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# Developing a maritime education and training examination system for higher marine engineer licences in China

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# DEVELOPING A MARITIME EDUCATION AND TRAINING EXAMINATION SYSTEM FOR HIGHER MARINE ENGINEER LICENCES IN CHINA

By

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## 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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## ABSTRACT

The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended in 1995 (the STCW95 Convention) came into force on 1 February this year. This convention is designed to establish uniform training standards and is widely regarded as one of the most important maritime safety conventions ever developed.

The current Chinese MET examination system for higher marine engineer licences is based on the initial STCW convention (the STCW78 Convention). Changing and developing this system to meet the revised Convention presents a problem that needs to be solved as soon as possible, further complicated by the huge size and intricate organization of the Chinese MET system.

This dissertation examines the current Chinese examination system for higher marine engineer licences as well as the Chinese MET System, and makes a comparison between the existing and the revised STCW convention. Analyses are provided for the purpose of effective implementation of the revised convention in China particularly in the sphere of certification examination for higher marine engineer licences. The analyses cover examination methods, course development, evaluation and assessment, qualification of instructors and assessors, etc.

Recommendations are provided to the administration, the institutions and the industry in this dissertation with the ultimate aim of improving higher marine engineer licence holders' qualifications in China.

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| ARPA | Automatic Radar Plotting Aids |
| CET | College English Test |
| COSCO | China Ocean Shipping Group |
| DMU | Dalian Maritime University |
| DNV | Det Norske Veritas |
| DWT | Deadweight Tonnage |
| GMDSS | Global Maritime Distress and Safety System |
| ICFTU | International Confederation of Free Trade Unions |
| ILO | International Labour Organization |
| IMCO | Inter-Governmental Maritime Consultative Organization |
| IMO | International Maritime Organization |
| ISF | International Shipping Federation |
| ISO | International Standardization Organization |
| JCT | Joint ILO/IMO Committee on Training |
| JNI | Jimei Navigation Institute |
| KW | Kilowatt |
| MARPOL | International Convention for the Prevention of Pollution from Ships |
| MET | Maritime Education and Training |
| MOC | Ministry of Communications |
| MSAMCC | Maritime Safety Administration of the Ministry of Communications of the P.R.China |
| MSC | Maritime Safety Committee |
| QOSMC | Qindao Ocean Shipping Mariners' College |
| SECPRC | State Education Commission of the P.R.China |
| SMU | Shanghai Maritime University |
| SOLAS | International Convention for the Safety of Life at Sea |

| | |
|---|---|
| STCW | International Convention on Standards of Training, Certification and Watchkeeping for Seafarers |
| STW | Standards of Training and Watchkeeping |
| TEU | Twenty Foot Equivalent Unit |
| UK | United Kingdom |
| UNDP | United Nations Development Programme |
| USA | United States of America |
| WHTU | Wuhan Transportation University |
| WMU | World Maritime University |

# Chapter I
# Introduction

## 1.1. General overview

China, as a developing country with an increasing rate of economic growth and a long coastline, needs strong support from maritime transport particular after her market was opened to the world in 1979. Today the tonnage of her fleet is in the top ten of the world. To meet the growing requirements of maritime transport, the Maritime Education and Training System is expanding and has become a large and complicated system. In China, people say: the bigger the bus is, the more difficult the turn is. The Chinese Maritime Education and Training System is like a big bus, how to turn it to meet the new international requirements of the STCW95 Convention, that has entered into force since 1 February, has been paid more and more wide-attention. The MET Examination System including examination and certification to higher marine engineer licences is one of the most important factors to be developed.

Compared with the STCW78 Convention, many new provisions as well as chapters are stipulated in the revised STCW Convention such as Regulation I/6 (Training and assessment), Regulation I/8 (Quality standards), Regulation I/12 (Use of simulators), Chapter VII (Alternative certification) and so on. The Code of the STCW95 Convention is another obvious feature different from the old Convention. In a few words, a series of new requirements of the revised Convention has impacted on the shipping industry as well as the Chinese maritime administration and MET system.

### 1.2. Research scope and methodology

The primary objective of this thesis is to identify the strengths and particularly the weaknesses of the present Chinese MET Examination System for higher marine engineer licences and how to minimise or avoid the negative effects in order to successfully implement the revised STCW Convention. In conducting this research, some models are chosen for analysis, evaluation and assessment of the system, because there are so many elements in the large system that it is not possible to examine all of them one by one. Generally speaking, the function of the system can be performed perfectly with these models which are carefully selected in terms of their performance in the system. Thus analysis results based on these models will be creditable.

The research methodology that was adopted for this study, relied mostly on library sources, practical observation and lectures. Most of the reading materials and references were drawn from maritime periodicals, newspapers in the WMU library, and from other publications and reports of China. Other useful information and experiences were derived from practical research carried out during the field studies to various places in Denmark, France, England, Germany, Poland and Sweden. Much valuable guidance was provided by visiting professors and experts from various institutions and organizations.

### 1.3. General content

The main body of the thesis includes five chapters, Chapter II to Chapter VI.

**Chapter II**: The Chinese Maritime Education and Training System

This chapter provides the basic characteristics of the Chinese MET System covering the Administration of the Chinese MET and MET institutions for training of new officers and upgrading licences. Some institutions which will be analysed in coming chapters as models are introduced in detail in this chapter.

**Chapter III**: The new international requirements of the STCW95 Convention

This chapter forms an important part of this dissertation. It makes a comparison between the STCW78 and the revised Convention in terms of their structures and technical provisions especially the major technical details of the revised Convention. Here, new requirements of the revised Convention, that will impact on the Chinese MET institutions and maritime administration, are examined as the basis of analysis of the thesis.

**Chapter IV**: The present structural formation of the examination system for higher marine engineer licences in China

This chapter introduces the infrastructure of the present examination system for higher marine engineer licences including the types of certificate, certification structure, examination subjects and methodology of setting and marking papers for examinations in terms of new officers and upgrading licences. These elements will be examined against the new requirements of the STCW95 Convention in the next two chapters.

**Chapter V**: Analysis and improvement of the Chinese Examination System for higher marine engineer licences

This chapter tries to find weaknesses existing in the current examination system and to seek a proper approach for solutions to identified weaknesses. The main aspects examined in the chapter include the structure of the system, methodology of setting and marking papers, external evaluation, assessment on board ships, teaching

materials, using simulators for assessment, English course and assessor's qualifications.

**Chapter VI**: Functional approach: impact on certification of higher marine engineer licences in China

In accordance with a new Chapter VII (Alternative certification) of the STCW95 Convention, this chapter concentrates on the possibility of implementation of the functional approach in China. Once the Chinese Government decides to issue alternative certificates, some events that would need to be carried out ahead of the implementation, are shown in this chapter.

At the end of this dissertation, recommendations and suggestions will be provided in Chapter VII, which will be helpful to the development of the Chinese MET Examination System for higher marine engineer licences.

# Chapter II

# The Chinese Maritime Education and Training System

## 2.1. Administration of the Chinese MET

The Chinese MET system is made up of different levels' of institution including universities, monotechnic technical schools, professional schools and vocational training centres (re-education and training centres). These institutions can be divided into two groups in terms of the competent authorities that are responsible for them. The institutions directly under the Education Department are formed by some universities, monotechnics and their own re-education and training centres (sometimes called adult education colleges), and perform maritime education and training on behalf of the highest level of MET in China. Those under shipping companies are usually responsible for training seafarers for the individual company as well as for preparation for national certification examination. The majority of the shipping companies are under the Ministry of Communications, so those institutions can be recognized under the Ministry of Communications indirectly, indeed their existence depends on support, covering supplement of qualified teachers, development of curricula, assessment of teaching effect, guidance of national certification examinations, etc, except finances, from the Education Department.

The responsibility of the Education Department for MET is distributed between two of its divisions, the Higher Learning Division and the Adult Education Division. The Higher Learning Division is in charge of education and training concerned with degrees and diplomas. These institutions include Dalian Maritime University (DMU), Shanghai Maritime University (SMU), Jimei Navigation Institute (JNI), etc. The Adult Education Division is in charge of education and training without degrees

and diplomas; such courses are mainly run by some adult education colleges sometimes called re-education and training centres under major institutions. Activities of the two divisions concern course design, development of curricula, approval of teaching materials, approval of teachers' qualifications, assessment of teaching effect, etc.

Another important department of the Ministry of Communications in close relationship with the Chinese MET is the Maritime Safety Administration (MSAMCC) that is in charge of national certification examinations and issuing certificates. Implementation of national law and international conventions in MET institutions is under the supervision of MSAMCC.

### 2.2. MET for new officers

#### 2.2.1. Institutions

There are eight higher learning MET institutions in which Shanghai Maritime University, Dalian Maritime University, and Jimei Navigation Institute, play very important roles in the Chinese Maritime Education and Training System, and all of them are governed by the Ministry of Communications of the People's Republic of China. They represent the highest level of the Chinese MET system with their degree and diploma education as well as professional training. Their contribution is not only for new officers, but also for senior marine officers directly or indirectly. The graduates are awarded a 2nd mate certificate for unlimited navigation for 1,600 GT and above after 12 months' service on board or a 3rd engineer certificate for ships of 3,000 KW propulsion power or more after 12 months' service on board.

### 2.2.1.1. Shanghai Maritime University

Shanghai Maritime University (SMU), a comprehensive university directly under the Ministry of Communications of the People's Republic of China, was formed in 1958. Its history can be traced back to the Shipping Section of the Shanghai Industrial College in 1909. Wusong Merchant Marine College emerged from this Section and the Department of Shipping Management of Jiaotong University merged into the Shanghai Nautical College in 1950, then it moved to Dalian in 1953. For the purpose of developing marine transport affairs in the largest port as well as the biggest city of China, the Ministry of Communications decided to establish Shanghai Maritime University based on Shanghai Nautical College in Shanghai in 1958.

Now SMU has six departments and department-level divisions. They are the Department of Machinery, Department of Computer Science, Department of Foreign Languages, the Great Division of Basic Course, Graduate Division and SMU's Branch, and two colleges, the College of Merchant Marine and the College of Management. Its research programmes covering law, computer, trade, navigation, marine engineering, etc, are running in its eight research institutes and centres.

SMU is empowered to confer the Bachelor's degrees in nineteen of its undergraduate programs and the Master's degrees in nine of its postgraduate programs and presently has 4710 full-time students and 249 professors and associate professors. It owns more than 40 labs, such as a navigation lab, an engineering lab, a management simulation lab and an audio-visual aids centre. A modern engine room simulator lab is now being set up. Its library provides strong support for its teaching and research activities with more than 640,000 books and over 2,000 types of Chinese and foreign periodicals. Its collection of literature in maritime law ranks first in China. It also owns a shipping company with three vessels of 10,000 DWT class and two ocean-going sailboats for navigation practice.

Regarding international co-operation, the university has friendly co-operation and academic exchanges with maritime education and training areas and relevant research institutes with more than 20 counties such as UK, Norway, Japan, Germany, Poland, etc. The international co-operation covers some Master Courses jointly run with overseas institutions, for example, a MBA programme with Maastricht School of Management of the Netherlands.

#### 2.2.1.2 Dalian Maritime University

Dalian Maritime University (DMU) was established in 1953 by combining Shanghai Nautical college, Northeast Navigation College and Fujian Navigation School. The origin of it can be traced back to 1909 when the Shipping Management Section was funded by the Shanghai South Sea Public Affairs Institute.

DMU has become the largest multi-disciplinary maritime university in China since 1953. It has six colleges and five faculties concerned with navigation, marine engineering, law, economy, etc. Today it provides twenty-two Bachelor Degree Programs, nine Master Degree Programs and four PhD Programs to around 5,000 registered students including some overseas students from developing countries.

DMU owns a number of modern equipment including a planetarium, a navigation simulator, a computer centre and 56 other labs. Its library owns about 700,000 books managed by modern computer system. There are three 10,000 DWT class ocean-going training ships in its Shipping Company for the sea-going practice of students. Around 2,250 staff which include over 350 professors and associate professors are employed by the university.

The first branch of World Maritime University was the Dalian Branch which was set up in DMU in 1985. The branch offers short-term courses to professional officers,

engineers and staff from harbour authorities, maritime administrations and teachers from maritime education and training institutions in Asia and Pacific regions to meet the requirements of the International Maritime Organization (IMO). The Asian-Pacific Region Maritime Training Centre was established in DMU jointly by the United Nations Development Programme (UNDP) and IMO in 1983. Apart from the above, another five maritime education and training institutions abroad from four countries have made co-operative and academic exchanges with DMU.

#### 2.2.1.3. Jimei Navigation Institute

Jimei Navigation Institute (JNI) is located in Jimei School Village nearby Xiaman City in the south of China. It was established in 1920. In the last two decades its development went through two significant steps: it was upgraded in December 1978 from the former Jimei Navigation School to an academy, and then upgraded to a senior institute of higher learning approved by the State Education Commission of China in 1989. The course duration was also changed from three years to four years with a Bachelorship available now. Today's Jimei Navigation Institute, so named in 1989, is under the direct jurisdiction of the Ministry of Communications, but jointly administrated by the Ministry of Agriculure of P.R.C, Fujian Province and Xiaman City as well.

Currently JNI has seven departments involving navigation, marine engineering, etc, and two research institutes. To facilitate the teaching, JNI owns over 20 labs including a navigation radar simulator, ARPA, GMDSS training simulator, Automatic Engine-room, etc. There are 102 professors and associate professors and more than 2,200 registered students in seven majors with 3 years junior college program and 4 years senior college program. The institute also provides a postgraduate class on a joint base with other maritime universities. Based on present

departments, JNI is developing its night school and correspondence school for adult education.

The institute owns three practice vessels, which are a 5,000 DWT ocean-going ship, a 400 DWT coaster and a 158 TEU container ship. Other practice facilities include a metal working shop and an aquatic training station. Its library comprises over 200,000 collections covering nautical science, marine engineering, maritime law, shipping management, foreign languages etc.

