Organisation and management of a maritime training institution

George M. Pimentel

World Maritime University

Follow this and additional works at: https://commons.wmu.se/all_dissertations

Recommended Citation
https://commons.wmu.se/all_dissertations/1296

This Dissertation is brought to you courtesy of Maritime Commons. Open Access items may be downloaded for non-commercial, fair use academic purposes. No items may be hosted on another server or web site without express written permission from the World Maritime University. For more information, please contact library@wmu.se.
ORGANISATION AND MANAGEMENT OF A MARITIME TRAINING INSTITUTION

BY

GEORGE M. PIMENTEL
Philippines

A paper submitted to the Faculty of the WORLD MARITIME UNIVERSITY in partial satisfaction of the requirements of the MARITIME EDUCATION (NAUTICAL) COURSE.

The contents of this paper reflect my own personnel views and are not necessarily endorsed by the UNIVERSITY.

Signature: [Signature]
01 July 1985

Paper directed and assessed by
GUENTHER ZADE
Professor WORLD MARITIME UNIVERSITY

Paper co-assessed by:
D.M. WATERS
Principal
Australian Maritime College
Launceston, Tasmania
Visiting Professor WORLD MARITIME UNIVERSITY
Maritime Education and Training is an essential component in any maritime activity. The development of human resources needed by the maritime industry has to conform with the development of maritime transportation and related activities.

The number, tonnage and variety of ships have increased considerably during the last decades. Many countries have established and expanded their merchant marine. Moreover, technological changes, safety and environmental requirements have been initiated and adopted. The whole process requires an establishment of a good education and training system.

A productive, competitive and strong merchant fleet and industry requires well-educated, well-trained and competent marine personnel. The purpose of Maritime Education and Training Institution is to ensure that such personnel are available to meet the demands of the maritime industry.
I wish to express my appreciation to the several Maritime Education and Training Institutions and individuals who have supplied me with valuable research materials, without which this paper would not have been possible.

In particular, I am specially grateful to
- Capt. William T. McMullen, USMS
  United States Merchant Marine Academy, Kings Point
- Prof. Joseph H. Mulders
  Maritime Teachers' Training College
  Amsterdam, The Netherlands
- Mr. Niels Overmark
  Navigation School
  Copenhagen, Denmark
- Prof. Capt. Christof Marcus
  Nautical Academy
  Bremen, West Germany
- Capt. Dr. Mirosław J. Jurdzinski
  Institute of Navigation
  Gdynia, Poland
- Dr. Andrew A. Yalushenkov
  Central Research Institute
  Leningrad, U.S.S.R.

for providing me with significant informations and whom I had the opportunity to interview.

I am deeply indebted to Prof. Günther Zade, Vice Rector, World Maritime University for his indispensable guidance, comments, and helpful suggestions in the preparation and development of this task.

Likewise, I am entirely responsible for any incorrect interpretations and understanding of any facts derived from all relevant informations and references.

Finally, I thank my family for their unfailing support and encouragements in my endeavor.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREFACE</td>
<td>ii</td>
</tr>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF ILLUSTRATIONS</td>
<td>vii</td>
</tr>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Purpose and Task</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Scope and Limitations of Research</td>
<td>1</td>
</tr>
<tr>
<td>1.3 Research Methods and Problems</td>
<td>2</td>
</tr>
<tr>
<td>2. INFLUENCING FACTORS</td>
<td>3</td>
</tr>
<tr>
<td>2.1 Economic Considerations</td>
<td>3</td>
</tr>
<tr>
<td>2.2 National Regulatory Requirements</td>
<td>4</td>
</tr>
<tr>
<td>2.3 International Convention on &quot;STCW 78&quot;</td>
<td>5</td>
</tr>
<tr>
<td>2.4 Manpower and Employment</td>
<td>6</td>
</tr>
<tr>
<td>2.5 Technology</td>
<td>7</td>
</tr>
<tr>
<td>2.6 Shipping Industry</td>
<td>8</td>
</tr>
<tr>
<td>3. INTERNAL FRAMEWORK OF MARITIME INSTITUTION</td>
<td>10</td>
</tr>
<tr>
<td>3.1 Function of Institute</td>
<td>10</td>
</tr>
<tr>
<td>3.2 Organisation and Administration</td>
<td>11</td>
</tr>
<tr>
<td>3.3 Education and Training Objectives</td>
<td>15</td>
</tr>
<tr>
<td>3.4 Financial Resources</td>
<td>17</td>
</tr>
<tr>
<td>4. FACILITY REQUIREMENTS</td>
<td>19</td>
</tr>
<tr>
<td>4.1 Buildings and Site</td>
<td>19</td>
</tr>
<tr>
<td>4.2 Equipments and Training Aids</td>
<td>20</td>
</tr>
<tr>
<td>4.3 Library Facilities</td>
<td>22</td>
</tr>
<tr>
<td>5. STAFF REQUIREMENTS</td>
<td>25</td>
</tr>
<tr>
<td>5.1 Teaching Staff</td>
<td>25</td>
</tr>
<tr>
<td>5.1.1 Minimum Qualification</td>
<td>25</td>
</tr>
<tr>
<td>5.1.2 Initial Training</td>
<td>28</td>
</tr>
<tr>
<td>5.1.3 In-service and Further Training</td>
<td>31</td>
</tr>
<tr>
<td>5.2 Motivations and Incentives</td>
<td>32</td>
</tr>
<tr>
<td>5.3 Administrative and Support Staff</td>
<td>34</td>
</tr>
</tbody>
</table>
TABLE OF CONTENTS

