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# An investigation into the current state of Chinese higher MET [Maritime Education and Training] in the light of new international legislation [and] with particular reference to STCW'95

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# AN INVESTIGATION INTO THE CURRENT STATE OF CHINESE HIGHER MET IN THE LIGHT OF NEW INTERNATIONAL LEGISLATION WITH PARTICULAR REFERENCE TO STCW95

**By**

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

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In

**MET**
**(Nautical)**

2000

# 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 content of this dissertation reflects my own personal views, and is not necessarily endorsed by the University.

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Title of Dissertation: **An Investigation into the Current State of Chinese Higher MET in the light of New International Legislation with Particular reference to STCW95**

Degree: **MSc**

This dissertation is a study of the new developments in Chinese higher MET according to the requirements of new international legislation in particular STCW95, Chinese ocean shipping and its own development.

A general study consists of the latest requirements of MET and MET methodology. The outcome indicates the influence of the international standard and new maritime technology. The new educational methodology and technology also have a deep impact on the traditional way of education in Chinese higher MET institutions.

The current state of the Chinese MET has briefly been described in order to delineate or outline the advantages and disadvantages of the MET. The focus is placed on the revision of curricula and programs, quality of teachers, replacement of old and out of date equipment for training by new and up-to-date training equipment, and main problems in the field of English teaching.

The results were collected and evaluated in the conclusions which highlight the necessity of adapting various effective steps to upgrade the quality of Chinese higher MET. A number of recommendations are also made in view of the deep influence on Chinese higher MET in the 21st century.

**KEYWORDS:** Maritime requirements, Education methodology, International legislation, STCW95, Chinese higher MET, Foreign experience.

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| | |
|---|---|
| AAP | Adaptive Auto Pilot |
| AIS | Automatic Identification System |
| ARPA | Automatic Radar Plotting Aid |
| MA | Maritime Administration |
| CBT | Computer-Based Training |
| CD-ROM | Compact Disk - Read Only Memory |
| DE | Distance Education |
| DGPS | Differential Global Positioning System |
| DMU | Dalian Maritime University |
| DNV | Det Norske Veritas |
| ECDIS | Electronic Chart Display Information System |
| ECS | Electronic Chart System |
| ENC | Electronic Navigation Chart |
| EU | European Union |
| GDP | Gross Domestic Product |
| GIS | Geographic Information System |
| GMDSS | Global Maritime Distress and Safety System |
| GNP | Gross National Product |
| GPS | Global Positioning System |
| IBS | Integrated Bridge System |
| IMLA | International Maritime Lecturers' Association |
| IMF | International Monetary Fund |
| IMO | International Maritime Organisation |
| INS | Integrated Navigation Systems |
| ISM | International Safety Management |
| ISO | International Standard Organisation |
| IT | Information Technology |
| MARPOL | International Convention for the Prevention of Pollution from ships |
| MET | Maritime Education and Training |
| OOW | Officer of the Watch |
| PID | Proportional, Integral and Derivative |
| PRC | People's Republic of China |
| RCDS | Raster Chart Display System |
| RENC | Regional Electronic Navigational chart co-ordination Centre |
| SMS | Safety Management System |
| SMU | Shanghai Maritime University |
| STCW | International Convention on Standards of Training, Certificate and Watchkeeping for Seafarers |

| | |
|---|---|
| TSS | Traffic Separation Schemes |
| UNDP | United Nations Development Programme |
| VHF | Very High Frequency |
| VTS | Vessel Traffic Service |
| WB | World Bank |
| WTO | World Trade Organisation |
| WWRNS | World-wide Radio Navigation System |
| WWW | World Wide Web |

# CHAPTER 1

## INTRODUCTION

The people's conceptual changes represent the greatest change in the past 20 years. The speed of such a change has exceeded that in Europe during the same period. The mushrooming of collective, private and foreign-funded businesses has turned China into a pluralistic economic society. The introduction of Western economic means and management expertise has bought tremendous conceptual changes related to investment, consumption and living style.

Modern technology has been applied so fast in the shipping industry that shipping had to undergo rapid changes in recent decades. Ships have become bigger, more complex and more sophisticated.

In recent years there has been a constant rise in maritime accidents which have cost a great loss of lives and property and also caused extreme damage to the marine environment.

The International Maritime Organisation (IMO) has rapidly developed technical standards, rules, regulations and codes of practice. Furthermore, IMO has improved minimum standards of competency for worldwide seafarers to ensure the safe and efficient operation of different types of ships and the prevention of marine pollution.

In 1978 the Chinese government decided to carry out the policy of reforming and opening to outside. According to the policy, the Central Governing Economy System has been changed into the Market Economy System. Over 20 years of economic reform, China has reached brilliant achievements in the field of economy.

These factors have resulted in the Chinese economy increasing by an average rate of 8% per year. The turnover of exports and imports has constantly increased with 90% of the total annual figure being transported by sea. Obviously, developing the national sea transport is an essential task at the present time and will be so also in the future.

## 1.1 Aims and Objectives

China is a very large maritime country. Since the foundation of the People's Republic of China in 1949, Chinese MET has experienced quite a rapid development. In particular since the reform and opening to the outside world in 1978, great achievements have been made in MET during the best period ever found in history, which has provided great effectiveness for the development of ocean shipping. Therefore, it should be said that Chinese MET has been playing a vital role in the development of ocean shipping.

With the promulgation of new international legislation, such as STCW95, Chinese higher MET is facing large opportunities and fierce competition. What are the strengths and weaknesses in Chinese higher MET? What are new needs for Chinese higher MET regarding China's ocean shipping and international legislation? How does Chinese higher MET speed up its development on the basis of drawing experience from foreign counterparts? The dissertation proposes to examine these factors to identify the real status of Chinese higher MET, and draw conclusions and make necessary recommendations to improve the quality of Chinese higher MET.

The objectives of this dissertation are:

To identify the strengths and weaknesses of Chinese higher MET contrasting with the requirements of new legislation with particular reference to STCW95.

To examine current methods of managing higher MET all over the country.

To compare the present situation of Chinese higher MET with that of other main maritime countries.

To identify new needs of ocean shipping for Chinese higher MET and the tendency or future development of the world MET.

To make proposals and recommendations to improve the quality of Chinese higher MET.

## 1.2 Research Methodology

The author researched the relevant literature in the library of World Maritime University (WMU), conducted an Internet based literary search on the maritime education and training (MET), and analyzed all collected information related to the author's dissertation.

A further study of Chinese, German, Norwegian, Australian, Canadian and Japanese systems was conducted with regard to the type of MET, courses and curricula, diploma and certificate, and promotion approach of seafarers.

Some contacts were made through e-mail and ordinary mail so as to collect the necessary information.

A questionnaire was made in order to get valuable information concerning how to fully and completely implement STCW95 from some MET experts all over the world.

# CHAPTER 2

# ECONOMIC AND SHIPPING ENVIRONMENT AROUND CHINESE HIGHER MET

## 2.1 World Economic Trends of the 21st Century

Entering the 1990s, the world economy is mainly featured by globalization and information revolution. In the 21st century, at least in the beginning period of the new century, the world economy will present the following trends focused on globalization.

- **Competition will accelerate the development of science and technology.** The promotion and application of high-tech in industrial production has been the major characteristic of the world economic development since World War II. In the 1980s, Japan took the lead in seeking the technological hegemony and became a shining star in the world economy. A decade later, the United States again achieved the dominant position in the field of science and technology, which laid a solid foundation for its high-speed economic development and greatly consolidated and strengthened the US hegemony in the world political, economic and military fields. In the 21st century, the scientific and technological competition among the big powers will turn white-hot. It is still difficult to tell who will finally win. However, one thing is certain: Only those countries possessing high technologies, including information technology, biological engineering, new energy technology and space technology, can stand erect in the forest of world nationalities.

• **The world economy will maintain at a high growth rate.** In the past few decades, the total import and export volume has occupied a larger and larger proportion of the gross domestic product (GDP) in each country. One of the reasons is the expansion of the international division of labor, which has led to the situation that different parts of a product are produced by different countries. Therefore, the world trade growth rate greatly increased. Meanwhile, the mutual dependence between economies is enhancing day by day. The economy of one country can hardly exist and develop by breaking away from the economies of other countries. Because of the deepening of the international division of labor, international trade will maintain a high growth rate.

• **Transnational direct investment continues to develop rapidly.** Direct investment was first developed to resist trade barriers. To avoid trade barriers, one developed country invested directly in another developed country or developing country and dominated the market there. Such an investment method saw an unprecedented development in the 1990s. Direct investment is closely linked with the global operation strategy of transnational companies. The Asian financial crisis did not stop the growing trend of direct investment around the globe, which shows the continuity of the global strategy of these transnational companies. In a long period to come, the direct investment promoted by transnational companies will be further developed. The investment in service and high-tech fields of developing countries will be accelerated.

• **Financial liberalization and globalization continues.** With the relaxation of each government in its restrictions on the cross-border flow of capital and the rapid development of information technology, the banking capital and securities capital, including shares and stocks, flow in a wider sphere and at a greater speed. A unified international financial market has been basically formed. At the same time, the flow of international capital is more and more separated from international trade and investment. Financial globalization, in fact, refers to the rapid floating of financial capital around the world in an effort to pursue the highest recovery rate. On the one hand, financial globalization helps promote the rational allocation of resources throughout the world; on

the other hand, it enhances the instability of the international financial system. As the international capital flows from one corner of the world to another, relevant countries will witness great changes in the exchange rate of their currencies and chaos in their domestic financial systems. This will lead to a severe economic crisis in a series of countries. In the new century, each country will further promote its financial liberalization. The cross-border flow of international capital will expand rather than shrink.

• **World economic organizations will strengthen their role in world economic affairs.** The world economic organizations result from globalization and at the same time guarantee it. At present, the International Monetary Fund (IMF), the World Bank (WB) and the World Trade Organization (WTO) exist as three major organizations in the fields of finance, trade and development to maintain world economic order. At the same time, the role of various non-governmental organizations representing different interest groups will also be strengthened.

• **Economic regionalization will be strengthened.** Economic regionalization and the regional economic integration made some progress in the 1990s. Through decades of efforts, the European Economic Community (later renamed the European Union) finally realized the union of currencies of all member countries. At the beginning of the 21st century, the euro will replace the currency of major European countries. In Asia, the voice for the establishment of regional economic groups is also rising. The Asian financial crisis has taught people a lesson: Under the situation of globalization, one country can hardly withstand the attack of powerful international capital. Under such circumstances, countries geographically close will inevitably put hope on their neighboring countries or the mutual help between economic communities. Besides, the success of the European economic integration has encouraged those countries and economic communities unwilling to accept the economic hegemonism in the world. Now it has become the common wish of all countries to seek regional economic integration or cooperation and thereby promote their own economic development. So, it

can be predicted that the economic integration process will be accelerated all over the world, especially in Asia.

## 2.2 Global Trends Affecting Future Sea Transport

The further development of world economic globalization will certainly have a notable impact on future sea transport. The main aspects are as follows:

- Manufacturing on demand will be the norm, which will result in transport functioning also as the inventory/warehouse, feeding raw materials into manufacturing and delivering stock to customers. Price competition among global manufacturers will continue to pressure transport providers for faster, cheaper, but more reliable, technology-driven door-to door services.
- The developing regions will need increasing supplies of food and raw materials to support the population and emerging manufacturing industries. Overall, the dry-bulk maritime trades are expected to grow at about 1% annually through 2010. If this trend continues, the world bulk carrier fleet in 2020 would be about 24% larger than it is today. Replacement tonnage, as well as some fleet expansion, will be required.
- Shifts in trade patterns will have a direct impact on shipping demand. For instance, as labor-intensive manufacturing continues to migrate from North to South and West Asia in search of lower-cost labor.
- Global seaborne trade, which comprises the largest volume of international trade, will almost triple from 3.5 billion metric tons in 1996 to 9 billion tons in 2020. This growth will drive global demand for increased maritime transport services and the related infrastructure.
- Japan, China, Southeast Asia and Far Eastern newly industrialized economies will increase their share of international trade 33% in 1996 to about 42% within the next 15 years.

• New vessel designs and propulsion/energy sources will produce larger, faster, more efficient ships, particularly in the high-volume line-haul trades from the Far East to Europe and the United States. Nonetheless, draft restrictions in many ports will create more demand for smaller vessels, including tug-barges, to transship cargo to final destination ports.

Containerships, which were introduced into service in the 1960s with capacities of less than 500 twenty-food-equivalent units (TEUs), will dominate all liner services, due to the advantages of lower loading costs and increased efficiency. Ships that can carry approximately 6,000 TEUs are in service today. Carriers planning for the expected increase in cargo volume have ordered vessels that can carry over 8,000 TEUs. By 2010 ships carrying 13,000 TEUs are possible.

The ability to miniaturize components, which has been essential to the computer industry, has applications in vessel technology. The capability to produce high amounts of power with small motors can greatly enhance the capabilities of commercial vessels, while generating significant savings in fuel and a reduction in environmental damage. Fuel cell development will lead to an environmentally friendly propulsion alternative for the future.

Around 2020, shipyards will see the beginning of a new building cycle, both to replace vessels built in the late 1990s as well as to accommodate increased cargo volumes, depending on trading and development pattern changes.

• Instantaneous exchange of immense stores of information. Virtually unlimited access to information and communications by manufacturers, consumers, intermediaries, and governments will increase the demand for goods and promote competition. Advanced information technology will be applied to all aspects of transport to create a seamless, user-friendly intermodal transport system. Thirty years ago there was no method to track

vessels and cargo automatically, and today a system is evolving that utilizes satellite-based communications. An instantaneous worldwide communications network will allow carriers and shippers to know the status of their cargo at all times. This information will be critical to shippers involved in global sourcing of raw materials, as well as of components for just-in-time manufacturing and retailing.

- Integrated navigation and communications systems will enable global positioning, electronic chart display, and data and voice transmission capabilities. Furthermore, interconnected fiber-optic local area networks will allow interface between control centers, offices and staterooms.
- Labor productivity will rise due to advances in onboard automation and the assignment of more duties to each crewmember on newer vessels. A ship with a crew of 50 seafarers in 1960 and 8, 16, or 21 today could have as few as 4 by 2020 if harmonized international regulations permit.
- "Flag of Convenience" (FOC) and second national registries will continue to attract the world's shipowners, due to simple registration procedures, low or nonexistent taxes, and the ability to crew vessels with citizens from lower cost, lesser developed countries.
- Even though ships will become larger and average crew sizes smaller, the current shortage of adequately trained mariners will occur worldwide as trade quadruples by 2020. As ships and transport systems become more complex, training requirements will grow.
- Increased public concern for safety and protection of the environment will accelerate the movement toward harmonized international requirements for vessel safety, environmental protection and crew qualifications. Advances in human factors technology and applications of system safety principles will demand better training and performance testing of personnel. Highly trained personnel will be required for most positions onboard and ashore.
- A global and intermodal focus on logistics sciences will grow with industry trends in

these directions. Institution graduates with transport-focused degrees will be more in demand to lead in international businesses.

- Ports will have to improve existing facilities and develop new terminals to accommodate larger vessels. Necessary port infrastructure improvements will be completed in a timely and cost-effective manner. Ports are striving to upgrade cargo-handling equipment and operational practices to increase the speed and volume of cargo throughout. In general, larger and faster ships and advanced port container-handling equipment will enable terminal operators to equipment and systems needed by tomorrow's ports.
- Vigorous global competition will continue to fuel the consolidation of today's transport providers into fewer, but more cost-effective, carriers. Transport will become integrated worldwide, linking land, sea and air operations in door-to-door service with optimal efficiency and safety.

## 2.3 Development of the Chinese Economy

- **Obtaining Great Achievements.** In 1978, China launched a reform that set the task centering on economic development. China has ushered in a period of rapid economic development since then. For instance, in 1997, the EU became China’s second largest trading partner next to Japan, with bilateral trade valued at US$43 billion, or 15 percent of total foreign trade. EU investment and loans have also risen. Governmental loans totaled US$12.8 billion, accounting for 40 % of total foreign governmental loans, while investment has exceeded US$10 billion. Over the past 20 years, China’s GDP (gross domestic product) registered an average annual growth of 9.7 %.