Today JNI is paying great attention to the academic exchanges and co-operation with foreign countries such as in HongKong, Australia, USA and so on. Some of its graduates are working in some overseas shipping companies now.

#### 2.2.1.4. Wuhan Transportation University

Wuhan Transportation University (WHTU) has a history of about 50 years under the Ministry of Communication. The university is located in Wuhan city in the central part of China and near to the Yangzhi river which is the longest river of China.

As a comprehensive university it has three colleges and ten departments, which are Shipping College, Management College, Adult Education College, etc. The university has 13 research institutes or groups, 52 labs and 2 quality control and test centres for inland waterway vessels and harbour machinery. There are over 400 full-time professors and associate professors in the university. WHTU provides 46 specialities in which 4 Doctoral degrees and 11 Master's degree are available. The total enrolment of the university is more than 7,500 including doctor, post-graduate, under-graduate and foreign students. The university has established academic ties extensively with 4 institutions of higher learning and 2 research institutes abroad. Activities of this university concentrate on MET in land-based water areas.

#### 2.2.1.5. Others

Apart from the above major MET institutions, there are some others on different levels for new officers. Guangzhou Maritime School is on a monotechnic level under the Education Department and provides three year courses with diploma education. The graduates are awarded 4th engineer or 3rd officer certificates without national certification examination like graduates of other monotechnics. Professional and Technical schools are in the lowest level of the Chinese MET. Their students are from graduates of middle schools with a general education background. After students graduate, they have to go sea for several years with a minimum of two years. Then some of them will be permitted to enter re-education and training centres for short courses just before national certification examination. In other words no degree or diploma is available for those graduates even if they successfully complete their two or three year course in school. There are more than ten such registered schools including Zhejiang Transportation School, Tianjin Maritime School, Zhoushan Maritime Transport School in China.

### 2.3. MET for upgrading licenses in seafarers re-education and training centres

#### 2.3.1. QOSMC

Qingdao Ocean Shipping Mariners College (QOSMC), under the China Ocean Shipping Companies Group (COSCO), was established in May 1976. In the past 20 years, QOSMC has developed from a technical school to one of those institutions which is authorized to enrol students of formal college schooling for adult education program.

QOSMC offers 3 year courses in marine navigation, engineering, electrical equipment management, radio communications, international ocean shipping administration and international financial accounting management. There are various academic facilities including 34 labs, 7 audio-visual rooms and 5 training centers.

Now the college has 390 staff of which more than 40 hold the higher officer certificate issued by the Chinese Government and over 170 are full-time instructors. The number of students is around 1300. Except short course students, QOSMC has trained over 5,700 students in the 2 year and 3 year courses since its foundation.

The college boasts a 10,000 DWT ocean-going training ship. About 100,000 books including 6,000 foreign language books are owned by its library. With the support of COSCO and through its own efforts, QOSMC has made wide relationships and co-operation with 130 units at home and abroad. According to ISO9001, QOSMC was approved by DNV in October 1996. In the near future, a "COSCO International Seamen's Training Center" will be set up here.

### 2.3.2. Others

The majority of re-education and training centres belong to major MET institutions, and they get powerful support from those institutions which have authority over the centres. There are two very important centres to be worthy of special mention, MOC (the Ministry of Communications) Shanghai Training Centre For Seafarers (under SMU) and MOC Dalian Training Centre for Seafarers (under DMU). The great majority of ocean-going trainees for upgrading licences were trained in the two centre especially the former in where more than half of trainees were trained. As a part of the two universities, both of the two centres are jointly organized by the Education Department and the Maritime Safety Administration.

Other institutions concentrate their attention on upgrading licences for land water-based vessels (e.g. TYPE C shown in 4.2.) and lower classes certificates (e.g. engineer certificates for the power of main engines under 750 KW).

All re-education and training centres run short courses of around four months for upgrading licenses of seafarers who have to have appropriate seagoing experience as a unique entry requirement. Degrees and diplomas are unavailable here.

Reviewing the above, the structure of the Chinese MET system is illustrated in Figure 2.1.

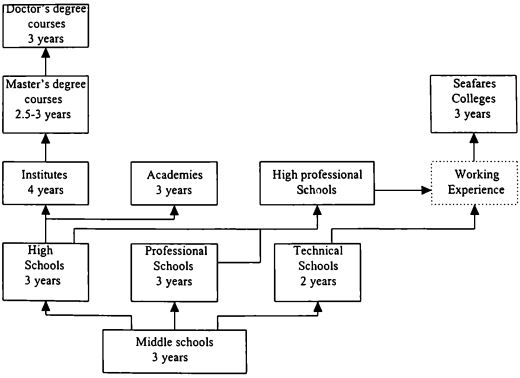



Figure 2.1 the Chinese MET System

# Chapter III

# The new international requirements of the STCW95 Convention

## 3.1. Background of the STCW95 Convention

### 3.1.1. Brief introduction of the STCW78 Convention

The commercial history of shipping has gone through almost 200 years from 1802, the first time whenfor a steam engine was used at sea with a commercially satisfactory result. The world total tonnage has risen up to over 700 million net tons, excluding the vessels under 100 grt in the mid 1990s, which is nearly a hundred times compared with the world total tonnage 150 years ago, the beginning of the golden age of shipping. The number of shipping disasters has increased during this time, although shipping techniques are improving every day.

Statistics indicate that a great number of shipping accidents are caused by human error, as indicated by Mr. O'Neil, the Secretary-General of IMO, who stated that a 50%-80% human error rate occurred in maritime accidents. In order to have safety at sea and to decrease accidents caused by human error, some relevant international organizations made great efforts in which one of the most important is the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) 1978 established by IMO.

The STCW78 Convention was drafted in the early 1970s, following a resolution by what was then IMCO (the Inter-Governmental Maritime Consultative Organization), the original form of IMO, in 1971 and adopted from an international conference in

association with the International Labour Organization (ILO) in 1978. By 1984 the new convention had sufficient support world-wide to become a part of accepted international maritime law. The Convention was the first attempt to establish global minimum professional standards for seafarers. Previously the standards of training, certification and watchkeeping of officers and ratings were established by individual governments, usually without reference to practices in other countries.

There have been three amendments since the STCW78 entered into force on 28 April 1984. The first is the 1991 amendment with respect to the additional requirements made by the implementation of the Global Maritime Distress and Safety System (GMDSS), which was adopted on 22 May 1991 and entered into force on 1 December 1992. The second is the 1994 amendment with respect to its special requirements for personnel serving on tankers, which was adopted on 25 May 1994 and entered into force on 1 January 1996. The last is the 1995 amendment, namely the STCW95 Convention which was adopted on 7 July 1995 and entered into force on 1 February 1997. Up to 1996, the STCW78 had been accepted by 115 states with fleets aggregating 94.90% of the world merchant shipping tonnage.

The technical provisions of the Convention are contained in an Annex which is divided into six chapters:

Chapter I: General provisions

The general provisions are covered by five regulations in this chapter.

Chapter II: Master-deck department

It outlines basic principles to be observed in keeping a navigational watch, lays down mandatory minimum requirements for the certification of masters, chief mates and officers, and also includes regulations designed to ensure the continued proficiency and updating of knowledge for masters and deck officers.

Chapter III: Engine department

It outlines basic principles to be observed in keeping an engineering watch, lays down mandatory minimum requirements for certification of chief and second engineer officers.

It also includes mandatory minimum requirements for certification of engineer officers in charge of a watch in a traditionally manned engine-room or designated duty engineer officers in periodically unmanned engine-room.

Other regulations in this chapter includes mandatory minimum requirements to ensure the continued proficiency and updating of knowledge for engineer officers and mandatory minimum requirements for ratings forming part of an engine-room watch.

Chapter IV: Radio personnel

This chapter establishes minimum additional knowledge and training requirements for radio personnel, mandatory minimum requirements to ensure the continued proficiency and updating of knowledge for the global maritime distress and safety system (GMDSS) radio personnel and mandatory minimum requirements for certification of GMDSS radio personnel.

Chapter V: Special requirements for tankers

This chapter includes mandatory minimum requirements for the training and qualifications of masters, officers and ratings of oil tankers, chemical tankers and liquefied gas tankers.

Chapter VI: Proficiency in survival craft

This chapter deals with mandatory minimum requirements for the issue of certificates of proficiency in survival craft and rescue boats, and minimum knowledge required for the issue of certificates of proficiency in survival craft.

The requirements of the STCW78 Convention were augmented by 23 resolutions, many of which contained more detailed provisions on the subjects covered by the Convention itself.

### 3.1.2. Background of the STCW95 Convention

Although the STCW78 Convention made great contributions to the world shipping industry with its global standards, the most frequently heard complaint about the STCW Convention over the years since its entry into force is its weaknesses caused by the Convention being out of date and not reflecting current working practices and new training technologies. If does not adequately define standards required of watch keepers and others with responsibility, and its mechanisms for ensuring flag state compliance. The weaknesses are shown below.

1. There are widely varying interpretation and different standards of implementation by parties. For example, "to the satisfaction of the Administration" which is one of the many vague phrases that have resulted in different interpretations being made.

2. There are varied standards of certificated seafarers, which led to complaints that standards differ widely from country to country and certificates could therefore not always be relied upon.

3. It is difficult to ensure that seafarers are skilled and competent, when it is based on the presumption that this is achieved during sea-going service.

4. It is impossible to provide assurance of the quality of training institutions and trainers, because the concept of qualifications of instructors, supervisors and assessors was established in the STCW95 for the first time.

5. The STCW78 Convention lacks a uniform standard about certification examination concerning with oral and written examination and practice assessment on board, which are usually beyond the control of maritime administrations.

6. As regards shipboard work organization, the STCW78 Convention is based on traditional divisions between the deck and engine departments. This has already proved too restrictive, limiting the potential career development of seafarers and preventing any safety-enhancing redistribution of work or workload on board during intensive working periods.

With the convention rapidly losing credibility, the IMO perceived a failure to enforce international safety standards so that the convention had to be amended.

There were five main aims behind the revision:

1. To transfer all detailed technical requirements to an associated code.
2. To clarify the skills and competence required.
3. To require administrations to maintain direct control over, and to endorse the qualifications of, those masters, officers and radio personnel they authorise to serve on their ships.
4. To make parties to the convention accountable to each other, through IMO, for the proper implementation of the convention and the quality of their training and activities.
5. To have the amendments enter into force for all parties to the convention with the least possible delay.

The revision process started back in 1992. In December of that year, the Maritime Safety Committee agreed with a proposal of the United States to commence a comprehensive review of the STCW78 Convention. The Committee further instructed that the sub-committee on Standards of Training and Watchkeeping (STW), who agreed in general with a proposal made by the International Shipping Federation (ISF) that a detailed examination and assessment should be made of current and future trends in maritime training and the methods of imparting knowledge both ashore and afloat in February of that year should prepare a comprehensive list of items to be reviewed and submit this for the Committee's approval.

In 1993, several serious casualties occurred especially the "Aegean Sea" which was carrying 80,000 tonnes of crude oil and sank off the Northwest coast of Spain in December 1992, and the "Braer" which spewed 85,000 tonnes of oil into the sea nearby the Shetland Islands in January 1993. Mr O'Neil stressed that it was necessary to accelerate the implementation of improvements in IMO Standards and the effort to amend the STCW Convention should be conducted with a view to bringing the amendments into force as soon as possible. In general, development of a comprehensive revision to a convention would take at least three if not five years to develop, given the normal cycle of meetings, which would involve three to four meetings of the STW Sub-Committee, a similar number of intersessional meetings, an interim and a final review of the proposed amendments by the Maritime Safety Committee. Therefore, at the request of the Maritime Safety Committee, IMO decided to utilise a small number of consultants provided by governments and organizations in consultative status and that maritime training institutes of international repute were invited to co-operate in the concerted efforts to accelerate the amendment pace.

The work of the consultants had received wide support from the governments of Germany, Korea, Mexico, Spain, the UK and the United States, and the International Confederation of Free Trade Unions (ICFTU), the International Federation of Shipmasters' Associations, ISF, the Arab Maritime Transport Academy (AMTA), DMU, Singapore Polytechnic, Singapore National Maritime Academy and World Maritime University (WMU). The Chairman of the STW Sub-Committee also participated as an observer. The revision of the STCW Convention was also the concern of the International Labour Organization (ILO) who co-operated by holding two sessions of the Joint ILO/IMO Committee on Training (JCT) to consider principles underlying the revision, particularly in the matter of basic safety training, the human element & fatigue, compliance & verification, and the functional approach principle. The outcome later showed that such kinds of co-operation, as well as the four meetings of consultants before adopting texts of the "1995 amendments" in July 1995, was successful and effective.

### 3.1.3. The major technical details of the STCW95 Convention

**Implementation schedule**

Implementation dates of the STCW95 Convention are shown below:

- The STCW95 Convention entered into force on 1 February 1997.
- New entrants commencing training will be required to do so according to the new requirements in the STCW95 Convention after 1 August 1998. Parties' governments will have to submit documentary evidence by 1 August 1998 to the IMO to show how they comply with the new requirements of the STCW95 Convention.
- All transitional measures will end on 1 February 2002.

It means from now on there is a five-year period of grace during which parties may continue to issue, recognize and endorse certificates that applied before 1 February 2002 in respect of seafarers who began training or seagoing service before 1 August 1998.

**The structure**

Compared with the STCW78 Convention, the new Convention makes radical changes. It consists of three parts as follows:

1) 17 articles
For legal reasons, namely making use of a "tacit acceptance" procedure to enable the changes to be adopted with the maximum speed; the 17 articles are unchanged.

2) An Annex of Regulations
The new Annex to the revised Convention contains basic legal requirements, and comprises eight chapters of which six are renewed, and two others are new.

3) A new Seafarers' Training, Certification and Watchkeeping (STCW) Code
All the technical provisions of the revised Convention are contained in the new Seafarers' Training, Certification and Watchkeeping Code (STCW Code), which also comprises eight sections and substitutes for some of the materials from resolutions in the old Convention. Further details and interpretation of the Articles and Regulations are presented in the Code.

