainer and trainee' attitude, training methods, equipment and an assessment system are essential. Besides these, shore-based training, no matter where it occurs, is the basis of on-board training. That is to say, one, who will work on board ships, must have been trained in maritime subjects, and gained a certain extent of knowledge and

skills. Without this basis, on-board training is impossible to be undertaken efficiently at present. Figure 2.3 shows that experience for modern seafarers means the combination of their knowledge or understanding, skills and feeling in the working environment. One's experience is gained at the workplace, based on the knowledge and skills he/she learned, only when tasks (including training programmes) are done in a real environment. Onboard training is to incorporate knowledge and skills with feeling at the workplace, and accumulate experience in order to make one competent at their job.



**Figure 2.3:** The Concept of Experience

### **2.3.1 Advantages of onboard training**

- Training taking place at workplace. A real environment can ensure that trainees are serious about learning. The implementation of their tasks also depends on a good interaction with the environment. Any risk on board a ship affects safety of life, so no one can doubt that he is fighting against danger. It is easier to motivate trainees to perform well.
- Highly effective in comparison with shore-based training. In regard to most programs, trainees hope to apply to their job what they have just learned. In other words, training is combined with real tasks. After practising several times, they can master relevant skills. "Learning by



doing " is the seafarers' traditional way of learning. It is still effective today.

- High efficiency. Operation of equipment or instruments may be just normal performance for seafarers. This is particularly so when on duty. Usually the same program run on shore gives trainees a general procedure of operation, not a specific one. Therefore, trainees maybe can operate equipment at the time, but will not be proficient when they go back to ships, or they may face different types of equipment from that they were trained on. On the other hand, one can not put all equipment or instruments in shore-based training centres. The level of efficiency resulting from trainers delivering a program without equipment is that much lower. Conversely, efficiency of on-board training is higher, relating to the hands-on practice. "We remember 90% of what we say and do", describes *'Training Course for Instructors'* (IMO Model Course 6.09).
- Tailored-made programs for specific vessels. Common courses, such as emergency procedures and basic safety, give trainees a general idea or knowledge. When they are assigned to a particular vessel, they have to familiarise themselves with the operation or execution of the safety arrangement on the vessel. With a tailored-made program, training can be conducted successfully.
- Indispensable linkage on modern ships. Generally speaking, graduates from maritime institutes are not proficient at their jobs when they go to work on board at first. They need to be conversant with the environment. The more important thing is that they have to fill the gap between nautical theory they have learned in the institutes and practical operation on the vessel though they have had some hands-on practice on simulators or on-board training as cadets. Perhaps this is essential for on-board training today.

- Time-flexible. To enhance competition and cut down costs, the total crew numbers in a shipping company and on board ships is slowly reducing eventually. Seafarers have no more time to be trained when they are on vacation ashore. Therefore a possible way for them to update their knowledge and skill is through on-board training and education, by means of new technology. They may learn something under supervision from senior officers or by use of computer-based training facility for self-study provided they are not under time pressure. On the other hand, contract seafarers (short term) have no more chances to be trained ashore, but they are allowed to use training facilities on board and to partake in any training programs on board.
- Good combination of training and assessment. A way to assess seafarers' outcome of training is at the workplace, and this is the most effective way. Without an assessment the training is invalid. Holder (1997) believes that "the essential skills in the future will be measured by performance in the workplace."

Some difficulties may be encountered, such as:

- Time-threat
- Qualification of instructors
- More preparation of work
- More jobs for senior officers
- Limitation of ships' conditions

Shipping companies should consider them adequately.

### **2.3.2 Objectives with different groups**

Whatever training is, objectives should first be established, which are derived from training needs. On the basis of the objectives, relevant contents and methods can be arranged.

Trainees of on-board training are, obviously, seafarers on board ships, but there is also a hierarchy among seafarers on board. One should identify different groups before training.

It is known that there are three levels of seafarers stated in the STCW 95, namely management, operational and support. So goals and contents of training can be made as follows:

- Management level: means the group serving as senior officers, including master, chief mate, chief engineer officer and second engineer officer. Their positions determine that the structure of their knowledge and skill consists of two types: technical and management. The latter is more essential for masters.
- Operational level: means the group 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. Officers in this group, besides normal tasks, will be encouraged to upgrade or proceed to management level by companies or by themselves. So training needs to concentrate on technical aspects, and some management knowledge.

There is a specific part of operational level, i.e. cadets or prospective officers. Their training needs to focus on familiarisation of the ship and equipment, practical operational procedures and practice relevant to their duties and responsibilities to be undertaken. The period of probation depends on their position to be assigned. In the STCW 95, it states that 'every candidate for certification (OOW) shall have approved seagoing service of not less than one year' before they accept new positions. For officers who are to be promoted to higher positions, their training needs to concentrate on familiarisation with the equipment in a new spectrum, procedures concerning new responsibility, regulations and teamwork skills, especially for those who are to be promoted from operational level to management level.

- Support level: means the group serving as ratings. Two things should be covered. One is their skill when they work alone, and other is an additional task when they assist the OOW forming part of a navigational watch. Training emphasis should be on basic safety, procedures in watch-keeping and teamwork concept.

### **2.3.3 Equipment and facilities**

For general purpose, on-board training is based on the ship's environment and sea environment. These are the most important facilities. Therefore sometimes people take it as on-the-job training or in-service training.

However on-board training needs some basic equipment that can be used to get a better outcome. Thanks to the development of new technology, many advanced tools and equipment can be available on board ships for training. The Anglo Eastern Company in Hong Kong for example has supplied every ship with a PC – based simulator for ship handling and engine operation. Some shipping companies have introduced new technology to create the office on board for the purpose of management, including on-board training. (Hapag-Lloyds) Such equipment consists of computers, satellite communication system, TV set, video-player, overhead-transparency projector and so on.

On the other hand, some world leading navigation aids suppliers now add recording functions in their products. The functions may be used by the masters and officers to replay critical parts of a voyage for training purposes though they may also be used in case of collision or grounding at sea. The versatile ECDIS – based Electronic Chart Navigation System, CHARTPILOT, made by the STN ATLAS Marine Electronics, for example, has two functions in term of onboard training: voyage recording and consulting and service. The former can store and replay voyage data for 8 weeks with each minute or 24 hours with each second. The latter can act as an internal ship motion simulator for test and training purposes. Effective use of these functions may bring about unexpected achievement for onboard training. Moreover one can expect that a networked computer system on board can make

training more effective by linking the computers used for training with a real integrated navigation system that trainees can retrieve data and graphics from the INS for training purposes.

There are other resources: a variety of software, books, materials and posters relating to on-board tasks.

The above mentioned equipment will be discussed further in Chapter 5.

#### **2.3.4 Training methods**

In earlier days, seafarers learned skills and basic knowledge of navigation by two ways: new navigators by knowledge and skills passed on by experienced navigators while experienced navigators by survey and summing up. Eventually they had learned to use basic mathematical and instrumental techniques of what was still the new navigation. Observation and practice were effective methods. Captain James Cook (1728 - 1779), for example, that most exceptional of seamen, acquired great skill with lunar distances during his first voyage (1768 - 1771) and he was described as the first 'complete seaman', and 'grand navigator'. Douglas Phillips-Birt wrote in "*A History of Seamanship*" that 'he had trained himself by survey and became, thanks to unrivalled opportunities which he grasped so competently, the greatest cartographer of any time.' So to be a good navigator in the past, one must have not only learnt from others, but also improved oneself with practice. There were few written 'operational manuals' or information to study or for reference.

Today, all seafarers have been given certain knowledge and skills before they work on board, and navigational equipment is more complicated than that of hundreds of years ago. Seafarers need to consider how to use the equipment correctly which is available on board ships. This means that skills for navigation today are different from those in the past. But learning by practice under supervision of experienced seafarers is still an effective method for the time being. Thanks to the development of new technology, computer-based training (CBT), distance learning via satellite communication at sea, video-based training, on-the-job training and so on are all effective methods. A great benefit can be achieved from those approaches to training on board.

## **CHAPTER 3**

### **Impact of conventions and regulations (related to seafarers' training) on shipping companies**

An organisation in our society cannot isolate itself from the influence of its external environment. In the maritime community, a shipping company engaging in international transport has to meet all requirements made by both national government and international organisations.

In recent years, IMO, a special agency under the United Nations, has changed many aspects of its conventions and codes, rather than adopting new conventions, for the purpose of safety and pollution prevention at sea. These changes have made a great impact on shipping companies, in their operation and management. Of the main conventions, the STCW 95 and SOLAS are the most influential with regard to seafarers' training. Being a contracting party, each country should make national level regulations based on the requirements imposed by the conventions. The Chinese government does this by keeping up international standards.

#### **3.1 International requirements**

##### **3.1.1 STCW 95**

With its enforcement on 1<sup>st</sup> February 1997, the STCW 95 gives more details about seafarers' training, assessment and certification. It identifies first the responsibilities of a shipping company in training seafarers and makes administrations, maritime institutes and shipping companies in a country jointly responsible to ensure seafarers' quality. This philosophy brings all aspects concerned into playing roles for safer ships and cleaner oceans.

A shipping company (or a company), according to its definition in STCW 95, means the owner of the ship or any other organization or person such as the manager, or the bareboat charterer, who has assumed the responsibility for operation of the ship from the shipowner and who, on assuming such responsibility, has agreed to take over all duties and responsibility imposed by these regulations. No matter whether a ship-management corporation or ship operator or ship-owner itself, each must take responsibility for manning with qualified seafarers and training them accordingly provided he operates the ships. All convention requirements on the company can be fully complied with as a result.

In Regulation I/14 of STCW Convention, companies are required by each Administration (Flag State) to ensure that the five aspects in connection to the assignment of seafarers for service in their ships are followed.

- Each seafarer holds an appropriate certificate,
- Every ship is manned in compliance with the applicable safe manning requirements of the Administration.
- Documentation and data on seafarer's experience, training, medical fitness and competency in assigned duties are maintained and readily accessible,
- Seafarers are familiarised with their duties and ships,
- All seafarers on board can effectively co-ordinate their activities in an emergency situation and in performing functions.

Morrison (1998, p98) explains the above-mentioned requirements that

“In assigning seafarers to their ships, companies need to be fully aware of the certificates held and training completed by each seafarer to be assigned, the capacity they are to fill and the functions and duties they are to perform. Companies must also be aware of the current on-board training and instruction capabilities of the crew being relieved and those of the crew being assigned to the ship. This is necessary to ensure that the qualifications of those who are to provide the on-board familiarisation training and instruction required by regulations I/14 and VI/1 and any other STCW related on-board

training, meet the in-service training qualification requirements of regulation I/6.”

The provisions of Section A-I/14 of the STCW Code gives more clear emphasis on the responsibilities of companies, masters and crew members. Its first paragraph states that

“Companies, masters and crew members each have responsibility for ensuring that the obligations set out in this section are given full and complete effect and that such other measures as may be necessary are taken to ensure that each crew member can make a knowledgeable and informed contribution to the safe operation of the ship.”

The second requires the company to

“provide written instructions to the master of each ship to which the Convention applies, setting forth the policies and procedures to be followed to ensure that all seafarers who are newly employed on board the ship are given a reasonable opportunity to become familiar with the shipboard equipment, operating procedures and other arrangements needed for the proper performance of their duties, before being assigned to those duties.”

Although Code B in the STCW Code is not compulsory, it still provides guidelines for maritime training. One should not neglect it when considering how to keep a high level of compliance with the requirements of the STCW 95. The provisions of Section B-I/14 state that companies should provide ship specific introductory programs aimed at assisting newly employed seafarers to familiarise themselves with all procedures and equipment relating to their areas of responsibility. It is noted that providing programs is not enough for companies to take their responsibility. They should ensure that newly employed seafarers are trained to be familiar with all procedures and equipment relating to their areas of responsibility. Programs and training are not separable in such circumstances.



### 3.1.2 ISM Code

From the management point of view, not the technology one, The International Safety Management Code (ISM Code) has been put into the SOLAS Convention. This, maybe, is a significant change of the Convention in recent years.

As one knows, management always relates to human resource and the use of human resources always relates to personnel training. So in the ISM Code there are several points concerned with training.

- One safety-management objective of the company is "to continuously improve safety-management skills of personnel ashore and aboard ships, including preparing for emergencies related both to safety and environmental protection." (1.2 Objectives). Here "continuously improve skills" means training for personnel in the company should never stop, whether they are on board or not, in order to keep pace with changes in the maritime industry.
- Part 6 of the ISM Code deals with resources and personnel. Of 7 points, the following 4 are mostly correlated.
  - "The Company should ensure that each ship is manned with qualified, certificated and medically fit seafarers in accordance with national and international requirements.
  - The Company should establish procedures to ensure that new personnel and personnel transferred to new assignments related to safety and protection of the environment are given proper familiarization with their duties.
  - The Company should ensure that all personnel involved in the Company's SMS have an adequate understanding of relevant rules, regulations, codes and guidelines.
  - The Company should ensure that the ship's personnel are able to communicate effectively in the execution of their duties related to the SMS."

The first paragraph makes clear that the company should always maintain qualified seafarers not only certificated but also in practice, through continuous training both ashore and on-board. So the company should establish a training policy and procedures to undertake seafarers training.

The second paragraph states that new seafarers and those transferred to new assignments are given proper familiarisation with their duties. How to conduct the familiarisation? How to know they have been familiar with the duties? These questions still need to be answered in accordance with the training policy and procedures in the company.

The third paragraph tells that adequate understanding of relevant rules and regulations by seafarers who are certainly involved in the SMS is required. "Adequate" can not be got through once training. While many new rules or regulations and their amendments are coming up every year, crew need to be familiar with them in time. The effective way is still training.

The fourth paragraph emphasises the working language on board in order to communicate both with the company and between seafarers. This issue is very important under multinational manning circumstances. Any seafarer who joins an international group must speak a common language used in the group. One thus needs to be trained.

- Part 8 of the Code requires that “The Company should establish programmes for drills and exercises to prepare for emergency actions.” Though this is not explicit, there is no doubt that ‘drills and exercise’ here indicate what should be done on board.

### **3.1.3 International Memorandums of PSC related to training**

One of the memorandums of understanding (MOU) on port state control (PSC) is The Paris MOU signed by 14 European countries in 1982, which is the earliest and most influential in the world shipping industry. In regard to seafarers’ training, its scope of inspection covers the STCW Convention and others related to levels of seafarers’ competence. As a shipping company, one should be familiar with

those aspects, not only to avoid detention of ships but also to enhance safe navigation.

In Section 3 of the Memorandum if there are clear grounds for believing that its crew does not substantially meet the requirements of a relevant instrument, such as STCW Convention, a more detailed inspection will be carried out and that may lead to detention of the ship.