In 1998, China’s GDP amounted to 7955.3 billion yuan, compared to 362.41 billion yuan 1978, with an average annual growth rate of 9.8%, the fastest rate in the world. According to a World Bank report in 1999, China ranked seventh in the world’s top 10

economic giants, after United State, Japan, Germany, France, Britain and Italy. However, since the country has about 1.25 billion people, its per capita GDP and income are still far behind. Therefore, China remains a developing country.

• **Having Optimistic Prospect for the New Century.** China would achieve a moderate level of prosperity by the end of this century, with an annual per capita GNP (gross national product) of US$800 to US$1000. "Then we will take that figure as a new starting point and try to quadruple it again, so as to reach a per capita GNP of US$4000 in another 50 years. It means that by the middle of the next century we hope to reach the level of moderately developed countries." (Deng, 1987)

Most Chinese economists believe that China can maintain its steady growth for at least 20 years. According to a report by the Development Research Center of the State Council, China is expected to maintain an average annual growth rate of 7 percent in the first decade of the coming century. It is very possible that the GDP in 2010 will be double that of 2000.

Chinese Prime Minister Rongji Zhu at Speaking at the 21st Century Forum-Conference 2000 ( Economic Globalization-Asia and China, 2000) said that at this crucial historical juncture when mankind is entering into the 21st century, the world is undergoing profound changes. The scientific and technical revolution as represented by information technology is developing rapidly, international economic restructuring is picking up speed, and economic globalization is visible accelerating. In the face of the new situation featuring scientific and technological progress in the world and economic globalization, China's economic development in the next ten years will have the following characteristics: there will be strategic restructuring of the economy, economic restructuring will be deepened, the strategy of rejuvenating the nation by relying on science and education will be further implemented, and opening up to the outside world

will be accelerated and expanded. "China can't develop without help from Asia and the world as a whole, and likewise Asia and the world need China for their own development." ( Zhu, 2000)

• **Deciding the Marine Economy as a New Economic Growth Point.** China has favorable conditions for the development of a marine economy. It boasts a continental coastline of more than 18,000km. There are more than 5,000 islands in China's territorial waters, each with an area of over 500m², and the islands' coastline total more than 14,000km. More than 160 bays spread along the coast, plus the deep-water stretches of coast with a total length of several hundred km. Many sections are suitable for constructing harbors to develop marine transportation.

China's marine economy involves more than 20 sectors, including marine fishery, salt industry, transportation, offshore oil and gas, and tourism, occupying a certain share in the world's marine industries.

Over the past two decades, China's marine economy has developed at a rapid pace. In the 1980s, the marine economy grew 17% annually. Since 1990, the average growth rate has stood at 20%. The total output value of marine industries rose from 6.4 billion yuan in 1979 to 300 billion yuan in 1997, accounting for 4% of the nation's GDP.

Significant achievements have been attained in marine transportation. By the end of 1997, merchant ships have numbered about 320,000 with a total deadweight tonnage of close to 50 million. China's coastal shipbuilding industry has registered rapid development, and in 1997, its shipbuilding tonnage ranked third in the world. In the fields of harbor construction and marine transportation, China now has 15 harbors each

with an annual handling capacity of more than 10 million tons. In 1997, the volume of freight handled by the country's major coastal harbors totaled 905 million tons.

China has a population of about 1.25 billion, and natural land resources per capita are lower than the world average. As a major developing country with a long coastline, China must take marine development and protection as its long-term development strategy.

The China Ocean Agenda 21 formulated in 1996 put forward a sustainable development strategy for marine programs. The basic ideas are as follows: to effectively safeguard the national marine rights and interests, rationally develop and utilize marine resources, earnestly protect the marine eco-environment and realize the sustainable utilization of marine resources and environment, as well as the coordinated development of the work in this field.

China's sustainable economic growth will increasingly rely on the ocean. Therefore, China has already designated the marine economy as a new economic growth point in the 21st century. It is estimated that by the end of 2000 the total output value of marine industries will come to 500 billion yuan, accounting for 5% of the nation's GDP. The strategic targets set in the China Ocean Agenda 21 are: After entering the 21st century, the growth rate of the marine economy will reach some 10%, higher than that of the GNP; By 2010, the added value created by the marine industries will make up 10% of the nation's total GDP.

## 2.4 Development of the Chinese Ocean Shipping

It is well known that there is a high correlation between economy growth and maritime transportation. China has a long history in Ocean shipping. Zheng He (1371-1435), the

Chinese ‘Columbus’, and his fleet of 300 ships and 270,000 seafarers sailed seven expeditions as far as the East Coast of Africa. However, despite these maritime successes, Chinese civilization has always been land orientated. China did not become a modern internationally trading maritime nation until late in the century. As far as China's ocean shipping is concerned, it has to speed itself up in order to undertake to transport 90% of the export and import volume of goods and to take part in international sea transportation.

### 2.4.1 Fleet of Ocean Shipping

Before 1960, there was no national ocean shipping fleet, and China had only 150 ships of 760,000dwt for coastal transport. China built up its own deep-sea fleet in 1961. From 1966 to 1975, the slow growth of the national fleet was partly due to the politics of the Cultural Revolution. Since 1980, the national fleet has increased quickly. It increased from 955 ocean ships of 10 million dwt in 1983 to 2197 ocean ships of 19.8 million dwt in 1992. There were more than 2200 ocean vessels of 20 million dwt in 1994. In 1998, China was ranked fourth in the world league. The following table outlines the growth of the Chinese fleet in the last 30 years:

**Table 2.1. PRC Merchant Fleet Development, 1960-1998**

| Year | Ships (no.) | GT | Net Growth (%) |
|---|---|---|---|
| 1960 | 201 | 402417 | -- |
| 1970 | 248 | 867994 | 115 |
| 1980 | 955 | 6873608 | 691 |
| 1990 | 1948 | 13899448 | 102 |
| 1998 | 3214 | 16503355 | 19 |

Source: Lloyd’s Register, World Fleet Statistics, 1960, 1970, 1980, 1990, 1999.

In 1961, the China Ocean shipping Company (COSCO) was formed under the control of the Ministry of Communications. Apart from COSCO, there are over 190 shipping companies which are run by coastal provinces, or cities, or private enterprises. COSCO is the largest shipping company in China at 600 vessels and more than 15 million dwt. It has ten branch companies based at Beijing, Shanghai, Guangzhou, Tianjin, Qingdao, Dalian, Lianyungang, Shenzhen, Xiamen and Hongkong. The Group has three other main areas of operation: China Ocean Shipping Agency, China Marine Bunker Supply Company and China Road Transport Company, and more than 300 subsidiaries world-wide.

As an open-door policy was adopted by the Chinese government after 1978, the national shipbuilding industry has developed quickly, and new building tonnage went up to 2.5 million dwt in 1990 and it was over 4 million in 1994.

### 2.4.2 Volumes of Ocean Shipping

Before the mid-1970s, around 65 per cent of the seaborne trade was with South-East Asia countries and the Soviet Union with a trade turnover of US$ 4 billion. In the 1980s, the growth of seaborne exports and imports increased quickly. The volume of turnover went up to US$ 83 billion. It increased to US$ 220 billion in 1994 and the total throughput of the ports was more than 1,500 million tons.

### 2.4.3 Future Development of Ocean Shipping

The 20$^{th}$ century saw China developing from a closed, land-oriented imperial economy into a global maritime power with a significant merchant fleet and the potential to become a major labor supplier of seafarers. At present, in terms of recent academic

calculations there are 330,000 active seafarers in China: 117,800 officers and 212,200 ratings.

Today, China is already the 7th largest economy and the 10th largest trading nation in the world. Foreign investment and foreign trade combined with the high domestic saving rate became the basis for China's economic development. In China, 90% of foreign trade has been fulfilled through ocean shipping. Therefore, it can be said ocean shipping has been exerting a vital and irreplaceable role in the development of Chinese foreign-trade economy.

According to the blueprint for the development of China's highway and waterway transport, the construction of trunk highway system, main waterways, main distribution centers for water and highway transport, and support system will be completed within 30 years or more.

Zhendong Huang, the Minister of the Ministry of Communications of PRC, said in 2020 highway and waterway transportation will basically meet the needs of social-economic development as a whole and in 2050 highway and waterway transportation will realize modernization.
In order to fulfill this grand target, transport education, in particular maritime education and training, is bearing a heavy responsibility for cultivating qualified personnel.

# CHAPTER 3

# SITUATION OF CHINESE MARITIME EDUCATON AND TRAINING

## 3.1 General Introduction

China’s maritime education and training started in 1909. It has passed 90 years. Since the liberation in 1949, Chinese MET has made great progress. Particularly, after China has carried out reforms and opening to outside, Chinese MET has entered into a quite new stage of development. A comprehensive MET system has been formed in China. It can be said that Chinese MET has made great contribution to the development of the shipping industry in China. The Chinese MET complies with the international and national requirements

For the time being the maritime education system in China is divided into two kinds of education in accordance with difference functions in the field of the MET. China has at least 80 maritime training institutions at various levels, which are financed and controlled by the Ministry of Communications, or local governments, or shipping companies. China’s MET system is shown as follows:

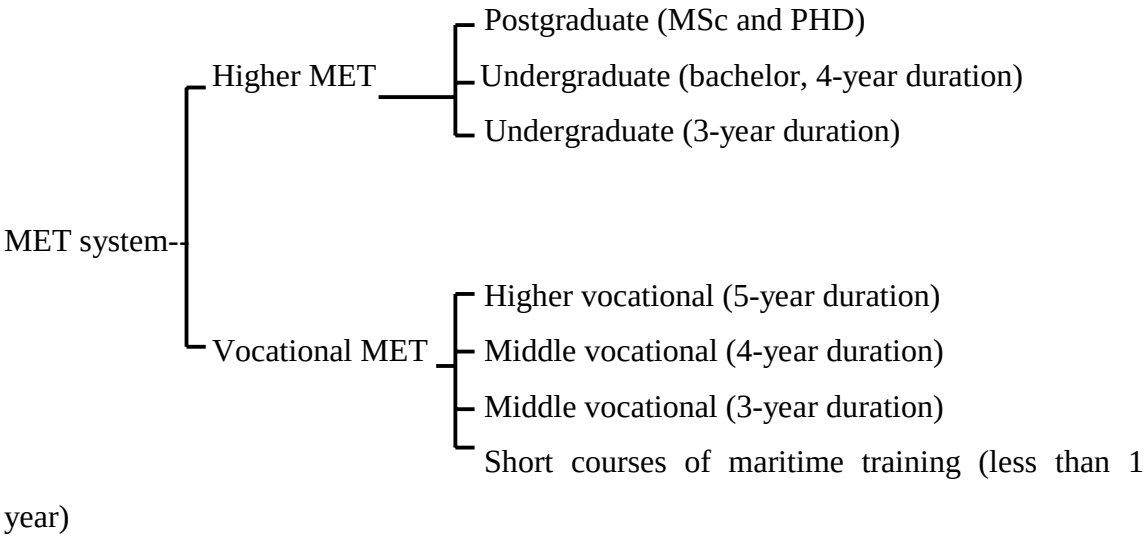


**Figure 3.1 China's MET System**

## 3.2 Higher MET in China

The higher maritime education is open to all people and students who graduate from senior middle schools. After passing the Annual National University Entrance Examination they can enter into these maritime universities and institutes. Normally these students have no sea experience. For the time being, there are six major maritime universities and colleges, which are Dalian Maritime University (DMU), Shanghai Maritime University (SMU), Wuhan Navigation College (attached to Wuhan University of Technology), Jimei Navigation Institute (attached to Jimei University), Guangzhou Maritime College and Qingdao Ocean Shipping Mariners' College.

### 3.2.1 Dalian Maritime University

Dalian Maritime University was formed in 1953. In 1960, it was assigned by the government as a national key institution of higher education in China. In 1983, UNDP and IMO set up the Maritime Training Center of the Asian-Pacific regions in the

university and in 1985 WMU set up its regional branch Dalian Branch there. Since the establishment of the University, it has cultivated more than 30,000 senior maritime personnel for the shipping industry, and it is called the cradle of maritime experts.

The campus of the university is about 725,000m² and there are various facilities for academic requirements, which are some 285,000m² buildings including classrooms and experimental spaces. As far as the academic organization is concerned, the university has nine colleges and five faculties: College of Navigation, College of Marine Engineering, College of Shipping Management, College of Law, College of Information Engineering, College of International Business, College of Marine Environment Engineering, College of Seafarer's Profession and Technology, College of Adult Education, Faculty of Social Science, Faculty of Foreign Languages, Faculty of Basic Science, Faculty of Physical Education, Faculty of Postgraduate. It is provided with 1 post-doctorate mobile station, 28 bachelor of science and engineering degree programs, 2 professional tech training programs, 15 master degree programs, 5 Ph.D. programs with 1 post-doctorate mobile station and there are more Ph.D. programs under approval. The university has established relationships with 13 famous maritime institutions in the world for academic exchanges. DMU, as a representation of maritime university, has been included into "211 Project" (Facing 21$^{st}$ century concentrate the investment on 100 national key universities' building) by Chinese government to build in next 15 years.

### 3.2.2 Shanghai Maritime University

Shanghai Maritime University is among the first universities accredited by Det Norske Veritas (DNV) and the Maritime Administration of China and has obtained certificates of Conformity on the basis of ISO 9001 and the national quality standards regarding maritime education. It currently runs 3 associate-degree programs, 23 bachelor's degree programs, and 22 master's degree. SMU is authorized to organize its own entrance

examinations to enroll in-service postgraduate students and is also qualified to award the master's degree to candidates who have fulfilled the required courses without taking the entrance exams. Three programs of SMU, namely, transport planning and management, industrial economics and electrical drive & automation, have been classified as the key disciplines of the Shanghai Municipality and the Ministry of Communications. The university has a teaching staff of nearly 700, including 300 professors and associate professors, and a large student population that includes more than 5,000 bachelor-degree and associate-degree students. About 600 postgraduate students, about 3,000 adult students, and some international students. SMU maintains friendly contacts, academic exchanges and joint academic programs with more than 20 countries, regions and international organizations, including the United States, the United Kingdom, Japan, Norway and the Netherlands.

SMU boasts a fairly complete set of teaching and research facilities: more than 40 laboratories such as the advanced experimental center for navigational technology and marine engineering. SMU has three training ships of the 10,000 DWT class and two ocean-shipping sailing boats. The university library possesses more than 700,000 books and over 2,000 Chinese and foreign periodicals. Its collection of books and journals in maritime law outranks any other library in China.

### 3.2.3 Jimei Navigation Institute

Jimei Navigation Institute is located in Jimei schools Village, Xiamen City. With a long history, the Institute is one of the major maritime education and training higher institutions in China. The Institute was originally founded in 1920 as Jimei Navigation School by Mr. Chen Jiageng, a patriotic overseas Chinese leader. It was upgraded to Junior College in 1978, and further upgraded to Senior Institute in 1989.

The Institute is currently made up of 7 teaching units and 2 research bodies. They are Maritime Navigation Department, Marine Engineering Department, Marine Electrical Engineering Department, International Shipping Management Department, Division of Basic Courses, Division of Social Science, Training Center for Seafarers, Nautical Science & Technology Institute and Studies of Higher Education Research Institute. It has 8 majors altogether, namely, Maritime Navigation, Marine Engineering, Marine Electrical Engineering, Radio Communications & Piloting, Communication Engineering, Industrial Automation, International Shipping Management, and Thermal Engineering. The Institute practices a 4-year senior college program. The number of students is more than 1,800 per year. It also provides training classes and upgrading courses for seafarers as well as higher learning programs for adult students, such as full-time study, correspondence courses and evening classes.

In order to fully implement STCW95 stipulated by IMO and to ensure quality of MET, the Institute has set up a quality system based on the guideline set up by the Administration and gained the Certificate of Quality System issued by the Maritime Administration (MA) of PRC.

### 3.3 Courses and Curricula

The main courses in Chinese maritime institutions are Maritime Navigation and Marine Engineering. The present system of MET in China has existed since 1978. During this period of time, the instructional programs of maritime courses were revised several times in order to meet the new requirements of the international conventions and national regulations. At present DMU can offer doctoral, master and bachelor programs in nautical technology, shipping engineering, marine engineering and marine communication & radio navigation. SMU can offer master and bachelor programs in those specialties; and others can only offer bachelor or 3 years programs in the

specialties. The following is an example of the course curriculum of maritime navigation offered by DMU.