The Code is divided into two parts, Part A and Part B. Part A contains mandatory provisions to which specific reference is made in the various regulations. The provisions give in detail the minimum standards of competence required to be maintained by parties in order to give full and complete effect to the STCW95

Convention. The standards of competence required to be demonstrated by candidates for the issue and revalidation of certificates of competency under the provisions of the STCW95 Convention are also contained in Part A.

Part B of the Code contains recommended guidance on the implementation, interpretation, application and enforcement of the Convention. The measures suggested are not mandatory and the examples given are only intended to illustrate how certain requirements in the Convention may be complied with. However, it is possible that some of the measures in this part may be upgraded to mandatory status in the future.

**The format**

The layout of the new Convention is more logical. It is a numbering sequence which allows provisions to be readily identified and cross-referenced throughout the text. Consider for example, Fitness for Duty in Chapter VIII as shown in the following relationship between the Annex and the Code:

- Regulation VIII/1 stipulates that each Administration shall, for the purpose of preventing fatigue, 'establish and enforce rest periods for watchkeeping personnel'.

  Section A-VIII/1 of the Code, as a mandatory requirement, contains detailed requirements which are 'All persons who are assigned duty as officer in charge of a watch or as a rating forming part of a watch shall be provided a minimum of 10 hours of rest in any 24-hour period' in paragraphs 1, 'the hours of rest may be divided into no more than two periods, one of which shall be at least 6 hours in length' in paragraphs 2, and 'the requirements for rest periods laid down in paragraphs 1 and 2 need not be maintained in the case of an emergency or drill or in other overriding operational conditions' in paragraphs 3.

- Section B-VIII/1, as a recommendatory guidance and advice regarding fitness for duty, points out in paragraphs 1 that 'in observing the rest period requirements, "overriding operational conditions" should be construed to mean only essential shipboard work which cannot be delayed for safety or environmental reasons or which could not reasonably have been anticipated at the commencement of the voyage'.

**The contents**

The contents in the new Annex of the STCW95 Convention and the Code are formed by eight chapters, which are shown below:

Chapter I General Provisions
Chapter II Master and Deck Department
Chapter III Engine Department
Chapter IV Radiocommunication and Radio Personnel
Chapter V Special Training Requirements for Personnel on Certain Types of Ship
Chapter VI Emergency, Occupational Safety, Medical Care and Survival Functions
Chapter VII Alternative Certification
Chapter VIII Watchkeeping

The contents of Chapter I is shown in Appendix 1, the more technical details of Chapter II to VIII of the Convention are outlined in Appendix 2.

### 3.2. Impact on Maritime Education and Training Institutions

#### 3.2.1. Quality standards

There is an entirely new provision of quality standards (Regulation I/8) in the 1995 STCW Convention. This regulation aims to ensure that the quality of the party's

training and certification processes meet those laid down in the convention: uniform implementation and application. In accordance with the new provision and Section A-I/8 of the Code, all training, assessment of competence, certification, endorsement and revalidation activities should be controlled by the maritime administrations who is also required to ensure that such activities including the qualifications and experience of instructors and assessors are continuously monitored through a quality standards system from 1 February 1997 onwards.

In many countries the assessment relies greatly on written examination. An oral examination is usually used by the maritime administrations to assess competence. Some countries have taken the step to transfer part or their whole examination system from the administration to the maritime education and training institutions recognized by the administration. It means that MET institutions have to establish and perfect their quality standards systems, which does not only concern written examinations but also other activities with a periodical external evaluation by qualified persons who are not themselves involved in the activities concerned to meet Regulation I/8 and Section A-I/8. A party is also required to submit information relating to the evaluation to the Maritime Safety Committee of the IMO.

### 3.2.2. Lecturers, supervisors and assessors

According to the new provision, Regulation I/6, lecturers, supervisors and assessors engaged in the instruction of seafarers in an MET institution recognized by the maritime administrations should be qualified and experienced for particular types and levels of training or assessment of competence of seafarers either on board or ashore. As a requirement of Section A-I/6 an instructor conducting in-service assessment of competence of a seafarers should have an appropriate level of knowledge and understanding of the competence to be assessed, be qualified in the task for which the assessment is being made, have received appropriate guidance in assessment methods

and practice, have gained practical assessment experience, and have gained practical assessment experience on the particular type of simulator under the supervision and to the satisfaction of an experienced assessor if conducting assessment involving the use of simulators.

### 3.2.3. Requirements for revalidation of certificates

Regulation I/11 requires member states to compare the standards of competence which it requires for certificates issued before 1 February 2002 to be compared with those specified for the appropriate certificate in part A of the Code. The holders of STCW78 certificates and revalidated STCW78 certificates for service after 1 February 2002 should meet the standards of competence required by the new Convention. In other words, an STCW78 certificate should not be revalidated for service after 1 February 2002 unless the holder undergoes appropriate refresher and updating training or assessment before that date. It is a challenge to MET institutions which have to promote the formulation of a structure of refresher and updating courses under Section A-I/11 of the Code for the purpose of the safety of life at sea and the protection of the marine environment.

### 3.2.4. Use of simulators

In the real world, skills are developed by exposure to relevant experience or by repetition of the training module. It is easy to understand that acquisition of skill based on the workplace is limited. In the simulator context, skills can be gained in a simultion risk-free environment by performing tasks to meet specific objectives without any risk. Whether training tasks can relate to the real world, setting clear training objectives is a key element. In the new Convention, simulators have become mandatory for radar and automatic radar plotting aid training under Section A-I/12 of the Code and are recommended for use in other areas, for example, cargo handling

and stowage simulation, navigation and watchkeeping simulation, and main and auxiliary machinery operation simulation under Section B-I/12 of the Code. The use of simulators is of course an improvement for the shipping industry. However, it threatens a number of maritime institutions which cannot install or bring into use simulators to meet the new requirement before 1 February 2002. To many maritime institutions, it may be a technical problem. However, for others it is a financial problem because the capital equipment costs are too high especially to many developing countries.

### 3.2.5. Requirement of alternative certification

From 1 February 1997 onwards, Parties are permitted to issue alternative certificates in accordance with the new Regulation VII and Section A-VII, if they want to do so. The alternative certification differs from traditional certification that is based on conventional divisions between deck and engine departments. It enables crews to gain training and certification in various departments of seafaring rather than just concentrating on one aspect throughout their careers, which makes it possible for a seafarer to hold one or more appropriate certificates in any function or group of functions specified in table A-II/1, A-II/2, A-II/3 or A-II/4 of Chapter II or in table A-III/1,A-III/2,A-III/4 of Chapter III or A-IV/2 of Chapter IV of the Code. As a new concept, alternative methods of issuing certificates provide a great flexibility to promote safety-enhancing redistribution of workload on board during intensive working periods. Undoubtedly, alternative certification is an advanced certification method. However, a few governments will try to do so in the near future for various reasons, one of them being the redevelopment of curricula in maritime institutions. How to redevelop curriculum of institutions effectively is a new problem facing institutions as well as administrations today.

### 3.2.6. Mandatory minimum safety training

Under Regulation VI/1, all seafarers with a designated safety or prevention of pollution duty on board have to receive basic mandatory minimum safety training before being sent to join a ship. Basic training to meet the standards of competence defined in Section A-VI/1 of the Code, covers personal survival techniques, fire prevention and fire fighting, elementary first aid, as well as personal safety and social responsibilities. In the same way as for the competence of watchkeeping, the competence required, methods of demonstrating competence and the evaluation criteria for the training are respectively tabulated in table A-VI/1 to table A-VI/4 of the Section with recommendations that IMO Model Courses may assist in the preparation of courses. The preparation of such courses is not easy to make in MET institutions in spite of having support from the IMO Model Courses, because it not only concerns teaching theory but also teaching facilities. For example, according to Section B-VI/1 of the Code, fire prevention and fire fighting should include theoretical and practical training. In addition, it is highly important for MET institutions to train qualified instructors before courses start.

### 3.2.7. Competency based training and assessment

The main emphases of the STCW78 about minimum standards of competence are competence, knowledge, understanding and proficiency. Apart from those, the new STCW Code states quite clearly its additional emphases, which are methods for demonstrating competence and criteria for evaluating competence in table A. In each case the functions and levels involved are identified in four columns within these tables. For example, taking the function of marine engineering at the management level on ships powered by main propulsion machinery of 3,000 KW propulsion power or more; for the competence 'Operate, monitor and evaluate engine performance and capacity', one element of knowledge, understanding and

proficiency in theoretical knowledge is 'operating principles of ship power installations (diesel, steam and gas turbine) and refrigeration'. The methods for demonstrating this competence are shown in table A-III/2 below:

Examination and assessment of evidence obtained from one or more of the following:

.1 approved in-service experience;

.2 approved training ship experience;

.3 approved simulator training, where appropriate.

It is obvious that competence in the STCW95 Convention is more dependent upon training and assessment compared with the competence based on knowledge requirements in the old Convention. In this situation, MET institutions have to redevelop their existing teaching curricula to meet the new competence requirements.

### 3.3. Impact on maritime administration

#### 3.3.1. To establish a record system for the issue of certificates and endorsements

A Party is required to establish a new record system concerning the issue, recognition and endorsement of certificates, by the use of three endorsements stipulated in Regulation I/2 of the new Convention. A Party can choose whether endorsements are incorporated in format of certificates or not. If incorporation is chosen by a Party, the endorsement required by article VI (Certificates) of the revised Convention is incorporated in the wording of the certificate itself.

Otherwise the form of endorsement used is set forth in paragraph 2 of Section A-I/2 with a title of 'ENDORSEMENT ATTESTING THE ISSUE OF A CERTIFICATE

UNDER THE PROVISIONS OF THE INTERNATIONAL CONVENTION ON STANDARDS OF TRAINING, CERTIFICATION AND WATCHKEEPING FOR SEAFARERS, 1978, AS AMENDED IN 1995'. When all requirements of the new Convention have been complied with, an administration which recognizes a certificate under Regulation I/10 (Recognition of certificates) should endorse a certificate set forth in paragraph 3 of Section A-I/2 with the title of 'ENDORSEMENT ATTESTING THE RECOGNITION OF A CERTIFICATE UNDER THE PROVISIONS OF THE INTERNATIONAL CONVENTION ON STANDARDS OF TRAINING, CERTIFICATION AND WATCHKEEPING FOR SEAFARERS, 1978, AS AMENDED IN 1995' to attest its recognition. Although, in terms of Regulation I/2, the format of certificates and endorsements may be varied to suit national needs, the required information must be shown in all cases.

Other requirements, for instance, the endorsement and the certificate number requirement and the form of the endorsement and the certificate on board, make the record system workable. The administration needs to improve its record system to better meet the new requirement.

### 3.3.2. To provide information to other parties as requested

A weakness of the old Convention is that a party can recognize the certificate issued by another Party without taking any responsibility for the competence of the seafarers and the validity of the original certificate. In accordance with the provisions of the revised Convention, the administration should hold companies responsible for the assignment of seafarers for service on their ships. To ensure the performance of such provisions, a Party is able to accept certificates issued by foreign administrations, and companies are entitled to request foreign administrations to confirm that certificates issued to seafarers serving on their ships are valid and authentic. In other words a foreign administration may be requested to provide any

information that the party wants about the standards of competence, the issue and endorsement of certificates and record keeping.

In accordance with Regulation I/10 of the revised Convention, an administration, which authorises the employment of seafarers holding foreign certificates on board its ships, has freedom to inspect the facilities and procedures for the issue, endorsement and record keeping of certificates of foreign parties. It means that inspection and control procedures are more stringent. Taking use of the words of the regulation, such investigation or inspection can be performed 'through all necessary measures'.

### 3.3.3. To establish standards of medical fitness

A new regulation, Regulation I/9, which deals with development of international standards of medical fitness for seafarers, appears in the revised Convention. In terms of this regulation, a Party should establish standards of medical fitness for its seafarers, particularly regarding eyesight and hearing and issue certificates only to candidates who can provide satisfactory proof that they comply with paragraph 3 of this regulation. A party is required to maintain registers of all certificates and endorsements for its seafarers and advise on the state of its certificates and endorsements when required by other parties and companies.

Although no any mandatory requirements for medical fitness are stipulated in Part A of the Code, there are fourteen provisions which are formed by two parts as regards their functions, namely medical examination and certification, and issue and registration of certificates as recommended requirements located in Section B-I/9. For example, paragraph 5 of Section B-I/9 shows:

> Medical examinations and certification of seafarers under the standards should be conducted by one or more medical practitioners recognized by

the Party. A list of medical practitioners so recognized should be made available to other Parties and to companies on request.

It means that a party should undertake fresh responsibilities which are not stipulated in the old Convention. A minimum in-service eyesight standard is set out in table B-I/9, as a recommended requirement, which is for the use of parties in the absence of mandatory international eyesight standards for seafarers. Parties can make use of their own standards but not lower than those given in table B-I/9.

### 3.3.4. Penalties to be imposed for Convention infractions

Parties are required to prescribe and enforce penalties or disciplinary measures where the Convention is not complied with by companies or ships' masters in accordance with a new regulation, Regulation I/5. The main aim of this regulation is to put teeth into the Convention and provide means for ensuring that the Convention is properly and effectively implemented by parties. The regulation states:

... penalties or disciplinary measures shall be prescribed and enforced in cases in which:

.1 a company or a master has engaged a person not holding a certificate required by the Convention;

.2 a master has allowed any function or service in any capacity required by these regulations to be performed by a person holding an appropriate certificate, to be performed by a person not holding the required certificate, a valid dispensation or having the documentary proof required by regulation I/10, paragraph 5; or

.3 a person has obtained by fraud or forged documents an engagement to perform any function or serve in any capacity required by these regulations to be performed or filled by a person holding a certificate or dispensation.