More detailed aspects of 'clear grounds' are listed in its Annex 1. However, these aspects in the list those warrant a more detailed or expanded inspection, which includes verbal questions and showing their qualifications, should be borne in mind:

- "Information or evidence that the master or crew is not familiar with essential ship-board operations relating to the safety of ships or the prevention of pollution, or that such operations have not been carried out;
- Indications that the relevant crew members are unable to communicate appropriately with each other, or with other persons on board, or that the ship is unable to communicate with the shore-based authorities either in a common language or in the language of those authorities;
- Evidence of cargo and other operations not being conducted safely or in accordance with IMO guidelines.

Under the provisions of the STCW 95, it states that control exercised by the port state control officer (PSCO) will be limited to

'assessment of the ability of the seafarers of the ship to maintain watch keeping standards as required by the Convention if there are clear grounds for believing that such standards are not being maintained because any of the following have occurred:

- .1 the ship has been involved in a collision, grounding or stranding, or

- .2 there has been a discharge of substances from the ship when underway, at anchor or at berth which is illegal under any international convention, or
- .3 the ship has been manoeuvred in an erratic or unsafe manner whereby routeing measures adopted by the IMO or safe navigation practices and procedures have not been followed, or
- .4 the ship is otherwise being operated in such a manner as to pose a danger to persons, property or the environment.”

Furthermore, if deficiencies are found during the course of a ship inspection the PSCO will further assess whether crew is able to safely handle or operate the ship throughout the forthcoming voyage as well as to perform their duties in case of emergency situations such as fire-fighting, ship-abandoning and pollution-preventing. The ship will be strongly considered for detention if the result of any of these assessments is negative.

Almost the same points have been stipulated in the Tokyo Memorandum. They all demand that the crew do substantially meet the requirements of a relevant instrument, or the master or crew are familiar with essential shipboard procedure relating to the safety of ships or the prevention of pollution.

### **3.1.4 Others**

#### **➤ SOLAS**

Besides the ISM Code, the SOLAS Convention and later amendments have imposed other requirements for the training of seafarers. But they are not in clear order. For example,

Regulation 19 of Chapter III states that on-board training in the use of the ship's life-saving appliances, including survival craft equipment, and in the use of the ship's fire-extinguishing appliances shall be given as soon as possible but not later

than 2 weeks after a crew member joins the ship. On-board training shall be recorded in the log-book.

Regulation 3 of Chapter VI states that the Administration shall take steps to ensure that crews of ships are trained in the use of such instruments (oxygen analysis and gas detection equipment).

Regulation 4 of Chapter XI states when there are clear grounds for believing that the master or crew are not familiar with essential shipboard procedures relating to the safety of ships, PSC officers will control the ships. This hints at training in familiarisation.

➤ **IMO: Inert Gas Systems (1990)**

Many IMO publications deal with training. One of them is *Inert Gas Systems* which was published in 1990. Section 10 titled with Training states that training in use of IGS for the tanker safety is essential and the requirements for training depend on the policies of the shipping company concerned as well as the Administration.

It is recommended that the training of both deck and engine-room personnel be co-ordinated to ensure a common understanding of the procedures

Because of the importance of operation of IGS, the Guidelines give an alternative location of training: aboard or ashore. “If shore training in basic design and operation is given, personnel should be made familiar with the equipment on board ship.” So no matter wherever the training takes place the theoretical and the practical aspects should be dealt with.

The training methods are also mentioned in the Guidelines in that there are currently three methods used in training: On board by shipping company staff, Specialist shore-based training (This may be undertaken by nautical colleges, either in consultation with shipping companies or with manufactures.) and shore-based by shipping company staff.

➤ **ILO: C147 Convention and R37 Recommendation**

Merchant Shipping (Minimum Standards) Convention, 1976, namely C147, entered into force in 1981. The objective is to promote each member to undertake legislation and jurisdiction over ships flying its flag and ships in its territory. Each member should 'ensure that seafarers employed on ships registered in its territory are properly qualified or trained for the duties for which they are engaged, due regard being had to the Vocational Training (Seafarers) Recommendation, 1970'.

R37 Recommendation is Vocational Training (Seafarers) Recommendation, 1970 for short. It makes clear objectives of training, organisation, training programmes, training methods and training schemes for seafarers. Though the Recommendation addresses the member states, it still needs to be implemented through maritime schools or shipowners. Part VI is concerned with 'advance training' which is obviously the requirement to the shipowners. It states that

- (1) Retraining, refresher, familiarisation and upgrading courses should be available as required for suitable officers and ratings to enable them to increase and widen their technical skills and knowledge, to keep abreast of technological changes, in particular in the development of automated ships, and to meet the requirements of new methods of operations on board ship.
- (2) Such courses may be used, for instance, to complement general courses and provide advanced specialised training opening the way to promotion, as well as to provide advanced electronics courses for appropriate personnel.
- (3) Special attention should be given to the ability of masters, other officers and ratings to navigate and handle new types of ships safely.
- (4) Where training would be facilitated thereby, shipowner should release suitable seafarers employed on board their ships for training periods ashore, at appropriate schools, to enable them to improve their skills, learn to use new techniques and equipment

and qualify for promotion. Persons in a supervisory position on board ship should take an active part in encouraging such training.

The responsibility of a shipping company is, therefore, to set up a training system, to well organise seafarers for post-graduate training and to make decisions whether training is to be undertaken on shore or on board.

### **3.2 Chinese National requirements**

In implementation of international conventions ratified by the Chinese Government, the Administration has promulgated a series of regulations relating to seafarers' training, examination and certification. Among those, Regulations on Examination, Assessment and Certification of Competence for Seafarers of the People's Republic of China is the most essential one. Of fourteen Chapters, Chapter XI is concerned with responsibilities of companies.

There are six articles in the chapter. They require the company to establish the archives for seafarers so as to ensure that their employment, training, safety and technical competence check, application for examination, assessment and certification shall be controlled in a continuous and effective way.

"When assigning a seafarer to serve on its ships, the company shall ensure that:

1. The seafarer holds an appropriate Certificate of Competency in accordance with the provisions of these Regulations and the applicable safe manning requirements of the Administration;
2. The seafarer is familiarised with the specific duties and all ship arrangement, installation, equipment, procedures, characteristics and limitations in relation to their routine or emergency duties; and
3. The seafarer can effectively co-ordinate his/her activities in an emergency situation and in performing functions vital to safety or to the prevention or mitigation of pollution."

Other provisions in the Chapter state that the company shall provide masters with written instructions to stipulate the relevant policies and procedures to be followed so as to ensure that each new seafarer shall be familiarised with the shipboard equipment, operational procedures and other arrangements for correct implementation of his/her duties before actually performing the duties. Designation of a knowledgeable seafarer who shall be in charge of others and ensure that an opportunity is provided for each newly employed seafarer to receive essential information in a language he/she understands should be made.

From the above international and national requirements, one can expressly see that shipping companies today have a lot of work to do in meeting the challenge of change. But do they understand themselves? How to deal with the concrete issues? How to deal with the relationship between safety and cost? These questions are worth being considered by shipping companies.



## CHAPTER 4

### A review of current situation of shipping companies in China

#### 4.1 The role of the major shipping companies

Shipping in China has a long history and has brought much benefit to the country. In the last two decades the economy in China has increased rapidly and the globalisation of economy has brought China into the trading circle of the world. The volume of goods imported/exported has gone up dramatically. The industrial expansion has increasingly created the maritime transport requirements. By the end of last year, there were about 220 shipping companies registered in China, more than 10% of which operate 10 or more vessels. Now China is the fifth maritime country in the world, according to the report made by UNCTAD.

According to the statistics made by the Ministry of Communications, the annual turnover of sea-borne cargo transport from 1991 to 1997 is shown in Figure 4.1. Ocean-going cargo transport in 1997 increased more than 40% in volume, the average distance was about 3,959 miles.

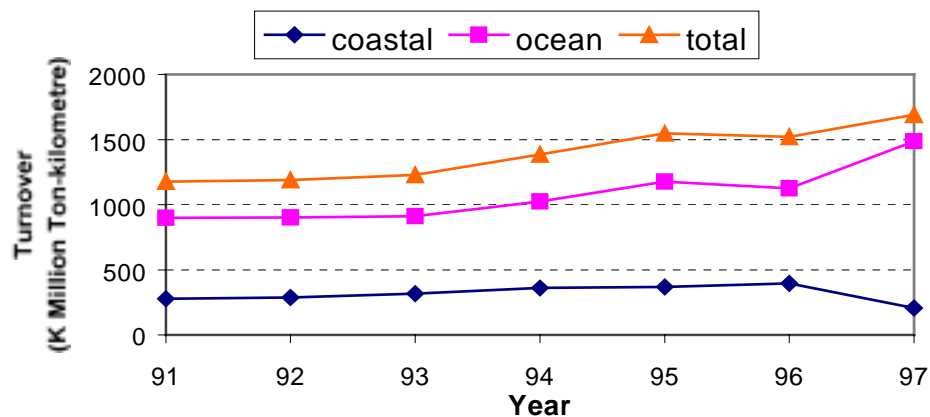


Figure 4.1: 1991-1997 Seaborne Cargo Transport Turnover in China

Currently, COSCO Group and China Shipping (Group) Company are two top leading companies. Each of them has several branch companies or specialised companies. About 1,000 vessels are owned and operated by them. The carrying capacity of their fleets is more than 25 millions dwt, about 67% of the total Chinese fleet. These two shipping (group) companies in sea-borne cargo transport have played, and are still playing, very important roles. They undertake over 80% of the total ocean cargo transport and coastal cargo transport.

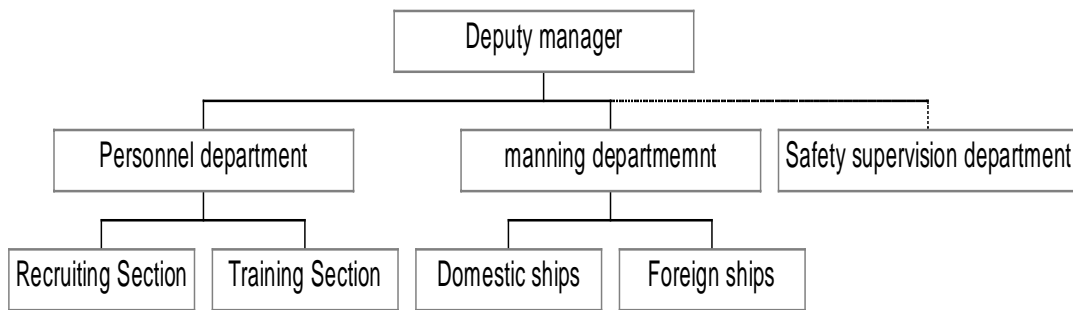
COSCO Group now has become one of the top ten shipping companies in the world. The container fleet and bulk carrier fleet is the fifth and the first place in the world respectively in the last year.

To supply a speedy, high grade and reliable service to the national foreign trade, and to make themselves competitive in the world, the shipping companies like COSCO Group need to retain, train and attract competent seafarers.

## **4.2 An analysis of current training systems**

### **4.2.1 Structure of training system**

Generally speaking, a structure that relates to seafarers' recruiting and training is no different in most shipping companies in China. A deputy manager (or vice president) is in charge of training for both shore-staff and seafarers (See Figure 4.2). But two departments, namely personnel department and manning department (sometimes called manning corporation), usually deal with training and recruiting of seafarers. So good co-operation between them is well needed. The Safety Supervision Department is not in the subsystem, but it is also involved in the training of seafarers. The personnel in this department know safety issues on board and deal with the safety management. In large companies such as COSCO Group, there is an Education and Training Committee that consists of deputy managers in subordinates and heads of maritime institutes. They meet once a year to review the last year's training, solve the problems and set a target for the coming year.



**Figure 4.2:** Basic Structure Relating to Seafarers' Training

#### 4.2.2 Regulations related to training

Training policy is a basic element that is written in the company's strategic plan. Most shipping companies in China, which are impacted on by the ISM Code, have had established training systems, some of which are incorporated in SMS. These training systems include the training procedures, organisations, responsibilities and recording methods. All training activities should be conducted in accordance with the documents. Each company has also stand-alone documented training regulations that state who should be trained, what sort of training should be undertaken and how training should be conducted, that are supplementary to the SMS. One company for example, besides formal regulations, has a One-Thousand-Item Inspection Checklist that contains training aspects. These regulations and checklist have played important roles in training of seafarers in China.

However, training items in the document or training policies are, in most companies, related to the certification of seafarers. A few companies have tailored training programs for seafarers' professional development, including updating of knowledge programs and familiarisation of new equipment programs. Assessment however is always done by the Administration and trainees must pass the examinations to qualify for certification. Onboard training is mentioned less in those documents.

### **4.2.3 Organisation of training**

According to the training system in each company, organisation of training, in general, is one of responsibilities of a personnel department. The department plans and determines training schemes for seafarers on the basis of the current situation such as new ships, the change of posts or certification of STCW. Sometimes the manning department (or corporation under the company) puts forward an outline of training, but it needs the personnel department to approve it. Fewer requirements come from the safety supervision department. All training schemes are carried out by the personnel department, which selects the training institutes and makes a budget for cost-control. In some shipping companies, manning departments (corporations) undertake the selection of seafarers for training.

Many companies spread some reading materials and videotapes relating to safety or generic topics such as English learning to ships under their control. Monitoring onboard training is little mentioned. The motivation and effectiveness are obviously poor. According to the results of the questionnaire made by the author, one company does not think that onboard training is necessary. So onboard training is a weak domain in the current situation.

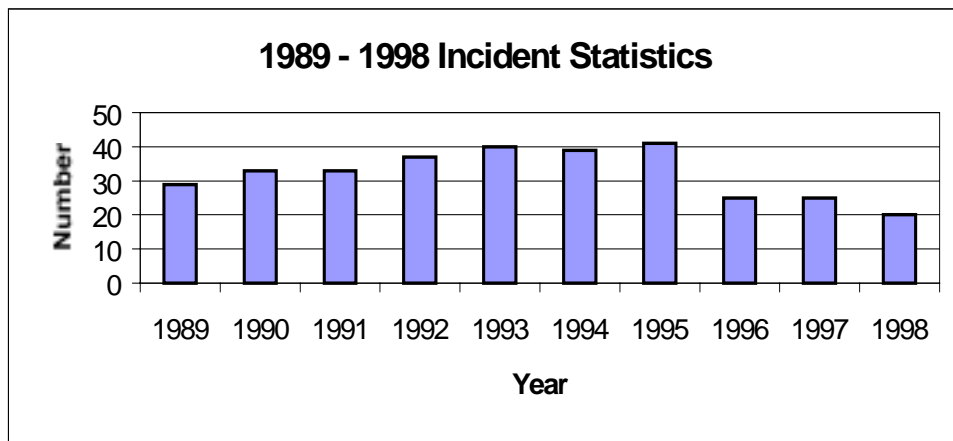
### **4.3 An analysis of current seafarers' competence**

Identification of weaknesses and shortcomings of seafarers, which can be overcome by training, is a primary procedure to improve effective training and make better training programs. While learning lessons from incidents always makes training effective, among all factors, human error is a focus recognised by the industry. An analysis of current seafarers' competence is right to aim at decreasing the possibility of human errors as far as possible and find what should be done for safe ship operations, not for reactions in emergency situations but for pro-action in advance. So the analysis hereinafter is concentrated on the weaknesses and shortcomings.