This main curriculum of the navigation course may be divided into four parts: Common Courses, Basic Courses, Supporting Courses and Specialized Courses.

**Common Courses:**

Social Science

Military Theory

Physical Education

College English

Spoken English

**Basic Courses:**

Advanced Mathematics

Physics

Physics Experiment

Mechanical Drawing

Fundamentals of Computer & its Application

Marine Mechanics

Marine Chemistry

Supporting Courses

Electric Circuits

Fundamentals of Marine Radio Technology

Principle for Naval Architecture

Fundamentals of Ship Automation

Introduction to Marine Engineering

Standard Marine Vocabulary

**Specialized Courses:**

Marine Navigation Theory

Ship's Structure and Deck Equipment
Ship's Maneuvering
Watch Keeping & Preventing Collision of Ship
Maritime Transport of Cargo
Oceanography and Meteorology
Ship's Safety and Management
Marine Navigational Instruments
Marine Radar and ARPA
Flag Signals and VHF Radio Communication
Theories of GMDSS Equipment
Maritime Radio Communication for GMDSS
Shipping Business and Maritime Law

The duration of the MET is either 4 years or 3 years. 4-year graduated students get a Bachelor of Science degree. The young navigators and engineers are almost all candidates for deck officers and engineers on board vessels.

Training courses are based on academic programs that comply with international requirements as well as Chinese regulations.

### 3.4 Diploma and Certificates

Generally students study in these institutions for four years. During the study period of four years, students go on board ships for almost one year for practical training at sea. If they successfully complete the program, they will get a diploma and bachelor degree. In addition to the academic courses there are different upgrading courses for navigators and engineers to get the Certificates of competency. At the end of these courses, participants have to take Examinations of National Certificates of Competence, Which are governed

by MA every year, before they go on board ships to be senior officers. The most important subjects of the examination are: Terrestrial Navigation, Celestial Navigation, Maritime Aids to Navigation, Maritime Law for Navigators and Diesel Engine, Ship Automation, Operation of Ship Propulsion Plant, Maritime English. The Certificate is issued by MA, based on the results of all examinations and sea experience. The titles of national certificates are as follows:

**Table 3.1 Titles of National Certificates**

| **Navigation** | **Engineering** |
|---|---|
| Third Officer | Fourth Engineer |
| Second Officer | Third Engineer |
| Chief Officer | Second Engineer |
| Captain | Chief Engineer |

Only unlimited certificates are included in this table.

## 3.5 Career Profile in Higher Maritime Education

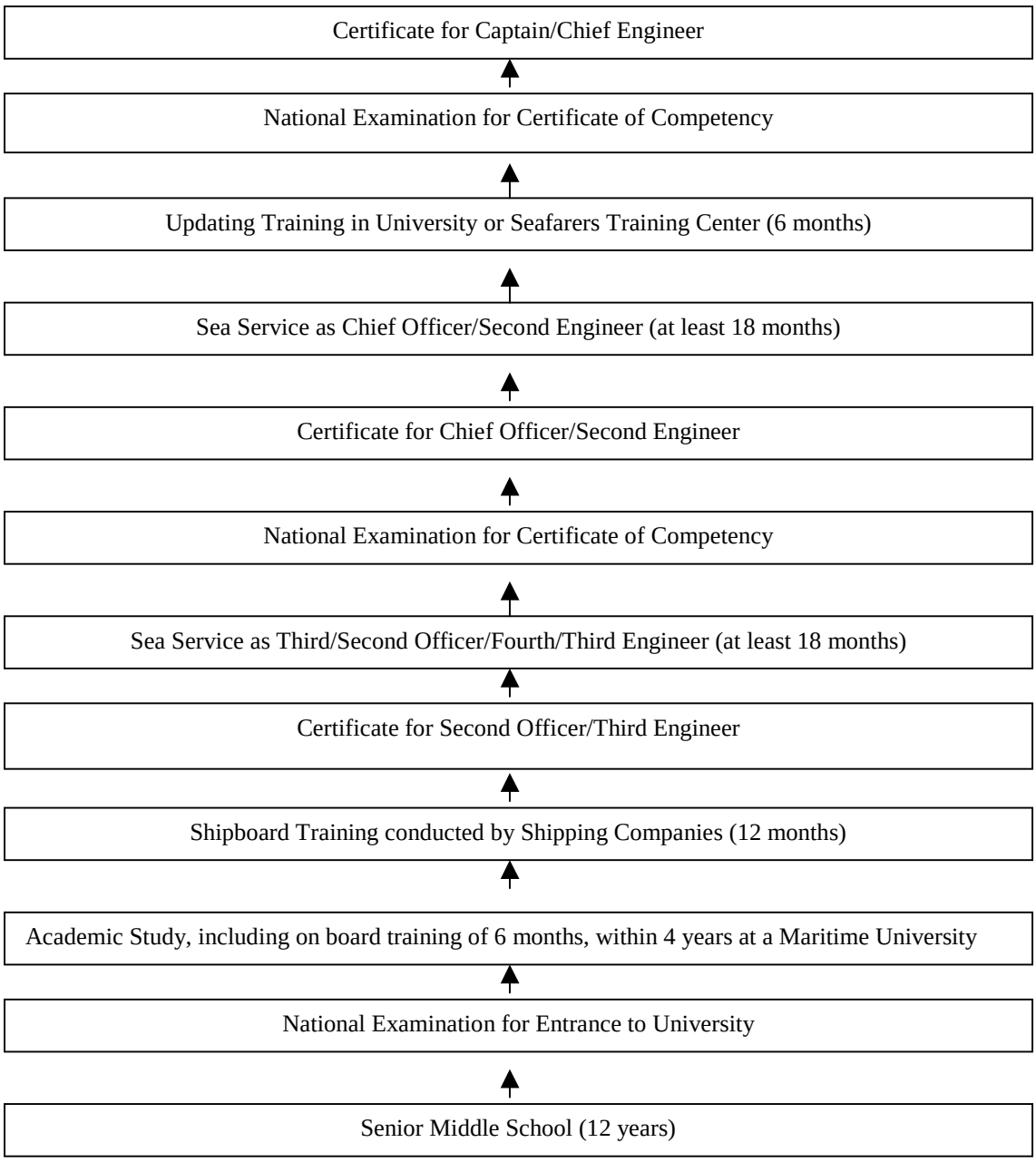


**Figure 3.2 Career Profile in Higher Maritime Education**

## 3.6 Implementation of the Revised STCW in China

The amendment to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) 1978 was adopted in 1995. The impact of the revised STCW Convention on Member States' MET is stronger than expected.

The Chinese government has taken action for the full implementation of the Convention and the major national legislation was made in 1997. Many requirements, with respect to the administration, watchkeeping, maritime education and training, certification, quality standards and control requirements, standards for personnel on maritime qualification and competency and internal requirements for the administrative personnel, have been regulated and entered into force in 1998.

The obvious change in the revised national regulations for seafarers is that the government shows concern for education administration, revising curriculum and shipboard manning as well as quality control. Standards on qualification and competency for senior officers are raised and are beyond the standards in the revised STCW Convention so as to satisfy the national requirements for improving maritime safety. Some major changes are given in brief:

- No institutions are allowed to conduct maritime education and training unless a Training Permit has been granted by MA. The requirements for facilities, equipment, plans, materials, programs and qualifications of the staff according to the national regulations must be satisfied.
- Any trainee, who wants to apply for examinations for the certificate of competency, must go to a school approved by MA for completing the essential education, basic safety training, specialised and competent training with the duration of at least two years. Any candidate has to have an academic basis of higher maritime education (at

least 3 years) before he applies for a certificate of competency on the management level.

- All candidates who apply for the certificates for marine officers, no matte where they graduate, must pass the national examinations organised by MA. Passing national examination means that trainees must satisfy not only the paper test, but also the assessment of competency.
- The senior officers who want to obtain the certificates for Master, Chief Mate, Chief Engineer and Second Engineer must complete the mandatory updating training courses before taking the national examinations.
- The MA has promulgated the Outline of Examination and Assessment for Certification of Seafarers so as to make the seafarers satisfy the minimum standards of the Convention.
- Institutions engaged in maritime education and training must establish quality control systems according to the requirements of the national "Regulations on Quality Control of Education and Training for Seafarers", and obtain the Quality System Certificate issued by MA upon successful verification. The authorised body is responsible for verification of the quality control system and organises an expert group to independently carry out verification for the quality control systems of the institutions.

Facing the STCW 95 Convention and the revised national regulations, Chinese maritime institutions also need to take action to improve MET. The curricula of all courses for MET were fully revised in 1996, and the revised programs of the higher maritime education for new students have been underway since 1997.

An important development has been adopted by maritime institutions for quality assurance in MET. Institutions are obliged to ensure that the education and training objectives and related standards of competence are clearly defined. All training, assessment of competence and teaching activities must be continuously monitored

through a quality standards system to ensure achievement of defined objectives including the qualification and experience required of instructors and assessors. The evaluation activities for quality assurance must be conducted by qualified persons who are not involved in the activities concerned.

# CHAPTER 4

# THE NEW REQUIREMENT FOR CHINESE MET

## 4.1 The Influence of Market Economy

The market economy has already had a profound effect on China's MET in some aspects:

First of all, it makes the circles of maritime education realize the importance of manpower market in regulating maritime technical personnel quantity and specifications, and the urgency and necessity to reform the current maritime education.

Secondly, it speeds up the process of changing China's MET from traditional educational mode to modern quality-orientated education. The traditional China's MET focuses on the science and technology teaching, but the comprehensive qualities such as psychological quality and cultural quality are ignored to some extent.

Thirdly, it makes the Chinese government and circles of MET adjust training content from meeting the requirement of national maritime employment market to meeting the needs of both national and international market. According to statistics, although China is the biggest country in population, it is not the biggest seafarer exports country. For example, China has about 330,000 seamen compared with the Philippine's 350,000 with 160,000 deployed on foreign-owned ships. China, however, has only about 10% of its seafarers employed on foreign flag vessels. In the light of the national strategy of rejuvenating the nation by relying on science and education, the Chinese government

will increase investment in education step by step. Therefore it can be predicted that China will emerge in the international maritime employment market as a main supplier of high standard seafarers in the foreseeable future.

Finally, it impels the government administration to give more power to institution authorities. Until now, the Ministry of Communications has taken measures to enhance the macroscopic management and reduce the microscopic management so as to make sure the maritime institutions to effectively implement the school-running authority.

## 4.2 New Technology Used in Ocean Shipping

The rapid development in the field of maritime technology has had a strong impact on the shipping industry. The new maritime technology developments include radar, automatic radar plotting aids (ARPA), the global positioning system (GPS) and the differential GPS (DGPS), adaptive auto pilots (AAP), track control systems, the electronic chart display information systems (ECDIS), the integrated bridge systems (IBS), the integrated navigation system (INS), the vessel traffic services (VTS), the automatic identification systems (AIS), the use of computers in navigation, and information technology (IT) used in shipping. The impact of the new maritime technology is on the safer operation and the more efficient maintenance of ships. The new methodology and technology in MET have a significant influence on the Chinese MET system and institutions. One of the key influencing factors is the wide utilization of multi-media for MET instruction, including distance education (DE) via internet and e-mail. Computer based training (CBT) and the use of simulators also play a key role in MET. The use of a radar and ARPA simulator for training was made mandatory by STCW95. The following is a brief introduction to the main new technologies.

### 4.2.1 Radar and ARPA

Radar technology has been developed and improved over 60 years from a prototype machine in the 30s to analogue signal processing in the early 60s, and to the digital signal processing in the late 80s. The latest radar advance with overlaying display of radar picture and ECDIS has great potential in the integrated bridge system, as the situation involving encounters with other vessels can at all times be assessed within the overall context. By integrating the functions of ARPA and ECDIS, a system would be developed to help officers of the watch to deal with complex traffic situations by giving them suggestions for avoidance routes. This system can also be used in a VTS center.

### 4.2.2 Global Positioning System (GPS) and Differential GPS (DGPS)

The Global Positioning System (GPS) was originally developed by the United States Department of Defense to provide precise navigation for a wide range of military requirements. In the mid-1980s it was decided to make the technology available to civilian users. The US Department of Defense decided to deliberately degrade the signals, through a process called selective availability, to deny unauthorized access to the system's full capability. Accuracy achieved under this regime is normally in the range of 50 meters. What will be the future development of satellite navigation systems? GPS is a part of the would-wide radio navigation system (WWRNS), which consists of satellite navigation systems and terrestrial navigation systems. WWRNS is capable of providing adequate position information within its coverage area. DGPS relies on the assumption that certain types of error, which can degrade the performance and accuracy of a system, are common to all users within a given area.

### 4.2.3 Electronic Chart Display Information Systems (ECDIS)

Electronic chart display and information systems (ECDIS) have emerged as a new aid to maritime navigation, the use of which results in significant benefits to maritime piloting and safety. ECDIS is a real-time geographic information system capable of integrating GPS/DGPS, echo-sounder, gyrocompass, radar, and electronic chart information into one display. As an automated decision aid, ECDIS is capable of continuously determining a vessel's position in relation to land, charted objects, aids to navigation and unseen hazards. As a navigation system, ECDIS also displays such important information as cross-track distance, course made good, speed over ground, and time-to-go. ECDIS and other forms of electronic charts like the raster chart display system (RCDS) represent an entirely new approach to the safety of maritime navigation and piloting.

### 4.2.4 Vessel Traffic Service (VTS)

A vessel traffic service (VTS) is any service implemented by a competent authority primarily designed to improve the safety and efficiency of traffic and the protection of the environment. It may range from the provision of simple information messages to extensive management of traffic within a port or waterway. Given this broad description, a VTS might embrace some or all of the following functions:

- Provision of routine information
- Co-ordination of ship movement reports
- Monitoring of compliance with established traffic rules
- Provision of advice or guidance
- Regulation of traffic

Fulfilment of all of the above functions requires a communications system, and surveillance is essential for all but the simplest information service.

**Communication:** in modern VTS systems a wide variety of communication systems may be found. These may include landline telephone, radiotelephony, telex, microwave data link and satellite communication.

**Surveillance:** radar is invariably the sensor used to carry out surveillance. In general, the systems are purpose built to achieve a very high degree of range and bearing discrimination.

### 4.2.5 Adaptive Auto Pilot (AAP)

The adaptive auto pilot is so designed that the ship can make the course steering more accurate taking into account the drag of the rudder angle and the ambient conditions, e.g. weather, currents and tide. The AAP makes use of the proportional, integral and derivative (PID) controls forming the PID autopilot systems which are widely used on board merchant ships. The autopilot is primarily used for steering the ship on long ocean passages, which reduces quartermaster's workload.

### 4.2.6 Integrated Navigation System (INS)

The purpose of an integrated navigation system is to provide "added value" to the functions and information needed by the officer in charge of the navigational watch (OOW) to plan, monitor, or control the progress of the ship. An INS provides benefits by automating some of the routine cross checking and selection of data sources, presenting situation awareness and decision support, keeping track of the configuration in use and of its limitations and aiding automatic control.

### 4.2.7 Automatic Identification System (AIS)

AIS is based on the installation of an onboard transponder, which uses the GPS signals emitted by satellites to transmit the ship's identity, position and other pertinent data to any ship or shore station with compatible equipment. This information can then be displayed on the screen of a ship's ECDIS (basically a computer screen displaying a digital marine chart and other vital information), immediately providing the master or pilot with the location of other ships in the vicinity, and enabling such ships to transmit short electronic messages to one another. The implementation of this technology will significantly improve the quality of marine traffic information, enhance the level of safety on board ships, and permit significant rationalization of the Vessel Traffic Services (VTS) program.

### 4.2.8 Track Control Systems

The objectives of track control systems with their sources of position, heading and speed data are intended to keep a ship automatically on a pre-planned track over ground under various conditions and within the limits related to the ship's maneuverability. The systems can be applied on board ships of maximum speed of 30 knots with maximum rate of turn not in excess of 600 degrees per minute, it is applicable to the straight tracks.