6. EDUCATION AND TRAINING PROGRAMMES ........................................... 36
   6.1 General Entrance Requirements ................................................ 36
      6.1.1 Direct Entrance ..................................................... 38
      6.1.2 Sea Training Prior to Studies ...................................... 39
   6.2 Curriculum and Syllabus .......................................................... 42
      6.2.1 Content and Depth ....................................................... 42
      6.2.2 Sequence ................................................................. 45
   6.3 Model Courses ............................................................................. 47
      6.3.1 Refreshing and Updating Courses ....................................... 48
      6.3.2 Upgrading Courses .......................................................... 52
   6.4 Examinations ............................................................................... 53
      6.4.1 Certificate of Competency ............................................... 53
      6.4.2 Academic Degree ............................................................. 55

7. FLEXIBILITY OF INSTITUTION TO CHANGES ........................................ 58
   7.1 Technology Changes ...................................................................... 58
      7.1.1 Ship Types ................................................................. 58
      7.1.2 Ship's Equipments ......................................................... 60

8. FUTURE ASPECT .................................................................................. 63
   8.1 Education and Training ............................................................... 63
   8.2 Cooperation Between Maritime Administration, Training Institution and Shipping Industry ......................................................... 64

9. CONCLUSIONS AND RECOMMENDATIONS .......................................... 67

APPENDIX ............................................................................................... 71

   International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978:
   Regulations II/2; II/3; II/4; III/2; III/3; and III/4 ........................................ 71

BIBLIOGRAPHY ...................................................................................... 89
# LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. United States Merchant Marine Academy Faculty Qualification Standards</td>
<td>27</td>
</tr>
<tr>
<td>2. Comparative Contents of Studies</td>
<td>44</td>
</tr>
<tr>
<td>3. List of Model Specialised Courses for Selective Offering</td>
<td>51</td>
</tr>
<tr>
<td>4. List of Certificates and Qualifications</td>
<td>54</td>
</tr>
</tbody>
</table>
# LIST OF ILLUSTRATIONS

<table>
<thead>
<tr>
<th>FIGURES</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. United States Merchant Marine Academy Organisational Chart</td>
<td>12</td>
</tr>
<tr>
<td>2. Amsterdam Higher Nautical Organisational Chart</td>
<td>14</td>
</tr>
<tr>
<td>3. Maritime Education Organisation in Denmark</td>
<td>16</td>
</tr>
<tr>
<td>4. Training Diagram in The Netherlands</td>
<td>40</td>
</tr>
<tr>
<td>5. Training Diagram in West Germany</td>
<td>41</td>
</tr>
<tr>
<td>6. Sequence of Training in West Germany</td>
<td>46</td>
</tr>
<tr>
<td>7. Sequence of Training in Denmark</td>
<td>46</td>
</tr>
<tr>
<td>8. Sequence of Training in the United States</td>
<td>47</td>
</tr>
</tbody>
</table>
1. INTRODUCTION

1.1 PURPOSE AND TASK

This paper deals with the general structures and fundamental operations of maritime education and training institutions. Maritime education and training system covers a wide spectrum of activities considering the different levels and scopes provided by training institutions in different countries. However, the functions and objectives of maritime establishments are similar in many aspects. It is in this concept, that some established maritime training institutions in developed countries are mentioned to illustrate this task.

Many maritime institutions have been operating efficiently for many years and have adopted their system to present practises. It is not within the aim and purpose of this thesis to present a better concept on the system of education and training. This study was undertaken to at least show the various means and ways an institution may operate and the elements that may affect such education and training. It is hoped, however, that this paper will contribute some relevant informations and ideas not only to developing institutions but to developed ones as well.

This research is consistent with a strong commitment in the future development of maritime training institutions.

1.2 SCOPE AND LIMITATIONS OF RESEARCH

The scope of the research focussed generally to the education and training structure for merchant marine officers. Many of the informations and materials in the text contain examples based on nautical education and training but the fundamental principles are applicable to the other related disciplines and their programmes of education and training. It is also not within the scope of this thesis to illustrate all the indepth details that an institution may be involved or faced with.

Due to the complexity of the structures and dynamics of a maritime institution, this paper will cover a define area but will incorporate the important elements present in an institution.
Chapter 2 incorporates the factors that influence the maritime institution. The internal framework within which the maritime education is provided is contained in Chapter 3. Two chapters on facility and staff requirements are also discussed in Chapters 4 and 5. Chapter 6, on the training programmes, includes the entry requirements and the course curriculum and syllabus structure. Flexibility of institution to changes and its future aspects are discussed in the two succeeding chapters.