Human errors can be summarised as three categories: knowledge-based, skill-based and rule-based errors. Additionally, the English language, recognised as a

common working language internationally, is a special issue for non-native speakers, as well as Chinese seafarers.

Figure 4.3 shows the number of incidents in a shipping company in the past ten years. Some of them were very serious. The chart shows that the number is decreasing but the causal factors behind the incidents need to be analysed and considered. The following cases mentioned are abstracted from those in 1998, if not indicated.



**Figure 4.3:** Statistics of Incidents in a Shipping Company

#### **4.3.1 Professional knowledge and understanding**

Seafarers in China by and large have adequate proficiency in professional knowledge and understanding, but they differ between different groups. Those who graduated from maritime colleges are better than those who have not received the years' professional education and training. Moreover the development of new technology in the shipping industry has changed the traditional approach for the safe operation of ships, which was simply relying on the seafarer's 'experience' without more theoretical analysis. Besides GMDSS equipment, the integrated navigation system has been introduced to the Chinese fleet. The result of competition amongst shipowners has brought higher requirements to seafarers such as one-man-bridge operation, and skills required for serving on different types of ships. Seafarers' training, on the contrary, has not kept pace. By the end of last year, for example, only

27% of the seafarers (officers and marine engineers) in a typical shipping company could operate desktop computers, that are common on modern ships. Those in other companies are less than this figure.

Knowledge based errors and rule based errors still happen in recent years, higher than should be. Looking at last year's incidents in a large shipping company, it is clearly seen what lessons should be learned from those.

- ❖ It is surprising that in the morning of 13<sup>th</sup> August 1998, the vessel contacted the stern of another one during overtaking in clear weather in the open sea, and the OOW did not know that at first until the other vessel called him by VHF.
- ❖ Over 75% of incidents in the last ten years are attributed to human factors. Among them, over 50 % are collision cases, and in the statistics of the last year, 3 out of 4 are related to collision or contact incidents.
- ❖ Four vessels violated local rules such as traffic separation schemes and ship reporting systems in foreign waters. Three of them involved the masters on board.

Collision incidents are often seen in the shipping industry. Some of them are due to skill based errors, but most of them are due to knowledge (or rule) based errors. One company in recent years has examined all navigation watchkeeping officers, including masters, in the COLREGs, in order to improve their ability in collision prevention, and has supplied ships with accident videotapes. However, was the approach satisfactory? Were effective training and assessment methods used? Were there any records for individuals' outcome?

#### **4.3.2 Practical (Operational) skills**

The current seafarers (officers) were trained under the maritime education and training system before 1997. The former system, under the prevailing knowledge based idea, lacked adequate skill training for seafarers. Persons in the maritime institutes placed the skill training on shipping companies, though they did some skill training in their laboratories and on the simulators. Training on board also lacked

monitoring and proper assessment. Seafarers had to acquire their practical skills by observing others and accumulating their experience little by little. Thus the systematic learning of navigational skills was not achieved. The probability of incidents was higher. The following cases revealed some evidence, which might be grouped as skill based errors:

- ❖ One container ship, with the capability of 3,800 TEU, was proceeding to the Yangtzi River in January 1998. When passing through the light-vessel at the River Entrance, she collided with it due to the master's improper manoeuvring.
- ❖ A very serious accident, which happened in 1998, was the sinking of a bulk carrier in the South China Sea. Because there was a lack of emergency drills on board, the seafarers could not deal with the danger effectively.
- ❖ A third officer was in charge of navigational watch for the first time. When the ship was sailing near some islands, he did not call the master and grounded the ship. Obviously, the third officer needed onboard training under supervision of senior officers or masters in order to get some useful experience and be familiar with bridge procedures.
- ❖ During the first ten months, there were 592 vessels inspected by PSCOs. Among 11 detention cases, about half of the vessels were found to be deficient in emergency equipment and that emergency drills were not carried out.

Liu Shi (1998) summarises that emergency drill records on board often show evidence that they have been done but not taken seriously. They cannot withstand inspections on the spot. So motivation and attitude of seafarers are very important factors when training for emergency response.

Other lessons to be learned are that structured on-the-job training should be established and monitored, and assessment methods on board should be effective in order to increase seafarers' motivation.

### 4.3.3 English language

With the implementation of the "open-door policy" and the development of output of labour, the proficiency of English language, mainly maritime English, is becoming more and more important for Chinese seafarers. Many Chinese shipping companies and crew management agencies are seeking to send more seafarers to serve on foreign-flag vessels, even multinational manned ships. Therefore, a common working language is an important key element in the safe operation of a ship. The bridge resource management principles emphasise crew interaction, communication and decision making. Ayeko (1997) has noted that "the ability of officers and crews to read and understand operating and safety instructions and their ability to interact effectively, to communicate with local pilots, with other ships and shore facilities in a common 'working language' is becoming increasingly important".

As an effective tool for communication, maritime English is required to a higher level. The STCW 95 states the issue clearly. Officers of the watch, for instance, in performing the function of navigation must be able to use the Standard Marine Communication Phrases (SMCP) and English in written and oral form. That means reading, listening, speaking and writing of English are basic requirements both for native speakers and non-native speakers. Not only should be navigational publications and messages in English relevant to the safety of the ship correctly interpreted or drafted, but also communications with other ships or coastal stations such as VTS centres (including pilots) should be clear and understood, as well as among multilingual crew on board.

Among Chinese seafarers, effective application of English language is a weakness, particularly for older seafarers, usually over fifty years old. This is why the Chinese government, shipping companies and maritime institutes are enhancing English language training, with more emphasis on spoken English.

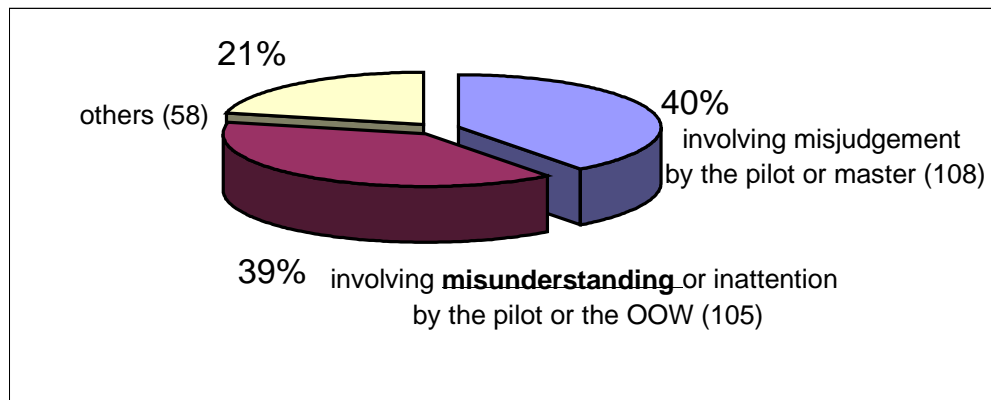
Some accidents were the result of misunderstanding between seafarers and other ships or coast stations. In 1995, for example, a Chinese bulk carrier, *Tuo Hai*, sailing in Canadian waters, did not understand the direction of an alteration of course



given by a local VTS station and consequently she collided with a Japanese fishing vessel, the latter sank about five minutes after the collision.

So, those having not filled the requirements of English language imposed by the STCW 95 are considered to be incompetent.

Between February 1981 and December 1996, in accordance with the Transportation Safety Board of Canada, among three hundred and sixty-one occurrences involving vessels in Canadian waters, there were 271 (75%) involving human factors. The most significant factors attributing to the 271 cases were identified as shown in the following chart:



**Figure 4.4:** A Breakdown of Human Factors

Now one can see that more than one-third occurrences were mainly caused by verbal communication. These lessons should be also learned by Chinese seafarers.

One of the largest shipping companies in China has established an assessment system for a seafarer's English proficiency. Seafarers are divided into six categories, ie from OSs (ordinary sailors, Level 1) to masters (Level 6). The approach of assessment consists of three ways, namely written (including reading, grammar and writing), listening and speaking. From September 1996 to November 1998, there have been totally 14 times of execution of such assessment. The results are shown in Table 4.1.

Though the assessment system is not perfect, it can still reflect some aspects that really exist in the shipping company. Level 1 and 2 are at the support level,

corresponding to the STCW 95, Level 3 and 4 are at the operational level while Level 5 and 6 are at the management level. Table 4.1 indicates that nearly half of seafarers assessed failed in examinations. This means that seafarers as a whole lack knowledge of English language. The problem confronting the shipping company is quite serious. Further analysis shows that seafarers at management level are more worthy of being drawn attention to. On one hand, seafarers at this level need intensive training. On the other hand, the difficulty of examinations needs to be modified, but it should not be lower than the standards. Nevertheless, English language training is, and will be, a key item in the training schemes.

**Table 4.1: Assessment Results (deck department)**

<b>Level</b>	<b>Number of seafarers assessed</b>	<b>Number of seafarers passed</b>	<b>Rate of seafarers passed (%)</b>
<b>1</b>	5	3	60.0
<b>2</b>	959	469	48.9
<b>3</b>	908	527	58.0
<b>4</b>	1,299	797	61.4
<b>5</b>	334	130	38.9
<b>6</b>	673	308	45.8
<b>Total</b>	4,178	2,234	53.5

#### **4.3.4 Management ability for senior officers**

Senior officers hereby mean the officers on board at management level, masters in particular. Those persons on board play key roles in the safe operation of ships. The ISM Code points out that the master is responsible for motivating the crew in the observation of safe and environmental-protection policy of the company.

So, masters are both leaders among crew on board and “bridges” between the company and crew. They do their jobs not only in technical matters but also in crew management (including training seafarers on board), cost management, risk management, etc. Therefore, their management ability is important. In Table A-II/2,

Section A-II/2 of the STCW Code, organization and management of crew is defined as one part of the senior officer's competence under the function of "controlling the operation of the ship and care for persons on board". The criteria for evaluating competence states that the crew are allocated duties and informed of expected standards of work and behaviour in a manner appropriate to the individuals concerned; training objectives and activities are based on an assessment of current competence and capabilities and operational requirements.

The Safety Management Systems have been established in most Chinese companies, but it is after all a new one to masters. The in-depth understanding and initiative implementing need to be improved. Management skills in dealing with cultural diversity of multinational manning should also be mastered when they are sent to serve on foreign-flag ships.

The key question is who will be responsible for and assess their training or upgrading of knowledge and skills?

In summary, from the foregoing, it can be seen that effectiveness of training in Chinese shipping companies needs further improvement, both in knowledge and in practice. Onboard training needs to be enhanced.

#### **4.4 Measures for implementation of the STCW 95 in shipping companies**

Since July 1995, the year of adoption of the STCW 95 Convention, shipping companies in China have taken some measures for the implementation in advance.

##### **4.4.1 Preparation for implementation of the STCW 95**

The understanding of the STCW 95 is a key element for implementation. But understanding should be achieved by everyone concerned, both seafarers and shore staff. Some shipping companies, therefore, have held special meetings to decide how they would keep up with the changes and what measures should be taken to meet the challenge. The identification of responsibilities in companies was undertaken. They disseminated relevant materials among seafarers and shore staff, and required them to be aware of the impact of the 'new convention' on shipping companies and

seafarers. The personnel departments in shipping companies contacted some maritime institutes for arrangement of training schemes with respect to the ‘new convention’. Those having their own training institutes or training centres have modified or changed some training courses. Some others revised the SMS to make sure that their responsibilities are fulfilled.

At the same time, China Maritime Administration was working out relevant regulations. Being bound objects, shipping companies put forward proposals positively to the Administration, not for reduction of their responsibilities, but for better co-operation with all parties involved.

As one knows, the ‘new convention’ is trying to make a globalized standard for seafarers’ performance on board. Thus co-operation with foreign shipowners and maritime organisations is one way to prepare implementation. So the China Shipping Group Company made an agreement with a Norwegian company in 1998 that they would jointly train Chinese seafarers for serving on the Norwegian ships. COSCO Group held the first Chinese Manning and Training International Conference last October in order to get better international understanding and co-operation. Many well-known organisations such as Videotel Marine International, International Shipping Federation (ISF), International Ship Managers’ Association (ISMA) and Wallem Shipmanagement Ltd. sent their delegates to attend the conference.

#### **4.4.2 Training practice**

Not only did shipping companies make preparations, but they also started to undertake the relevant practice. Most of the companies had made training schemes in line with the new requirements and speeded up the establishment of quality standard systems.

Training seafarers is a costly business, and increasing the budget is necessary for strengthening the skill-based training. Some companies have set up ‘Advanced Fire-fighting’ training bases while others are sending seafarers to maritime institutes to be trained.

One large company organised special training successfully in 1997, with the assistance of STN Atlas Marine Electronics, on the latest navigation equipment that was on their newly built ships. Besides this, it is also conducting some other training, for instance, GMDSS, tanker operation, and pre-examination training for certification in the light of new requirements.

Most Chinese marine engineers used to work on traditional ships where there were electricians. The matters related to electric equipment on board ships were usually dealt by electricians. So marine engineers had little skills and experience in this field. With the revision of the STCW 78, the function of electrical and electronic engineering today has been imposed upon marine engineers. Most shipping companies will not man ships with sole electricians. Now those marine engineers would not be well qualified according to new requirements. Therefore, some companies started to conduct supplementary training in consideration of functions in the STCW Code and national regulations, against the inadequate electrical or electronic knowledge and skills of marine engineers.

The English language once again is a hot issue among Chinese seafarers. Almost all companies in China pay much more attention to the issue. Some of them provide enhanced intensive training aimed at spoken English. Some companies apply additional tests when recruiting new seafarers from maritime institutes.

The issue concerned is the assessment of seafarers' outcome of training. Are seafarers trained or re-trained in effective ways? What is the efficiency, compared with the input efforts? For most shipping companies in China, assessment of seafarers is not addressed adequately. 'Compliance culture' is still prevailing in the current situation, compared with 'safety culture' in some leading companies in the world. Therefore, the tasks facing Chinese shipping companies need managers to consider well and make a long term training scheme as practical as possible based on the vision of the 21<sup>st</sup> century.

## **CHAPTER 5**

### **Change to training, new approach for Chinese shipowners**

#### **5.1 Impact of new technology on operation practices**

Developments in the use of information technology (IT) have increased dramatically in recent years. From daily life to the whole society, one cannot be involved with many things that are not related to IT. Carter (1989) defines that “IT is the use of technology to perform these information processing tasks.” The “processing” here means to capture the facts, to store them, to process them and to communicate the results of the processing.