### 4.2.9 Integrated Bridge System (IBS)

An integrated bridge system (IBS) is defined as a combination of systems which are interconnected in order to allow centralized access to sensor information or command/control from work stations with the aim of increasing safe and efficient ship's management by suitably qualified personnel. IBS should support systems performing two or more of the following operations:

- Passage execution
- Communication
- Machinery control
- Loading, discharging and cargo control
- Safety and security

### 4.2.10 Computers in Navigation

The maritime industry is changing in a steady and positive manner. The application of computer technology has a profound influence on the entire shipping sector. Computers are present in every field of the shipping industry including vessel operation and management, voyage planning, maintenance scheduling, communications, and engine room controls.

### 4.2.11 Information Technology (IT) in Shipping

Information technology (IT) is a term commonly used to cover the range of technologies used for the transfer of information, in particular to computers, digital electronics, and telecommunications (Crystal, 1990). IT provides data to support decision making. But data is not information, and information is not knowledge. Hence, it is necessary to translate data into information to provide the knowledge needed for action. The full advantage of the latest IT developments in the shipping sector lies in the fact that the use of IT can increase the efficiency of shipping operations and reduce the time spent on labor intensive work, it therefore ensures the safer navigation and operation of ships.

## 4.3 The Revised STCW Convention

The original 1978 Convention had been criticized on many counts. Critics pointed out many vague phases, such as " to the satisfaction of the Administration", which resulted in different interpretations being made. Others complained that the Convention was never uniformly applied and did not impose any strict obligations on Parties regarding implementation. There was also a general recognition that, after 17 years, the Convention badly needed to be brought up to date.

Therefore a series of amendments including a restructuring of the existing treaty was adopted. Until 1 February 2002, however, Parties may continue to issue, recognize and endorse certificates which applied before that date in respect of seafarers who began training or seagoing service before 1 August 1998.

One of the major features of the revision is the adoption of a new STCW Code, to which many technical regulations have been transferred. Part A of the Code is mandatory and Part B is recommended.

Some of the most important amendments adopted by the conference concern Chapter I (General Provisions). They include the following:

Parties to the Convention will be required to provide detailed information to IMO concerning administrative measures taken to ensure compliance with the Convention, education and training courses, certification procedures and other factors relevant to implementation (Regulation 7).

This information will be used by the Maritime Safety Committee (MSC), IMO's senior

technical body, to identify Parties that are able to demonstrate that they can give full and complete effect to the Convention. Other Parties will then be able to accept that certificates issued by these Parties are in compliance with the Convention.

This regulation is regarded as particularly important because it means that governments will have to establish that they have the administrative, training and certification resources necessary to implement the Convention.

No such proof was required in the original Convention, leading to complains that standards differed widely from country to country and certificates could therefore not always be relied on. Further regulations dealing with this aspect are contained in the mandatory Part A of the STCW Code.

Parties will be obliged to investigate incidents in which incompetence or negligence is alleged against seafarers to whom they have issued certificates.

Administrations wishing to recognize certificates issued by another State for use in their ships will be required to ensure that the standards concerned are in accordance with the Convention.

Enhanced procedures concerning the exercise of port State control under Article X of the Convention have been developed to allow intervention in the case of deficiencies deemed to pose a danger to persons, property or the environment.

This can take place if certificates are not in order or if the ship is involved in a collision or grounding, if there is an illegal discharge of substances (causing pollution), if the ship is maneuvered in an erratic or unsafe manner.

Technical innovations, such as different working practices and the use of simulators for training purposes have been recognized. Simulators will become mandatory for training in the use of radar and automatic radar plotting aids.

Special requirements have been introduced concerning the training and qualifications of personnel on board ro/ro passenger ships.

This was done in response to proposals made by the Panel of Experts set up to look into ro/ro safety following the capsize and sinking of the ferry Estonia in September 1994.

Previously the only special requirements concerned crews on tankers. Crews on ro/ro passenger ferries will have to receive training in technical aspects and also in crowd management and human behavior.

Parties will be required to ensure that training, certification and other procedures are continuously monitored by means of a quality assurance system (regulation 8).

A reference is made in regulation 14 to the International Safety Management (ISM) Code, which was adopted by IMO in 1993 and was made mandatory under the May 1994 amendments to the International Convention for the Safety of Life at Sea (SOLAS), 1974.

The regulation details further company responsibilities for manning and certification.

Regulations regarding alternative certification have been included in a new Chapter VII.

This involves enabling crews to gain training and certification in various departments of seafaring rather than being confined to one branch (such as deck or engine room) for

their entire career.

At the same time, the new Chapter is intended to ensure that safety and the environment are not threatened in any way.

Measures have been introduced for watch-keeping personnel to prevent fatigue. A new Chapter VIII requires Administrations to establish and enforce rest periods for watchkeeping personnel and to ensure that watch systems are so arranged that the efficiency of watchkeeping personnel is not impaired by fatigue.

**The STCW Code**

The regulations contained in the Convention are supported by sections in the Code. Generally speaking, the Convention contains basic requirements which are then enlarged upon and explained in the Code.

A detailed STCW Code consisting of two parts was added to the regulations in the annex to the Convention. This Code gives specifications of minimum standards of competence, and allows for a modular qualification system as an alternative to the less flexible traditional system. Part A is mandatory and Part B is recommended. The competency tables in Part A list three levels of competence:

the ***management*** level for masters, chief mates, chief engineers and second officers;

the ***operational*** level for officers in charge of the navigation watch or engineering watch;

the ***support*** level for ratings forming part of a navigational watch or engineering watch.

The standards of competence are grouped under seven functions:

1. Navigation;
2. Cargo handling and stowage;
3. Controlling the operation of the ship and care for persons on board;
4. Marine engineering;
5. Electrical, electronic and control engineering;
6. Maintenance and repair;
7. Radiocommunications.

Section A-I/6 of the Code, for example, contains detailed requirements concerning training and assessment that back up those contained in regulation I/6 of the Convention itself.

Section A-I/7 of the Code goes into considerable detail about the communication of information required in regulation I/7. To help in assessing the information provided by Governments, for example, the Secretary-General is required to maintain a list of competent persons (approved by the MSC).

Part B of the Code contains recommended guidance which is intended to help Parties implement the Convention.

The measures suggested are not mandatory and the examples given are only intended to illustrate how certain Convention requirements may by complied with.

However, the recommendations in general represent an approach that has been harmonized by discussions within IMO and consultation with other international organizations.

## 4.4 The MARPOL 73/78 Convention

Maritime Education and Training was not relevant to the marine pollution prevention until 1978. No specific subject on this matter was included in the syllabus of maritime training institutions. With the increase of the marine pollution accident, the result of marine pollution, the growing interest of the public and the media in environmental matters produced a trend towards better-trained seafarers with regard to preventing and fighting marine pollution. The experiences gained with the application of the OILPOL Convention motivated the promotion of new initiatives in the protection of the marine environment, namely the adoption of a new Convention for the Prevention of Pollution from Ships (MARPOL 73/78). At the same time, the STCW78 was adopted taking the protection of marine environment into account. MARPOL 73/78 provoked the need to pay more attention to the teaching of marine pollution prevention as a subject did.

The influence of this Convention and the adoption of the STCW 78 required that marine pollution prevention should be included in the syllabuses of maritime institutions as a basic topic. In order to implement the MARPOL 73/78 and STCW 78 conventions most of the Maritime Administrations which have ratified the conventions have approved national legislation to restructure the requirements for maritime training including the subject of marine pollution prevention. The STCW Code has established mandatory standards for seafarers with regard to the demonstration of knowledge, understanding and proficiency on the protection of the marine environment to obtain the certificate of competency.

Following the requirements of MARPOL73/78, MET institutions should introduce updated material into their syllabuses and improve training systems in order to update the knowledge of seafarers concerning the new developments in the field of marine pollution prevention.

Masters, Chief Engineers and Ship Officers play an important role in the protection of the marine environment, so the minimum requirements for their certification should be updated to cover the present needs in this field so as to acquire expertise in modern techniques and equipment. For this reason they should have knowledge of the general principles to mitigate the effects and know how to combat spillage in order to be able to take the appropriate measures and also to provide adequate information to other persons combating the spill. After the adoption of the International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC). This obligation of Masters and Officers becomes more important due to the requirements contained in the Art. 26 of Annex 1 of MARPOL and Art. 3 of the OPRC Convention to have oil pollution emergency plans on board tankers.

Masters and Ship Officers are involved in the following pollution prevention aspects during the transport of pollutant substances or in case of accident:

- It is their duty to report any pollution incident in accordance with the provisions of MARPOL and OPRC conventions.
- Masters of Oil tankers should have a shipboard oil pollution emergency plan. (MARPOL and OPRC Conventions)
- In case of accident on board oil tankers, the Master should activate the emergency plan and command operations.
- In case of pollution the Master and Officers evaluate the situation and provide initial information on the spillage.

- Although the operations to combat pollution are organised by land personnel, the Master and Officers are usually involved in the following activities:

  - Co-operation with the personnel of operations.
  - Preparation of reports on the accident.
  - Declaration to the Judge and Maritime Authorities.
  - Information to the Shipping Company and the media.

All requirements mentioned above should be implemented in MET.

## 4.5 The ISM Code

The purpose of the International Safety Management (ISM) Code is to provide an international standard for the safe management and operation of ships. The requirements of the ISM Code include:

- the effective functioning of a designated person appointed (DPA) ashore to monitor the safety aspects of ship operation and ensure that sea staff are provided with sufficient support;

- the reporting, analysis and follow up of shipboard incidents and accidents;

- regular internal audits to assess the effectiveness of a company's safety management systems.

Part 6 of the Code is related to resources and personnel and provides for:

- the master to be properly qualified and fully conversant with the Safety Management System (SMS);

- the ship to be manned with properly qualified and fit personnel;
- new personnel to have safety training;
- all personnel to have adequate understanding of relevant rules and be able to communicate effectively within the SMS;
- procedures to be established to identify SMS training needs.

Training of sea and shore staff to meet the requirements of the ISM Code should then start with the designated person and the selected project team who in turn having been trained themselves and involved in developing and implementing the SMS, can then ensure that all remaining shore and sea staff are trained in house.

The content of training is:

1. ISO Quality Standards (ISO 9000 series).
2. The ISM Code requirements.
3. Objectives and policies.
4. Procedures and systems.
5. Instructions and auditing techniques.
6. Motivation skills.
7. Appraisal skills.
8. Problem solving.

Training for trainees should reach the following objectives:

- Being able to plan a simple safety management system.
- Understanding the history, requirements and implications of the ISM Code.
- Interpreting and understanding the ISM Code and the relationship with ISO 9002.
- Being able to write and develop procedures/plans.
- Performing and reporting on audits relating to both ISO and the ISM Code standards.

- Conducting in-house training courses for shore and sea staff to ensure everybody is aware of the ISM Code
- Enabling sea and shore staff to have the confidence to query the findings of third party auditors who raise non-conformances when they audit the office and vessels for the Document of Compliance (DOC) and Safety Management Certificate (SMC) respectively.
- Dealing with in house internal audit training for both shore and sea staff.

# CHAPTER 5

# SITUATION OF THE DEVELOPMENT OF MET IN SELECTED MARITIME COUNTRIES

A comparative study of MET for deck officers in Germany, Norway, Australia, Canada and Japan is introduced in this chapter. MET varies from country to country depending on the specific situations of geography, history, culture, legislation, economy, politics, technology and society. By examining other countries' MET, new ideas can be obtained to update and improve the Chinese MET system. The main reason for selecting the particular countries is that their systems and course programs are representative and Chinese MET can learn something from them.

The comparative study is based upon the following elements:
MET system, admission requirements, main courses and levels of certificate of competency.

## 5.1 German MET System

### 5.1.1 General Introduction

The type of German MET is monovalent. It is a kind of knowledge-based MET which focuses on learning of theoretical subjects with limited emphasis on the application of

theories. There are 8 government-controlled maritime academies, which offer courses leading to unlimited certificates of competency (polytechnic, vocational institutes).

### 5.1.2 Admission Requirements

The candidate must have at least 12-year general education experience and sea time before studies. There is a medical examination for applicants. There is no entry examination, but the applicants need to have special technical knowledge required in subjects.

### 5.1.3 Curricula and programmes

For Master and Chief Engineer, the duration of school time and sea time for unlimited certificates of competency are 24 months and 42 months respectively. At MET institutes in Germany, courses leading to unlimited certificates of competency and academic degrees are offered. An unlimited certificate of competency can also be obtained without an academic degree.

In Germany, the students follow an academic programme. Students, as pre-requisite knowledge, have passed a Schiffsmechaniker vocational training.

Generally for deck officers the total teaching hours are 2111, among them simulator and workshop hours are 114. Out of the 2111 teaching hours 1540 hours are total STCW hours. The major subjects are navigation, cargo, operations, gen. oper. Certf., pers. survival, fire prevent, first aid, pers. safety/soc., medical care, English, mathematics, physics, chemistry and others.

In Germany dual-purpose officers are being cultivated. As for dual-purpose unlimited certificates, generally the total STCW hours are 1890. Simulator and workshop hours are 114 among them. The major subjects are navigation, cargo, operations, engineering, m & repair, electric, gen. oper. certif., English, pers. survival, fire prevent, first aid, pers. safety/soc. and medical care.

### 5.1.4 Certificate Structure

The certificate structure in Germany is, for the deck officer, to issue Certificates of Master and Mate. The Ministry of Transport is in charge of issuing certificates of competency. Shipboard experience after studies for obtaining the highest certificate of competency is required in Germany.

### 5.1.5 Sequence of German MET

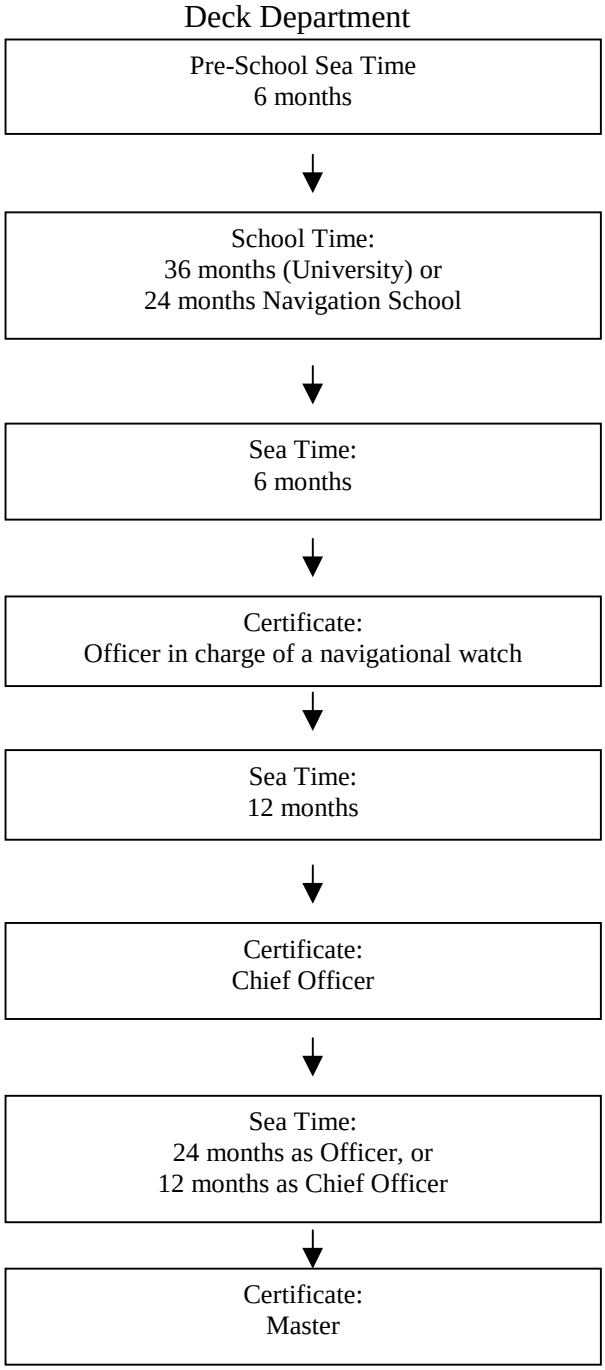


**Figure 5.1 Sequence of German MET**

## 5.2 Norwegian MET System

### 5.2.1 General Introduction

The type of Norwegian MET is monovalent. It is a kind of knowledge-based blended with skill-based training. There are 22 government-controlled maritime academies, which offer courses leading to unlimited certificates of competency (polytechnic, vocational institutes).