### 3.3.5. To determine the extent of refresher and upgrading training

Under the new Regulation I/11, parties must compare the standards of competence they have defined with those they required for certificates issued before 1 February 2002 and determine the need for requiring the holders of such certificates to undergo appropriate refresher and upgrading training or assessment. Parties must also take action immediately to formulate or promote the formulation of a structure of refresher and updating courses, which should include changes in relevant national and international regulations concerning the safety of life at sea and the protection of the marine environment and take account of any updating of the standards of competence concerned, and incorporate all necessary mandatory refresher and upgrading training and assessment into the arrangements made for revalidation of certificates under the revised Convention.

### 3.3.6. To ensure companies comply with their responsibilities

According to Regulation I/14 and the codes of the revised Convention, each administration should ensure companies comply with their responsibilities made in the provisions of this regulation. These provisions cover a company's responsibilities for certification, manning, record keeping, shipboard familiarisation and crew co-ordination. For example, as a requirement of record keeping, the administration should require each company to ensure that:

> 'documentation and data relevant to all seafarers employed on its ships are maintained and readily accessible, and include, without being limited to, documentation and data on their experience, training, medical fitness and competency in assigned duties' (Regulation I/14).

Under the administration, companies are required to man in compliance with the applicable safe manning requirements of the administration and issue an appropriate certificate to each seafarer working on board its ships in accordance with the revised Convention established by the administration.

### 3.3.7. Monitoring of quality standards in MET institutions

Parties must clearly define their education and training objectives and related standards of competence, and ensure that from the entry into force of the revised Convention onwards all training, competence assessment, certification, endorsement and revalidation activities are monitored through a quality standards system that not only applies to agencies and companies, but also to maritime education and training institutions. Parties should ensure that such quality standards are continuously monitored by internal quality assurance reviews and an independent evaluation of the knowledge, understanding, skills and competence acquisition and assessment activities, in addition to the administration of the certification system itself by qualified persons who are not themselves involved in the activities concerned, at intervals of not more than five years. Reports on MET standards should be forwarded to the Maritime Safety Committee (MSC) of IMO. The administration is also required to ensure that instructors, supervisors and assessors are appropriately qualified for the particular types and levels of training or assessment of competence of seafarers whether on board or ashore and have relevant experience. Any simulators in use for compliance with the revised Convention standards must be monitored by the administration whose tasks should cover performance standards to be used, training objectives and procedures, assessment procedures as well as qualification of instructors and assessors.

# Chapter IV

# The present structural formation of the examination system for higher marine engineer licences in China

## 4.1. The current structure of issuing certificates

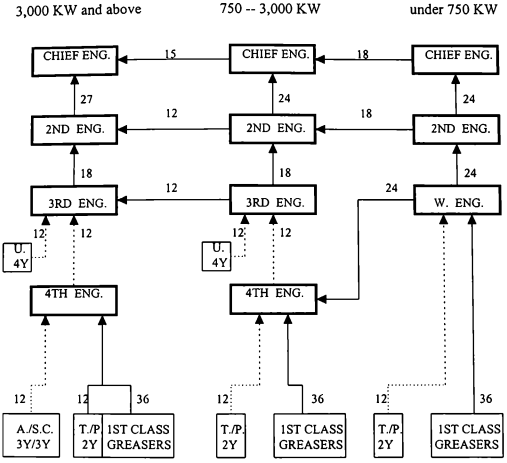
Figure 4.1 and 4.2 (see next two pages) illustrate the certification structure of the Chinese MET system for marine engineers and marine electrical engineers. Except for Fourth Engineer to Third Engineer, people in this process cannot upgrade their certificates unless they pass an examination of the Maritime Safety Administration of the Ministry of Communications of China (MSAMCC).

Before the twice yearly examinations, students must study for four months at least in a seafarer re-education and training centre acknowledged by the MSAMCC. Such re-education and training centres are numbered in the dozens in China. Generally, they are governed by big shipping companies or institutions, for example, the QOSMC governed by the COSCO, and Shanghai Centre for Crew Training jointly governed by the SMU and the MSAMCC.

## 4.2. National examination requirements

After the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW 1978) entered into force on 28 April 1984, the Chinese government formulated a series of regulations and rules. In terms of the Convention there are three rules related to seafarers' training, certification and examination in China. They are:

Figure 4.1. The certification chart for marine engineer




Note: 1. U. : university graduates

A. : academy graduates

S.C. : seafarers' college graduates

P. : professional school graduates

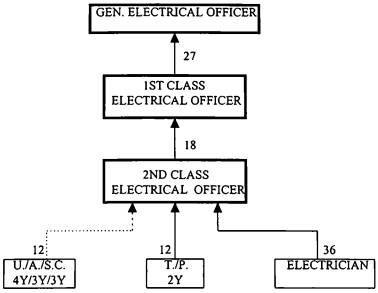
T. : technical school graduates

2. "_" : examination

3. "---" : check

4. Figures indicate: time requirements in months

Figure 4.2. The certification chart for marine electrical engineer




Note: 1. U. : university graduates

A. : academy graduates

S.C. : seafarers' college graduates

P. : professional school graduates

T. : technical school graduates

2. "__" : examination

3. "---" : check

4. Figures indicate: time requirements in months

- Regulations Governing the Examination and Certification of Seafarers On-board Sea-going Ships of the People's Republic of China, which entered into force on 1 January 1988;
- Rules on the Issuing and Carrying of Seaman's Record book, which entered into force on 1 January 1985;
- Rules of Seafarer's Special Training of the People's Republic of China, which entered into force on 14 June 1984.

As a competent authority, the MSAMCC is in charge of governing the Seaman's Record book, issuing the Special Training Certificate with its guidance, and superintending the examination and certification. According to the rules above, there are three types of competency certificate for seafarers on board:

TYPE A, which is applicable to

1. the master and officer on board a ship navigating in unlimited navigation areas;
2. the chief engineer and engineer officer on board a ship navigating in unlimited navigation areas; and
3. the general, 1st-class and 2nd-class radio telegraphy operator and general radio telephony operator.

TYPE B, which is applicable to

1. the master and officer on board a ship navigating in coastal navigation areas;
2. the chief engineer and engineer officer on board a ship navigating in coastal navigation and off-shore navigation areas; and
3. the general, 1st-class and 2nd-class electrical officer.

TYPE C, which is applicable to

1. the master and officer on board a ship navigating in off-shore navigation areas; and
2. the special radio telegraphy operator and special radio telephony operator.

The "unlimited navigation area" means any area of the sea, including foreign ports and canals that is open to international navigation.

The "coastal navigation area" means the coastal water area of China, including domestic ports along the coast. The "off-shore navigation area" means the water areas near the coast of China.

According to the power of the main engine, there are three classes of competency certificates for higher engineer licenses in China:

- 3,000 kilowatts and above;
- 750 to 3,000 kilowatts;
- under 750 kilowatts.

Instead of a 3rd and 4th engineer, the watchkeeping engineer takes responsibility for the engine room watch in the class under 750 kilowatts. Engineers in the other two classes are divided into chief engineer, 2nd engineer, 3rd engineer and 4th engineer. The relevant examination subjects are shown in Appendix 3. Appendix 4 shows the current examination subjects for electrical officers required by the MSAMCC.

Before examination the five major maritime safety administrations, which are the Shanghai, Dalian, Qindao, Guanzhou and Tianjin maritime safety administrations under the Ministry of Communications of China, are required to set a great number of questions for the exam. One of the administrations appointed by the MSAMCC is in charge of setting the paper for examination each time. The questions for the examinations provided by the designated administration are usually provided by the maritime institutions themselves.

### 4.3. The current examination methods

There are two current sub-examination systems for higher engineer licences in China, namely, the sub-examination system for new officers and the sub-examination system for upgrading licences. Although the purpose of both examinations are to obtain licenses issued by the state, the experiences of examinees are not the same, which lead to quite different procedures.

### 4.3.1. Examination for new officers

New officers in China are usually educated in maritime institutions but not in re-education and training centres and seafarers' colleges. As shown in Figure 2.1, new officers are from high schools after they pass a national examination. The majority of new officers majoring in marine engineering will be awarded 3rd engineer and 4th engineer certificates after graduating from institutions and academies. However, they do not have any experience on board before enrollment.

To meet the requirements of the MSAMCC with certificate, institutions and academies supervised by the Education Department of the MSAMCC have designed their examination system with relevant curricula covering all subjects in the national examination system. Such a system was agreed by the MSAMCC in 1985, and means that new officers can directly obtain higher licences without participating in the national certification examination as shown in Figure 4.1.

Before they obtain licences, students must train in a special training centre for special training programs in accordance with the "Regulations Governing Special Training and Certification for Seafarers of the People's Republic of China" and hold relevant certificates after examination. The special training programs for majoring in marine engineering are:

- survival at sea
- ship's fire fighting
- manoeuvring of survival craft
- first aid at sea

The certificates are effective until the seafarer retires. At the same time as obtaining a higher licence, students will be awarded a Bachelor's degree, so the system also has to meet the degree requirement of the State Education Commission of the People's

Republic of China (SECPRC). This is the main difference between the examination system for upgrading licences, namely, the national certification examination system shown in Figure 4.1, and the examination system for new officers in institutions or academies.

Some graduates with excellent grades from some institutions are able to take up advanced studies for a Master's degree, even a Doctorate degree as shown in Figure 2.1. However, such degrees do not relate to the higher licences. So relevant examinations are supervised by SECPRC without MSAMCC.

### 4.3.2. Examination for upgrading licences

The examination system for upgrading licences has the following requirements, which are also the components the system for new officers does not offer:

- The purpose is to get licences without a degree
- A four-month short course should be taken before examination
- It is necessary to have some experience on board before examination

Everybody, who wants to upgrade his licence, must pass the national certification examination. In order to enter the four-month short course people should have the following qualifications:

- a personal application
- a permit from the company served in
- a good record of health check-up
- holding the special training certificate
- appropriate service experience on board recorded in the Seaman's Record Book issued by the MSAMCC.

If the students fails in one or more subjects, the examinee cannot upgrade his licence. In this case, there are two chances to make up for each subject. If the examinee fails again, all records including the successful subject records are cancelled, and the examinee has to start from the beginning again. The national certification examination is held twice yearly, generally in January and July every year.

### 4.4. The current curricula for examination

#### 4.4.1. The curricula for the new officers

The curricula for the new officers not only meets the requirements of certification but also satisfies the requirements of degree education. Therefore the curricula design for a new officers is more complicated than in a re-education and training centre, and the duration of study is also longer, for instance, universities provide four year courses and academies provide three year courses for new officers.

It is necessary to state that the curricula in each university or academy is not same completely; such difference is agreed by the MSAMCC and the SECPRC as long as the target remains the same.

In regards to the current syllabus at university level for the four-year marine engineering course which is based on SMU, there are eight common subjects including Seamen's Culture, Basics of Law, Basics of Computer, English, and nine basic specialist subjects including Advanced Mathematics, General Physics, Engineering Mechanics, and Hydrodynamics with 1,516 total teaching hours arranged in the first and the second teaching year.

Fourteen specialist subjects and eight optional subjects are delivered in the third and the fourth teaching year. The teaching hours of subjects in the optional courses required of students should be 180 hours at least, while all specialist subjects are obligatory. Practical work includes six weeks seagoing practice, which is carried out in the first semester of the third teaching year, twenty-one weeks fieldwork and graduation thesis in the last semester of the fourth year and further five practical programmes.

The current syllabus at university level for the four-year electrical engineering course includes eight common subjects, six basic specialist subjects, twenty-three specialist subjects, eight optional subjects and forty-five weeks practical work. The arrangement of subjects in each teaching year is similar to the arrangement for marine engineering. The current syllabuses at university level for the four-year courses are shown in Appendix 5 and Appendix 6.

### 4.4.2. The curricula for upgrading licences

The curricula for upgrading licences in seafarers' re-education and training centres are exactly the same as the subjects of the national certification examination shown in Appendix 3 and 4. Each seafarer's re-education and training centre has its own teaching plan with relevant teaching hours. The number of teaching hours in different re-education and training centres is not the exactly same. Sometimes the differences are considerable, but the weight of the subjects in the national certification examination are the same. Therefore, the subjects for marine engineer provided by re-education and training centres depend on the level of the certificates. Appendix 7 gives a sample of the current syllabus with teaching hours for high engineer-licences at 3,000 KW and above based on the Shanghai Centre for Crew Training.

# Chapter V

# Analysis and improvement of the Chinese Examination System for higher marine engineer licences

## 5.1. MET Examination System: the need for change

The typical administrative hierarchy of a current Chinese maritime university is shown in Figure 5.1, which is based on SMU.

From the setting of papers for examinations to the finalization of results, the examination management procedure usually follows the steps as below:

1) setting of examination paper by the teacher who is involved in the teaching activities of the subject to be examined;
2) vetting and approval of examination papers by the course head who is responsible to the head of department for certain subjects;
3) final approval by the head of department;
4) examination invigilation by invigilators assigned by the course head;
5) marking and grading by the teacher who sets the paper;
6) finalization of results by the head of department;
7) checking of results by the Office of Supervision and Auditing; and
8) keeping the results in the Office of Teaching Affairs which also deals with appeals.