The shipping industry, without exception, has been influenced by IT considerably. From ship design to operation, many organisations and companies are involved, such as designers, manufacturers, shipowners and operators, cargo-owners and brokers. The forms of transaction are being transferred from paper to paperless, from face to face to e-commerce. The purpose is to better assist customers and improve effectiveness and efficiency.

#### **5.1.1 Brief introduction to new technology in shipping industry**

##### **5.1.1.1 Review of the development of new technology**

Generally speaking, IT consists of mainly four aspects: computer technology (processing and storage), satellite technology (communication), audio-visual technology (capture and communication) and network technology (communication).

**Computer technology.** Since the first computer, ENIAC (Electronic Numerical Integrator and Computer), was invented in 1946, computer technology has developed rapidly, especially in the past ten years. Firstly, the Intel microprocessor is the core part of a PC computer. Its evolution shows the rapid

development of the technology (See Appendix 1). At the end of January of this year, the Pentium III was released, which at 550MHz extends processing power further by offering performance headroom for business media, communication, and Internet capabilities. Secondly, from the users' point of view, computers are becoming easier to operate. This means the man-machine interfaces are user-friendly, and software is user-oriented. Thirdly, memory storage capacity in a desktop PC is also increasing rapidly. The leading industry company, IBM, produced the world's highest capacity hard drive for desktop PCs, the Deskstar 25GP, in November 1998. The Deskstar 25GP offers capacities up to 25 GB running at 5400 RPM. A 25-gigabyte (GB) drive has 5,000 times the capacity of that first drive. Powerful solutions and innovations in desktop storage give many opportunities to develop applications for the workplace and home. Lastly, Virtual Reality (VR) is another significant technology in the computer industry. It can simulate the life-like environment and test what may more rarely happen around us or what cannot be seen in normal ways. So, computer technology, the basic or cardinal part of IT nowadays, has been, and still is, developing astonishingly.

**Satellite technology.** In modern society, information has been considered as globalisation. To facilitate the users or to get a better transmission of information, the satellite was introduced. However, the current satellite (GEO) systems are not ideally suited for voice network (GEO: 35,880 KM high and 0.24 second delay for one way communication), or for other delay sensitive applications. Therefore, the Low Earth Orbit Satellite (LEOS: 500 - 5,000 KM high and offering global coverage but more satellites needed, 0.01 second delay for one way communication) has been developed for two-way interactive telecommunication applications.

**Audio-visual technology.** The significant use of audio-visual technology is in TV series. Modern Digital TV (DTV) can provide a movie-quality TV signal (from analogue to digital), CD-quality sound and sharper (ultra-sharp) pictures, multicast digital programming (up to four standard-resolution programs to be broadcast on one channel), giving wide-screen pictures. Digital TV can work with, or incorporate computers, and the standard provides for cable and satellite transmission

as well as terrestrial broadcasts. Its system can also send high-speed data to receivers along with pictures and sound.

‘TV at sea’ gives another picture of audio-visual technology.

The digital camera can easily put pictures into a computer system. One can send some pictures taken in an emergency situation to the experts far away to get help or advice.

**Network technology.** Communication refers to the transfer of messages in the form of electromagnetic signals, and ranges from satellite broadcasts and computer-to-computer communications, to the ordinary telephone.

There are many kinds of networks being used in information transmission. Among those, the Internet is now often used, coupled with ISDN, and it is the most effective and the broadest network in the world. Some people describe it as an “information highway”. Established in 1969, (but with the first international connection in 1973), the Internet has been, and is still being, developed rapidly. The growth of Internet may give us a clear picture. In 1992, there were about one million hosts. However, this had reached 10 million in 1995. According to one survey (Zakon, 1999), it had reached over 43 million in January 1999. The services on the Internet, as the Information Society Initiative (ISI, 1996) stated in the *Development of the Information Society*, are basically in communication, publishing, distribution, marketing and transactions. One can use the Internet now to buy something by on-line shopping, to send an e-mail, to make a call by Internet phone, to buy and print stamps via e-stamp, to deal with business via e-commerce, to attend a conference by video conferencing, to ‘talk’ with one’s family or friends in remote regions by IRC, etc.

#### **5.1.1.2 The applications of new technology in the shipping industry**

Modern ships are based on the use of IT. They are getting more and more specialised. In broad sense, however, a modern ship is not only a vessel herself but also concerned with advanced equipment and manning. One article, titled *One-man*



*Watch Row Splits IMO Committee*, in *Compuship* (June/July 1998), describes modern ships as being characterised by the following aspects:

- Incorporated new bridge layouts,
- Special equipment,
- Innovative on-board organisation, and
- Specially trained personnel.

For deck officers newly designed ships are centred on three aspects: IBS and INS, unmanned engine room (24 hours) and computer network (high degree automation and information processing).

**IBS and INS and other shipborne equipment:**

Integrated Bridge System and Integrated Navigation System are newly developed technology in ship design and building. Like the aircraft cockpit, the systems allow deck officers to operate the ships more efficiently, reduce their workload and give them more reliable and accurate navigation. Consequently, a reduction of the human errors has been achieved. IBS has been defined as a combination of systems that are interconnected to allow centralised access to sensor information or command/control from workstations. It consists of the INS, the integrated control system such as cargo handling and communication, and the individual steering and propulsion controls. The INS, as defined in the IMO document comprises three levels, namely INS A, INS B and INS C. The INS A is involved with ship heading, speed, position and time. Position is the most important parameter in safe operation of a ship, which can be given as a MPP using Kalman filter technology. INS B is involved with INS A as well as chart (including ECS) and ECDIS, radar and ARPA, and depth of water where they could affect safe navigation. INS C is involved with INS B as well as autopilot and heading and track control. A central processor in a workstation controls all of these.

For example, the world leading shipborne equipment manufacturers give more bright pictures on the integrated systems:

- Atlas: NACOS xx – 3 series, which is the third generation, with common workstation technology for Multipilot, Chartpilot, and Conningpilot as well as Watch – One Systems.
- Norcontrol: DataBridge 2000 can be connected with shore-based LAN in addition to navigational multi-functions.

**Ship Control Centre (SCC)**, produced by SNT ATLAS, is the integrated or a complete nautical bridge; the scope of work involves shipyards and shipowners.

The key performance factors of the second generation are as follows:

- ◆ Centralisation of nautical information and alarms
- ◆ Immediate redundancy in the event of a failure
- ◆ Integrity and commonality of data and parameters
- ◆ Access to all data from various workstation
- ◆ Automatic safety check of navigation data with the electronic chart
- ◆ Visual fusion of radar, chart and manoeuvring information.

On February 12, 1998 - Litton Marine Systems has announced the introduction of a new navigation system, where has been designated ECDIS-radar, that superimposes live radar video output over an Electronic Chart Display and Information System (ECDIS) in a single integrated picture.

Unveiled recently by Racal, the Tracs-SAT/C marine system, which is a new ship tracking system capable of relaying detailed position and status information from ships operating in remote locations, can be used to transmit vessel data such as engine performance, bunker levels and cargo condition to company control centres by utilising software to obtain input from onboard sensors. The system is designed so small that one can carry it in his/her bag. When running in normal mode, the unit transmits the vessel's progress and performance ashore at pre-determined intervals. A GPS receiver integrated with an Inmarsat-C transceiver is the feature of the unit.

**External ship control and tracking services:**

External ship control and tracking services also describes the whole picture of applications of new technology in the shipping industry. WWRNS and VTMS are representatives.

WWRNS: accepted by IMO in 1995, the World-Wide Radionavigation System (WWRNS) for maritime users comprises two sections, Satellite Navigation Systems and Terrestrial Navigation systems. Currently satellite navigation systems include GPS (DGPS), GPS-SPS, GLONSS, INMARSAT and GNSS-1. The future Global Navigation Satellite System (GNSS) is now being under consideration, and will improve integrity, availability, and control and system life expectancy. The system will enable shipborne equipment to provide the user with information on position, course and speed over the ground, have a data-link capability (e.g. for updating ECDIS) and meet the requirements for interoperability with the shipborne GMDSS equipment.

VTMIS, together with the AIS, presents reliable vessel control and safe navigation, especially at harbour areas and other confined waters that are within VHF coverage. VTMIS (vessel traffic management and information service) can respond to public and private demand to facilitate vessel traffic management, and distribute the pertinent information to be used both in real time and in retrieval modes by actors involved. All ships, equipped with an AIS transponder, can receive that information such as ship position, speed over ground, name, call sign, heading, course over ground, rate of turn. The VTMIS-NET, a European project, is an undertaking, which can operate on a European level to increase the efficiency of such services and their information flow. In addition, potential use of AIS on board will provide shipowners with worldwide fully automatic intermittent position reporting via satellite communication equipment such as Inmarsat C/M.

**A new concept: “Office at Sea”:**

One article in Ocean Voice (1999) states that “a number of Inmarsat LESOs have implemented systems whereby users of most shipboard Inmarsat terminals can access the Internet using a simple two-digit code.” Using this method, with the aid of Microsoft Window 95, direct access via Inmarsat can be obtained to Internet e-mail service, the World Wide Web (www) and any relevant intranet networks. This means that ships will be in exactly the same position as shore-based offices and other users

with Internet access. The article also predicts that “shipboard access to the Internet will soon be as commonplace as access to satellite telephones has already become.”

P&O Nedlloyd have introduced e-mail communication to their fleet. The vessel, P&O Nedlloyd Kobe, reports her voyage diary to the company, and then the messages are put on the Internet. One can share and enjoy the life with the seafarers. However, they do not allow seafarers to access the Internet directly. P&O thinks that the Internet access via satellites endangers all shipping. One wrong character can take a satellite out of service and this means no ships in that area can send messages, especially in an emergency situation. Another reason is that the stability of the computer would be taken out if a virus were downloaded. So the use of the Internet at sea is still under discussion. Owners are also concerned of possible cost implications.

The experience of Hapag-Lloyd shows that ‘office at sea’ is possible and effective. An integrated ship management system is a multi-user system with a decentralised structure on the basis of a local area network (LAN). The main aspects are concerned with the following:

- Ship’s safety and cargo handling
- Servicing and maintenance
- Diagnostic systems
- Electronic log management
- Office automation
- General documentation
- Long-term data storage

**Ship communication:**

A survey undertaken by Inmarsat into satellite communications usage has forecasted the fall of telex and the growth of data transmissions. It is estimated that more than 6,000 ships are using some form of ship-management application tool or hub e-mail, telex or fax network. It revealed that a surprisingly high proportion of ships have modern PCs on board. The single biggest area of cost savings identified

was in communications, with use of e-mail generating savings over use of voice and telex.

Satellite communication (SATCOM) by ships at sea is now considered a revolution in the shipping industry. The Globalstar, Iridium, ICO, INMARSAT and so on are examples.

The **Globalstar** system, comprising 48 low-earth-orbit (LEO) satellites and a global network of ground stations, will allow people around the world to make or receive calls using hand-held, vehicle-mounted and fixed-site terminals, and also provide data transmission, messaging, facsimile and position location services. The expected service will start in October 1999.

The **ICO** satellites will communicate with existing communications networks such as public-switched telephone, mobile and data networks through the ICO developed and managed ICONET. It will provide digital voice, data, facsimile, messaging and information services through a global distribution system. The communications will be by a hand-held terminal, similar to current mobile phones. It will fully start in October 2000 with 12 satellites (10 operational, 2 spare).

With its long experience, **INMARSAT** is now utilising the latest Inmarsat-3 generation satellites to provide customers with overlapping operational coverage of the globe (apart from the extreme polar areas). Each Inmarsat-3 satellite also operates a number of spot beam "cells". This enables the satellites to concentrate extra power in areas of high demand and to provide services to simpler terminals. Roaming users communicate directly via Inmarsat's satellites. For maritime purpose, INMARSAT A, B, C, D, M and Mini-M are widely used equipment.

This operational status requires the crewmembers who operate ships on the bridge to have more knowledge and skills. Not only do they traditional navigation tasks, but also they have to do other navigation-related tasks, with the aid of that equipment and services, such as communication and control of the engines, even control of the whole ship.

### 5.1.2 Applications of new technology in MET

**CAL** (computer assisted learning) has been known for many years. Its application in maritime education and training is being developed rapidly. In particular, **CBT** (computer based training) has been used as a better method for improvement of seafarers' competency and **CBA** (computer based assessment) has also been used to evaluate achievements of seafarers' training. Their effectiveness has brought benefit for both maritime institutes and shipping companies as well as trainees themselves.

Vanstone (1997, p63) summarised the advantages of CBT, stating that little or no assistance is required from the trainers during their operation, that trainees proceed at their own speed, without any pressure coming from trainers, and select or concentrate on what they really need. It supports training directly in the workplace during the training period. At the same time, CBT increases retention by up to 80% and reduces training time to almost half.

Now with the advent of technology, the concept of CBT has been developed to a broad sense that it can be used to educate learners. A number of unique stand-alone CBT modules that can be grouped in a variety of constellations to form different types of educational programmes can provide a combination of text, illustrations and drawings, supported by sound, animation and video. The so-called training programmes are just parts of it though it is not mentioned specifically. Knowledge and skills for seafarers (officers in particular) today cannot be separated distinctly.

A big problem is that there are not enough adequately tailored programmes for each individual or a group of trainees.

**Simulator** based training is not a new thing. However, with the application of new technology in MET, it has become more powerful and effective. Simulators have been upgraded from single-task model to multi-task model and full-mission model with life-like sea view, day/dust/night/fog. Based on strong powerful PCs, a six-free-dimension simulator can make a 'virtual reality' of a modern ship with vivid sea environment. Besides training of students and seafarers, it can be used for

research work and to check contingency plans for pollution prevention since it is environment friendly.

Due to many advantages of simulators in maritime education and training, the IMO has taken it into account for seafarers' training. The STCW 95 is a good example. In Regulation A-I/12, ARPA and radar simulators are mandatory requirements for training. In Part B of the Convention, many other simulators are mentioned. This means these simulators will be taken as mandatory requirements in the not-too-distance future, such as cargo-handling simulator, ship-handling simulator and main-and-auxiliary-machinery-operation simulator.

There are many manufacturers that can produce full-mission simulators. The most well known are for example Kongsberg Norcontrol Simulation AS, STN ATLAS Marine Electronics, Ship Analysis, Sperry and Transas.

Norcontrol has developed the concept of "the total ship simulator" which means that a "total ship" environment can be created by linking several different simulator systems such as bridge simulator, GMDSS simulator and cargo-handling simulator. The total ship simulator gives trainees a 'realistic environment' as if they were on board a real vessel. Following the concept, VTS, SAR and OSM (oil spill management) can also be incorporated into the configuration, and enabling trainees (both onboard and ashore) to experience a life-like total maritime training environment.

One problem is that the psychological factor in trainees' mind may lead them to taking the training as a game. The other problem is that trainees may lose the feel for seamanship when they go on board in the future. Lastly, it is very difficult to change the layout or hardware when a new type of ship is built. So training on simulators is still general-function training, otherwise more money will be spent. Who can afford it?