The conclusions added are drawn based on the contents of the text. This paper also embodies a series of recommendations which may be of importance for future improvements of maritime education and training.

1.3 RESEARCH METHODS AND PROBLEMS

The methods used in the research includes library research, personal interviews and relevant materials received from lecturers involved in the maritime activity.

Library research was undertaken only at the World Maritime University. This has pone some restrictions in gathering a more extensive literature pertaining to the subject matter. Personal interview was attained with some of the visiting professors to the University. Likewise, the opportunity to interview a number of executives of different training institutions was achieved during field trips. This has provided a clearer understanding of the operations and management of training institutions in the developed countries visited.

A substantial amount of research materials and informations required in the study was also received from other visiting lecturers who are actively participating in maritime education and training. Due to some time and financial constraints, it was not possible to conduct a much broader and deeper procedure in research as originally planned.
2. INFLUENCING FACTORS

2.1. ECONOMIC CONSIDERATIONS

Trade, Industry and Commerce has a tremendous impact on a country's economic development. In the movement of commodities from one country to another, sea linkages is of vital significance. Sea transport will continue to be a prime vehicle of world commerce since it has the lowest cost per ton-mile and can move a great quantity of goods over long distances.

Ocean transport is an important industry in a nation's economic policy. The strong need for a merchant fleet as a powerful economic tool has been manifested in the history of many developed countries. Shipping industry is an extremely complex industry. It involves not only the different types, design and employment of ships but also the cargoes and passengers they carry from one port to another, the shipboard personnel who operate them afloat, those who manage them shore and the laws and regulations relating to the ship and the shipping companies. The need for an efficient and reliable maritime transport system is obviously essential.

Simultaneous to the need of ships as a vehicle for sea transport, is a need for a developed maritime training establishment. Ships, like any other type of transport, needs well trained and educated personnel to manage and operate them. The need for trained crew can thus be fulfilled by a well established training institution.

The system of maritime education and training adopted by a country depends to a great extent the economic course of such country. Though each country has their own problem and developmental economic growth, the economic scene is world wide in nature.

Education and training are inevitably an integral part in a country's economic status. Manpower requirements, at the same time, are playing an important place in the national goals for education system. The government aim for economic growth can be demonstrated by its concern for manpower development within the maritime activities. The coherence of economic development and advance level of education and training is very significant.
2.2 NATIONAL REGULATORY REQUIREMENTS

The maritime objective of national government is to provide legislative and regulatory environment that will promote safety at all levels and enhance and protect economic, social and political interest of the country. In terms of safety of life and property at sea, the programme of the government is to set regulatory requirements as to the proper education and training of seafarers that not only for those who will serve onboard the ship but also to those who will be serving in any maritime activity.

Regulatory requirements adopted by governments depends upon the extent to which maritime activity is involved. The degree of regulations varies from country to country. However, the main consideration for public regulations on training and education is the safeguard of public interest.

Maritime legislations are influenced by the following elements:

1. technical requirements of the country;
2. political requirements;
3. legal considerations.

Technical progress calls for better qualified personnel in any capacity. In order to adopt to technical advancements in the maritime industry, updating of regulations to reflect such advancements and the enforcement of such regulations to a great extent is desirable.

The time required for developing a competitive industry covers a long period of time and experience. History and experience have influenced national maritime legislations and regulations notably in developed countries. With stable economic policies, the possibility of maritime industry to function successfully and execute desired innovations can be achieved without much difficulty. The same holds true for training and the development of the human resources within the industry.

Within the country, public interest often times change to a certain degree. As a consequence, regulations arising from any change must also be change in order for such regulations to be more effective. The government's responsibility and interest in the operations of their merchant fleets goes well beyond the considerations of safety
and protection of the environment.

Maritime policies adopted by governments has to suit not only national requirements but as well as international standards. In addition to education and training of seafarers, maritime policies covers the areas of:

1. Crew Operation and Manning;
2. Examination and Certification of Seafarers; and
3. Working and Living conditions.

Ships and its equipments are subject to international sets of standard. It is in this aspect that national maritime regulations and the system of education and training are significantly affected.

2.3 INTERNATIONAL CONVENTION ON "STCW, 1978"

The "STCW, 1978" convention entered into force in April 28, 1984. The convention has influenced the professional standards of sea-going personnel. It is the first attempt to establish minimum international standards on training, certification and watchkeeping for both officers and ratings which was previously set by individual governments.

Contracting parties to the convention are mandated to meet the prescribe regulations set forth by the convention. For many developing countries, particularly those with little maritime structures, the convention appeared to present some problems. In many countries, however, the standards are often higher than those required by the convention.