It can be found that the weaknesses in the above procedure are: firstly, the current procedure involves so many aspects, for example, the involvement of the course head, the head of department, the Office of Supervision and Auditing, the Office of Teaching Affairs and the teacher involving teaching activities means the procedure is

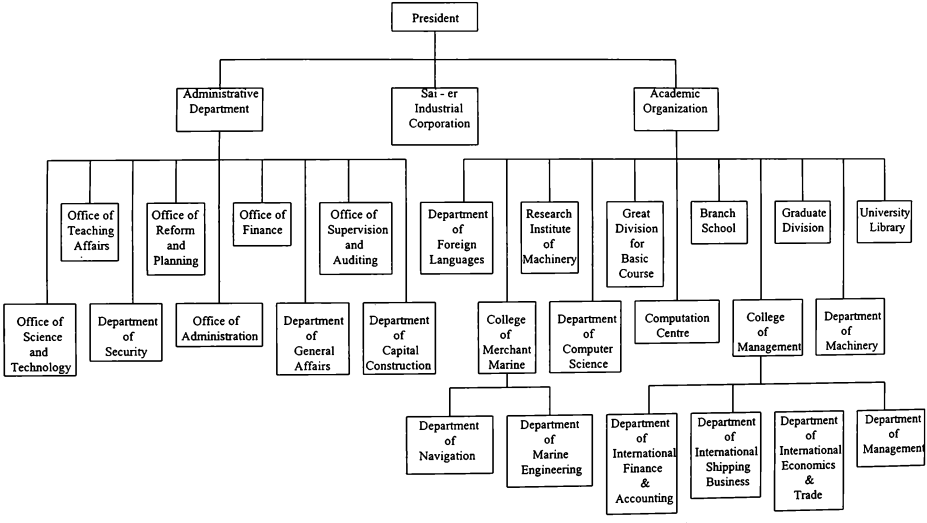



Figure 5.1 The administrative hierarchy of Shanghai Maritime University

difficult to manage; secondly, the setting and marking of the examination paper by the same person who is involved in the subject as a teacher is questionable without certain safeguards.

To fulfil the requirements of quality standards of the STCW95 Convention, an examination committee formed by few course professors should be created to be responsible to the head of each department of the academic organization for the setting of papers, examination invigilation, marking, grading, finalization of results and appeals. So the above steps can be simplified as below:

1) setting of papers through the use of a question bank, marking, grading, finalization of results and dealing with appeals under the examination committee;
2) taking part in examination invigilation or assigning qualified invigilators for the examinations by the committee; and
3) keeping results from each examination committee together in the Office of Teaching Affairs.

The examination management procedure in almost all medium and small sized Chinese institutions is usually performed by the academic department itself, marking it too difficult to ensure the implementation of quality standards. Therefore, such examination committees should be accepted by all Chinese MET institutions extensively.

### 5.2. Establishment of a question databank for examination

#### 5.2.1. Question bank in academies

The traditional method of setting questions for written examinations in Chinese MET academies is for them to be prepared by the lecturer who is involved in the subject to

ɔe examined as teacher. The weakness of the method, which had discussed in 5.1, is hat setting questions by the person himself has some disadvantages such as safeguards of questions and influence of the person's subjectivity, etc. An examination committee can participate in the work using a computer-based question oank instead of the lectures himself.

The main objective of setting question bank for examinations is to ensure the implementation of the quality standards provisions in the revised Convention, though there is no requirement about the bank in the Convention. Now it is possible to set up computer-based question bank for examinations in medium or large sized maritime academies particular in maritime universities in China. All problems for each subject in the bank are from the course team and should be checked by the examination committee one by one, then be classified in terms of their types (e.g. short answer problems, True-False problems, etc.) and for level of difficulty by the committee. Papers for examinations are formed by question with varying degrees of difficulty which are taken from all problems by computer randomly. The use of item difficulty will help to classify the degrees. Item difficulty is based on the percentage of students completing an item incorrectly, namely:

$$\text{Percentage Difficulty} = \frac{\text{Number giving wrong response}}{\text{Total number in group}} \times 100\%$$

Taking a sample of 100 students for a multi choice item, if 42 of them chose wrong response, the Percentage Difficulty = (42/100) × 100% = 42%.

Percentage Difficulty can also be determined for essay or extended question items. For example, an essay item is worth 10 marks, if the 100 students scored 750 marks out of the possible total of 1000(10 × 100 = 1000) marks,

An expert team whose members are from the five Administrations should be established and put in charge of setting up the question bank with sufficiently number of questions to cover all examination needs. Model answer for each question can be decided by the expert team one by one. Question should be selected by computer automatically and randomly. Questions in the question bank should be renewed regularly to keep them up to date. Update of the system can be carried out by the expert team in terms of new national law and international requirements including relevant international convention. Safeguard of question bank is based on the number of questions, that means the bigger the number of question is, the more secure the question bank is. It is possible to establish a several thousand question-based question bank for marine engineering in China today, normally, the number of question in national examination papers for higher marine engineering licenses is less than 70 including 60 for multiple-choice and 6 to 8 for essay and calculation.

### 5.3. Independent external evaluations of the examination system

The purpose of the independent external evaluation in accordance with Section B-I/8 of the Code is to provide an independent assessment of the effectiveness of the quality standards. As one of the key elements of the quality standards, an independent evaluation should be a systematic and independent examination of all quality activities including examination activities concerning with maritime institutions and national certification examination.

The present evaluation for examination activities in Chinese MET institutions only depends on an internal evaluation without an external evaluation required under Regulation I/8 where the external evaluation shall be periodically undertaken by qualified persons who are not ordinarily involved in the activities concerned. So it is necessary to decide which qualified persons, who must be outside of the National

Administration Quality Standards System, namely the MSAMCC as well as the Ministry of Communications of China, will be selected for assessment of examination activities of MET institutions first. The most suitable persons may be from the State Education Commission of the People's Republic of China (SECPRC), educationalists from outside the institution under evaluation could be part of the team(i.e. from other MET institutions).

The work done by the independent external team (or persons) should cover all examination activities. Some necessary advance information should be provided to the team, the information should include:

- an examination chart;
- examiners and examinees information;
- a description of the methods used in setting and marking of examination papers;
- appeals; and
- feedback from examinees.

The results of the independent external evaluation need to be documented and brought to the attention of those responsible for the area evaluated. The evaluation should be undertaken at intervals of not more than five years.

Similarly, a new external evaluation team, formed by qualified persons from the SECPRC should be established to be responsible for assessment of the national certification examination system. Advance information similar to that above should be provided particular regarding examiners' qualifications which is the main weakness existing in the national certification examination system today. It is believable that this weakness can be overcome through the development of supervisory functions of the MSAMCC itself.

### 5.4. Assessment on board ships

Different from MET in some other countries, MET in higher learning institutions in China places emphasize very much on degree level education against professional training. In this case, the graduates have a satisfying performance of theoretical knowledge, such as mathematics, physics and chemistry (those are also influenced by the general education) and even speciality theory about marine diesel engines, and marine auxiliary machinery. But the industry often complains of that their hands-on ability is unsatisfactory for their job as engineer on board ships.

The complaint is due to the demands of the industry. All the shipowner wants today is a skilled operator, not an educated seafarer whose practical capability is lower then a skilled operator.

Yet, on the side of the higher learning institutions, multi purpose education is required by the state, which means that the graduates not only demonstrate their professional ability on board ships, but some of them will employed as officers in the administration or as ship designers for whom the degree education is important, and educated graduates are required. In addition, the disadvantages of front ended training schemes conducted by all the Chinese higher learning maritime institution are:

- Cadets lack enough time to practise during the time of education and training at school;
- Cadets lack practical experience before they graduate. This makes it more difficult to teach as they are unable to relate to real world experience;
- The courses may become very theoretical and lack the means to assess skills for competency;
- Cadets possible lack of motivation.

How to meet the demand of the industry without changing the current education scheme is a problem to be solved in China. A possible approach is to improve assessment on board ships.

The most important practical work in the Chinese higher learning MET institutions for marine engineering is the Fieldwork and Graduation Thesis that involves a 21 week board ships training programme, occuping the whole last semester of the four years course (see Appendix 5). The students are allocated to individual ships owned by shipping companies that the student will be employed after his graduation. Assessment of the training programme is formed by two parts:

- a check-list including various training items required by a fieldwork training syllabus provided by the institution with marks by Chief Engineer of the ship, which are returned to the institution at the end of the 21 weeks;
- a progress report based on a training report as well as the thesis of the student which is sent back to the institution with the check-list by the Chief Engineer, and marked by assessors at the institution.

Student will be recalled for his thesis presentation, if his composite training result is unsatisfactory.

The above assessment has the following weaknesses:

- Once the assessment is carried out by an unqualified Chief Engineer, the result will be less valid;
- The result based on the thesis presentation is located outside of where the practical work is conducted and will be doubtful;
- The qualification of instructors as practical work assessors is doubtable.

World developments are forcing shipowners to fit the most advanced equipment available to their new-building vessels, while rapid technological advances and developments are outpacing the ability of shipowners to cope with training needs.

An basic training scheme for qualifying chief engineers should be carried out by owners in co-operation with MET institutions. Putting the thesis presentation on the location where the practical work is conducted will enhance creditability of the result. A spot check by a qualified assessor (it is discussed in 5.8.) and the Chief Engineer should be made for such students whose training report and graduation thesis looks satisfactory.

All the schemes need funding support which can be obtained from the industry and the administration, in other words, conducting the schemes needs co-operation of the industry, MET institutions and the administration as well. It is believed that complaints from the industry will be reduced if on board assessment relying on above the schemes is conducted efficiently.

### 5.5. Standardization of teaching materials

The purpose of standardization of teaching materials is to fit materials to national examination requirements. At present, teaching materials for new officers used by MET institutions in China is quite uniform although compilers or publishers are different, because the materials have to meet the degree requirements in some institutions and they have to be approved and be accepted by the Administration. However, teaching materials used by re-education and training centres for upgrading licenses are in disorder.

Today in China, almost all major maritime institutions (e.g. DMU, SMU and JNI) have their own re-education and training centre for the most important purpose of upgrading marine officers' licenses. Teaching materials used by these centres are often compiled by themselves according to their comprehension of the national examination syllabus. For example, who is responsible, the shipowner or the

shipyard, for a certain item during dry dock job of a ship. The answer is negotiable in real the job without being defined in the national examination syllabus. For such indefinable items, the model answer issued by each institution usually depends on their experience and sometimes is different. There may be two correct answers in the national examination, because the source of questions with model answers is based on contributions of the teaching materials of the individual institution. It is unreasonable, particular for multiple-choice, that there is one question with two correct answers.

Apart from the establishment of a question bank for the national examinations, standardization of teaching materials is very important approach to solve such kind of problems. A team in which members are formed by some major MET institutions including DMU, SMU and JNI at least can be responsible for standardization of teaching material under the Ministry of Communications for re-education and training centres. Details concerning vague definitions and concepts that are impossible to be defined by the national examination syllabuses should be defined by the team. Once the uniform teaching materials are published, they should be used by each MET institution as a standard as well as a standard source of questions for the national examinations.

### 5.6. Simulators for assessment

#### 5.6.1. Methodology of assessment

Compared with assessment, people have emphasized the training side of simulators since engine room simulator-based training and assessment appeared in China around ten years ago. In other words, the use of simulators is much like a dispensable supplementary training method, not a method for assessing competence of students. Yet this opinion has been shaken by the revised Convention. There are a number of

reasons why an assessment of somebody might be conducted, for example, an assessment for the purposes of recruitment; assessment for promotion; an assessment of proficiency to satisfy a particular company's standards; assessment of competence for the purpose of certification; or assessment to evaluate training effectiveness.

Funds shortage hampers China, as a developing country, to set up new engine room simulators in a short time. How to fulfil the increasing requirements of using engine room simulators for marine engineer training and assessment with the present simulators is a big problem facing the Administration. There are four main features of present simulator-based training and assessment in China:

1). A general shortage of simulators

The systematic training and assessment of around a thousand chief engineer certificate holders with simulators has just started which is the first step in a training and assessment scheme for all engineer certificate holders. It is difficult to rely on a few of engine room simulators for the scheme.

2). Differing functional capability

Some of them incline to simulation of in land water-based vessels due to a considerable transportation capacity that has to be considered in China.

3). Out of date software and hardware

Conservative ideas and shortage of funds make present simulators lacking the necessary upgrades to meet the requirements of developing high technology used in the engine rooms of modern merchant ships.

4). Lack of effective training assessment

Sometimes, simulator training in China is much like a teaching performance to trainees for the purpose of familiarization with a certain simulator without

assessment at the end of the 'training'. The qualification of trainees, therefore, can not be ensured in this way, and certificates issued to trainees after the training are of doubtful quality.

One method to make present simulators training and assessment much more effective and economic is to improve the present assessment software with a simple and uniform assessment criterion based on a trainee's degree of achievement which was defined by Professor Takashi Nakamura(1997).

The instructor can assess a trainee's degree of achievement by checking how many errors (abnormal procedure) he has made during the performance of a given exercise. The normal procedures to perform each exercise should be decided by the instructor, and should include the procedures to make proper judgement about conditions of the system and to ensure proper behaviour in the operation of machinery. The definition of the degree of achievement is as follows:

$$T_A = \left(1 - \frac{E_N}{E_T}\right) \times 100\%$$

where, $T_A$: Degree of achievement

$E_N$: Number of errors made by trainee

$E_T$: Number of possible opportunities to make errors in the normal procedure

To obtain the degree of achievement by using the above definition, it is necessary to define errors first. A schematic model of the performance of an exercise given to a trainee is shown in Figure 5.2.

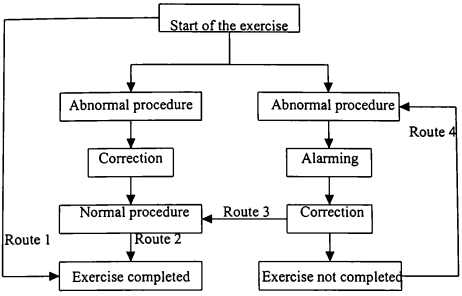



Fig. 5.2. Model of performance

Source: ICERS/3 paper '*An Assessment Criterion with Respect to Training for the Marine Engineer as an Operator*'

Route 1: The trainee performs the exercise according to the procedure based on the rules;

Route 2: The trainee performs the exercise according to the normal procedure where there is no possibility of alarm and he notices something wrong in the procedure and corrects the mistake;

Route 3: The trainee performs the exercise according to the procedure and he notices something wrong in the procedure with the information of alarms and corrects the mistake;

Route 4: The trainee can not perform the exercise because he can not correct the abnormal procedures despite the occurrence of the alarms.