**Distance learning via satellites and the Internet** is a significant gift given by new technology for seafarers at sea or maritime students in remote regions. Lanfranco (1999) takes it as an ICT-based (information and communication technology) distance learning. Different from conventional distance learning, ICT-

based distance learning can address learning activities to individuals, groups, organisations and communities, in the presence of ICT-based electronic venue, both asynchronous and synchronous in time. The approach provides learners, who are far from tangible colleges or ashore, with an opportunity to gain some knowledge and skills for their work in service. High-speed data transfer gives much help to develop the system.

The technology has opened a window for onboard training by means of distance learning. Muirhead (1995, p7) believes that much of the training for operational skills which is carried out in shore-based training institutions may be now transferred to the onboard environment, with the aid of new technology. The assessment of seafarers' competency to perform the necessary skills can also be done in the workplace. The innovative vessel operators are encouraged to take hold of the opportunity.

The development of IT is rapid. The application of IT in MET has had much impact on the traditional model and is changing people's concepts. To meet the challenge actively, not only should one learn about new technology, but one should also think about the future of MET. What courses should be shortened, based on efficient methods used in MET? How should students be taught, based on the state-of-the-art facility? What training should be offered, based on competency consideration? Vision is the basis of successful business. Think more; take most advantages of information technology.

## **5.2 Factors influencing a training system**

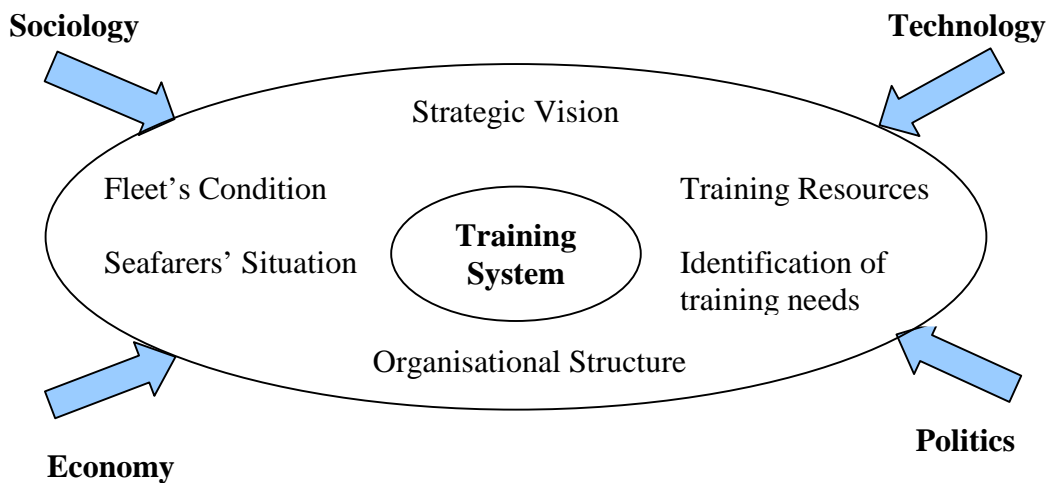
The factors that have impact on a training system are put into two main categories, i.e. internal and external. See Figure 5.1.

### **5.2.1 Internal environment and situation**

Internal environment and situation mainly is concerned with organisational structure, strategic vision of the head of the company, fleet and seafarers' condition, training resources and identification of training needs for each group.



**Strategic vision:** companies need strategic vision to make decisions on what directions they will march forward and how big they will develop and what objectives they will achieve. This policy has much influence upon the recruiting scheme and the training system.



**Figure 5.1:** Internal and External Factors

**Organisational structure:** training seafarers in a company might be done in a different way than in other areas. The departments involved are also different. So the whole training system may be different. At the same time, the structure of an organisation may affect the effectiveness and efficiency of training.

**Fleet's condition:** training of seafarers should meet requirements of the technical condition of ships. Therefore, the ages of ships and the types of ships need to be considered when developing training schemes. For example, in Chinese shipping companies there are a lot of ships built before 1980 and about one third of ships were built after 1990. So training policies should be made on the basis of the condition.

**Seafarers' situation:** training is to give all seafarers opportunities to improve their knowledge and skills. But different groups of seafarers have their own background and experience. Each individual training program should comply with their real needs.

**Training resources:** as mentioned in Chapter 2, training resources herein means trainers and trainees, training equipment and facilities, materials and environment.

**Identification of training needs:** in general, organisers must know what are the training needs of seafarers in their companies, based on which training schemes and programs can be made. For example, a Chinese crew needs more enhanced training in English language and computer operation skills according to the results given by shipping companies. What should the focus be for each group (level)? In addition, dual-purpose watchkeeping and IBS-orientated training courses should be widely considered.

### 5.2.2 External environment

External environment mainly involves sociology (or the industry), technology, economy and politics.

**Sociology:** the shipping industry's regulation, such as the STCW Convention and the ISM Code of the IMO, national requirements on shipping companies, the trend of multinational (cultural) manning across the world and fierce competition among shipping companies have much more impact on a training system. Quality standards and assurance system (or Safety Management System) should be set up in each shipping company to meet the stratified requirements.

**Technology:** the application of new technology in the shipping industry, such as new ship's design, advanced equipment (INS, GMDSS, Unmanned engine-room), communication systems via satellites, distance-learning technology and 'Internet shipping' have also much more impact on a training system.

To meet the challenge of new technology in ship operation, seafarers need integrated skills and capacities, both for safe operation of ships and for further professional development. As Muirhead (1992) pointed out, what should be considered are multi-skilling, integration of duties, expansion of skills, shipboard based computerised training programs and use of distance education methodology.

**Economy and Politics:** the growth of economy in the world or in a nation does not have an impact on a training system directly, but it influences the internal situation of an organisation, such as strategic vision, organisational structure and people's perceptive or attitude and their behaviours. The legal aspect and stability of the society may give managers different visions. So one cannot prevent being involved in these aspects.

### **5.3 The use of experience of others**

“A wise man learns from experience and an even wiser man from the experience of others.” So the use of experience of other organisations is one of the effective ways to develop or improve one's own training system.

#### **5.3.1 The Norwegian approach**

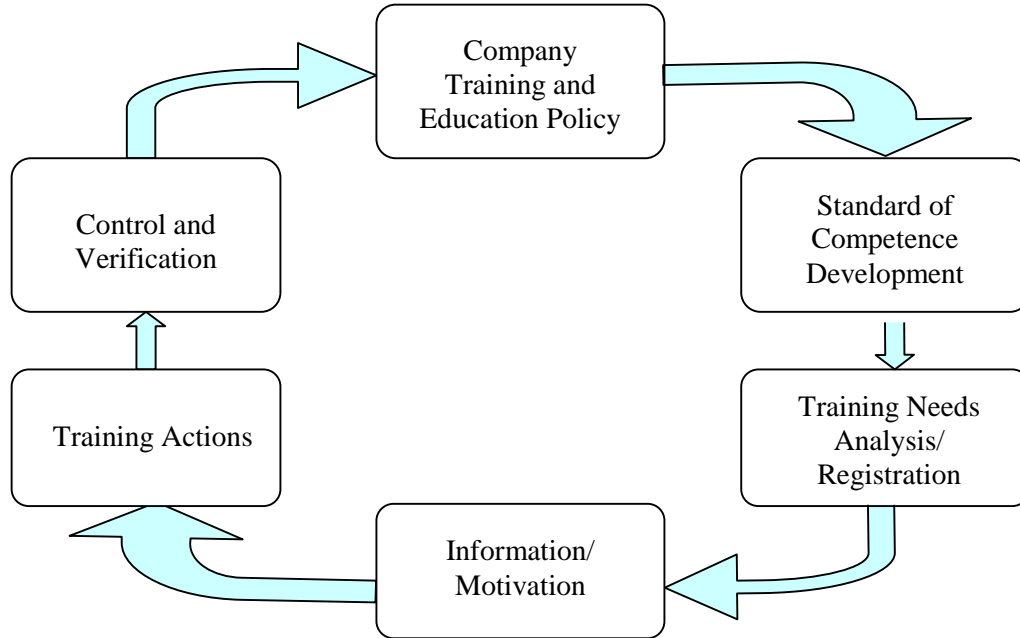
As a part of the Research Council of Norway's programmes, *Information Technology in Ship Operation*, the R&D project, namely Training, Recruitment and Selection, was carried out in three Norwegian shipping companies, described by Berg (1996), to test training systems, from 1994 to 1997. A baseline for an improved training system was developed (See Figure 5.2)

The company training and education policy is defined as in part of fulfilling the ISM Code requirements. The functional approach of the revised STCW Convention is a starting point for developing the company's specific standards of competence. Having set up the standards, the competence gap (training needs) for an individual crewmember can be identified by assessment in different ways. One of the most effective ways in the Norwegian system is computer-based training and assessment.

Three types of computer tools have been developed. They are

- ❑ The knowledge assessment database (CES2000)
- ❑ The Ability Profile (APRO)
- ❑ The Performance Profile (PPRO)

Having the necessary financial and human resources made available by the top management, it is time to design an improved, functional approach based



**Figure 5.2:** Baseline for an improved training system  
(Source: Berg, T E (1996))

training system where the training activities are the results of identified gaps between actual crew competence and the company's standards of competence. Following the intentions of the revised STCW Convention and the ISM Code, the training system should take into account that the best place for skill-based training is onboard through structured on-the-job training.

Training for a person, especially in the current society which is changing the ways of human's daily life and work, should be conducted in succession. A cyclic retraining principle in the Norwegian system therefore has been established based on the functional approach (See Appendix 2).

The project proposes that the training system will include:

1. Before signing on:
  - ❑ Competence assessment test (CES2000 or similar);

- ❑ Training plan based on available assessment results (test, onboard assessment records etc.);
  - ❑ Refresher courses on company policy and ship specific procedures including safety management system review.
2. Onboard:
- ❑ Familiarisation training (necessary level defined by previous experience from actual ship/sister-ship);
  - ❑ Structured on-the-job training enhanced by use of CBT;
  - ❑ Training record book (if relevant);
  - ❑ Continuous feedback from instructor/tutor/mentor.
3. Signing off:
- ❑ Company assessment scheme;
  - ❑ Recommendations for promotion, education and training courses to be passed before next sea service period (simulators, Bridge Resource Management course, supplier's courses etc).

The experience gained on the two case vessels shows that CBT modules should be used to enhance on-the-job training whenever possible. All officers involved had a positive attitude and proved that the programs were very beneficial as a learning aid and refresher tool for basics learned long ago.

The lessons learned from the 12 months' test period on the vessels are:

1. Initial CBT training could preferably take place onshore, at the company or manning agency office prior to embarkation;
2. Pre- and post-tests built into the CBT modules can be interpreted as part of the training activity and are thus less risky than the written tests;
3. Senior officers must recommend the system as a new tool to improve the competence of all crew members and thus increase the work quality and social atmosphere onboard;
4. The high work load on ships with short voyages prevents the full use of CBT as the time available for such onboard training is reduced;

5. Use of CBT modules should be expanded to vessel specific topics to fulfil the ISM Code requirements for familiarisation training.

In conclusion, the company's experience with onboard CBT systems indicates that:

1. the interactive training principles used in the CBT have been rated favourably by both senior and junior officers;
2. introduction to onboard CBT has increased the interest in ways to enhance onboard training in general;
3. training activities have become more focused and thus have paved the way for better preparation of weekly work plans;
4. the use of CBT has functioned excellently on vessels with long sea voyages;
5. the success of onboard CBT systems is closely related to the company management showing interest in the application of new training technology;
6. motivated senior officers will inspire the rest of the crew to work hard to improve their competence.

### **5.3.2 The Japanese approach:**

The private shipping companies in Japan such as "K" Line have their own training system for seafarers. The system consists of three parts:

#### **Part one: Training of seafarers with SMS**

In the company's SMS, there is the Safety Management Manual, which includes some procedures for seafarers' training, emphasising responsibilities and procedures relating to the SMS. See details in Appendix 3.

#### **Part two: Onboard Education (technical and safety/sanitation education)**

In this part, three aspects are covered, namely general aspects, on-board Manuals, and safety and sanitation. (Note: 'Education' is used in the original information.)

1. General aspects

With the aim to attain sufficient knowledge and skills to keep their watches, the company provides those, who are newly employed as ship officers/engineers, with training of three months on board ships as cadets on watch duty, application and clerical. For navigation officers, items in Table 5.1 should be covered.

**Table 5.1:** Three-month Onboard Training Program

Items	Contents
Mariner on watch duty	Maintenance of watch duty, measurement of ship's location and compass deviation, method of utilisation of hydrographic map and pilot, handling of navigation instruments, preparation of various records.
Application	Preparation for entry and departure from ports, watch duty for cargo loading and unloading, handling and operation of onboard facilities and machinery/equipment, security and first aid post.
Clerical	Preparation of various onboard documents.

2. Onboard Manuals (technical)

The principle for technical education is that crewmembers should strive to study on their own while performing their duties on board. However, the company also publishes various manuals and distributes them to each vessel to provide operating and technical guidelines and to enable crewmembers to function fully as part of the company in line with its policies. Those manuals include:

- ❑ Guidelines on the Code of Federal Regulations (CFR)
- ❑ Suez Canal Manual
- ❑ Practical duties for onboard labour
- ❑ Vessel Traffic Service manual
- ❑ Practice service manuals for exclusive ships

- Division bulletins (to inform all crew of the domestic and overseas laws, regulations and port information, bylaws and in-house policies on ship operation technology)
3. Education on safety and sanitation

Continuous safety education is conducted in such a way that:

The Central Labour Relations Commission for Seafarers drafts an annual implementation plan to prevent disasters. “K” Line Company publishes a guide on how to implement safety and sanitation measures on a daily basis, based on the Commission’s plan. Each ship also checks various implementation items once a month for safety and sanitation.

The Company also uses a safety reporting system independently to encourage participation in all fields of disaster prevention activities. It collects examples of accidents, and distributes them, together with comments of the head office person in charge of safety, to each ship. Safety measures are taken by each ship, if necessary.

### **Part three: On-land Education**

Two-days in-service training for newly appointed captains/chief engineers and other officers and engineers is conducted at the Head Office, on safety-centred courses as well as management on board. All seafarers are encouraged to select the English language correspondence course in order to improve their ability in using maritime English.

The “K” Line has its own training centre where all lecturers are crewmembers and teach seafarers new, practical knowledge.

### ***Analysis of the system***

It is not difficult to see that:

1. The training items relating to the SMS for officers and ratings will help them become familiar with the safety policy of the company and their responsibilities in the safe operation of ships.