### 5.2.2 Admission Requirements

The candidate must have at least 12-year general education experience. There are no other requirements such as medical examination, mental fitness test, special knowledge required in subjects and entry examination.

### 5.2.3 Curricula and programmes

For Master, the duration of school time and sea time for unlimited certificates of competency are 30 months and 52 months respectively. At MET institutes in Norway, courses leading to unlimited certificates of competency and academic degrees are offered. An unlimited certificate of competency can also be obtained without an academic degree.

Generally for deck officers the total teaching hours are 2217, among them simulator and workshop hours are 409. In 2217 teaching hours 1576 hours are total STCW hours. The major subjects are Navigation, Cargo, Operations, Gen. Oper. Certf., Pers. Survival, Fire Prevent, First Aid, Pers. Safety/Soc., Medical Care, English, Physics, Chemistry and Others.

### 5.2.4 Certificate Structure

Norway is carrying out a traditional certificate structure, namely, for the deck officer, the certificates are Master, Chief Master and Mate. The Norwegian Maritime Directorate is in charge of issuing certificates of competency.

### 5.2.5 Sequence of Norwegian MET

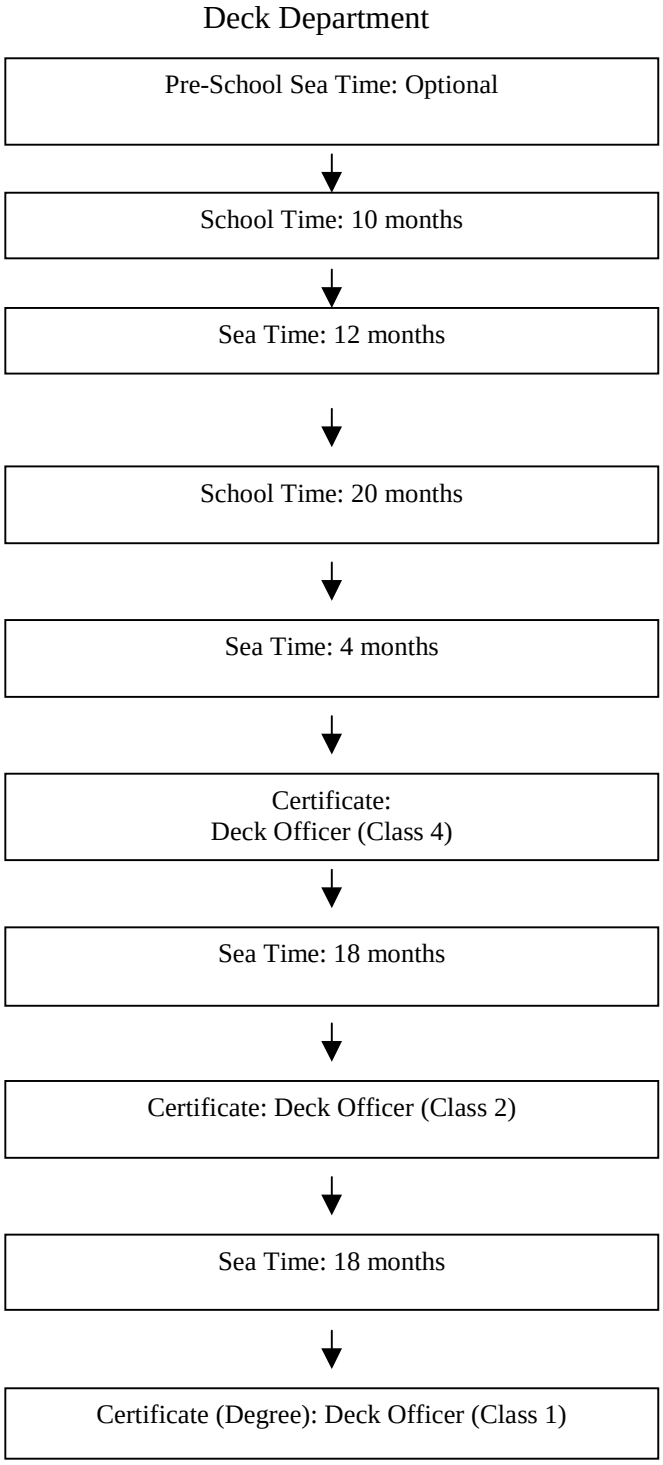


**Figure 5.2 Sequence of Norwegian MET**

## 5.3 Australian MET System

The Australian MET system for the maritime industries has quickly developed since the 1970s, when there was the beginning of a period of rapid technological change in the shipping industry. Nowadays, the Australian Maritime College, which was established by an Act of Federal Parliament in 1978 and is playing a significant role in the MET in Australia, provides educational programs and practical training for the shipping and fishing industries from certificate to doctoral levels. The courses not only reflect the general trend in industry towards recruiting a greater proportion of graduates into executive positions, but also are flexibly structured and suitable both for school leavers and for-experienced mariners wishing to upgrade their qualifications.

### 5.3.1 Courses for Deck Officers

There are two levels of ship operations' courses in the Australian Maritime College. They are called the Diploma of Applied Science (Nautical Science) and the Diploma of Applied Science (Shipmaster) both including an advanced Certificate in Marine Operations. The main difference between these two courses is that the former provides a course for Australian sponsored deck officer trainees only, the latter being provided for all other deck officer trainees both having a program which covers not only the academic requirements for deck officers to different levels, but also such professional qualifications for integrated marine operations.

For Diploma of Applied Science (Nautical Science), the course provides a trainee officer with the academic and practical training to progress from junior navigation officer to shipmaster. It incorporates the basic knowledge requirements for the Certificate of Competency as Second Mate and Master Class. The program includes two elements:

1. Certificate in Marine Operations (Year1) or Certificate in Pre-Sea Training (Deck);

2. Nautical science studies at the Australian Maritime College and an industrial experience program (years 2 and 3).

Applicants must have good passes in Year 12 Mathematics, Physics, and English and must attend an interview with a shipping company. Upon enrolment, students must be sponsored by a shipping company, whose responsibility it is to arrange industrial experience for cadet trainees.

For Diploma of Applied Science (Shipmaster), there are two core teaching blocks lasting for ten weeks each and concluding with one additional week of examinations. The teaching blocks run consecutively throughout the year. Mandatory and optional short courses are conducted prior to or after the main teaching blocks depending on demand. Completion of these courses could take another 10-12 weeks, depending on individual circumstances and AMSA requirements.

This course is a continuation of the subjects covered in the Diploma of Applied Science (Second Mate) course and can only be attempted after students have completed the required sea going experience stipulated by AMSA and outlined in Marine Orders Part 3. This course incorporates all the requirements necessary to attain a Chief Mate's and Master's Certificate of Competency Class 1 & Class 2 issued by AMSA.

### 5.3.2 Training System and Certification

Trainees, who are sponsored by shipping companies, can enroll on the course called the Diploma of Applied science (Nautical Science) with a program which covers the academic requirements for Australian Maritime Safety Authority Certificates of Competency as a Deck Watchkeeper, Chief Mate and Master Class 1. The admission requirement is that students graduate from Australian secondary schools with

satisfactory results in mathematics, English and physics, or have completed satisfactory service at sea.

Students study in College with a sandwich-type course over four years. There are five academic semesters (2.5 years) and three semesters at sea (1.5 years), including ratings training on board ships and seagoing training with industrial experience.

Today, in Australia, any person who works on board ships as a mariner must first pass an Integrated Ratings Course. Therefore, in the first year, all students have to follow the Integrated Ratings (multi-skill) Course which consists of 3 weeks Safety Training, 16 weeks Vocational Training and 20 weeks Sea Service.

### 5.3.3 Curriculum

The curriculum for the Diploma of Applied science (Nautical Science) (Marine & Offshore Systems) is briefly introduced as follows.

In the first year, the subjects of the integrated ratings course concentrate on shipboard safety and vocational practice both on deck and in the engine room. From the second year to the fourth year, the curriculum provides not only normal subjects such as the basic knowledge of ships, navigation, communications and cargo handling, but also a wide range of shipping aspects such as shipping business, maritime law and port marine operations. All the subjects are concerned with the safe and proper operations of ships. In particular the subject of Safety & Emergency Procedures provides necessary and formal training in rendering first aid to the injured and in fire prevention and control, with particular emphasis on those situations that may arise on board a vessel.

A good arrangement is the practical training at sea for one year between the academic

studies. After 475 hours of teaching the fundamental knowledge of ships, equipment and normal operations, students can go on board ships for the industrial experience program. It is very beneficial for students to obtain practical experience on how to operate a ship in a real situation.

### 5.3.4 Sequence of Australian MET

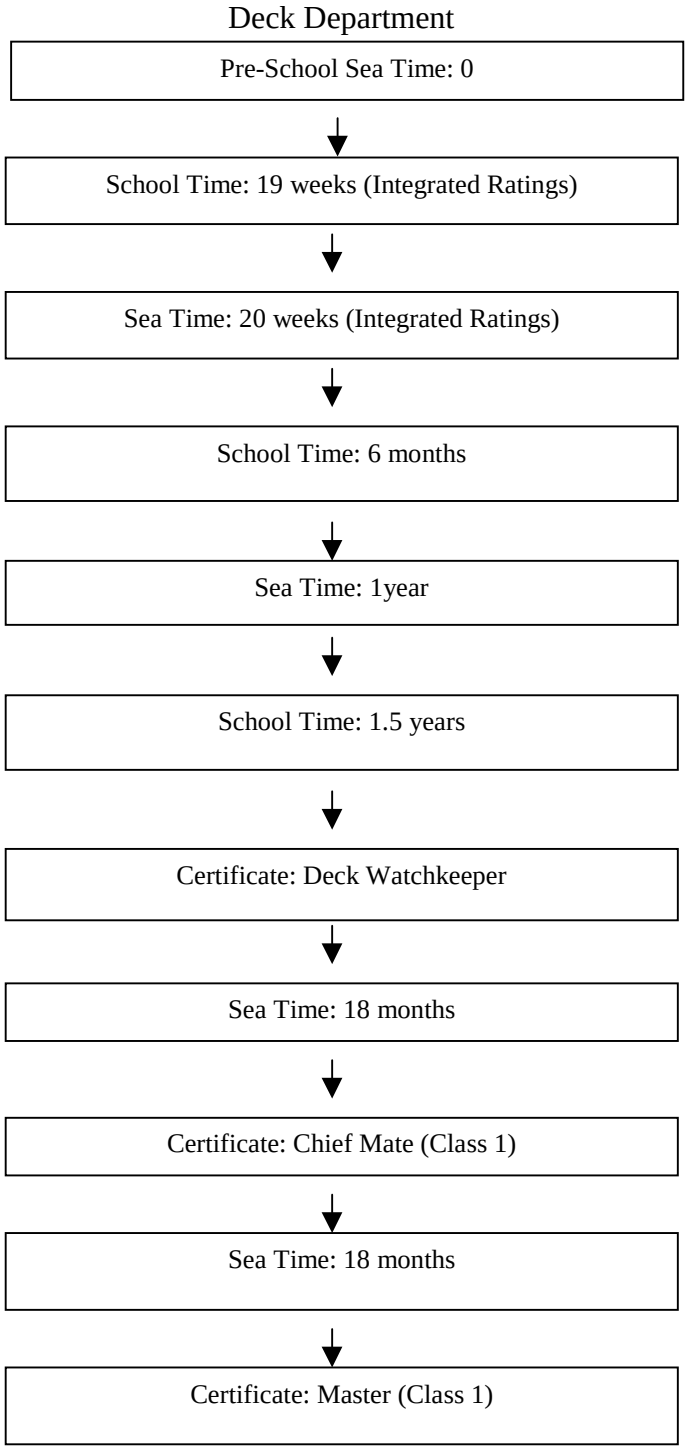


**Figure 5.3 Sequence of Australian MET**

## 5.4 Canadian MET System

### 5.4.1 General Introduction

The type of Canadian MET is monovalent. Presently there are mainly five institutions cultivating seafarers, which are The Marine Institute (attached to Memorial University), The Nova Scotia Nautical Institute (attached to the Community College System), Owen Sound Nautical Training Campus, Georgian College and Pacific Marine Training Institute (part of BC Institute of Technology). These institutions can offer courses leading to certificates of competency. Under the Canadian Constitution, education comes under the jurisdiction of each province. This includes MET despite the fact that certification is a federal responsibility.

Canadian MET system focuses on training. Regarding provincial maritime training institutions, there are two institutions to be mentioned. Firstly, the Marine Institute of Newfoundland, which has grown out of the former fisheries training institute in the province, has excellent premises and facilities, a staff which is reasonably well-qualified and constantly up-graded, and also has fairly strong financial support. However, that is due to the fact that the provincial government considers maritime training a priority as part of its policy to deal with chronic unemployment. As a result, training in fisheries, navigation and oil and gas operations has been given a fairly high profile and the Marine Institute has benefited from this. Secondly, in the province of Quebec, the Institute Maritime du Quebec, in Rimouski has, for a number of years already, enjoyed an established reputation for maritime education for Francophone Canadians. The institute, which is strongly supported by the Province of Quebec, enjoys an international reputation, and has demanding entrance requirements.

### 5.4.2 Admission Requirements

The candidate must have at least 11 years general education experience. There are not other requirements such as entry examination.

### 5.4.3 Training Content

MET in Canada varies from one province to another, because it is under the province's jurisdiction. So there are some differences in the teaching programs between them. Here the author would like to introduce the programs offered by the Marine Institute.

The duration is 4 years, which includes 6 semesters, 3 technical sessions and 2 sea service phases. Besides fundamental studies in subjects such as mathematics, chemistry, physics and Communications Skills, first year students receive training in Computer Applications and Engineering Graphics. As well there are courses in Electrotechnology, which provide the basis of electric theory.

At the end of the first year, following the two common semesters, there is a 5-week technical session followed by three weeks Marine Emergency Duties course. Courses in the technical session are designed to prepare students for summer work placement and for entry into the second year of study. During this technical session students are introduced to theoretical and practical aspects of seamanship, cargo operations and navigation.

The second and third years of the programme include technical courses designed to give as broad an education as possible in the field of nautical science, while maintaining concentrated study in subjects such as Seamanship, Navigation, Cargo Operations,

Naval Architecture, and Stability. These courses are used as foundations for the other courses that complete the programme. (detailed programs see appendix 4).

### 5.4.4 Certification Structure

In general, Canada subscribes to international maritime training standards set out under the requirements of the IMO. These requirements are enforced through the Mnistry of Transport, through a series of tests, examinations and re-examinations. The Marine Safety Directorate of the Ministry of Transport takes charge of issuing Certificate of Competency. Students who successfully complete the programme will have sea service requirements needed to obtain the Watchkeeping Mate Certificate of Competency reduced by 12 months and will have sea service requirements for the ONII Certificate of Competency reduced by 6 months.

### 5.4.5 Sequence of Canadian MET

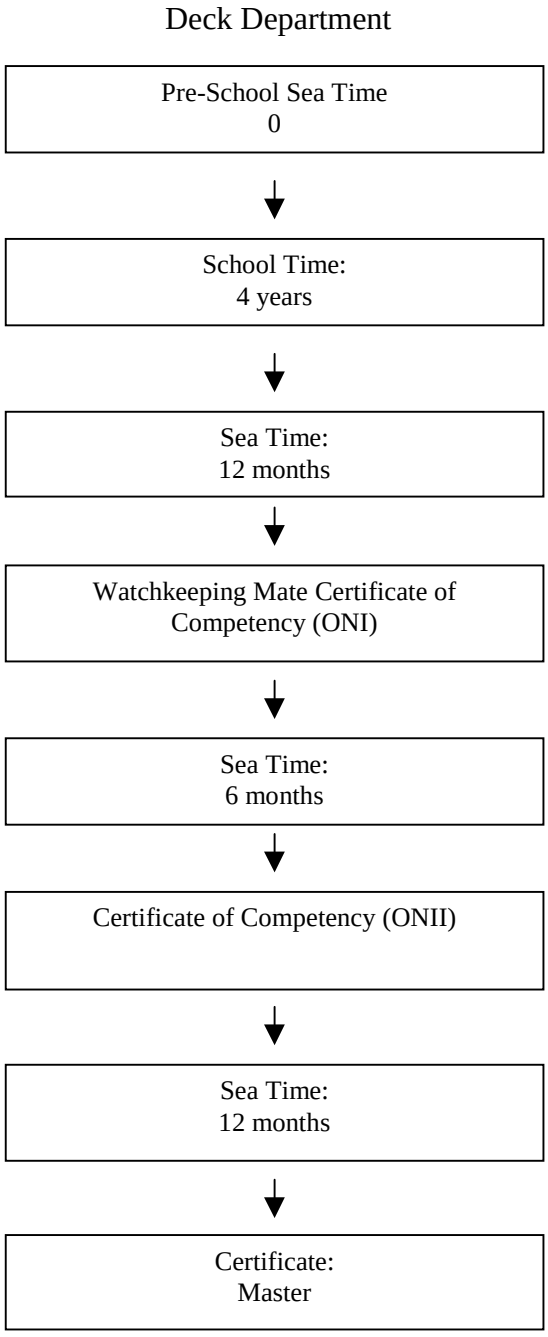


**Figure 5.4 Sequence of Canadian MET**

## 5.5 Japanese MET System

### 5.5.1 General Introduction

As the seafarer's education in Japan has been undertaken mostly by the central government or the municipalities, school facilities are financially supported by them. Also, the school expenses of students are subsidised in the same way as in other ordinary national universities or schools.