In this flow chart, the error means a procedure which leads to sound alarms and a procedure which deviates from the specified normal procedures. The $E_N$ can be easily measured by using the alarm printer and the event printer on the simulator. The $E_T$ can be determined by calculating the number of possible errors for each exercise.

The time required to complete each exercise is also an important factor to assess a trainee's degree of achievement. The time factor can be expressed by a time coefficient Ct:

$$C_t = \frac{T_1}{T_2}$$

Where, $T_1$: standard time defined by the instructors

$T_2$: time spent to complete a exercise

Therefore, considering the time coefficient Ct, a corrected degree of achievement can be used to assess competence of trainee, which is $T_A$':

$$T_A' = C_t \times T_A = C_t \left( 1 - \frac{E_N}{E_T} \right) \times 100\%$$

That means, during the final examination, the more time the trainee spends to complete a given exercise, the smaller the Ct is(when Ct is less than one, it means the trainee fail in the examination), and the lower the $T_A$' is; the larger the number of errors is, the lower the $T_A$ is, and the lower the $T_A$' is.

A passline (an approved minimum $T_A$'), and ranges for different levels such as very good, good, pass and failure if necessary, should be decided for each exercise by the instructors before exercises are conducted.

Taking a sample of starting a turbo generator, the following steps will be followed:

- Check the boiler's steam pressure and open the main steam shut off value; ($E_T$=1)
- Open the steam supply value of the turbine; ($E_T$=1)
- Start the condenser vacuum pump; ($E_T$=1)
- Start the main condensate pump; ($E_T$=1)
- Open the T.G. drain valve for about one minute to blow off the condensate from the steam line and the turbine casing then close the valve; ($E_T$=2)
- Start the T.G. electric lubricating oil pump to lubricate the bearing of the turbine; ($E_T$=1)
- Manually open the emergency stop valve slightly and let the turbine run at 300 RPM for about one minute; ($E_T$=1)
- Gradually open the emergency stop valve to 6,400 RPM (the valve is opened completely which the generator is controlled to work at the set RPM, the governor will take control as the speed approaches its set point, the turbo generator is working at normal speed); ($E_T$=1)
- Stop the electric lubricating oil pump; ($E_T$=1)
- Parallel contacting on bus-bar. ($E_T$=1)

If system alarms twice before the exercise is completed, so the $T_A$ is (there, the total $E_T$ is 11):

$$T_A = (1 - \frac{E_N}{E_T}) \times 100\% = (1 - \frac{2}{11}) \times 100\% = 81.8\%$$

Suppose the standard time defined by the instructors is 10 minutes, and the trainee spends 8 minuets to complete the exercise, the time coefficient is:

$$C_t = \frac{T_1}{T_2} = \frac{10}{8} = 1.25$$

So $T_A' = C_t \times T_A = 1.25 \times 81.8\% = 102.25\%$

If ranges of decided levels are based on the scale shown below(when $T_2 = 0.9\ T_1$):

Very good: $E_N/E_T <= 0.15$

Good : $0.15 < E_N/E_T <= 0.30$

Pass : $0.30 < E_N/E_T <= 0.40$

Failure : $0.40 < E_N/E_T$

So the ranges for the above sample are:

Very good: $T_A' >= 94\%$

Good : $78\% <= T_A' < 94\%$

Pass : $67\% <= T_A' < 78\%$

Failure : $T_A' < 67\%$

Therefore, the mark of the trainee in the sample is located in 'Very good'. Generally speaking, a result of fixed quantity is better than an unfixed one to assess competence of trainee in simulator training as a basis of issuing certificate, which can avoid influence of the assessor's subjectivity as much as possible.

### 5.6.2. Qualification of instructors and assessors

It is believed that more and more engine room simulators will be installed in China in the near future. The qualification of simulator instructors and assessors is thus a hidden problem impeding the development of simulators for training and assessment unless the Administration pays great attention to qualifying the instructors for their job from now on.

In accordance with STCW95 Section A-I/6 of the Code, people conducting in-service training of a seafarer using a simulator shall:

have received appropriate guidance in instructional techniques involving the use of simulators; and

have gained practical operational experience on the particular type of simulator being used.

And people conducting in-service assessment of competence of a seafarer using a simulator shall:

have gained practical assessment experience on the particular type of simulator under the supervision and to the satisfaction of an experienced assessor.

In China, using engine room simulators for training and assessment has just started, and some new simulators are being installed. How to ensure that those who are the instructors or assessors already or who will become instructors or assessors has become a challenging task. There are some options:

1). Learning on the job

It is an economic as well as effective way, but a little bit difficult to do due to having only a few experienced staff who can act as supervisors in China.

2). Using IMO model courses

All the instructors and assessors will benefit from the model course 2.07 (Engine room simulator) and the model course 6.09 (Training course for instructors). Regarding model course 2.07:

The instructors in charge should hold a merchant navy chief engineer certificate, and should have experience in the operation and control of engine room of a modern merchant ship as well as the training and experience necessary for using an engine room simulator as a training aid.

That means the instructors should be experienced, and maybe they should be educated (it is discussed in 5.8.).

3). Training by manufacturer's training programs

The instructors and assessors can get valuable knowledge and skills from manufacturer's training programs which are often written in the contract. Some domestic manufacturers of engine room simulators installing in China will suit the instructors' and assessors' convenience with their training programs.

4). Understudying at another institution

Understudying at another experienced domestic MET institution is the best approach, provided there is no language obstacle. But there are two unfavourable factors against the approach:

- Lack of experienced supervisors
- Improper competition between institutions

It is believed that the first factor can be improved gradually, if the above options are conducted. Unfortunately, competition especially between two leading institutions, DMU and SMU, means that they are not willing to share the knowledge and skills that they have. This unhealthy competition must be restrained, otherwise understudying at another institution has no meaning. It will not be very difficult to solve the inharmonious relationship, if the administration makes a greater effort.

After learning and training like the above, the characteristic elements of a qualified instructor or assessor should include:

- knowledge, that is at an appropriate level of understanding on the specific item;
- instructor skills, gained through practical skills in the use of a simulator in training;

- marine engineer certificate, that is a qualification in the task for which training is given.

### 5.7. Improvement of English course

In Part A of the STCW Code, engine watchkeepers are required to demonstrate an adequate ability to interpret English language publications, and communications in English should be clear and easily understood when they perform engineering duties. It is suggested in Part B of the Code that flag states should ensure that seafarers designated to safety or pollution prevention duties have an ability to use at least an elementary English vocabulary.

The inability to communicate in English is one of the biggest problems facing the Chinese seafarers today, which has influenced the existing and future of the industry of China. How to improve seafarers' ability in English as soon as possible has been attended to by the administration, especially MET institutions where maritime English education is delivered to cadets in a unique way before cadets go to sea.

As a universal language in the shipping industry, English makes up a great percentage in the teaching program in all the universities, colleges, training centres professional schools and technical schools. Considering the English teaching in maritime universities and colleges as an example, the teaching is divided into two categories: College English and Maritime English. The students have to take the CET (the College English Test) -Band-4, which is a course designed for various non-English major students of different specialities and required by the State Education Commission of China, after two years study, and a student will be awarded a qualification certificate issued by the National Testing Centre showing his English proficiency if he has succeeded in the examination. In the third and fourth years, the

students will take the courses of Maritime English to show their proficiency in professional English. For example, the English teaching hours for marine engineering students in SMU are 450 periods (360 for College English and 90 for Maritime English) accounting for one sixth of the total periods in their four years course (see appendix 5).

Then, what are the main reasons causing the lack of ability in English of students under a seemingly good English teaching scheme with a great percentage of teaching hours. The following aspects will provide the most important reasons, and work out a solution for the problems.

### 5.7.1. Textbooks and oral examination

College English textbooks are compiled and published by some well-know language universities and approved by the Government as standard textbooks for CET. The textbooks are uniform and emphasize training of grammar. In this case, students can usually demonstrate better in grammar compared with speaking and listening, which leads to the lack of ability of speaking and listening in English. This status is influenced by the conventional training of the Chinese language, which is totally different from English as two language systems and attaches importance to grammar training very much. This trend that overemphasizes grammar training in English should be improved relying upon language experts from the English speaking countries. In addition, CET is a multiple-choice examination, which neglects the oral English ability of students to a certain extent, therefore it is unsuitable for navigation students in the light of the special requirements for navigation. Maybe it is better for navigation students to use a renewed multi choice and oral-based CET instead of current multi choice-based CET.

The Maritime English textbooks in China are written by the professors or experts of each university or college and used for new officers' training and for training officers who want to upgrade their licences. The contents and arrangement are diversified and are therefore different from school to school. For instance, there are two main maritime English textbooks for marine engineering existing in the Chinese MET area, not only for training of new officers but also for training of upgrading licences in re-education and training centres. One is compiled by DMU and the other is compiled by SMU. The textbook compiled by DMU is composed of three parts: Oral English, Reading Materials and Writing English. Oral English includes some introductory lessons covering Greetings and Introductions, Operational Expression in the English Room, etc, and lessons in conversation including dialogues between crewmen and between crew and staff on shore; Reading Materials includes some technical lessons such as Diesel Engine Construction, Operating Troubles and their remedies, etc; Writing English shows some samples about standard form of Repair List, Accident Report, Engineer's Report, Memos and Telegraph, etc.

The textbook published by SMU is composed of two parts: Grammar and Reading Materials. Grammar part, like a simplified manual of English grammar, covers almost the basics of English grammar; the content of Reading Materials is similar to the contents in textbook published by DMU.

It is obvious that the textbook of SMU concentrates on the skill of grammar much compared with the textbook of DMU, but is closer to the requirements of the national examination for upgrading licences. Taking a sample of English examination for upgrading licences, examination papers for each engineer level are composed of four parts:

Part One : Dialogue, marine engineering terminology and abbreviation
Part Two : Grammar
Part Three: Writing

All examinations are written and the grammar part, which usually occupies a significant percentage, includes:

- Syntax and word-building
- The use of infinitive, gerund, participle and phrase
- Tense and voice
- Subordinate clause
- Others

In fact, teachers of English in not only SMU but DMU have generally laid stress on grammar, which is based on traditional College English teaching in China. Oral English ability is often neglected, or even ignored (i.e. national examination for upgrading licences)

It is time that unifying and reforming the current Maritime English textbooks and developing oral examinations took place in the Chinese MET institutions due to the revised STCW Convention, and some prerequisites become a requirement: not long ago, an English test was held jointly by some major maritime institutions in China, including DMU and SMU, the two most important maritime institutions, that means co-operation between some major maritime institutions has formed; students have studied English for at least six years (three years in the middle school, and three years in the high school) before entering the university or college, some started English learning as early as in the elementary school, while majority of students in universities or colleges just started English learning in the high school ten years ago.

But some obstacles still obstruct development of textbook and oral examinations. They are:

- Backward language teaching and evaluation equipment

Oral training and examination need necessary equipment such as an audio-visual lab, which needs plenty of funds and is very difficult to fund by the majority of middle or small size maritime institutions themselves up to now. Therefore, relying on major maritime institutions and amalgamating their funds together for a regional audio-visual training and examination centre are two ways that those institutions can choose.

- Lack of qualified and experienced maritime English teachers (analysed in 5.7.2).

### 5.7.2. Qualification of teachers

Almost all English teachers in higher learning Chinese MET institutions are language graduates, and most of them are capable of College English teaching after several years teaching practice, because they were trained in language universities or colleges with various nucleus courses including English Listening and Speaking, English reading, English Conversation, English Grammar, Comprehensive English, etc, which cover all requirements of College English. So College English is taught by English teachers in all Chinese MET institutions. Maritime English teaching is usually carried out by English teachers or subject teachers who teach navigation, marine engineering and so on. Table 5.1 shows the advantages and disadvantages when Maritime English is taught by English teachers and subject teachers.

It is difficult to say who is a qualified teacher for Maritime English teaching in China, if only based on Table 5.1. So, it is necessary to provide a standard for all teachers who are involved in Maritime English teaching as soon as possible. The standard should cover requirements of ability of using English, the methodology of teaching language, specialized maritime vocabulary and fundamental knowledge of maritime-related subjects.

Table 5.1. Features in the teaching of Maritime English

| Teacher / Feature | English Teacher | Subject Teacher |
|---|---|---|
| Advantage | - have plenty of experience as a language teacher<br>- be proficient at English language | - be familiar with maritime - related subjects<br>- be familiar with specialized maritime vocabulary |
| Disadvantage | - lack of fundamental knowledge of maritime-related subjects<br>- lack of specialized maritime vocabulary | - lack of the methodology of teaching language<br>- have limited ability of using English language |

A final examination can be used to check the quality of the teachers; a certificate is awarded to each person who passes the examination. Those without the certificate should not be allowed to teach maritime English.

In-service training courses can be designed for English teachers and subject teachers up front in the final examination. The course for English teachers should emphasize expansion of specialized maritime vocabulary and accumulation of fundamental knowledge of maritime-related subjects, and the course for subject teachers should emphasize the methodology of teaching language and developing ability of using English language.

Another important suggestion is the establishment of a specialized section called Maritime English to be in charge of Maritime English teaching. The section is composed of qualified teachers (certificate holders), and is independent of other sections such as English Language Department. Advantage of the organisation structure is that the teachers in the section can concentrate their attention on Maritime English teaching so that the quality of teaching can be ensured as far as possible. But

the disadvantage of it is that the sustaining funds will need to be increased so that the majority of middle and small size MET institutions in China cannot bear the funds. In addition, issuing of the certificate should be under the Ministry of Communications, a spot check of the qualifications of teachers should be made by the Ministry of Communications regularly.

### 5.8. Examination assessors: standards

#### 5.8.1. Requirements for knowledge

In accordance with Section A-I/6 of the Code, instructors, supervisors and assessors ashore are required to be qualified. From the point of view of knowledge, examiners in MET institutions should be trained for their work and required to keep their knowledge in line with current practice.