Technical provisions of the convention are contained in six chapters covering the requirements for:

2. Deck Department
3. Engine Department
4. Radio Department
5. Special Requirements for Tankers
6. Proficiency in Survival Craft
The regulations provided in the convention are mandatory. Regulations II/2, II/3 and II/4 establishes the mandatory minimum requirements for certification in the various levels of competency in the Deck Department. While Regulations III/2, III/3 and III/4 provides the mandatory minimum requirements for certification in the Engine Department. These Regulations are shown in the Appendix. In addition to these regulations, the STCW '78 Convention also adopted 23 Resolutions which are recommendatory in nature.

The regulations set out in the convention has enhanced the standards worldwide and have influenced the system of maritime education and training to a considerable extent especially to those countries whose standards have to be raised.

Consequently, governments has to carry out a more effective national legislations parallel to the international requirements not only to the levels of education and training but as well as in the areas of maritime safety and the system of examinations and certification.

2.4 MANPOWER AND EMPLOYMENT

One of the problem in the operation of ships is labour cost. In an effort to reduce such cost, shipping companies has considered reduced manning within the context of national regulations. Reduced manning, however, has increased the duties and responsibilities of the crew that are left onboard.

Consideration on reduced manning has to take into account the wide range of practises and procedures involved such as:

1. the difference in size, design and sophistication of ships in various trade routes and areas of operations;

2. the differences in political and social attitudes with respect to "Manning Cost";

3. the extent to which maritime industry is regulated;

and

4. the differences in training philosophies, whether training is directed primarily to safety requirements and whether it caters for onshore positions as well as afloat.
The decline in the number of shipboard positions creates not only problem to the training institutes but as well as the problems of employment of prospective seafarers. In countries where labour cost is low and lack of advance technology, the operation of conventionally manned ships still arise. This factor is all important since it involves the employment of nationals and at the same time maintain an area of safe and efficient operation of their shipping fleets. In many developed countries, however, the reduced number of entrants have caused a certain decrease in the number of training institutions.

Reducing the number of entrants, with a percentage of leverage, to match the requirements of the shipping industry is desirable so as not to create problems of unemployment. Training more people beyond the requirements of the industry will result in an over supply of ship personnel and may cause wastage of money and effort.

The competitive factor in view of reduced manning has forced training institutions to upgrade their training standards. The successful operation of ships economically and safely requires not only less manning cost but as well as trained crew. The size and effectiveness of the ship complement is determined by the way in which workload is divided between available manpower and the method of carrying out actual task involved. Ship's teamwork has to be enhanced.

Although reduced manning is a means of reducing operational cost, the problem that may arise is whether it will have an effect on the safety aspect of ships' operations and the protection of the marine environment.

2.5 TECHNOLOGY

During the past decades, there has been a tremendous advances in the field of ship's technology and marine equipments. This advances has greatly influenced the ability of sea-going personnel who are tasked to operate modern types of ships and its equipments.

World trade is changing continously in composition, type and physical form of cargoes, trades and distances of trading ports. These changes has brought about the following:

1 improved design and materials of ship types and sizes;
2 handling and stowage of cargoes;
3 new methods of ship control and equipments;
4 improved shipboard operations and management; and
5 other shipping technology such as communications.

Specialised ships have been designed owing to the nature of the cargoes and its trade. The increased of ship's speed have lessen the time coverage between trading ports at the same time reducing operational cost in terms of energy savings. Shipowners today are placing more and more attention on automation with centralised control; integrated navigational systems; modern communications and the use of shipboard computers.

With the realisation of new techniques and shipboard operations, safety standards are likewise enhanced. Designed of ships and its modern equipments are not purely for economic reasons but as well as to meet national and international requirements on safety.

The transportation of hazardous and dangerous cargoes and other substances has also increased over the years. Again, this factor has increased the requirement of new technology in order to reduce pollution to the marine environment and damage to marine life.

All these scientific and technical developments has given rise to the complexity of ship operations. Consequently, the need for improved educational qualities and professional skills of shipboard personnel is very essential.

2.6 SHIPPING INDUSTRY

The degree of requirements and levels of needs of the industry can be identified principally on two contributing factors. These are:

1 the element of operating a commercial and profitable shipping fleet and
2 the element of operating a ship that is geared to safety and the protection of the marine environment.

The first element involves the need for marine personnel who are not only technically oriented but who are also professionally trained in the aspect of ship management. Ships today are expensive and requires
a large amount of money to maintain and operate. Shipping business being complex needs to be operated in a cost effective manner.

The second element involves the need for shipboard crew who have the required competency. This element requires the employment of properly qualified and trained crew. Equally important is the need to maintain a good reserve of qualified personnel. This involves professional commitment by the sea-going personnel and the commitment of the shipping company to open a wider scope of career pattern for these personnel.

In the era of increasing technology and competitive structure of the shipping industry, shipowners requires efficient and competent crew.
3. INTERNAL FRAMEWORK OF MARITIME INSTITUTION

3.1 FUNCTION OF INSTITUTE

A maritime institution plays a vital role in executing national policy as regards education and training of merchant marine personnel. The mobility of maritime education and training is determined by the mode or arrangement in which it is establish. Most maritime schools, if not all, are either national or state government institutions and thus funded by the government.