At present, there are 8 marine technical schools, 5 mercantile marine colleges, 2 mercantile marine universities and 1 institute for sea training as well as its branch and 1 marine technical college for education and training of seamen in Japan. The characteristics of the existing institutions are introduced hereunder.

### 5.5.2 Marine Technical School

#### 5.5.2.1 Jurisdiction and Admission Requirements

Marine Technical Schools are under the jurisdiction of the Ministry of Transport and are located in eight places; namely Otaru, Miyako, Tateyama, Shimizu, Namikata, Karatsu, Kuchinotsu and Okinawa.

Applicants are required to be graduates of a junior high school at the age between 15 and 19, or, of a senior high school at the age between 18 and 20, and should pass the entrance examinations consisting of a written examination and a physical check-up.

#### 5.5.2.2 Courses

The courses mainly include Regular Course, Special Course and Sea Training Course.

- Regular Course

The course is aimed to recruit officers and engineers for the home-trade, or dual purpose crew (DPC) of ocean-going vessels, with a schooling period of three years that includes three-month training aboard a training ship. Both general and specialised subjects are taught to students from junior high schools.

- Special Course

The course is aimed to recruit officers and engineers for the foreign- or home-trade. The two-year schooling, including nine-month sea training aboard a training ship, is focused on specialised subjects. Students come from high schools.

- Sea Training Course

The course is designed to give those who intend to apply for the fourth grade competency necessary practical training on board. Trainees are Regular Course graduates of the Marine Technical School.

#### 5.5.2.3 License and Qualification

##### 5.5.2.3.1 Marine Technical Officer's License

Those who have graduated from the Regular Course, after having acquired two-year sea service aboard a ship are exempted from the written examination for the Fourth Grade Maritime Officer (Navigation), thus being qualified for corresponding oral examination.

Those who have graduated from the Special Course or the Sea Training Course, are exempted from the written examination for the Fourth Grade Maritime Officer (Navigation).

##### 5.5.2.3.2 Qualification for Admission to a University

Those who have completed the Regular Course are qualified for being equal to the graduates of a senior high school and to be an applicant for a university or a college.

### 5.5.3 Mercantile Marine College

#### 5.5.3.1 Jurisdiction and Admission Requirements

Mercantile Marine Colleges are under the jurisdiction of the Ministry of Education, and are located in five places, namely Toyama, Toba, Hiroshima, Yuge and Oshima.

Candidates are required to be the graduates of a junior high school and should pass an achievement test and a health examination.

#### 5.5.3.2 Contents of Education

Courses are provided for navigation and engineering. The period of study is five years and six months, and both general and technical subjects are taught. One-year practical training on board a training ship of the Institute for Sea Training is included at the end of schooling period. Besides courses for recruitment of ship's officers, colleges have also established other courses concerning the maritime industry and its relating industries.

#### 5.5.3.3 Licenses and Qualifications

Those who have graduated from the navigation course are exempted from the written examinations of the third grade maritime officer (Navigation) and third grade maritime officer (navigation) for bridge watch, thus being qualified for corresponding oral examination.

### 5.5.4 University of Mercantile Marine

#### 5.5.4.1 Jurisdiction and Admission Requirements

Universities of Mercantile Marine are the highest educational institutions for ship's officers in Japan. They are under the jurisdiction of the Ministry of Education, and are located in Tokyo and Kobe.

Candidates are required to be the graduates of a senior high school or those whose intellectual ability is judged to equal or surpass that of the former, and there is no age limit. They should pass the entrance examinations consisting of an achievement test and a health examination.

#### 5.5.4.2 Contents of Education

Each of the Japanese universities of mercantile marine has a Faculty of Mercantile Marine Science. The faculty of the Tokyo University of Mercantile Marine consists of the Department of Marine System Engineering, the Department of Information Engineering and Logistics, the Department of Electronic and Mechanical Engineering.

The faculty of the Kobe University of Mercantile Marine, on the other hand, is composed of the Department of Maritime Science, the Department of Transportation and Information System Engineering, the Department of Ocean Electro-Mechanical Engineering and the Department of Power System Engineering.

The two universities have a four-year academic system and the students must take subjects from both academic and specialised divisions. Graduates are granted with a bachelor's degree.

Those students at the universities who hope to obtain a license of maritime officer are requested to study further for six months at the Sea Training Course after completing the courses in the Department of Marine System Engineering, the Department of Maritime Science. These students have to receive practical training aboard the training ships of the Institute for Sea Training for one year totally; six months during undergraduate and another six months during the Sea Training Course. One-year sea training is necessary for the application for maritime officer's competency.

The Sea Training Course at each university consists of the navigation and engineering courses. Those who proceed to the navigation course should win the credits of the subjects required in the undergraduate navigation course.

#### 5.5.4.3 Licenses and Qualification

The students who have successfully completed the navigation or engineering courses as well as the Sea Training Course at one of the two mercantile marine universities are qualified to take the examination for the third grade maritime officer (navigation) license and the third grade maritime officer (navigation) for bridge watch. They are exempted from the written examinations.

### 5.5.5 Institute for Sea Training

#### 5.5.5.1 Jurisdiction and Admission Requirements

Institute for Sea Training is under the jurisdiction of the Ministry of Transport, and its headquarters is located in Yokohama with its branch office in Kobe. It owns two large sail training ships, two turbine training ships and two diesel training ships.

Cadets must be the students of mercantile marine universities or mercantile marine colleges who are specifically entrusted by the Minister of Education and also the students of Marine Technical College who are designated by the Minister of Transport. Trainees must be the students of Marine Technical Schools that are designated by the Minister of Transport.

#### 5.5.5.2 Contents of Education

Available are the navigation course, the engineering course and the basic training course.

(a) Cadets of a mercantile marine university or a mercantile marine college must receive the practical training of either the navigation course or the engineering course.

The navigation course offers practical training of six months on board a motor or a turbine ship and another six months on a sailing ship.

(b) Students from the Marine Technical College must receive the practical training of either the navigation course or the engineering course necessary for officers or engineers of the foreign-or home-trade vessels.

Each course offers the practical training of nine months on board.

(c) Trainees from a Marine Technical School must receive the basic practical training relating to both the navigation and engineering course on board a motor ship.

The training period is three months for the Regular Course, nine months for the Special Course and six months for the Sea Training Course.

### 5.5.6 Marine Technical College

The Marine Technical College is the sole government-run institution to re-educate seamen who previously have served aboard vessels. Administered by the Ministry of Transport, the college is headquartered in Ashiya, the neighbouring town of the port city of Kobe, Hyogo Prefecture.

The courses consist of an Advanced Course, a Special Training Course, a short Training Course and a Correspondence Course. Admission requirements differ for each course. Accordingly, the number of students, period and subject of the courses and the qualifications after graduation vary with the aim of the respective courses.

- The advanced course is designed to give those who possess a license higher than the Third Grade M.O. (nav.) the necessary education for obtaining higher certificates of competency and deeper knowledge on the ship's operation.

- The special training course is designed to give the necessary education in accordance with the license qualification prescribed by the Law for Ship's Officers.

- The short training course is designed to conduct short-term education for seafarers on the ship's technical aspects, which is at times demanded by the administrative authorities.

- The correspondence course is designed to provide seamen with education by correspondence for the purpose of deepening their knowledge on the ship's operation and/or giving preparatory study for higher maritime officer's competency.

Some of the courses offer officers those types of the education which they have not previously received for the purpose of contributing to modernisation of the seafarers' system. The courses which train W/O a DPC include the W/O courses and DPC courses in the senior and junior classes of the short training section. The senior class furnishes holders of competency higher than Third Grade M.O (nav.) with education on navigation so that they may qualify for the Third Grade M.P. for watch, thereby fostering W/O (type 3, 4 and 5).

### 5.5.7 Sequence of Japanese MET

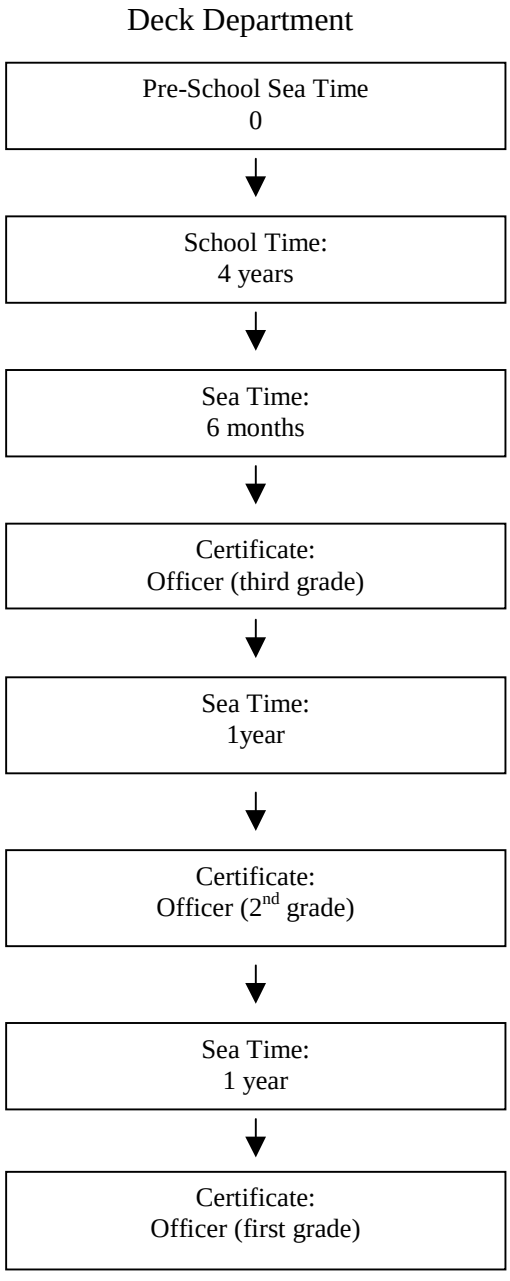


**Figure 5.5 Sequence of Japan MET**

# CHAPTER 6

## THE MAIN ADVANTAGES AND DISADVANTAGES OF CHINESE HIGHER MET

In the light of the introduction in Chapter 5 the author has made a table comparing some items based on 4-year course of undergraduate students who studied in the countries selected.

**Table 6.1 Comparison among Selected Countries**

| | Germany | Norway | Australia | Canada | Japan | China |
|---|---|---|---|---|---|---|
| Admission Requirements | yes | yes | yes | yes | yes | yes |
| a. General education | 12 years | 12 years | 12 years | 11 years | 12 years | 12 years |
| b. Sea time before | 6 months | optional | no | no | no | no |
| c. Entry examination | no | no | no | no | yes | yes |
| Duration | 4 years | 4 years | 4 years | 4 years | 4 years | 4 years |
| a. School time | 3.5 years | 30 months | 3 years | 3.5 years | 3.5 years | 3.5 years |
| b. On board training | 6 months | 16 months | 1 years | 6 months | 6 months | 6 months |
| Teaching hours | 2111 | 2217 | 780 | | 2160 | 2650 |
| -Simulation and workshop hours | 114 | 409 | 290 | | 225 | 152 |
| Monovalent | yes | yes | yes | yes | yes | yes |
| Dual purpose | yes | no | no | no | no | no |

From the above comparison, it can be seen that China's MET is more or less practicing the same system as the countries' mentioned. The only difference to Chinese higher MET is that the ratio between theoretical teaching hours and simulation hours should be properly adjusted. Increasing simulation hours should be a good way with a view to enhancing practical training.

China's higher MET has accumulated some good experiences, while some disadvantages are still there. Therefore, it does make sense to review Chinese higher MET from various angles.

## 6.1 Main Advantages

- China has had a long tradition of shipping and shipbuilding. Similarly, China has a long history of maritime education and training. "The MET system in China is well administered and has a clearly structured hierarchy." (Final Report of Study on the maritime education and training systems of China, funded by the European Commission, 1998) Therefore China is experienced in MET. Chinese MET has been playing a vital role in the Chinese shipping industry.

- The certification system and the related administration for unlimited certificates of competency is well defined and controlled.
- The content of curricula is in compliance with STCW95 and in certain areas the standards are higher than the minimum requirements of the Convention. The student can acquire sufficient theoretical knowledge after academic studies.
- Although in recent years the number of maritime students who comes from the city has slightly decreased, the resource of maritime students is still rich, because the resource of students from the countryside is adequate.

## 6.2 Main Disadvantages

- There is a shortage of capital which is used in the development of MET. Although the government, since 1978, has gradually increased investment in this field, it is not satisfactory in comparison with the requirements of the shipping industry at home and abroad.
- The old equipment used for training purposes requires replacement in the higher maritime institutions.
- There is a shortage of teachers who have more theoretical coverage of subjects together with shipboard experience.
- The inadequate knowledge of English among students is the biggest weakness.
- As a whole the teachers need to improve their English as well, in particular in the skills of listening and speaking.
- The pace of absorbing and digesting the new knowledge and technology should be speeded up.
- The use of modern tools in teaching and learning should be encouraged.

# CHAPTER 7

# CONCLUSIONS AND RECOMMENDATIONS

## 7.1 Conclusions

The world today is divided into three main economic trade blocs: Europe, North America and Asia. International shipping is controlled by Europe but Asia is dominant in the provision of manpower.

Inter-bloc trade and consequent shipping demands will increase significantly and will be serviced by very large capacity inter-bloc hub ports capable of handling very large capacity vessels. Ships plying between the blocs and feeding these hubs will carry significantly larger cargo loads, will be larger by dimension, faster and more manpower efficient and considerably more sophisticated in their operation. Leading edge communication technologies, automation and computerization will dominate ship operations.

The future operating environment for international shipping will be more complex, dynamic and knowledge-and information-dependent than it is today. The industry will increase globally in both size and quality. Shipping operations including manning will be controlled and effected by Asia, while Europe will continue to dominate the industry politically and shape its future direction, particularly in terms of technological innovation. The demographics of the seafarer of the future will see him originating from

Asia and requiring long term investment in his professional and personal development. This will be necessary in order to synchronize his thinking and abilities with the European drivers of shipping technology, particularly in the field of information management, where the seafarer of tomorrow will need to be all he is today, as well as an expert information processor.

Ocean shipping has made great contribution to the economy globalization in the world. With the further intensification of economy globalization, accordingly, ocean shipping must be further developed. To achieve this goal, the key is to cultivate qualified maritime personnel. The world has become a much smaller place and seafarers of every nationality are roaming globally across the seas. To be able to maintain safety at sea and protect the marine environment then seafarers, no matter what their nationality is, will have to be trained efficiently according to the requirements. For this reason MET is going towards globalization, the mark of which is international standards of personnel cultivating set by STCW.

Maritime institutions ashore will still be teaching principles and underpinning knowledge for seafaring careers. Colleges will still need dedicated professional teachers. First and foremost, these teachers will need to know their subjects. Secondly, they must be good teachers. For maritime institute members, there will be a self-study distance-learning diploma scheme, giving additional support and guidance. Teachers need time, space and financial support to master and to up-date their skills if they are to increase their productivity in the same way as seafarers have done in recent years.