2. Three-month “cadets” training will enhance the basic knowledge and skills of an officer of the watch and make their performance under the company’s safety culture environment.
3. The idea for the company to give its ships a guide on how to implement safety measures on a daily basis is good. But how does it combine with onboard training? The relationship between training practice and routine work needs to be well organised.
4. Learning from accidents is always an effective way for maritime education and training. The company distributes examples of accidents to each ship. It is possible to prevent the similar incidents in such a way. To train seafarers in skills that are lacking is a popular approach to using minimum requirements. However, to meet higher standards in the current situation, Formal Safety Assessment (FSA) for safer ships and pollution prevention is a better way. Prevention is always better than the cure and improvement of own safety system is better than that of only learning from others.
5. Technical manuals on board, of course, need operators – seafarers to read or study them carefully. This is a cardinal step to operate equipment or an instrument. Usually those manuals tell seafarers the basic procedures. One should follow them. How can they be used to train seafarers?

As one knows, a modern vessel is often fitted out with equipment from many manufacturers. The majority of the manuals are written in English. The non-native English seafarers must master the skills of the English language. Therefore, they can improve their maritime English proficiency when following manuals. Full utilisation of those manuals can bring more benefit for non-native English seafarers.

6. The issue that the author is particularly concerned with are assessment of seafarers’ outcomes and structured training schemes. CBT was not mentioned in the training programs. This is a weakness.

### 5.3.3 Others

➤ **An approach to systematic training:**

Holder (1997) makes a case for systematical onboard training in “*Training and Assessment on Board*”. Effective organisation of onboard training is required at three levels: trainees, shipboard management and shore-based management. He has identified the responsibilities of each role in a shipping company and on board ship, gives advice for trainers in their setting of objectives, use of resources, keeping records and the assessment of competence. For shore management of onboard training, Holder also gives some ideas and advice on producing clear company training policies.

Without any doubt, Holder’s points of view and his advice are highly consulted in general. However one should consider his/her own situation when improving the training system individually. Furthermore high standards of safety need highly competent seafarers besides minimum standards for certification.

➤ **Mearsk approach:**

The A.P.Moller Group, in which the Mearsk Shipping Line is one of its branches, has its own training system, which is specifically directed towards meeting the particular requirements of international organisations, and updates it constantly. Seafarers’ competence is evaluated annually by their immediate manager. All cadets have to go through a test programme for employment whereafter the actual practical training will be done on board one of the Group’s vessels. Both practical and theoretical training are arranged and managed by Maersk Training Centre.

➤ **USCG refresher training programme**

“Navigation and Vessel Inspection Circular No. 1 – 99”, issued by the USCG, provides a policy guidance on the content of approved refresher training programmes used to qualify candidates for renewal of licenses. It requires that the programmes, 40 hours at least, provide sufficient training to refresh trainees’ knowledge, understanding and proficiency in some areas. For deck officers, for example, the following subject matters should be addressed:

1. Bridge Teamwork Procedures/Bridge Resource Management (BRM);

2. Keeping a navigational watch;
3. Rest requirements/work hours;
4. Shipboard instruction and assessment;
5. Distress at sea;
6. New technology; and
7. National and International law.

#### **5.4 Improved training system for Chinese shipowners**

Keeping up with changes in the shipping industry and meeting the challenge of new technology are features of the successful shipping companies of today. How does a company achieve its goals? Bill Gates says, “continuous learning is about the only chance any organisation has to keep up with change.” Learning means adding to existing levels of knowledge and skills, with valuable things from others. Identification of strength, weakness, opportunity and threat (SWOT) therefore is a prerequisite for changing. But change never means to change one’s core value. It only means to better realise one’s objective. One can be successful on the basis of keeping one’s own characteristics and seeking for changes.

Human resources are the most valuable in any organisation. Improvement of a training system should also focus on developing the human’s competence effectively, namely seafarers’ competence in shipping company.

A new approach to the improved training system for Chinese shipowners is clear after analysis of the situations and others’ experiences. The following points should be considered.

##### **5.4.1 The principles and organisation**

1. The basic principles:
  - Strategic vision: incorporated with the aim of a company, taking long-term strategy into account. At the same time, the safe operation of current ships and capabilities of operation of new ships for seafarers need to be

analysed. What types of ships should the fleet have and what manning complements in the policy of a company should be made?

- ❑ Consideration of external and internal environments
- ❑ Investment in people: intelligent or highly qualified people are the key factors of success. Investment in people means investment in productivity. Being a shipowner or operator, he/she should not hesitate to make a budget for seafarers' training. Positive attitude is needed in defining the company training and education policy related to seafarers.
- ❑ Quality assurance: training seafarers without assessment and evaluation is invalid. Quality standards, working procedures and relevant policies need to be clarified in the documents such as SMS or ISO9000 series, etc.
- ❑ Creation of training environment on board: supply with the necessary equipment, tools, books (including electronic 'books') and co-operate with navigational aids suppliers to let them offer some interactive electronic manuals and corresponding CBT software. Or encourage some maritime institutes to make tailored CBT programmes for onboard training.

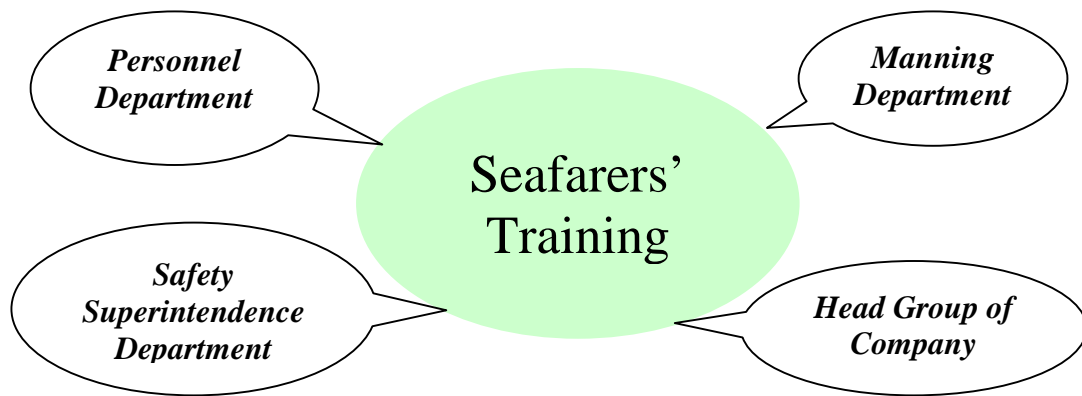
## 2. The organisational structure and responsibilities

As mentioned in Chapter 4, an achievement of an objective is based on the relevant organisational structure and internal co-operation. Greater efficiency is needed to review and streamline the organisational structure.

The departments (or groups) involved in a seafarer's training in a large shipping company are as below. See Figure 5.3.

**Head group of a company:** makes a decision on seafarers' training policies.

**Safety Superintendence department:** collects all incident reports, analysing accidents in order to find main causal factors at human being side, takes Formal Safety Assessment (FSA) related to shipboard operation and makes training proposals to the personnel department. It may also conduct an assessment and evaluation of the outcome of onboard training by supervising at the workplace.



**Figure 5.3:** Sectors Affecting a Seafarers' Training

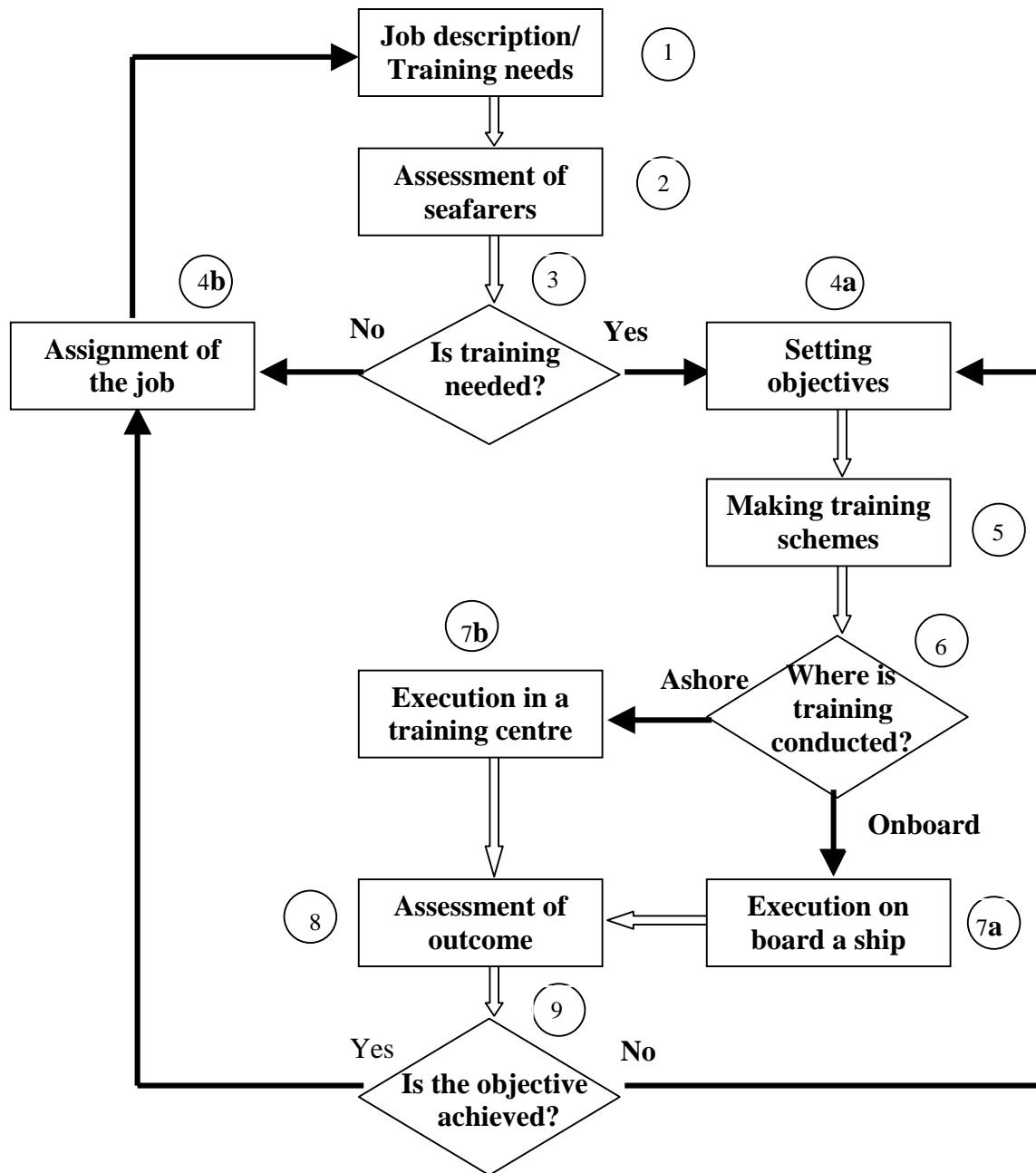
**Personnel department:** designates company training officers in the department, who are responsible for implementation of training schemes and overall administration of the programmes of the training, makes a general plan, budgets. Onboard training is a part of the whole training scheme. He/she should also be responsible for co-ordination between departments and make a link with maritime institutes as well as the maritime administration.

**Manning department:** makes clear that what shipowners' requirements on seafarers are and what the situation of the seafarers under its control is, and makes a proposal for the training of these seafarers if they think some seafarers need to be trained. On the completion of a period of assignment, they should also collect opinions from the shipowners or operators for the next training cycle.

3. Well structured schemes

Onboard training is a systematic engineering. The integrated consideration needs to be taken. McAnally (1997, pp46-47) states that a system approach to training is a methodology recognised as a quality system which aims at delivery of training required so as to ensure that trainees can carry out a specific job, duty or task in the operational environment. Therefore, four interdependent activities, namely job-analysis, training design, training execution and training evaluation, form an integrated body. Onboard training is of course included.

The starting point for a sound training system therefore is job-analysis or identification of training needs for each group (level). Figure 5.4 illustrates the procedures for organisation of training.



**Figure 5.4:** A Flowchart of Training Procedures

At the first stage, the Personnel Department, Manning Department, together with the Superintendent Department shall describe jobs for each post on board as detailed as possible. Some specific tasks should be given clearly, besides requirements imposed by the STCW Code and the SMS of the company. The questions are raised accordingly: are the seafarers to be assigned to the ships competent or qualified? Do they need to be trained? In this case, the following action will be taken, i.e. assessment of seafarers.

Having made the training schemes, onboard training programmes may be structured. Training officers on board, under supervision of the master, will be informed to organise and conduct the training.

When designing effective onboard training programmes, several factors need to be taken into account:

- ❑ Identification of essential aspects of training
- ❑ Preparation of curricula
- ❑ Selection of training ships
- ❑ Selection of trainers among senior officers
- ❑ Allocation of necessary equipment and training materials

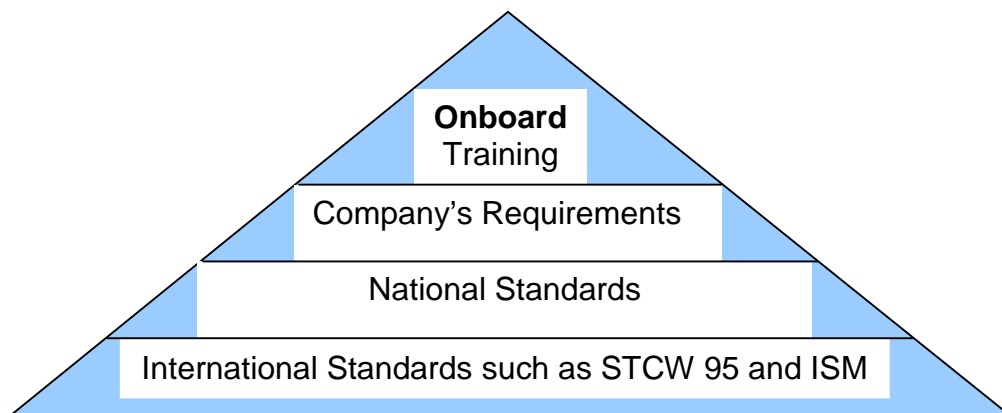
#### **5.4.2 Identification of essential aspects for onboard training**

##### **1. Standards or requirements**

The basic standards are the STCW 95 and other international regulations. This is the first level of priority for vessels engaged in international trade. Secondly, national standards that are broader require seafarers to have more competencies. Thirdly, on the basis of the statutory requirements, a shipping company puts additional requirements on seafarers for commercial purposes and long-term consideration by means of job descriptions. Onboard training is part of them. See Figure 5.5.

Parsons (1997, p180) notes from a priority point of view that three levels of priority are to be established. The first priority is training leading to a mandatory qualification, without which a vessel cannot sail. The second priority is the training

that provides the essential skills and experience to operate a modern vessel successfully, a far wider reaching set of requirements than the mandatory qualifications alone. Lastly, the training should be targeted at the desirable qualities that will enhance the safety, efficiency and the overall quality of the operation. This point reminds a shipping company to fulfil its obligations when manning a ship. Following which, training for better performance therefore may be established. The hierarchy of training standards is now easily set up.