The functions of maritime schools varies in accordance to the particular purpose it was developed. Maritime institutions ofentimes has dual role. While providing facility for training individuals for future shipboard employment with professional skills and knowledge, it also offers educational background and academic credentials. Factors in traditions, social and economic considerations are elements that may tend to determine the character of the institution.

The role of maritime institutions may cover many aspect in maritime activity, however, some of its basic functions can be mentioned as follows:

1. to provide training courses and instructional facilities;
2. to ensure that standards of ship personnel produced meets the demands of the maritime industry and safety requirements;
3. to ensure that appropriate training facilities and programmes are provided;
4. to ensure that such facilities are operated efficiently and effectively;
5. to award degrees, diplomas and certificates provided all academic and training requirements are complied;
6. to perform other functions inherent to the efficient performance of the institution.

In carrying out effectively its functions, there is a need for a good organisational structure. The process of organisation has to include
the formulation of an education and training policy taking into consideration both regulatory and training needs of the students.

3.2 ORGANISATION AND ADMINISTRATION

Maritime institutions operate under different charter and sponsorships. Merchant marine schools are either within a state system of higher education, components of the Ministry of Transport, Ministry of Commerce, Local (Municipal) education authorities or joint sponsorships. In some cases, a form of sponsorship also comes from the Shipping Industry. These involved parties to maritime education define how each institution is organised and operate.

The United States Merchant Marine Academy, a component of the Maritime Administration, is organised and administered in accordance with federal status and policies and regulations promulgated by the Maritime Administration of the Department of Transportation.

The Administrator of the Maritime Administration, who heads the agency, determines broad policy for the Academy, and details and implementing procedures are developed by various offices within the headquarters organisation having cognizance over the subject matter such as budget, personnel, administration.

The Academy is under the immediate supervision and direction of the Superintendent, who reports directly to the Administrator or the Maritime Administration. Within the framework provided by the latter’s policies, the Superintendent is vested with all necessary authority to carry out the mission of the Academy. The Deputy Superintendent is the second highest ranking official of the Academy’s administration. He is the Superintendent’s principal staff assistant and serves as Acting Superintendent in the latter’s absence.

There are three principal organisational subdivisions of the Academy each headed by Assistant Superintendents. The subdivisions include Administration, Academic and Regimental Affairs. The responsibility of developing, recommending, administering and directing the academic programmes of the academy is under the Academic Dean. There are also several boards and standing committees which advise responsible officials on matters pertaining to specialised nature. Figure 1 shows the organisational structure of the academy.
FIGURE 1: UNITED STATES MERCHANT MARINE ACADEMY ORGANIZATIONAL CHART

EXTERNAL ACTIVITIES OFFICE

SUPERINTENDENT

DEPUTY SUPERINTENDENT

CHAPLAINS OFFICE

ASSISTANT SUPERINTENDENT FOR ADMINISTRATION

DEPARTMENT OF ADMINISTRATIVE SERVICES

DEPARTMENT OF BUDGET & ACCOUNTS

DEPARTMENT OF PUBLIC WORKS

DEPARTMENT OF WATERFRONT ACTIVITIES

INFIRMARY

ASSISTANT SUPERINTENDENT FOR ACADEMIC AFFAIRS (DEAN)

REGISTRAR

LIBRARY

SHIPBOARD TRAINING

ACADEMIC DEPARTMENTS

ENGINEERING

NAUTICAL SCIENCE

MATH & SCIENCE

MARITIME LAW & ECONOMICS

HUMANITIES

NAVAL SCIENCE

PHYSICAL EDUCATION & ATHLETICS

ASSISTANT SUPERINTENDENT FOR REGIMENTAL AFFAIRS (COMMANDANT OF MIDSHIPMEN)

ASSISTANT COMMANDANT

SIX COMPANY OFFICERS

MIDSHIPMEN PERSONNEL

MIDSHIPMEN HOSTESS

DIRECTOR OF MUSIC

MIDSHIPMAN ACTIVITIES COORDINATOR

FEMALE PROGRAM ADVISOR

OPERATIONS OFFICER

DIRECTOR OF PHYSICAL FITNESS AND INTRAMURALS

FIRE AND SECURITY FORCE
In the Netherlands, the Ministry of Transport and the Ministry of Education are closely involved in the concept of maritime education and training. Certificates of competency are issued by the Ministry of Transport while academic diplomas are issued by the Ministry of Education. The Higher Nautical School in Amsterdam is under the management of a School Board composed of persons from the National Government and the Municipal sector. They are responsible for outlining school policies, appointing and terminating tenure of personnel. The head of the school is the Director, who is responsible to the School Board in carrying out the general policy of the school, matters pertaining to finance and represents the school in other related functions. The Director is assisted by two Deputies.

The first Deputy Director is responsible for the organisation in the school such as timetable, examination, serves as the chief purchaser, and as a liaison with the Ministry of Education. He acts as the Director in case of the Director’s absence. The second Deputy Director is the Dean of Students. He keeps contact with the shipping companies during the vocational training of the students and responsible for other special student’s activities.