In order to further understand the trend toward the development of the world MET in the near future, the author made a questionnaire, which includes 7 objectives. The questionnaire was sent to 25 MET experts in the world and 22 people among them have filled the questionnaire.

In order to fully and completely implement the STCW95 Convention, on what should the maritime education and training (MET) concentrate with special reference to the following aspects? Please rank in the blank square [from 1 (high)-7 (low)] the issues listed below according to your urgent need.

1. Modification of teaching programs and syllabuses
2. Improvement of teaching methodology
3. Purchasing teaching equipment, in particular necessary simulators
4. Improving the quality of teaching staff
5. Strengthening domestic cooperation in MET
6. Strengthening regional cooperation in MET
7. Strengthening international cooperation in MET

The author has made an analysis of the answers. It is assumed that if the question is ranked first out of the questions, it will get 7 marks and if the question is ranked seventh, it will get 1 mark. As a result, these calculations based on such assumption indicate the ranking importance of the questions (objectives) (see Figure 7.1)

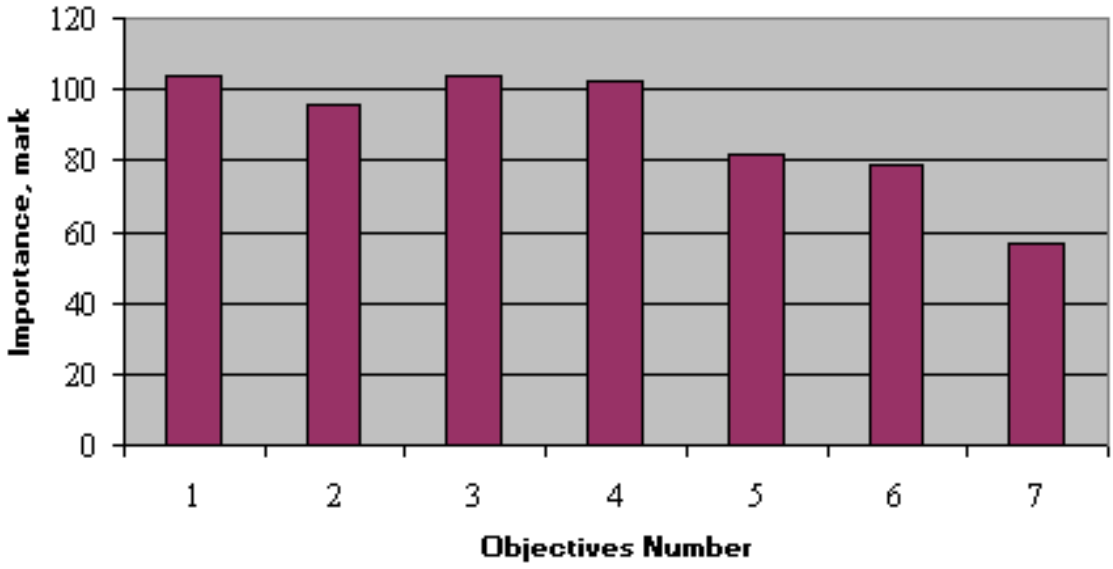


**Figure 7.1 Importance of MET Organizational Objectives**

Figure 7.1 shows that the experts agree that the 7 objectives are present MET organizational objectives to be achieved in terms of the requirements of STCW95 and question no.1 and no.3 are more important objectives in the scope of the MET world. The situation of Chinese MET is almost the same as this indication.

For the time being the world is changing very fast. Science and technology is developing at an incredible rate. How to accommodate the impact exerted by these developments in shipping industry is the challenge for MET. So the new curriculum must reflect this change. Cramming students' heads with facts is not good, but providing them with a framework of knowledge, plus the skills required accessing information quickly and efficiently. Given the likely range of mother tongues of recruits and the predominance of the English Language in shipping and information technology, a significant part of the teaching will be helping students to master communication skills in English. Speed and cost will be at the center of decision-making. Navigation specialists may regret the loss of hundreds of hours of teaching of navigation theory, but the essential skills in the future will be measured by performance in the workplace. Practical seamanship at the basic level and simulation of the more complex situations will help to bridge the gap between classroom and ship.

Therefore, China’s higher MET should adapt to the new change and at present its most important task is full implementation of the revised STCW Convention together with Chinese Program for Education Reform and Development. Chinese higher MET has its own advantages although several weaknesses still exist. However Chinese higher MET should be able to surmount the rough seas and navigate the ocean of the 21$^{st}$ century safely.

## 7.2 Recommendations

The recommendations are divided into three parts, namely for both the government and the higher maritime institution, for the government and for the higher maritime institution.

### 7.2.1 For both the Government and the Higher Maritime Institution

There are two main recommendations put forward in this part.

7.2.1.1 Changing Some Concepts about Development of Chinese MET

There are four critical concepts to be changed so as to further develop China's higher MET.

1. Positively Serving the Requirements of Chinese Ocean Shipping

When development was measured only in terms of economic growth a significant correlation was visible between the level of education of a country and its gross national product. To develop productivity, increase vocational efficiency and raise the earning capacity, the contribution made by education is two-fold: First, by equipping people with basic learning skills such as literacy, numeracy and capacity for rational thinking. These skills enable them to acquire advanced technology, methods and techniques. Second, education, itself, provides opportunities for skills development through formal and non-formal programs of study. Similarly, education promotes self-reliance and motivation for self-improvement (Unesco ROEAP, 1982). The growth of national revenue depends among others on two factors: increase in the number of productive workers, and increase in labor productivity. The increase in labor productivity in turn

depends on two factors. Improvement of technical equipment, and raising the educational and qualifications level of workers. Some people add to these a third factor: improving work organization. But this improvement finally depends on the educational and qualifications level of workers (particularly those who are specialized) (Unesco Press, 1975).

The world is currently witnessing a reaction against the notions that used to lie at the root of the theory of integrated economic and social development, and of the “human resources planning” practices associated with it. Two ideas underpinned these conceptions: education is a factor of economic development, and this depends on manpower skills, which are developed by the education system. Two consequences flowed from this: the need to argument the proportion of resources devoted to education (considered as an investment), and the need to determine-in the light of output targets-skilled manpower requirements in terms of the different degrees and types of training required, so as to integrate educational planning with economic planning. It is now therefore agreed that the goals of equity laid down by educational policy can only be made effective if they are an integral part of development policies pursuing this aim through a whole range of diverse and mutually coordinated measures. This has led to attempts to devise an integrated development policy, in which the aim of education would be to contribute to the achievement of the social and economic goals of development (Debeauvais, 1980).

A survey conducted by Tsinghua University, one of China's most prestigious institutions, has revealed a surprising fact: Many projects producing severe pollution in the Taihu Lake and Huaihe river valley areas were caused by officials with a higher educational background. This points out one of the problems plaguing higher education in China over a long period: The lack of a strong link between science and engineering with knowledge related to liberal arts, along with the limitations of current fields of

specialty. Thus, how to improve this situation by training students with initiative, broad knowledge, and social responsibility is a huge task.

For the time being everything is quickly changeable, following the development of IT. This problem affects all four corners of the world, and the shipping industry as a part of global economic development is no exception. So how does MET suit such changes? This is an urgent problem which must be punctually solved. In the past (even now) some people thought MET should emphasize its own development, such as the development of discipline, even setting up subjects due to lecturers. Nevertheless, the actual requirements of the shipping industry were overlooked; even some out-of-date knowledge has been taught in class. As a result, the employers often complain that the graduates are not competent for the designated job until they are taught on the job for a long period of time.

So, people, no matter who the manager or lecturer is, must establish a significant concept that Chinese higher MET must positively meet the needs of the shipping industry. Dramatically speaking before MET begins to dance with new partners, it needs to hear the many strains of music resounding through the marketplace. MET should be driven by the employment market.

2. Expanding Connotation of the Word "Speed"

There is a very popular market saying in the Hong Kong market, which is “things over their value”. This is a model of value which affects the company’s strategy for management. This idea has made the traditional concept about productivity (capital) changed and it is described in following formula:

$$\text{V (value)} = \frac{Q(quality) + F(flexibility)}{C(Capital)}$$

Here “speed” has become a vital factor with which the value of goods or services can be measured. As a matter of fact, it results from the development of IT.

As for Chinese higher MET, some economic concepts can not fully be used in education. But after all, education has a close relationship with the economy and the society, so some advanced ideas can be absorbed, such as the concept of speed. That means the speed of innovation of higher MET must follow the beat of the development of the shipping industry. Nevertheless, for the time being, Chinese MET can not entirely meet the needs without delay.

3. Changing Traditional Educational Mode to Quality-Orientated Education

China has a long history of traditional education. In the late sixth century, an imperial examination was invented by the central government to select new officials. To cater for this, a special education system was formed to prepare candidates for the examination.

For a long time, the operational system remained a mechanism to select government personnel, with rigid examination seen as the best method to select talent. The examination, to some extent, reflected a kind of equality for every participant. However, the system bred various malpractice and does not suit the requirements of social and economic development, which plagued efforts to improve Chinese education.

Most college teachers today would complain that newly enrolled students lack comprehensive knowledge and suffer from one-sided development. Some students arrived with very high entrance marks, but demonstrated poor ability in actual practice.

It is really a pity to see students so focused on science and engineering that they lack the wider knowledge of humanity and literature which comes from a wider study of the Chinese written language.

Educators promoting "quality-orientated" hold that it is a new education mode which aims to deal with the deficiencies of an exam-dominated approach. It will teach students to gain more ability for survival, to show concern for, and to cooperate and get along with others, to correctly settle various conflicts and disputes and distinguish right from wrong. It also makes it clear to students the historical tasks they should undertake with lofty ideals and firm convictions, as well as the deep historical and cultural background. "Quality education focuses on the entire young generation with comprehensive effects. It represents a profound transformation of traditional education that has existed for centuries," said Zhe Wen, vice-president of Beijing Academy of Education Science.

But most educators are optimistic about the prospects and have a clear mind toward the transition from traditional education to the new mode. They agree that quality-orientated education is not only a key task of education circles, but also a responsibility of the whole nation. The key to the transition is to set up a scientific and effective appraisal system to completely change the old-fashioned way of assessing students, schools and personal values, leading to profound changes in concepts on higher education, employment and social reward standards.

The reform in China is to seek the best way of development between tradition and modernization that suits the present condition. As to reform in education, "we should combine traditional Chinese education that focuses on foundation and tradition with Western education that stresses creativity," said Xunzhang Wang, president of Zhongshan University in Guangzhou.

In terms of the requirement of changing traditional higher educational mode, the goal of the modern higher maritime education should illustrate the optimized structure of quality, which is composed of quality of morality, culture, specialization and health. Among the structure of quality, the specialization is called technical quality, the rest of them are called non-technical quality. An investigation shows that Chinese MET should improve non-technical quality education as soon as possible. In other words, the student lacks the knowledge of non-technical quality right now. In a word, the quality-orientated education should be embedded in the educators' mind throughout the whole process of education.

4. Information “Ventilation”

It should be said that mankind has entered into information time. With the development of Internet, at present people can easily and quickly get some useful information through computers. Even some on-line cyber-universities have been run so the student can directly learn something from Internet. The tendency towards getting information through computers will spread out rapidly in all directions. This brings a big opportunity for Chinese MET. Those who work for Chinese MET can get the latest information, not only about MET itself, but also about the shipping industry in order to innovate the teaching content.

However, there is a problem, namely two-way information exchange. On the one hand, people are doing their best to get information through various channels, which, of course, is very important to improve Chinese MET. On the other hand, they hardly offer their own information to the external world for various reasons. In this case, the teaching content and methods can not be checked by other organizations in time. This does not benefit the further improvement of Chinese MET. In addition, although in recent years international communications in the fields of MET have been enhanced, in the long run

it is not enough, in particular in the field of introduction of foreign MET experts. So there are two pragmatic ways which can be taken to improve the situation. One is to continuously get advanced information through some effective ways such as Internet, introducing experts (including short-term and long-term) and sending the people concerned to take part in international activities. Another is to give some information about Chinese higher MET to the world by establishing Chinese MET internet station and offering some relevant materials in the international activities in order to make it possible for information to really flow between China and the rest of the world back-and-forth.

#### 7.2.1.2 Continuously Full Implementation of STCW95

The revised STCW Convention will significantly affect the world MET. As for Chinese MET, presently the stress of implementation is taking various steps, such as stimulating policies giving enrichment to maritime students, increasing investment, improving teaching content and methods (in particular enhancing English teaching and learning and sea training), strengthening liaison with the society and international exchange, to ensure the quality system running well with a view to further improving the quality of Chinese MET.

### 7.2.2 For the Government

#### 7.2.2.1 Focusing on "PIIEE"

PIIEE is an abbreviation of Policy, Investment, Information, Evaluation and Environment.

- Policy means to formulate a series of policies, such as enrollment, employment, investment, management and international exchange, making it possible to give priority

to developing Chinese higher MET.

- Investment means to provide proper investment to ensure a sustainable development.
- Information means to offer necessary information collected from all directions to higher maritime institutions in order to adjust the teaching content in time.
- Evaluation means to carry out due evaluation to supervise the teaching and learning quality.
- Environment means to create the better external environment to ensure Chinese higher MET to develop smoothly.

#### 7.2.2.2 Setting up a National Simulator-Training Center

STCW95 stimulated standards governing the use of simulators for mandatory simulator based training. Experience proved that simulator training is playing a more and more important role in MET. In the meanwhile for developing countries, it is a huge investment for any maritime college to purchase a series of simulators such as the bridge simulator and engine room simulator. So from an economic point of view, if every institution has to buy a set of simulators, it must be a complete waste of money. In other words, in that case the educational resources are not used in an optimal way. This is a very serious matter to be considered.

A better way is to establish a national simulator-training center, which is located in one of the coastal provinces. It is directly financed and controlled by the Ministry of Communications of the PRC. The location depends on the human resources at the maritime institution in the prospective province.

Its major function is to offer maritime simulator training to cadets and seafarers from all over the country. Meanwhile, there should be three other additional functions. One is to train maritime lecturers, who need to renew their maritime knowledge; two is to use the

simulator for research; and another is to offer integrated maritime English training to people who need it, in particular those who will be sent to crew foreign ships of various types.

Its aim is to offer first-class simulator training to those people who need it. For this purpose some maritime professors and captains, who can speak fluent English, will be invited to help work in the center.

Also, the center will keep in touch with relevant maritime organizations and institutions all over the world and offer information services to maritime institutions in China.

The proposed organizational chart is as follows:

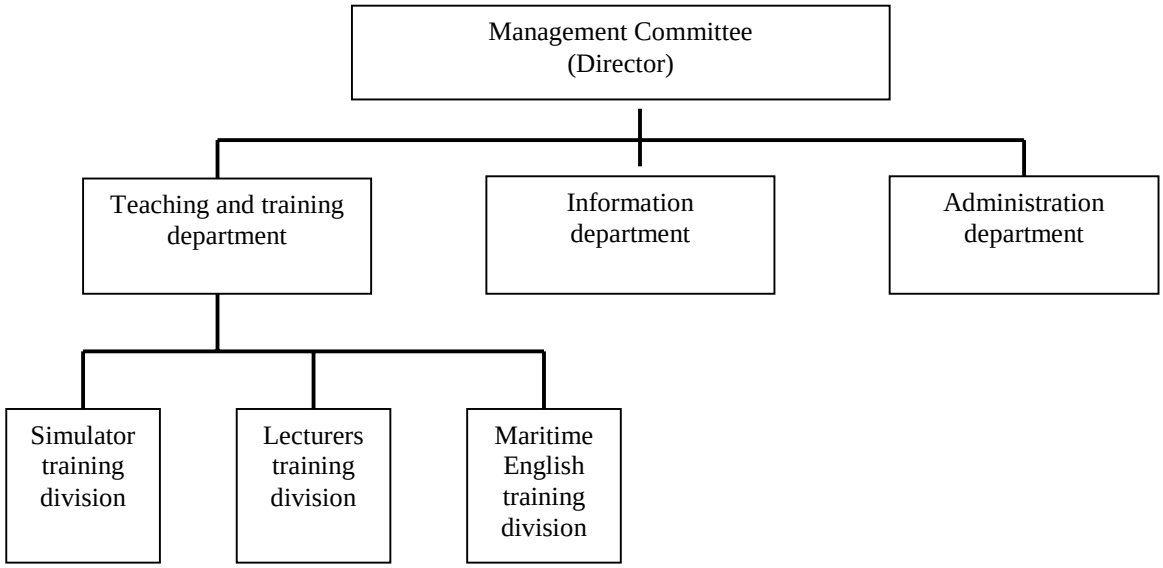


**Figure 7.2 Proposed Organizational Chart**

7.2.2.3 Expanding the Market of Sending to Crew Foreign Ships

In developed western countries, with the narrowing of the pay differential between seafarers and land-based workers, the shipping industry with hard working conditions has lost the once attraction to western seafarers. This has caused in developed countries, including Japan, Singapore, South Korea and some EU countries, a decline in recruits to maritime training institutions and a falling number of national seafarers.