**Figure 5.5:** Hierarchy of Training Standards

2. Essential aspects for onboard training
  - A. Familiarisation: this aspect is a statutory requirement for each group. The main contents should be shipborne equipment, working environment (including emergency routes), operating procedures and other arrangements specified for each ship.
  - B. Refreshing and updating knowledge and skills: the guidance set by USCG may be used for reference. But for onboard training, continuous formal operations on for instance GMDSS and other new equipment, and new regulations are needed.



- C. Professional development in advanced navigational knowledge and skills related to the safety of ships and pollution prevention. By self-study via distance learning, more techniques and knowledge will be acquired.
- D. Training for specific ship types: for the companies that have a diversity of ship types such as bulk carriers, tankers and container vessels, seafarers need to be versatile and have ability to adapt to change of fleet profile. Training for operations of specific ship types therefore is necessary.
- E. Resource management and the company's policies: bridge resource management (BRM) is addressed in Section B-VIII/2, the STCW 95. The objective is to make masters and OOWs allocate and use bridge-watch resources effectively. Companies should issue guidance on proper bridge procedures and promote the use of checklists appropriate to each ship. The principles on BRM in Section B-VIII/2 may be taken for best reference when conducting BRM training. The book, *Bridge Procedures Guide*, published by the International Chamber of Shipping (ICS), is worthy of reference. Company's policies may be incorporated with the ISM Code for seafarers to be aware of.
- F. Training for certification: upgrading courses and sea experience for officers who want to be promoted to higher positions and onboard training programmes leading to certification of OOW for cadets or prospective officers. But shipping companies at present shall follow the programmes designed by maritime institutes for cadets' training.
- G. Computer operation skills: on the basis of the underpinning knowledge and skills gained ashore, the requirements may be narrowed into the application of modern equipment and management on board. For example, searching information from shore-based information resources; communication by e-mail and data transfer to shipping company, charterer, agent, store and sparepart supplier; instructional skills for onboard training.

- H. English language skills: focus on maritime English. Technical manuals and CBT programmes that are in English may be best used. In addition, practical uses of English in an emergency situation need to be taken into account.
- I. Onboard drills related to safety and oil pollution prevention: in the SOLAS Convention, onboard drills have been mentioned many times. There does exist some shortcomings and weakness in the field among Chinese fleets. One cannot say that drill is not training on board. The key issue is how to structure it.

The above mentioned aspects may be concluded in functional groups. See Table 5.2

**Table 5.2:** Training Items for Each Group

<b>Group level</b>	<b>Training Items</b>
Management Level	A, B, C, D, E, G, H
Operational Level	A, B, C, D, E, F, G, H
Supporting Level	A, B, D, H

### 5.4.3 Onboard training resources

Training resources include mainly human resource and material resource. Human resource here refers to instructors and supervisors. Material resource refers to equipment and other tangible things related to onboard training.

#### 1. Instructors and supervisors

In general, an instructor should have three aspects of qualification due to his/her responsibilities as a trainer on board. One is sufficient learning. The second is relevant sea experience. The third is some teaching skills. In the Part B of the STCW Code, an instructor is defined as the shipboard training officer who is under the authority of the master, organises and supervises the programmes of training for the duration of each voyage.

## 2. “Library at sea”

Modern ships with higher level of technology need more qualified seafarers. The operation of such ships is not more complicated than that of conventional vessels. However, in achieving effective operations, there lies more understanding and correct judgements on the use of the equipment and ship characteristics. Therefore, in-depth education or learning is needed besides normal operational skills. The library at sea or ‘library on-board’ is becoming important accordingly. This is a supplementary tool for onboard training. Both paper books and electronic books should be provided onboard. With the aid of technology, the latest versions of regulations may be downloaded via satellite systems on the Internet or company’s intranet. How to use these resources is a new challenge to shipping companies.

## 3. Equipment and other resources:

New technology has brought onboard training to a new era. Communication technology and computer technology can make some training programs, that are usually conducted on shore, emerge into onboard training so as to broaden the spectrum of onboard training. These new technologies can also combine knowledge learning with skill training on board and give seafarers many opportunities to gain better outcomes of training. The use of new technology now is one of the criterions to describe a company as competitive or not.

Some companies in other countries have set a ‘crew resource centre’ – a classroom on board – where typically six computers, possible networked, are used to carry out some training.

**CBT** is considered as one of the most effective training methods. The equipment is simple in that it needs a PC with a CD-ROM and tailor-made software.

CBT on board can function as “briefing” when familiarisation is carried out. It can also function as “debriefing” when a task is done. Star Cruises, the Asia-based cruise operator, now uses its newly built simulator, which can be connected with the voyage data recording (VDR) devices fitted on a newly built ship – Superstar, to train marine officers by replaying the situation in real circumstance. This technology can also be applied in CBT on board. In the coming days, one can see that new

technology can make CBT on board more close to the real world and give officers more opportunity or more effective training to be familiar with the equipment, and improve their abilities in the use of the equipment.

Holder (1997) listed the most likely multi-media and CBT applications on board that they are

- ❑ Assessment for entry into, and progression on, training programmes,
- ❑ Remedial teaching (filling the gaps) possibly linked to TV instruction,
- ❑ Ship familiarisation,
- ❑ Teaching English language (particularly maritime English),
- ❑ Training for special shipboard operations,
- ❑ Understanding some shipboard management techniques,
- ❑ Safety awareness, and desk-top safety exercises,
- ❑ Teaching/revising some underpinning knowledge for certificates of competency, self-assessment and part of the formal assessment for certificates of competency, refresher and up-dating training.

Seagull AS has already produced, and is still producing, a series of CBT training programme packages in accordance with the functions and ship types. See the detail in Appendix 4. How can Chinese shipping companies be inspired from such developments?

**The video training package** is a common way for both onboard and shore-based training and has been used for a long time. It is still really effective for most training. It gives seafarers a direct perception of reality through frames. It is its effectiveness that has prolonged video-based training. Vanstone (1997, p64) states that video-based training programs nowadays not only give basic safety training but also are an effective way to show legislation, management skills and instruction to the modern seafarers. These programs can be produced specifically for in-company use for subjects such as induction, company procedures and specialised equipment operations. “Video will be available for many years to come and should continue to be regarded as a very powerful tool in any trainer’s armoury.”

Videotel, a video products leading company in the maritime field has made several training packages by means of video and CD-ROM (See Appendix 5). Chinese shipowners may take advantages of existing resources for their onboard training.

**Distance learning via satellite and Internet communications** (e-mail) needs more equipment than CBT. Inmarsat A, B, C, D and M as well as other satcom facilities may be selected. GMDSS is now indispensable equipment on board a seagoing vessel. One can use it to transfer data or connect with the Internet and the office ashore.

**Suitable software or programmes** are the key to effective training by the above mentioned training methods. So it is important to make relevant software available on board. In addition to Seagull AS and Videotel, Norcontrol, Atlas, PC Maritime, Transas and others are all good software suppliers that may be consulted.

**Reference readings** are complementary for onboard training. They include technical manuals, books, codes, regulations, guidelines and so on.

**TV at sea** is also a kind of training facility besides having a leisure and recreation function. But cost-effectiveness needs to be considered.

#### **5.4.4 Methodology and effective implementation**

Correct selection of training methods depends on what will be trained and who will be trained, group or individual.

The essential ways for onboard training may be as follows:

- distance learning via satellites and Internet
- self-study and education by multimedia equipment (CBT)
- learning by doing (at workplace) and observing (experienced persons)
- others

#### **Individual training:**

- ◆ On-the-job training (learning by doing or observing) under supervision of senior officers or experienced personnel. A junior officer to be promoted

to a higher position on board needs to observe those who are in the position. He/she may be assigned to be as a “co-pilot” on the job. Together with CBT and other resources he/she will be getting competent related to the tasks, duties and responsibilities.

- ◆ Self-study for his/her specific needs such as refresher and higher knowledge and skills through CBT, Library at Sea and other resources.
- ◆ Distance learning for professional development and advanced knowledge and skills via satcom, the Internet or e-mail to get assistance.
- ◆ others

**Group training:**

- ◆ Video-based training programmes should be properly introduced and followed by a discussion. Onboard training officers in such case need to lead trainees to the objectives set beforehand.
- ◆ Overhead projector or networked CBT can be used for common training needs by masters or training officers such as voyage briefing (including safety and contingency plan) and drill debriefing. “The skills of leaders and trainers in these circumstances are vital, and the attitude of the trainees is important. The use of training aids can help.” (Holder, 1999)

In consideration of effective training on familiarisation, Holder (1998) gives a proposal that the ‘new joiner’ starts the process before he/she leaves home or the office. Using training resources available such as manuals, videos or multi-media scene shot on board, he/she is “encouraged to learn about safety matters, company policies and operational procedures, etc in a more related environment than a busy ship in port.” Then he /she knows what else needs to be found out once he/she gets on board. For the senior officers on board they can “concentrate on making sure the particular information about their ship and the current voyage has been delivered and understood.”

No matter which methods are used, the final assessment is always based on each individual’s outcome.

#### **5.4.5 Assessment, evaluation and recording for onboard training**

The assessment of onboard training is not such an easy thing, because training objectives sometimes are difficult to define in quantity and some are impossible in quantity. The integrated outcome can only be observed at workplace. So the IMO made an instrument titled “*Guidance on Shipboard Assessments of Proficiency*” in May 1998 (hereafter: the Guidance). The Guidance stresses that the process of assessment is through a quality standards system, subject to verification to ensure validity, reliability and consistency of results. It also points out that “evidence of having achieved proficiency in certain competencies may be obtained from approved in-service experience on board ship.” Therefore, the key to assessment of training is to appraise one’s practical ability in operations.

##### 1. Assessment approaches

The Guidance is in three parts. The first part provides an outline of the six steps that comprise the shipboard assessment process. The second part provides definitions and examples central to the discussion of the shipboard assessment process. The final part outlines the issues and factors that should be taken into account in the conduct of each of the six steps.

- I. Identify performance objectives
- II. Select performance objectives for shipboard assessment
- III. Determine performance measures and standards
- IV. Prepare assessment package
- V. Conduct assessment
- VI. Develop a performance improvement plan

The main assessment approaches are:

- ◆ Computer based assessment (CBA) such as *SETS* and *CES 3000*
- ◆ Assessment by doing or demonstrating at workplace
- ◆ Assessment by interviewing
- ◆ Assessment by examination and oral test
- ◆ Assessment by integrated performance

In accordance with specific objectives, one or more methods may be used. However, assessors should keep the training objectives in mind and the six points are fully taken in account when selecting assessment methods. The six points, noted by Holder (1999), are repeatability, reliability, utility, validity, authenticity and sufficiency.

## 2. Evaluation report

After assessment of onboard training, officers or assessors should make an evaluation report as an evidence of onboard training. Corrective action may be suggested if training objectives be failed in terms of quality assurance. The report may be either sent ashore via satcom equipment or given to the shore-based officer when the ship arrives.

## 3. The management of records

The STCW 95 requires shipping companies to ensure that documentation and data (records) on all seafarers' experience, training, medical fitness and competency are maintained and readily accessible. So a computerised recording system will give great benefit to managers. Parsons (1997, p184) suggests that "the system should be capable of presenting the information in a variety of forms so that progress in any particular area can be monitored." Most Chinese shipping companies have had an established Management Information System (MIS) based on computer technology for many years. Some of them have incorporated seafarers' records within the system. Now it needs to be revised and modified for adapting new requirements.

Records also refer to individual seafarers in addition to shore-based records. It is not only to show inspectors (PSC, Flag State or others) the evidence that a seafarer has been trained and has acquired knowledge and skills in some aspects, but also to give a sign that the company is in compliance with relevant regulations, in this case, the STCW 95 and the ISM Code.

Such training record books should be held by each seafarer, but need to be checked regularly. The contents may be divided into three parts: those leading to statutory certification of competence, those verifying some skills and knowledge required by the company and others.



The International Shipping Federation (ISF) published new booklets at the beginning of 1999. They are the “*Personal Training and Service Record Book*” and “*Emergency Drills and Exercises Supplement*”. These booklets, together with *On Board Training Record Book*, are a good reference for Chinese shipowners to design a personal training record book or they may be used directly.

## **5.5 Limitations and constraints**

The improved training system has been established. How to make it effective is still confined by some factors. To identify those factors and make endeavours to reduce their affect on the operation of the system is essential.

Limitations and constraints are listed as below:

- ◆ Many Chinese seafarers lack skills in computer operation.
- ◆ Tailored training packages for each group of crew need to be developed and maintained for update. But are financial support and human resources available?
- ◆ Now due to high cost in transfer of data via satellites, not many companies are likely to afford to give many opportunities to crewmembers in access to the Internet except for e-mail messages.
- ◆ More training equipment both on board and ashore is needed.
- ◆ Traditional attitudes and approaches to teaching and learning need time to be changed.
- ◆ Shipping companies need to be clear on where they are heading and what level of skills they require from their seafarers tomorrow.
- ◆ Time for training on board is not easy to allocate, especially for short distance voyages.
- ◆ Attitude and proficiency of senior officers on board as trainers need to be improved.

## **CHAPTER 6**

### **Conclusions and Recommendations**

#### **6.1 Conclusions**

International conventions and codes such as the STCW 95 and the ISM Code have put strong obligations and responsibilities upon shipping companies. The Maritime Administration in China has also promulgated a series of regulations in the past two years. It is practical for all Chinese shipping companies that are engaged in international trade to consider seriously how to improve their ship operations and management before it is too late.

Lessons learned from past accidents show that safety is the fundamental issue to deal within the shipping business. Formal Safety Assessment is essential for risk management in ship operations. However, risk control of ships is usually done by seafarers on board ships. Therefore, seafarers are encouraged to become more involved in risk management and to be trained thus ensuring that “competent seafarers equate to safer ships and cleaner oceans.”

Development of Information Technology in the shipping industry has opened a window that shows in training seafarers, onboard training in particular, that it is possible to obtain better achievement by using new methods. Distance learning via satellite communication and the Internet, specific CBT packages and video-based training will be the most often-used approaches to effective training in the not-too-distance future. Reduction of marine incidents and accidents by improving seafarers’ competency is just round the corner.

There are some aspects for Chinese seafarers to be improved, which do reflect the weakness in the training system. Onboard training is one of them. Shipowners and operators should envisage the current situation and take effective

measures timely to meet the changes in the shipping industry. Opportunities are only given to those who can recognise them.

Improvement of current training systems needs shipowners to change their attitude to investment in people, to well consider training cost versus loss in accidents and to retain highly qualified seafarers. External environment and internal circumstances need to be taken into account. Effective use of training resources available in a shipping company is an essential consideration when developing a training programme.

There was a saying in ancient China that “there are other hills whose stones are good for working jade.” It means that other people’s good qualities can be used to remedy one’s own defects. The Norwegian approach and Videotel approach are good for reference. Some CBT and video packages such as ‘Onboard Library’ (Seagull AS), ‘Officer of the Watch’ and others (PC Maritime), and ‘Videotel training packages’ and “Seafarers’ Evaluation and Training System (SETS)” (Videotel Marine International) are worth looking at. On the other hand, the Norwegian practice in making equipment suppliers or manufacturers involved in seafarers’ training gives other thought provoking ideas. Chinese shipowners and operators can be motivated to learn from the Norwegian experience.