There are four faculties in the organisation (see Figure 2). These are Deck Officer for Deep Sea Trade, Hydrographic Survey, Radio and Deck Officer for Coastal Trade. Each faculty is headed by Department Heads. The Department Heads discuss all educational matters with the School Board. Within the organisation, there are council groups that are advisory in character.

The organisation of maritime training, including study for nautical examinations, in Denmark is under the management and control of the Directorate of Maritime Training which is an institution under the Ministry of Commerce. The Directorate is responsible for the operation of all nautical schools and training ships. The Directorate appoints teachers; allot economic resources to the different schools; issues standard timetables for school teaching; prescribes the syllabus for individual subjects; issues textbooks; prepares examination papers; and conduct examinations at all schools.

Teaching in Denmark is centrally controlled but teachers and students are consulted when decisions are to be made. Teachers meet once a year
Figure 2: Amsterdam, Netherlands Organisational Chart
to discuss the contents and arrangement of the course of study; the importance of individual subjects as compared with other subjects; and other academic matters. The instructions and decisions of the Directorate are prepared in the light of such discussions. Figure 3 illustrate the Maritime Education Organisation in Denmark.

The comparison of the organisational structure of the three maritime schools in the three countries shows that there exist a considerable degree of relationship between the internal organisation independence and the system of sponsorship. The organisational concept on which the three institutions are manage reflect the variability of their decision making. There seem to be more flexibility and autonomy in one school compared to the other.

3.3 EDUCATION AND TRAINING OBJECTIVES

In developing a system of maritime education and training, identifying the objectives, immediate or future, is one of the initial step to consider. The initial objective may cover a limited area of providing programmes of training personnel for the manpower needs of the shipping industry. Depending on the resources of the institution, the objectives may be expanded to cover other areas in the maritime industry such as off-shore, fishing and other related-maritime activities.

Training of personnel for qualification as ship officers has to conform with national and international regulations in force. At the same time, provisions for certificate of competency has to conform with safety requirements. In some cases, the objective of achieving the level required to comply with international standards requires sufficient training equipment, instructional facilities and expert staff.

In addition to the provision of improving professional competence in dealing with shipboard duties, the objective of incorporating maritime education with the general education system of the country is desirable. This would enhance the flexibility of sea-going personnel for shore qualification. In some countries, training of merchant personnel is combined with the training for career in the naval service. Situations, however, vary in different countries.

In determining the objectives of the institution, particular attention
Figure 3: Denmark Maritime Education Organisation
is given to the extent, character and level of education and training. Future developments of the maritime industry has to be considered. The extent of future objective may not only cover the safety aspect of training but as well as maritime related commerce, engineering, research, economic and management endeavors. Again, the prevailing conditions of the country is an important determinant in identifying objectives. All these process requires a good understanding on how the system fits in the national system and the provision of required facilities to carry out institutions' goals.

3.4 FINANCIAL RESOURCES

Funding is a major element in the management and operations of a maritime school. The availability of adequate funds to meet expenditures is likely to be a major factor in influencing decisions in the establishment of a maritime institution.

Capital expenditures involve many areas such as building structures, training equipments, laboratories, library facilities, accommodations, office equipments and other supplies. Coupled with these are salaries of staff and other administrative cost. Effective operation of the institute requires funds and efforts has to be made to acquire needed funds.

Another area which involves high cost is training. In many cases, the cost of training onboard ship are borne by the shipowners. In countries like Poland, Taiwan, United States and others, they have training vessels. These vessels are used by their students for practical shipboard training. Where training vessels are not available, maritime institutions rely on the cooperation of the shipowners.

In institutions where funds are not readily available, assistance from international organisations and donor countries are good alternative. A good example in this scenario is the Philippine Merchant Marine Academy. To upgrade its education and training standards, the academy has recently received funding assistance from the United Nations Development Programme through the International Maritime Organisation. The technical assistance programmes provided were in the areas of:

1. updating of curricula and course contents within international standards;
.2 development of faculty programmes by granting of fellowships/scholarships to faculty members; and
.3 selection, procurement and installation of equipment and related training aids.

This assistance received by the Merchant Marine Academy of the Philippines has significantly enhanced the system of maritime education and training in the country. Several maritime academies in Africa, the Arab States, Asia and the Pacific have also received technical assistance in the field of maritime training from the International Maritime Organisation and from donor countries. Other sources of funds may come from foundations, alumni and other sector of the community.
4. FACILITY REQUIREMENTS

4.1 BUILDINGS AND SITE

Buildings and land site are elements that involve capital expenditures in the establishment of maritime training institution. Buildings are essential to house training facilities and equipments. Construction of suitable purpose built structures should accommodate various facilities such as:

1. classrooms
2. nautical, engineering and science laboratories
3. library and research materials
4. lecture theatres
5. offices for teaching, administrative and office staff
6. recreational, athletic, health and physical facilities
7. teaching equipments and aids
8. dormitories and dinning room for students if the institution is residential
9. other in-house equipments and facilities.