The Chinese government has been conscious of the importance of knowledge to examiners, and stipulated a provision which was used to ensure qualification of examiners from the side of knowledge several years ago. The provision indicates that all examiners in maritime universities and institutes should gain a Doctorate Degree or a Master Degree and examiners in institutions of monotechnical level should gain Bachelor Degree at least. A main problem existing in the provision is that the true competence of the examiner is hidden by his or her degree.

Paragraph 3 of Section A-I/6 points out:

> 'Each Party shall ensure that instructors, supervisors and assessors are appropriately qualified for the particular types and levels of training or assessment of competence of seafarers either on board or ashore, ... '.

In the Chinese MET institutions, examiners usually come from two sources, one of which is as a postgraduate of the university itself or other maritime universities, the other is as a postgraduate of general universities. Of the two sources above, the advantage of the latter is that it can avoid inbreeding effectively while its disadvantage is also remarkable, for example, a postgraduate whose speciality is the land-based diesel engine may not understand the maritime diesel engine as a particular type of diesel engine. It is obvious that such a person can the fit degree requirement but his competence is not enough to be up to his work as an examiner in the maritime sphere and to meet the new STCW Convention as well. How to train and qualify such examination assessors for their task has to be faced by the Administration. Perhaps the following two means will help to solve the problem.

1). Learning on the job

It is necessary to provide a performance standard before the method is performed, such as passing some basic specialism subjects or holding relevant licences (this is discussed in 5.8.2.) whether the person will undertake it on board or ashore. The subjects for the person being assessed in the aspect of marine engineering should at least include Main Engines and Auxiliary Engines with the level the same as the entry level for Master degree in marine engineering. That means that the person is qualified for marine engines as a certain level required by the Government. The degree requirement is necessary, however, a higher degree provides no guarentee that the holder's knowledge has covered the certain area that he want to deliver. This is the main weakness existing in the education and training policy stipulated by the Government. That is why people holding a land-based Master Degree should qualify in some main courses, such as the main engines and the auxiliary engines, as the entry level for Master Degree in marine engineering. An introduction about the relevant international conventions, especially the STCW Convention, is also very important to them.

2). Using IMO Model Courses

Many assessors in MET institutions lack understanding of the importance of the conventions of IMO, which is caused by the certification syllabus issued by the Ministry of Communications. There are only a few technical standards required in the syllabus. In fact, the importance of the international conventions(e.g. STCW, MARPOL and SOLAS, etc.) has been paid great attention world-wide. The Chinese government is also aware of the importance of them recently. It is believed that more and more details will be required by the certification syllabus. So it is very urgent to help all assessors in familiarity with the international conventions and pay more attention to the assessors who come from general universities without any knowledge about the conventions. All assessors will benefit from the IMO Model Courses.

Model Course 6.09 for instructors provides basic instruction in the principles of teaching and applications of the principles, using various styles of learning. Persons from general universities should undertake training along the lines of this model course which is a key course to them. Model Course 7.02 provides details for training of chief and second engineer officers who will be examined by such persons, so a course developed by this model course will help them to do their job in the future. For familiarity with relevant international conventions particular the STCW Convention, which is a fundamental convention for maritime education and training, the course should cover Model Course 3.12, especially sections 2.2, 2.3, 2.11, 3.1, 3.2, 4.1 and 4.2 which are very useful for familiarisation with the STCW Convention.

Two other problems appearing in the Examiner provisions should also be taken into account by the Administration. One is that this provision does not cover the examiners in professional schools and technical schools. Normally, the examiners for marine engineering in professional schools and technical schools, which are usually under some shipping companies, are from on board ships and hold some high engineer licences with good experience at sea. However, some of them may not have

a Bachelor Degree or above, and it means that such persons may not have a theoretical basis of marine mechanics. Perhaps it is better to refer to the basic rule issued by the State Education Commission of P. R. China that trainers as well as examiners shall hold licences higher than the licences that the trainees will be awarded in education institutions. So the examiners in maritime professional schools and technical schools should hold Bachelor Degree at least and of course high marine engineer licences to meet the quality standards requirements of the revised Convention.

The other is that the provision sitpulated by the Chinese government does not define a time limitation for its implementation. New entrants commencing training will be required to do so according to the newly adopted standards of the revised Convention after 1 August 1998, therefore the Administration of China should immediately take action to decide the implementation of the provision within a certain time limitation but not later than 1 August 1998.

### 5.8.2. Certificates and seagoing experience requirements

Examiners should have relevant professional experience in accordance with the provisions of section A-I/6, and the qualifications and experience of instructors and assessors are covered in the application of the quality standards provisions of Regulation I/8 which applies to all training and certification activity. Maybe in the current Chinese maritime sphere it is advisable that an instructor has relevant professional experience that can be judged against his seagoing experience or relevant certificate. Table 5.2 shows certificate holder status of the instructors in the marine engineering department of the Merchant Marine College of Shanghai Maritime University, which mirrors the general status of instructors in the three main MET institutions of China.

Table 5.2. Structure of certificate holders in the marine engineering department of SMU

| | Age | | Total |
|---|---|---|---|
| | under 50 | 50 and above | |
| Number of certificate holders | 35 | 2 | 37 |
| Number of persons without certificate | 33 | 23 | 56 |
| Percentage of certificate holders (%) | 51.5 | 8.0 | 40.7 |

From Table 5.2, the average percentage of certificate holders (40.7%) is not able to fulfil the minimum requirement of 60% of the MSAMCC (the Maritime Safety Administration of the Ministry of Communications of P.R.China). In addition, the structure of certificates shown in Table 5.3 is also unsatisfactory.

Table 5.3. The certificate structure of the holders

| | Age | | % |
|---|---|---|---|
| | under 50 | 50 and above | |
| C. Eng. & 2nd Eng. | 6 | -- | 16.2 |
| 3rd Eng. & 4th Eng. | 12 | 1 | 35.2 |
| Gen. Elec. Officer | 2 | -- | 5.4 |
| 1st & 2nd Class Elec. Officer | 15 | 1 | 43.2 |

According to Table 5.3, there are two weaknesses. Firstly, the distribution of certificates is unreasonable in terms of courses for mechanical and electric engineering. The holders are distributed over these two areas with almost half respectively while the number of students for mechanical engineering is three times the number of students in electric engineering. Secondly, the rate of higher certificates such as Chief Engineer, Second Engineer and General Electrical Engineer

certificates is too low compare to the rate of lower certificates to the extent of a ratio of one to four.

Therefore the administration should stipulate some provisions to rationalise the structure of certificates and push the rate of certificate holders up. One practicable method is to raise requirements of certificates and seagoing experience to the instructors. For instance, instructors responsible for on board training and assessment should hold chief engineer or second engineer certificate, or qualify in the function of marine engineering at the management level on ships powered by main propulsion machinery of 3,000 KW propulsion power or more in accordance with the alternative certification of the revised Convention. This could occur if the Government decides to issue certificates to instructors responsible for main specialisms, such as Marine Diesel Engine, Marine Auxiliary Machinery and Marine Engineering Management which are required by the national certification examination and hold third engineer or fourth engineer certificate at least. Alternatively they should qualify in the function of marine engineering at the operational level at least; and instructors responsible for other specialisms shown in Appendix 5 should have one year at sea experience, or qualify in the function of marine engineering at the support level at least.

# Chapter VI

# Functional approach impact on certification of higher engineer licenses in China

## 6.1. Functional approach

From 1 February 1997, the revised STCW Convention permits governments to issue certificates not based on conventional divisions between officers in the deck and engine departments if governments wish to. The option of issuing alternative forms of certificate has been made possible by the seven 'functions':

- Navigation
- Cargo handling and stowage
- Controlling the operation of the ship and care for persons on board
- Marine engineering
- Electrical, electronic and control engineering
- Maintenance and repair
- Radiocommunications

The standards of competence that will need to be achieved for each of these functions are defined at up to three levels of responsibility, namely, Management Level, Operational Level and Support Level.

The industry will receive benefit from the functional approach, because:

- A functional approach allows greater role flexibility to respond to alternative forms of shipboard organization which provides a great flexibility to promote safety-enhancing redistribution of workload on board during intensive working periods.

- Unlike the old Convention, which only specifies knowledge required by candidates for certification, the competency tables in the revised Convention specify detailed criteria for evaluating competence which relates to the actual ability required by a qualified seafarer to perform his or her job effectively, and provides a specification for training programmes.

However, alternative certification may easily make people misunderstand or seek to gain advantage by trickery. To avoid these, the revised Convention establishes clear principles in Regulation VII/3 governing the issue of alternative certificates:

'.1 the issue of alternative certificates shall not be used in itself:
.1 to reduce the number of crew on board,
.2 to lower the integrity of the profession or 'de-skill' seafarers,
.3 to justify the assignment of the combined duties of the engine and deck watchkeeping officers to a single certificate holder during any particular watch; and
.2 the person in command shall be designated as the master; and the legal position and authority of the master and others shall not be adversely affected by the implementation of any arrangement for alternative certification.'

### 6.2. Implementation of alternative certification in China

As known to all, alternative methods of issuing certificates provides flexibility for the parties to meet the industry's anticipated needs in the future. But it is not easy to implement the alternative certificates in China because of the training and assessment of candidates. Harmonizing relations between re-education centres and other MET institutions between internal organizations of the Ministry of Communications and

between the administrations and the industry will be key elements for the implementation.

### 6.2.1. Training in institutions

It is not possible for students who successfully complete the courses for new engineer officers in MET institutions to get alternative forms of certificate about navigation, cargo handling and stowage as well as controlling the operation of ship and care for persons on board immediately for three reasons:

1). Limitation of current course curriculum

The current course for marine engineer aims to bring up morally, intellectually and physically accomplished Bachelors of Engineering, and given the basic training necessary for an engineer, they have a good grasp of the basic mechanical and electrical theory and knowledge with regard to ocean-going ships and equipment on board ships. Thus, the curriculum designed for this program excludes many of the subjects for the above certificates.

2). Limitation of course duration

It is hard imagine packing any other subjects into the four years' course with total teaching hours of around 2,700 hours excluding 49 weeks' practical work. It is very difficult to re-arrange the 2700 teaching hours, because in China all courses concerned with degree education have to followed a provision of degree education published by the State Education Commission of the People's Republic of China. Without permission of the Commission any considerable change of teaching plan is illegal and degrees issued in terms of this plan will be invalid. It is rare to revise this provision for a few maritime institutions in the near future. The course duration cannot be extended without permission of the Commission.

3). Requirements of the revised Convention

In accordance with the Section A-VII/2 of the Code, every candidate for certification under Chapter VII shall:

> have approved seagoing service of not less than one year, which service shall include a period of at least six months performing engine-room duties under the supervision of a qualified engineer officer and, where the function of navigation is required, a period of at least six months performing bridge watchkeeping duties under the supervision of a qualified bridge watchkeeping officer.

It is also impossible to meet the requirement within 24 weeks (3 weeks practice on the sea plus 21 weeks' fieldwork and graduation thesis, see Appendix 5) without duties during the four years course.

Although students cannot directly gain alternative certificates involving not only engineering department but also navigation department, some necessary subjects for navigation should be set up in their four years' course for preparation of alternative certificates of students in the future. Comparing with re-education and training centres good facilities, qualified and experienced instructors especially in maritime universities will be convenient to the preparation. A practicable method is a renewal of optional courses with necessary subjects for navigation.

### 6.2.2. Training in re-education and training centres

The unique approach that the state issues alternative certificates is to train candidates through re-education and training centres where the entry requirement of cadets includes an appropriate seagoing experience which is required by the Section A-VII/2 of the Code. In such centres, a series of short courses can be designed for training and assessment of students who are interested in the alternative certificates.

However, there is a main problem existing in Chinese re-education and training centres: the training capacity cannot satisfy training requirements.

Today there are around ten registered re-education and training centres appointed to be responsible for education and training of seagoing seafarers in China. In fact, only four of them have a genuine ability to satisfy training of alternative certificates, while there are several thousand marine engineer licenses holders (potential trainees) in China. It will take around twenty years to train the holders excluding increasing holders if relying on the present training capacity only. It is apparent that the training capacity is unsatisfactory, once the Chinese government decides to issue its alternative certificates.

The main reason causing the shortage of training capacity is lack of qualified and experienced instructors who are kept constantly on the run with the present work and are too busy to attend to other things such as training for alternative certificates. The most effective method to overcome the shortage of instructors is to rely on the human resource of the major MET institutions in short-term. But the use of this resource is limited. Thus, a long-term plan should be designed for instructors' qualifications.

### 6.2.3. Harmonizing relations between organizations of the Ministry of Communications

Alternative certification will concern two departments of the Ministry of Communications. They are the Education Department that is in charge of maritime education and training at levels of academy and university with degrees and/or diplomas, and the Maritime Safety Administration that is in charge of certification and maritime education and training in professional and technical schools whcih are often under shipping companies. The most important subject to be discussed by them is an implementation schedule. Suggestions of the Education Department

should be in a dominant place, because the department has authority over most major re-education and training centres having the potential ability for education and training of alternative certification. It seems to be impossible that alternative certificates will be issued in coming years due to the limited training capacity.

### 6.2.4. Harmonizing relations between the administrations and the industry

Whether issuing alternative certificates or not will depend on demands from the industry to a certain extent. Normally, shipping companies get used to the conventional method based on traditional divisions between deck and engine departments for management on board ships, whereas alternative certification is undoubtedly an advanced certification method and different from the conventional certification method completely. So the administration bears responsibility for interpretation of the advanced method to shipping companies and solution of the industry's misgivings. Some safeguards, such as manning of each ship, should be decided in front of the implementation.

# Chapter VII

# Conclusions and recommendations

## 7.1. Conclusions

The advantages of the Chinese MET System which will be of benefit to the examination system for higher marine engineer licences can be expressed as follows:

- All the MET institutions are under the Ministry of Communications and/or the State Education Commission. They can get strong resource support including human and financial from the government.
- The majority of trainees have a good general educational background particularly in mathematics, physics and chemistry because they are qualified through national enrolment examinations. They benefit from this general knowledge as trainees or engineers.
- Some high quality academic staff in high level institutions (e.g. university level) are embarking on teaching and scientific research which is able to promote the improvement of teaching and educational circumstances.