There is a trend nowadays that co-operation amongst strangers makes for better service and more benefit for their own. Shipping companies should also make close links with maritime institutes and the administration on their own initiative to streamline their recruiting and training systems and programmes.

The selection of trainers and structured programmes are basic measures to assure achievement of the objectives set while assessment of training outcomes is a key element in a training system. To take a focus on the assessment should enhance the proficiency of assessors and methods used. The IMO has produced guidance for onboard assessment of proficiency. Some others have made practices on their own. Chinese shipping companies should make a feasible scheme for their own.

## **6.2 Recommendations:**

As a result of this study it is recommended that Chinese shipping companies:

- Review training systems and identify the weaknesses in organizational structure, procedures and working manuals.
- Modify the Safety Management System if necessary.
- Make a sufficient budget for seafarers' training, such as equipping ships with basic facilities, computers and relevant software and so on.
- Co-operate with maritime institutes in order to develop suitable training programmes, particularly familiarisation programmes, according to their own situations.
- Use selected software available across the world such as Seagull AS before tailor-made training packages are produced.
- Develop and establish one's own computer network on board new ships as soon as possible to meet changes and challenge in the shipping industry.
- Make a plan for training trainers (senior officers) and carry out the plan as early as possible.
- Develop a training record book or utilize those produced by the International Shipping Federation and have them approved by the Administration.
- Prepare a handbook or manual for each post on board in order to assist the new seafarer to become familiar with the ship.
- State a long term training policy in the strategy plan and secure further improvement of training environment.
- Arrange for the Chinese Shipowner Association to hold a meeting to discuss the issue of seafarers' training.

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## Appendix 1

### Evolution of Intel Microprocessors

YEAR AND TYPE	SIGNIFICANT EVENTS
1971: 4004	Intel first microprocessor (2,300 transistors)
1972: 8008	First PC predecessor
1974: 8080	The brains of first PC----the Altair
1978: 8086-8088	First IBM PC. Intel: one of Fortune 500
1982: 80286 (286 for short)	First processor to run all the software.
1985: 386 (TM)	In 6 years, 15 m PC in the world. 275,000 transistors, 100 times than 4004, a 32 - bit chip, multi-tasking.
1989: 486 (TM) DX cpu	First to offer a built-in math coprocessor. From command-level into point-and-click computing.
1993: Pentium®	More easily incorporate “real world” data, such as speech, sound, handwriting and photographic images
1995: Pentium® Pro	Designed to fuel 32-bit server and workstation-level applications, with a second speed-enhancing cache memory chip, 5.5 m transistors.
1997: Pentium® II	With 7.5 m transistors, 3,200 times than 4004, incorporates Intel MMX TM technology, capture, edit, add text, share digital photo, music or between-scene transitions to home movies, video phone, sending video.
1999: Pentium® III	Released in Jan. 1999, with 550MHz offering performance headroom for business media, communication, and Internet capabilities.

(Arranged by the author according to the source: <http://www.intel.co> 05-07-99)

## Appendix 2

### Norwegian Onboard Training Programmes

*Table 1: Cyclic retraining of crew*

Period \ Position	1, 4, 7 ...	2, 5, 8 ...	3, 6, 9 ...
Senior officer deck	Controlling the operation/care for persons on board	Cargo handling	Navigation/Radio Communication
Junior officer deck	"	"	"
Rating deck	"	"	"
Senior officer eng.	"	Marine engineering/ maintenance and repair	Electrical/ electronic/control engineering
Junior officer eng.	"	"	"
Rating engine	"	"	"
Catering	Familiarization and basic safety training and instruction		

(Source: <http://www.marintek.sintef.no/mt23doc/mitd/05-07-99>)

*Table 2: A matrix of training activities (including CBT modules)*

Topic	Land-based	Land and/or ship based	Ship based	Personnel category							
				Master	Chief officer	Jun. officer	Bosun	Pump man	Ratings	Chief cook	Mess-man
Basic Safety and Emergency-Survival and First Aid		X		M	M	M	M	M	M	M	M
Fire fighting - Basic	X					M	M	M	M	M	M
Fire Fighting - Advanced	X			M	M	M					
Oil Pollution Control Course	X			M	M						
Bridge Resource Management Course	X			C	C	C					
Safety Familiarization		X		C	C	C	C	C	C	C	C
Ship General Safety		X		C	C	C	C				
Personal Safety		X		C	C	C	C	C	C	C	C
ISM-Code		X		C	C	C					
OPA-90		X		C	C	C	C	C			
SOPEP		X		C	C	C					
Safety Equipment		X		C	C	C	C	C	C	C	C
Vessel Structural Conditional		X		C	C	C					
Corrosion		X		C	C	C	C				
On Board Vessel Familiarization			X	M	M	M	M	M	M	M	M
Upgrading course for cooks	X									C	

M : Mandatory  
C : Company policy

**Remark:** The system involves extensive on-board use of CBT's. All modules of Seagull's CBT2000 system have been linked to the knowledge and understanding requirements found at sub-function levels in the standards of competence defined in the relevant tables of the STCW 95 Code. Some new CBT modules used on board are not listed in the above table such as Autochief, Tanker Operation and Fuel Handling.

(Source: <http://www.marintek.sintef.no/mt23doc/mitd/05-07-99>)

## Appendix 3

### Japanese “K” Line Training Programmes

*Table 1: Training of seafarers with SMS in Japanese shipping companies*

Training items	Contents and trainees	Trainers
I. Training for master and chief engineer	Understanding of the system and the important matters for safe operation of ships and environment protection Master and Chief Engineer who will be assigned to the vessel	General Manager of Marine Department
II. Pre-boarding training	Necessary information about vessels to chief officer, first engineer and other responsible officers newly assigned to the vessel.	Marine Personnel Affair Section
III. Shipboard on-the-job training	Matters related to the SMS. <input type="checkbox"/> For all crew and officers: √ Company’s policy for safety and environmental protection √ Company’s rules for seafarers √ List of duty for crew √ Procedures for control of drugs and alcohol √ Procedures for management of safety and health onboard <input type="checkbox"/> For officers: √ Safety Management Manual √ Various procedures about crew control and training, safety and health, environmental protection, communication, document, emergency response etc. <input type="checkbox"/> For rating: √ Procedures for entry into enclosed spaces √ Procedures for hot work √ Procedures for watchkeeping in port, in engine room.	The Master

(Arranged by the author according to the Textbook for the Group Training Course on Seafarers’ Management System 1997 by Japan Ministry of Transport)

## Appendix 4

### Seagull AS: CBT Training Programmes

#### Subject Groups:

##### 1. Navigation

<i>Available Modules</i>	<i>Planned Modules</i>
CD19 Remote Control System; AutoChief 4	Mooring
CD 17 Steering Gear Info.	Electric Chart Display
CD 22 Maritime English	Watch keeping –SMS
CD 20 Search & Rescue	COLREG Safe Passage
CD 31 Emergency Towing System	Manoeuvring Controls
CD 49 Radar Observation and Plotting	Doppler Log Echo Sound
CD 50 Operational use of ARPA	Gyro Compass
CD 51 Navigational Aids	Voyage planning
	Electronic Navigation Systems

##### 2. Cargo Handling and Stowage

<i>Available Modules</i>	<i>Planned Modules</i>
CD 11 Marine Fuel Properties	Chemical Tanker
CD 12-13 Tanker Operation I & II	Familiarisation Program
CD 32 Liquid Cargo Properties	Cargo Pumps
CD 33 Stability	Cargo Cooling Plant
CD 37 Gas Tanker Familiarisation Program	Cargo Stripping System
CD 38 Oil Tanker Familiarisation Program	Cargo Vapour
CD 48 Gas Measurement	Treatment
CD 53 HAZMAT – IMDG Code	Inerting
CD 54 COW	Crisis Management
CD 55 ODME Operation	Crowd Management
	Ro/Ro Passenger Safety
	Ro/Ro Passenger Familiarisation
	Environmental Model
	BC Code

### 3. Controlling operation of ships and Care for Persons Onboard

<i>Available Modules</i>	<i>Planned Modules</i>
CD 1 Personal Safety	Fire Prevention & Fighting
CD 2 Ship General Safety	MARPOL
CD 3 Safety Equipment	SOLAS
CD 4 SOPEP	Toxicity & Hazards
CD 5 SMS - Safety Management System	
CD 6 OPA 90	
CD 14 Vessel Structural Conditions	
CD P & I	
CD H & M Hull & Machinery	
CD 56 Assessor Training	

### 4. Marine Engineering

<i>Available Modules</i>	<i>Planned Modules</i>
CD 7 Inert Gas Generator	Advanced DataChief
CD 8 Flue Gas Plant	Fuel Combustion Efficiency
CD 9 Fuel Oil System	Propulsion System
CD 10 Marine Fuel Handling & Pre-treatment	Familiarisation
CD 11 Marine Fuel Properties	Steam Turbine
CD 18 Cooling System	Advanced AutoChief
CD ALCAP (Alfa Laval Separator System)	Deck Machinery
CD 24 Auxiliary Engine	Exhaust System
CD 30 Marine Lubricants	Compressors
CD 46 Auxiliary Steam Boilers	Pumps
CD 52 Steering Gear - Operation	Hydraulics

(Remark: Planned Modules are not totally listed)

### 5. Electrical, Electronically & Control Engineering

<i>Available Modules</i>	<i>Planned Modules</i>
CD 25 Sensing Devices	Marine Electronics
CD 41 Generator	Measuring Instruments
	Ex Equipment
	Exi Systems
	Reading Drawings
	General Electronics
	Automation



6. Maintenance & Repair

<i>Available Modules</i>	<i>Planned Modules</i>
CD 15-16. Corrosion Protection I & II	RAST
	Repair & Maintenance Safety
	Maintenance Systems in Genera

7. Radio Communication

<i>Available Modules</i>	<i>Planned Modules</i>
CD 21. GMDSS	

8. Others (All in planning)

<i>Planned Modules</i>	<i>Planned Modules</i>
General English	Learning MS Project
Encyclopaedia	Using Internet
Maps	General First Aid
Operating Systems	Environment Information
Learning MS Word	Cooking Guide
Learning MS Excel	Edutainment

9. Competence Evaluation of Seafarers

***STCW Test Menu and CES 3000***

Results from a CES have many applications such as:

- Screening potential crewmembers in the hiring process.
- Verifying the competence of existing crew.
- Assessment of personnel to justify and document promotion decisions.
- Assisting in the pinpointing of training needs & designing training programs to meet ISM code and STCW 95 requirements.

All STCW Levels of Responsibility covered

Tests questions directly relevant to crewmembers duties are automatically selected by the program through CES's various rank options.

- Management level: Senior Deck Officer and Senior Engine Officer
- Operational level: Junior Deck Officer, Junior Engine Officer, Senior Catering and Electrician.
- Support level: Deck Rating, Engine Rating and Catering Rating.

All CES tests are rank specific and crossed referenced with either vessel type or subject area. Vessels types:

- Chemical Tanker
- Combined Carrier
- Container Vessel
- Dry Cargo
- Gas Carrier
- Oil Tanker
- Passenger Vessel

#### 10. Custom - Company specific CBT

- Familiarization - ship specific
- Familiarization - company specific
- Customer service tool for marine equipment manufacturers
- Sales & marketing tool for marine equipment manufacturers
- Familiarization - marine equipment specific

**(Rearranged by the author. Source: Onboard Library - <http://www.sgull.com/> 05-07-99)**

## Appendix 5

### Videotel Training Packages

#### **1 Video Training Packages (including audio cassettes)**

##### **1.1 Amongst the training packages most frequently requested are:**

###### Fire Fighting Series

1. Fire Prevention
2. Basic Fire Fighting
3. Command & Control Part 1
4. Command & Control Part 2

###### Solas Chapter III Series

5. Solas Chapter III: Part 1 - Preparing for Abandonment
6. Solas Chapter III: Part 2 - Abandonment by Lifeboat
7. Solas Chapter III: Part 3 - Abandonment by Liferaft
8. Solas Chapter III: Part 4 - Techniques of Survival
9. Solas Chapter III: Part 4 - Amendments & Updates

###### Personal Safety Onboard Ship Series

10. The Shipboard Management Role
11. Personal Safety on deck
12. Personal Safety in the Engine Room
13. Personal Safety in the Galley

###### Others

14. Fighting Pollution
15. Bridge Watchkeeping
16. Entering Into Enclosed Spaces
17. Port State Control
18. Drugs - Way Off Course
19. Shipping Casualty Emergency Response
20. Crisis Communications

##### **1.2 New packages**

###### **The Latest Packages:**

- English for Seafarers (audio cassettes)
- Watchkeeping in Port
- Ship Handling in Following Seas
- Chemical Tanker Operations
- Ship Vetting Inspections for Bulk Oil Carriers

- Bridge Resource Management
- Fatigue and stress at sea
- Surveying a Bulk Carrier
- Onboard Training & Assessment
- Cargo Claim Prevention on Board Reefer Ships
- Electric Propulsion & High Voltage Practice

### **Other Packages**

The Chemistry of Liquefied Gases

Drug and Alcohol Prevention

Engine Room Resource Management

Enclosed Space Entry

Man Overboard

Portable Gas Detectors

Personal Survival Parts 1 & 2

Rule of The Road

Ro-Ro Watertight Integrity

Safe Offshore Cargo Transportation

STCW and Flag State Implementation

Ship Stability CD-ROM

Seven Steps to Ship Stability Parts 1 and 2

Working Together Racial & Sexual Discrimination on Board

Basic Steam Turbine Plant Operation

Cold and Heavy Weather

Entering into Enclosed Spaces

GMDSS Single Trainer

The Year 2000 -- Beating the Millenium Bug

The Mooring Series

Port State Control

Permit to Work System

Vessel Lay-up

Waste and Garbage Management

Crisis Communications

Lifeboat On-Load Release Mechanisms Shipboard Familiarization

US Port State Controls

Prevention & Reaction to Marine Oil Spills

Fire Fighting on Container Ships

Don't Gamble with Safety on Chemical Tankers

Management for Seafarers Series

Basic Instincts - Passenger Mustering & Crowd Management

Personal Protective Equipment

## **2 Computer Based Training Packages**

- Rules of the Road
- International Marine Signalling
- Principals of Radar
- Clouds (Meteorology Part 1)
- Officer of the Watch

## **3 Computer Based Assessment**

SETS (Seafarers Evaluation and Training Systems) includes questions for:

Junior Deck & Engineering Officers

Deck & Engineering Ratings

Electrical Officers

Currently the SETS database includes over 3,000 questions.

(Source: <http://www.videotel.co.uk> 25-07-99)