Location of the institute should provide an optimum training area. Access to suitable waterfront area for adequate training in the use of survival craft, emergency drills, fire fighting and other shipboard evolution is necessary. Adequate water area can provide the facilities for training ships and boats for other hands-on training activities and programmes.

Many maritime institutions are located in very suitable areas where hands-on training are optimised. A good example is the United States Merchant Marine Academy. The Academy is located on eighty acres of land at Kings Point, on the north shore of Long Island, approximately twenty miles of New York City. The Academy campus and facilities were carefully planned for a normal enrollment of approximately 1,100 midshipmen. The design of the buildings is simple yet functional and the campus had been laid out to take full advantage of the picturesque landscape on the north shore. On the slope overlooking the Long Island Sound are facilities such as boat basin; pier faci-
ilities; indoor and outdoor swimming pools and buildings housing the Administration of the Academy; Public Works and Finance and Supply Departments; Science and Engineering laboratories; classrooms and laboratories for teaching nautical science. Other buildings are located within the area.

Provisions for buildings and other structures to accommodate training requirements would obviously constitute a large amount of financial resources. However, these elements can directly contribute significantly to the mobility of the institution in imparting training in a satisfactory manner.

4.2 EQUIPMENTS AND TRAINING AIDS

The acquisition of equipments and training aids is an integral part in the evolution of maritime training and educational programmes. Classroom instructions and lectures when supported by appropriate training aids will provide a motivating force for professional development.

The variety of in-house training equipments generally depends on the curriculum and syllabus structure provided by the institution. Today there is a wide range of modern training equipments. Training aids for practical training could be categorised as:

1. teaching aids
2. part task trainers
3. simulators

The use of audio-visual aids to support lectures are now commonly used by many nautical colleges. Video cassettes machines is also used onboard ships as a supplement to actual task. As a teaching medium these aids includes transparencies, projectors, slides, films, recorders and other instructional materials. Nautical equipments and teaching aids includes ship models, lights and shapes, chart and plotting equipments, towing tank, cargo handling and rigging models, compasses, radar sets, meteorological instruments and other expendable and non-expendable equipments.

Workshop training facilities is an essential part of basic marine engineering education. This includes machine shop, working models of
ship engine, welding shops, physics and chemistry laboratories and other needs.

The establishment of a Standard Language to assist in the safety of navigation and communication for navigation at sea, in port approaches and in harbours was adopted by the International Maritime Organisation. In order to develop the skills and understanding of students in this aspect, provision for language laboratory including instructional cassettes were included as part of the training tools in many maritime institutions.

The advent of modern microelectronic and information technology has influenced the adoption of micro computers specially in developed maritime training institutions. Electronic and electrotechnique were enhanced. Onboard computer based training aid is gaining more acceptance as desk top micro-computers and related softwares becomes more available and more and more equipments build in simulator functions.

The growing demands for improvement of seafarers professional skills led to the recognition of advantages of electronic simulation techniques. Simulators have become internationally acknowledge as an effective tool in closing the gap between theory and practise. Today, there are different types and models of simulators available for the training of deck and engine officers. Simulators used for training deck officers are:

.1 Radar simulator
.2 Ship Handling (Bridge) simulator
.3 Liquid Cargo Handling simulator
.4 Navigation Lights
.5 Electronic Position Fixing simulators such as Radio Direction Finding, Loran C, Satellite, Omega and Echo Sounding
.6 Automatic Radar Plotting Aid

To provide safer and more efficient engine room operations, simulators available for marine engineers training are:

.1 Steam Propulsion Plants and Control simulator
Practical training onboard real ships in most cases involves danger to life and property. Simulator training provides many advantages although it has its limitations. The advantages that simulators can achieve can be enumerated as follows:

1. simulation can initiate any type of ship to be operated;
2. there is no danger to life or property;
3. selection of effective exercise irrespective of the weather;
4. pre-selection of systems failures on different situations;
5. training exercises can be recorded and repeated for efficiency; and
6. marine simulators can be use for research and analysis of navigation casualties.

The complexity of simulators are expensive in terms of capital and maintenance costs. Lack of funds would inhibit maritime institution in acquiring sophisticated simulators for training purposes. However, efforts have to be made to acquire even the simplest form of simulator to suit requirements in order to ensure continuity for future developments.

4.3 LIBRARY FACILITIES

An indispensable part of the learning process is the availability of reference materials to suit the requirements of the curriculum and training programmes. The increasing pace of technology and rising academic standards have encouraged the development of maritime libraries which are comparable to libraries in universities. Libraries serves the needs of teachers, students as well as the industry.

Forms of references available in well establish maritime libraries are micro-films, micro-fiche, hard cover books, video tapes, journals, magazines, and others. These libraries provides reading rooms, seminar
room, private study rooms, desk typewriters, copiers and other supplementary activities.

A good example of a well established library is the Nutting Library of the Maine Maritime Academy in the State of Maine, United States. In addition to academic work, students and faculty use the library to explore other interests and casual reading. The library subscribe to over 800 American and foreign magazines and newspapers. There are more than 42,000 microforms, ranging in variety from a complete microfilm run of the New York Times from its inception in 1851 to the 20,000 volume Library of American Civilisation on Ultrafiche.