For example, presently the EU seafarer is in danger of becoming extinct. A consequence of this negative trend is already visible in some EU countries where it has become more and more difficult to recruit national personnel with ship officer experience for positions in the maritime industry ashore in which such experience is considered necessary or at least desirable. The United Kingdom is a typical example (see Figure 7.3). A shortage of qualified maritime personnel already exists.

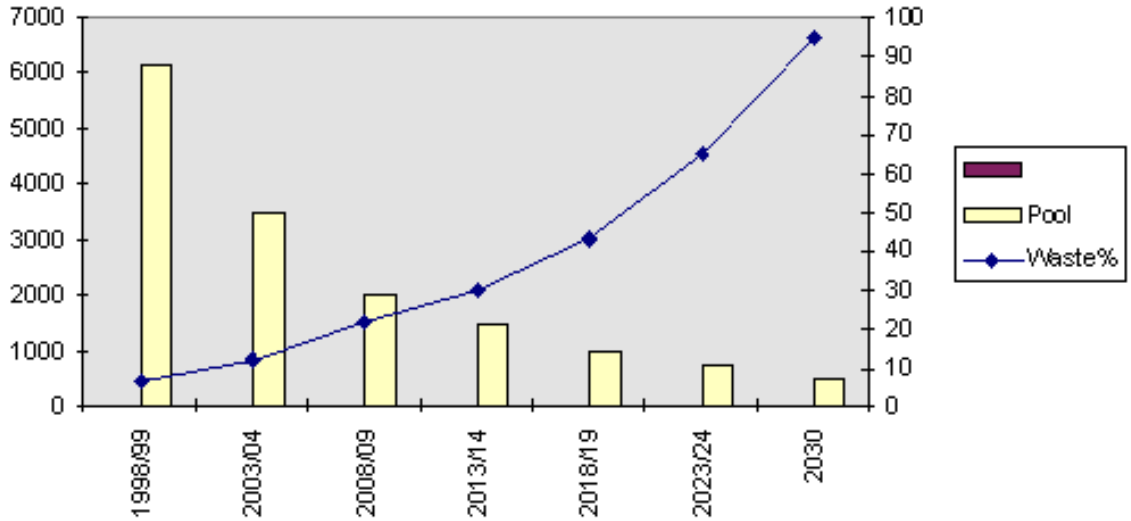


**Figure 7.3 Supply and Wastage Rate**

(Source: Southampton Institute)

Indeed, this situation provided a good opportunity to occupy the maritime employment market for developing counties, which are traditional maritime countries, in Asia-Pacific region. In other words, the international maritime employment market has been moving to Asia.

In order to seize this worldwide and historical opportunity, the Chinese government should pay more attention to strengthening the cooperation with western countries in the field of employment of seafarers, and cultivate sufficient and high-quality maritime personnel, meeting the needs of both national and international maritime employment markets.

### 7.2.3 For the Higher Maritime Institution

#### 7.2.3.1 Optimizing Educational Resources on Campus

Educational resources on campus are limited, so the following steps should be taken so as to optimize them.

- Restructuring the administration system and cutting unnecessary administrative departments.
- Creating new resources of funds, at the same time, reasonably controlling the spending.
- Setting up a fairly competitive machinery in an effort to improve the structure of working staff.
- Opening library, and computer rooms as well as some other educational facilities to teachers and students for as long time as possible.

#### 7.2.3.2 Improvement of Teaching Staff

"The industry needs capable people with an aptitude for the sea. It also needs good teachers who understand the sea" (O'Nill, 1997). This means the teachers play a role in the development of the shipping industry.

First of all, teachers, during the years of their working life, should frequently attend refresher courses in order to bring their knowledge up to date. Furthermore, the following 14 training fields of the common core classified under the five factors should be considered:

- Teacher
    1. Self-knowledge. (particularly knowledge of new technology and maritime English).
    2. Sea training.
    3. Quest for innovation and improvement in teaching methods.
- Student
    4. Knowledge of students.
    5. Psychology of motivation.
    6. Working methods.
- Human Relations
    7. Transmission of information, and communication.
- Teacher-Student Relations
    8. Planning of instruction.
    9. Content analysis.
    10. Preparation of teaching material.
    11. Teaching and learning methods.
    12. Use of modern teaching tools.

13. Monitoring of the learning process and evaluation of the results.

- Institutional Context

14. Knowledge of the relationship between the educational establishment and its environment.

Secondly, people who possess both theoretical knowledge and shipping skills should have more chances of being hired as teaching staff in maritime institutions.

#### 7.2.3.3 Modification of Teaching Programs

In terms of the real situation of Chinese higher MET and the requirements of STCW95, and in comparison with the practice of MET in other developed maritime countries, the Chinese seafarers should be trained in such a way to satisfy not only the demands of the domestic shipping market but also the requirements of the international employment market. In view of this, the national legislation, management system and operational mechanism should also be in line with international practice so as to increase the market share of the total exported seafaring labor force in the world.

The concept of quality education should be drawn into MET. Not only the knowledge but also the skills and attitude have been placed in an important position. The stress of modification should be laid on the following aspects:

- Strengthening practical training, in particular sea training, to enhance the students' abilities of quick response, ship operation and dealing with emergency.
- Improving the teaching of the English language with an emphasis on listening and speaking.
- Enhancing to cultivate the students' non-technical quality.

- Practising the training of dual-purpose seafarers in order to meet the needs of integrated manning on modern ships. After a certain number of years, the second stage is to establish a fully integrated training system. Graduates can obtain the certificate of competency both for deck and engine room.

#### 7.2.3.4 Improvement of Teaching Methods, Tools and Training Facilities

Subjects are important not only for their information but also as opportunities for learning how to think about and to understand events and how to find out more about them. Some teachers in China inculcate knowledge in students, who simply memorize procedures, facts, and generalizations within each area. They may never develop techniques of learning that are very useful in many fields. If teachers in each area challenge students with questions and allow them to make discoveries and solve important problems, the students will learn how to learn. In fact this is a developing trend in the field of higher education all over the world. So the situation of inculcating students with knowledge should be changed as fast as possible.

So far some teachers are getting used to chalking on the blackboard within the whole class. The teaching efficiency in the classroom is obviously low. In view of this, some modern teaching tools such as overhead projectors, video projectors, slide projectors, public address system and multi-media teaching tools should be introduced to the class.

At the same time, application of modern teaching facilities, including computer technology, communication technology and simulation technology, should be used in education and training so as to improve the teaching efficiency as much as possible.

#### 7.2.3.5 Improve the Quality of English Teaching

The Chinese higher maritime institutions should set up very ambitious plans to improve English for the students. The total English teaching hours not only should be increased, but also the teaching efficiency within each unit hour should be improved at the same time. Using English to teach some maritime subjects should be encouraged with a view to achieving the goal that graduates from the higher maritime institutions should have to communicate well in English.

#### 7.2.3.6 Strengthening International Exchange and Cooperation in the Field of MET

With the further intensification of economic globalization and the integration of the world transport system, there is an urgent requirement within the Chinese shipping company for understanding and mastering the up-to-date technology.

In order to meet the urgent need, the Chinese higher maritime institutions need to cooperate with the international MET society to train more professional personnel qualified for international shipping and modern port management.

Firstly, it is a good way to exchange visiting staff for both institutions, which have built close relationship. They can regularly conduct lectures at respective institutions.

Secondly, joint seminars should be held. Nowadays, changes of the international conventions, such as SOLAS, MARPOL, STCW conventions will affect everyone involved in the maritime industry. More and more regulations stimulated by the IMO are affecting not only seafarers, but also maritime institutions and shipping companies. They also keep abreast of changes in flag State, port State and local rules and regulations. So, seminars can also stress on technical cooperation programs and the practical implications of the STCW Convention, in particular in the fields of standards for maritime institutions, teaching programs, new course model, assessment, examination

systems, sea training practice, qualifications of instructors and examiners, development of simulators, and quality control system.

## BIBLIOGRAPHY


Angas, G. (1999, October). The effect of technology on maritime education. Seaways, 6-8.

Australian Maritime College 2000. Handbook 2000. AMC, Launceston, Tasmania, Australia.

Berking, B. (2000). ARPA Systems Development. Unpublished lecture handout, World Maritime University, Malmö: Sweden.

Berking, B. (1992). Changes of standards in navigation training: from mono-valent to bi-balent officers. International Conference on Maritime Education and Training (pp. 6.1-6.11). New York: International Maritime Lecturers Association.

Botterill, G. J. (1997). Training sea and shore staff to meet the requirements of the ISM Code. In Nautical Institute, Maritime Education and Training (pp. 286-291). London: Author.

Chandra, G. (2000, January). Enterprise systems: Challenges and opportunities for information systems education. Journal of Engineering Education, 25-29.

China. Ministry of Communications (1999). 50 years of communications education in China. Dalian, China: Dalian Maritime University Publishing House.

Chitty, C. (1990). Education and Training. In N. J. Entwistle, [Ed. Et al.]. Handbook of Educational Ideas and Practices (pp. 33-42). London: Routledge.

CIIPMET (1998). Study on the maritime education and training systems of China, India, Indonesia and the Philippines, World Maritime University, Malmö, Sweden.

Det Norske Veritas (1996). Rules for Classification of Maritime Academies. Hovik, Norway: Author.

Det Norske Veritas (1996). Rules for Classification of Maritime Simulator Centres. Hovik, Norway: Author.

Dirks, J. (1998). Improving employment opportunities for European seafarers-An investigation to identify training and education priorities. Retrieved July 10, 2000 from the World Wide Web:
http://www-user.uni-bremen.de/~jdirks/edu.htm

Gao, D. Y. (1995). An investigation of Chinese maritime eduation and training institutions: the introduction of new technology, methodologies and quality assurance programs. Unpublished mater's thesis, World Maritime University, Malmö, Sweden.

Gao, D. Y. (1998). Innovation and development of the Chinese maritime education and training. International Conference on Maritime Education and Training (pp. 38-45). Saint Malo, France: International Maritime Lecturers Association.

Giddings, I. C. (2000, March). On-board training. Seaways, 3-5. Gold, E. (1990). Canadian maritime training: Time to change course? Maritime Policy & Management, 17 (3), 177-188.

Hadley, M. (1999, April). Remote pilotage. Seaways, 8-10.

Hikima, T. (1999). Management of MET Systems & Institutions (Japan). Unpublished lecture handout, World Maritime University, Malmö, Sweden.

Holder, L. (1997). Challenges and opportunities for onboard training and assessment. International Conference on Maritime Education and Training (workshop presentation). Newfoundland, Canada: International Maritime Lecturers Association.

International Maritime Organization [IMO]. (1996). International Convention on Standards of Training, Certificate and Watchkeeping for Seafarers, 1978, as amended in 1995. London: Author.

IMO. (1997). MARPOL 73/78. London: Author.

IMO. (1997). International Safety Management Code. London: Author.

Laubstein, G. (1997). Keynote address: Globalisation of maritime education and training. International Conference on Maritime Education and Training. Newfoundland, Canada: International Maritime Lecturers Association.

Lawrence, S. (1996, August). Practical applications of the ISM Code. Seaways 5, 11.

Liu Z. J., Wang, Y. H. & Zhang, Y. J. (1997). Opportunities, directions, and challenges in China's MET in the 21st century. International Conference on Maritime Education and Training (section 5). Newfoundland, Canada: International Maritime Lecturers Association.

Lloyd's Register. (1999). World fleet statistics as at December 1998. London: Author.

McDonald, A. (1997). The development of a regional maritime education and training centre-political, technical and culture challenges. International Conference on Maritime Education and Training (section 5). Newfoundland, Canada: International Maritime Lecturers Association.

Memorial University, Newfoundland (2000). Marine Institute of Memorial University of Newfoundland [handbook]. (2000, April 03). Retrieved August 02, 2000 from the World Wide Web:
http://www.ifmt.nf.ca/aboutmi/message.htm

METHAR (1998). EC Waterborne Transport 4th Framework Programme 6.4.4 Task 43: Harmonisation of European MET Schemes, World Maritime University, Malmö, Sweden.

Muirhead, P. (1999). Effective Learning & Teaching Practice 1. Unpublished lecture handout, World Maritime University, Malmö, Sweden.

Muirhead, P. (1996). Implementation by maritime training institutes of the revised STCW: Meeting the challenge of change amid a world of evolving methodologies and new technology. International Conference on Maritime Education and Training (pp. 51-63). Kobe, Japan: International Maritime Lecturers Association.

Muhirhead, P. (1998). IT development in shipping-are MET institutions ready for the training challenge? International Conference on Maritime Education and Training (pp. 219-226). Saint Malo, France: International Maritime Lecturers Association.

Muirhead, P. (2000). Making STCW95 work-the need for global cooperation. In Baltic and International Maritime Council, BIMCO review 1999 (pp. 85-88). London: Author.

Muirhead, P. (1999). Management of MET Institutions. Unpublished lecture handout, World Maritime University, Malmö, Sweden.

Muirhead, P. (1999). Training. Unpublished lecture handout, World Maritime University, Malmö, Sweden.

Morris, G. (1990). Resource procurement and allocation. In N. J. Entwistle, [Ed. Et al.]. Handbook of Educational Ideas and Practices (pp. 401-408). London: Routledge.

Olofsson, M. (1993). World-wide developments in merchant fleet manning levels. Svensk Sjöfarts Tidning 40, 37-45.

Pardo, F. (1998). Environmental protection as syllabus subject in maritime education and training in EU member states. International Conference on Maritime Education and Training (pp. 93-108). Saint Malo, France: International Maritime Lecturers Association.

Robert, J. M. (1990). Watchstanding Guide for the Merchant Officer. Maryland: Cornell Maritime Press.

Rodger, D. (1999). Training successfully for the future. In Baltic and International Maritime Council, BIMCO review 1999 (pp. 76-78). London: Author.

Signorini, C. (2000, March). Continuing professional development. Seaways, 6-7.

STCW: A bigger headache than ISM? (1998, May). Marine Log, 31-32.

STCW Convention amended by the IMO. (1995, August). BIMCO Bulletin 90 (4), 4-5.

Stevenson, C. (1998, June). Who is tomorrow's seafarer? Seaways, 3-6.

Ten Ways to Change Undergraduate Education. (1998). Retrieved December 21, 1999 from the World Wide Web: http:/notes.cc.sunysb.edu/Pres/boyer.nsf/webform/tenways

Waters, D. & Muirhead, P. (1999). Development of STCW 1978 and background to the revision of the Convention (STCW95). Unpublished lecture handout, World Maritime University, Malmö, Sweden.

Williams, M. L. (1998, November). AIS transponders. Seaways, 9-10.

Wilson, J. B. (1997, September). Further education for master mariners. Seaways, 13-14.

Wright, J. R. (1995, August). The ISM Code-opportunity or burden? BIMCO Bulletin, 90 (4), 17-20.

Zade, G. & Horck, J. (1997). Seeking excellence through co-operation: the European commission's methar project and concerted action on MET. International Conference on Maritime Education and Training (section 5). Newfoundland, Canada: International Maritime Lecturers Association.

Zhang, R. P. (1998). A vision of Chinese MET in the 21st century-The impact of new technology on Chinese MET. Unpublished master's thesis, World Maritime University, Malmö, Sweden.

Zhao, M. H. (2000, February). Chinese seafarers at the end of the 20th century. Seaways, 7-10.

Zhou. N. Z. (Ed.). (1992). English readings in education. Beijing: Education and Science Press.