The negative influences that obstruct development of the Chinese MET System and training and education for higher marine engineer licences as well can be identified as:

a) Dual control under the two authorities, sometimes results in their being out of harmony with each other.

b) Unreasonable competition among some institutions is harmful to co-operation between them.

c) The examination system is too complicated to ensure the quality of examinations.

d) Out of date training and assessment facilities have obstructed improvement in the examination system.

e) Two major elements of the examinations, the setting and marking of papers for examinations, have defects.

f) Lack of external evaluation.

g) Lack of reasonable assessment on board ships.

h) Lack of standardized teaching materials.

i) Lack of engine room simulators for training and assessment.

j) Lack of effective training and assessment to enhance trainees' English level.

k) Lack of enough qualified instructors and assessors.

### 7.2. Recommendations

To solve the present problems, the following recommendations are put forward for consideration:

a) Relations between the Ministry of Communications and the State Education Commission should be harmonized regularly.

b) Unreasonable competition between academies should be stopped through administrative means, and co-operation needs to be enhanced and encouraged.

c) The structure of the examination system needs to be improved and simplified.

d) Backward training and assessment facilities need to be updated as early as possible.

e) A question databank for examinations needs to be established.

f) An independent external evaluation needs to be conducted for quality control.

g) Co-operation with the shipping industry needs to be improved for developing assessment on board ships.

h) A special team formed by some of the major MET institutions needs to be appointed to focus on the standardization of teaching materials.

i) New simulators need to be set up, and the functions of the existing simulators need to be improved.

j) English courses need to be improved with unified textbooks and oral examinations need to be developed.

k) An action plan needs to be developed to ensure assessors and instructors are qualified in spheres of specialized knowledge and seagoing experience.

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# APPENDIX 1

## Contents of Chapter I (General Provisions) of the revised annex to the STCW Convention and the STCW Code

Regulation

**I/1 Definitions and clarifications**
Defines and clarifies key terms used throughout text.

**I/2 Certificates and endorsements**
Explains the format and information, including photos, to be incorporated into STCW certificates and flag state endorsements.

**I/3 Principles governing near-coastal voyages**
Explains conditions pertaining to different STCW standards that might apply to such voyages.

**I/4 Control procedures**
Outlines circumstances in which port state control inspectors may assess the operational competence of seafarers and in which ships may be detained with regard to non compliance with STCW.

**I/5 National provisions**
Specifies circumstances in which flag state should apply penalties to companies and seafarers not in compliance with STCW requirements.

**I/6 Training and assessment**
Concerns qualifications of trainers and assessors.

**I/7 Communication of information**
Concerns the requirements for governments to IMO documentary evidence of compliance with the Convention.

**I/8 National objectives and quality standards**
Stipulates the incorporation, by governments, of quality standards in their training and certification regimes subject to independent evaluation.

**I/9 Medical standards and the issue and registration of certificates**
Concerns medical fitness, eyesight and minimum age requirements, etc.

**I/10 Recognition of certificates**
Clarifies flag state responsibilities concerning the competence of foreign seafarers.

**I/11 Revalidation of certificates**
Concerns requirements for governments to revalidate STCW certificates and to compare the qualifications of existing certificate holders with those issued certificates under the revised Convention.

**I/12 Use of simulators**
Contains extensive mandatory requirements and recommendatory guidance concerning performance standards for simulators.

**I/13 Conduct of trials**
Concerns procedures for experimentation, conducted under the authority of flag state, with new practices and technology not covered by the Convention.

**I/14 Responsibilities of companies**
Contains explicit requirements with which shipping companies must comply.

**I/15 Transitional provisions**
Concerns provisions of the revised Convention that government are not required to implement by February 1997.

Source: ISF *The Revised STCW Convention* 1995

# APPENDIX 2

## Contents of Chapters II to the revised annex to the STCW Convention and the STCW Code

**Chapter II** **Master and deck department**
Contains precise standards of competence at different level of responsibility, defined in detailed Competency Table for the functions that comprise the deck department, and mandatory minimum requirements for certification.

**Chapter III** **Engine department**
Contains precise standards of competence at different level of responsibility, defined in detailed Competence Table for the function that comprise the engine department, and mandatory minimum requirements for certification.

**Chapter IV** **Radiocommunication and radio personnel**
Contains precise standards of competence for GMDSS operators defined in a detailed Competency Table.

**Chapter V** **Special requirements for personnel on certain types of ship**
Contains special training requirements for personnel on tankers and ro-ro passenger ships.

**Chapter VI** **Emergency occupational safety, medical care and survival functions**
Contains minimum requirements for familiarisation in safety matters for all categories of personnel except passengers, plus basic safety training and instruction, detailed in Competency Tables, for all seafarers with designated safety and pollution prevention duties.

Contains standards of competence, detailed in Competency Table, for personnel with special responsibilities concerning survival craft, rescue boats, fast rescue boats, medical care and advanced fire fighting, plus the relevant certification requirements.

**Chapter VII** **Alternative certification**
Contains conditions and principles governing alternative methods of issuing certificates that deviate from conventional divisions between the deck and engine department.

**Chapter VIII** **Watchkeeping provisions**
Consolidates watchkeeping requirements governing the performance of deck, engine and radio watches contained in the different parts of the existing Convention, including new mandatory provisions concerning minimum rest periods for seafarers and recommendatory guidance on the prevention of drug and alcohol abuse.

Source: ISF *The Revised STCW Convention* 1995

# APPENDIX 3

**Examination Subjects for higher engineer licences**

| Power | 3000 KW and above | | | | | | | 750-3000 KW | | | | | | under 750 KW | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Licence | Chief | | 2nd | | 3rd | 4th | | Chief | 2nd | | 3rd | 4th | | Chief | Watch |
| | Eng. | | Eng. | | Eng. | Eng. | | Eng. | Eng. | | Eng. | Eng. | | Eng. | Eng. |
| Subjects | I | II | I | II | II | I | II | I | I | II | II | I | II | I | |
| Marine Power installation | * | * | * | * | * | * | * | * | * | | * | * | * | * | * |
| Marine Auxiliary Machinery | | * | * | * | * | * | * | * | | * | * | * | * | * | * |
| Marine Engineering Management | * | * | * | | * | * | | | * | | | * | | * | * |
| Fundamental Theories of Marine Engineering | | | | | | * | * | | | * | * | * | * | | * |
| Marine Electricity | | | | | * | * | | | | * | | * | | | * |
| General Knowledge of Ship Building | | | | | | * | * | | | * | * | * | * | | |
| Marine Engineering Automation | * | * | * | * | | | | * | * | | | | | | |
| English | * | * | * | * | * | * | * | * | * | | | | | | |

Note: 1. I -- Post promoted

II -- Power raise

2. English is only for unlimited navigation areas

3. "*" -- The subject to be examined.

# APPENDIX 4

**Examination Subjects for Electrical Officers**

| Licences / Subjects | General | 1st class | 2nd class |
|---|---|---|---|
| Fundamentals of Electronic Technique and Electrical Engineering | | | * |
| Electronic Technique and Electric Circuits | | * | |
| Automatic Control System of Electric Drive | | * | * |
| Electric Power Supply System and Automation | | * | * |
| Fundamentals and Application of Ship's Electric Automation | | * | |
| Ship's Motor | | | * |
| Ship's Electric Equipment Supervision and Technology | | | * |
| Theory of Ship's Automation Control | * | | |
| Micro- Computer and its Applications | * | | |
| English | * | * | * |

Note: "*" -- The subject to be examined.

# APPENDIX 5

**Current syllabus for marine engineering**

| Category | No | Subject | Total Hours | | | |
|---|---|---|---|---|---|---|
| | | | Sum | Class | Lab | Others |
| Specialism | 1 | Engineering Thermodynamic and Thermal Transfer | 110 | 105 | 5 | |
| | 2 | Materials For Marine Engineering | 45 | 45 | | |
| | 3 | Introduction of Naval Architecture | 36 | 36 | | |
| | 4 | Basic of Mechanical Design | 108 | 80 | | 28 |
| | 5 | Automatic Control Theory | 54 | 48 | 6 | |
| | 6 | Micro-Computer and Its Applications | 60 | 60 | | |
| | 7 | English For Marine Engineering | 90 | 90 | | |
| | 8 | Marine Diesel Engine | 110 | 100 | 10 | |
| | 9 | Marine Auxiliary Machinery | 120 | 110 | 10 | |
| | 10 | Shipboard Electrical Equipment | 72 | 62 | 10 | |
| | 11 | Marine Steam Power System | 64 | 64 | | |
| | 12 | Marine Engineering Management | 72 | 72 | | |
| | 13 | Techniques of Marine Machinery Repairing | 36 | 36 | | |
| | 14 | Marine Engineering Automation | 90 | 75 | 15 | |
| Optional Courses | 15 | Linear Algebra | 30 | 30 | | |
| | 16 | Function of Function | 30 | 30 | | |
| | 17 | Probability | 18 | 18 | | |
| | 18 | Basic of Navigation | 18 | 18 | | |
| | 19 | Metal Materials | 36 | 36 | | |
| | 20 | Main Engine Remote Control | 30 | 30 | | |
| | 21 | Prevention of Pollution by Port | 30 | 30 | | |
| | 22 | Technique of Marine Diesel Machine Test | 30 | 30 | | |
| Practical Work | 23 | Practice on the Sea | 6weeks | | | |
| | 24 | Military Training | 5weeks | | | |
| | 25 | Metal Work | 9weeks | | | |
| | 26 | Special Training Programs | 2weeks | | | |
| | 27 | Marine Engineering Practice | 3weeks | | | |
| | 28 | Engine Room Simulator | 3weeks | | | |
| | 29 | Fieldwork and Graduation Thesis | 21weeks | | | |

Note: "Other" -- Entries may be the number of hours spent on Computer Operation, Course Design, etc.

# APPENDIX 6

**Current syllabus for marine electrical engineering**

| Category | No | Subject | Total Hours | | | |
|---|---|---|---|---|---|---|
| | | | Sum | Class | Lab | Others |
| Specialism | 1 | Circuitry | 90 | 90 | | |
| | 2 | Circuitry Laboratory | 24 | | 24 | |
| | 3 | Electrical Machinery | 90 | 90 | | |
| | 4 | Electrical Machinery Laboratory | 36 | | 36 | |
| | 5 | Electronic Technology | 80 | 80 | | |
| | 6 | Electronic Technology Laboratory | 24 | | 24 | |
| | 7 | Digital Electronic Technology | 54 | 54 | | |
| | 8 | Digital Electronic Technology Laboratory | 20 | | 20 | |
| | 9 | Power Installation | 54 | 54 | | |
| | 10 | Automatic Control Theory | 72 | 72 | | |
| | 11 | Automatic Control Laboratory | 10 | | 10 | |
| | 12 | Micro-Computer and Its Applications | 54 | 54 | | |
| | 13 | Micro-Computer Laboratory | 20 | | 20 | |
| | 14 | Electrical Towing | 40 | 40 | | |
| | 15 | English for Marine Electrical Engineering | 60 | 60 | | |
| | 16 | Electrical Towing Control System | 54 | 54 | | |
| | 17 | Converting Technique | 50 | 50 | | |
| | 18 | Shipboard Power Plant and Its Automatic Control | 72 | 72 | | |
| | 19 | Shipboard Power Plant Laboratory | 18 | | 18 | |
| | 20 | Automatic Meters and Systems | 36 | 36 | | |
| | 21 | Engine Room Monitoring System | 30 | 30 | | |
| | 22 | Main Engine Remote Control | 46 | 46 | | |
| | 23 | Automation Laboratory | 20 | | 20 | |
| | 24 | Management & Techniques of Marine Electricity | 36 | 36 | | |
| Optional Courses | 25 | Linear Algebra | 30 | 30 | | |
| | 26 | Function of Function | 30 | 30 | | |
| | 27 | Nonlinear & Collection System Theory | 30 | 30 | | |
| | 28 | Communication in Shipboard | 30 | 30 | | |
| | 29 | Shipboard Electrical Instrument | 30 | 30 | | |
| | 30 | Direct Governing System | 30 | 30 | | |
| | 31 | Micro-Computer Applications in Automatic Engine Room | 30 | 30 | | |
| | 32 | Controlling Electric Motor | 30 | 30 | | |
| Practical Work | 33 | Practice on the Sea | 6weeks | | | |
| | 34 | Metal Work | 4weeks | | | |
| | 35 | Special Training Programs | 2weeks | | | |
| | 36 | Electrical Instruments Disassembling & Assembling Practice | 5weeks | | | |
| | 37 | Military Training | 5weeks | | | |
| | 38 | Fieldwork and Graduation Thesis | 23weeks | | | |

Note: "Other" -- Entries may be the number of hours spent on Computer Operation, Course Design, etc.

## APPENDIX 7

**Current syllabus with teaching hours for higher engineer licences (3,000 KW and above)**

| Licences / Subjects | Chief Eng. | | 2nd Eng. | | 3rd Eng. | 4th Eng. | |
|---|---|---|---|---|---|---|---|
| | I | II | I | II | II | I | II |
| Marine Power Installation | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Marine Auxiliary Machinery | | 100 | 100 | 100 | 100 | 100 | 100 |
| Marine Engineering Management | 100 | 100 | 100 | | 100 | 100 | |
| Fundamental Theories of Marine Engineering | | | | | | 120 | 120 |
| Marine Electricity | | | | | 100 | | |
| General Knowledge of Ship Building | | | | | | 80 | 80 |
| Marine Engineering Automation | 140 | 140 | 130 | 130 | 100 | | |
| English | 110 | 110 | 110 | 110 | 110 | 110 | 110 |

Note: I -- Post promoted

II -- Power raise