In the audio-visual room, students can watch video recording or work on a micro-computer. Notable strengths of the collection, numbering over 55,000 volumes and growing about 2,500 titles yearly, are materials relating to nautical science, marine engineering, marine management, naval architecture, maritime history, oceanography, and ports. The humanities are also represented.

The library is a selective depository for United States government documents and is the depository for the Atmospheric Administration charts and Defense Mapping Agency maps of the country. A computerised interlibrary loan service extends the library’s reach in helping students with research.

Functions of maritime libraries covers a wide area of activities. Libraries should be able to:

1. provide the demands of its users;
2. maintain a good system of catalogues, indexes and bibliographies to provide easy references;
3. achieve an up to date informations and keep abreast of current and future developments;
4. subscribe to a wide range of journals, periodicals, and magazines;
5. provide users with an open access to the facility.

The system of libraries in many academies is an "Open Library System". This will ensure that students are
able to choose and read books and other materials quite freely; and

6 libraries should have the means to purchase relevant books.

A broad range of library reference materials provided would also support and contribute greatly to research activities. Research will not only add development to students but to the quality of teachers as well. Inspired teaching often emanates from research. Other benefits that research can bring are:

1 applied research can develop closer ties with the industry which can help update relevant topics;

2 develop links with other educational establishments;

3 serves as stimulus to creative thoughts amongst students and faculty; and

4 active research is likely to attract high quality staff.

A new entrants to the system may find some difficulty in understanding the basic concept of maritime education. Aside from classroom lectures, practical training and self studies, he has to find other means of understanding the subject he is dealing with. Informations gathered from available references in the library will surely enhance his comprehension. Furthermore, this would enable an advance idea of what he has to know in the future.

The value of informations derived from a well established and equipped library can not be underestimated. Although, an effective and well operated library involves a considerable amount of funds, the vital importance of it to educational advancements is worthy of consideration.
5. STAFF REQUIREMENTS

5.1 TEACHING STAFF

The fundamental requirements of a maritime training institute is the availability of qualified teaching staff. For an institution to fulfill its objectives and to execute its desired programmes, there must be a sufficient number of teachers. The number of teachers varies according to the number of students and to the training programmes offered by the institute.

Programmes leading different degrees or diplomas in any disciplines requires teachers who are not only technically qualified but as well as academically qualified. It is essential that students are taught by competent and able teachers. This would ensure better results in the quality of future merchant marine officers.

Teaching personnel besides from their professional qualification has to have the ability to cope with the rapid challenges of technology. Sound teaching experienced supplemented by specialised training in educational technology and pedagogics is necessary. Furthermore, teachers must have the interest and sense of commitment to his task and responsibilities.

It is the task of the teacher to prepare his students to meet the challenges of shipboard technology; and to encourage and develop the student’s confidence. Competent teachers with innovative ideas are vital to the introduction of changes that are needed by their training establishment.

5.1.1 MINIMUM QUALIFICATION

The lack of maritime teachers poses one of the greatest problem of a maritime institution. The degree to which this problem applies depends on the situations and conditions prevailing in the country. This problem is more apparent in developing countries compared to developed ones. The difficulty of attracting teachers is caused by the lack of trained teachers and the inability of the institution to offer attractive salary.

Experienced ships’ officers will not stay all their lives onboard the ship. They may look for shore jobs and teaching position may be an
alternative provided conditions of service are desirable. Their qualification, specially if they have attained the highest certificate of competency, can be a good asset for a teaching job.

The minimum requirements for qualification as teacher in a maritime college varies from country to country. Two maritime institution can be illustrated to show this scheme.

The Navigation School in Copenhagen, Denmark has the following requirements for an apprentice teacher:

1. Must pass examination for master and mates license with honors and achieved a mark of 9.5;
2. First Class Mate (foreign going) with at least 2 years of practical service although this is not compulsory; and
3. That the subject to be taught by the teacher are basic subjects.

As an apprentice teacher for 2 years, he also has to attend a 3 year course at a Danish Technology University where he can acquire an academic level in Mathematics, Physics, Ship Construction, Ship Stability, and Navigation. Successful completion of the course can lead to an appointment as a permanent teacher. Appointment to a teaching position is approved by the Danish Directorate of Education. While attending a course in the University, the teacher receives ninety percent of his pay from the Navigation School and a subsidy from the Government.

In the United States Merchant Marine Academy, the minimum requirements for an academic rank of instructor is a Third Mate license plus a Bachelor's Degree or a Masters Degree. Faculty rank in the academy is categorised as Instructor, Assistant Professor, Associate Professor, and Professor. An additional criteria for a rank of instructor is an evidence of high standards of scholarship and or professional achievement. For promotions and appointment to a higher faculty rank, a teacher must have a higher certificate of competency; academic achievement plus fulfillment of required additional criteria, Table 1. Faculty members are appointed in accordance with the regulations of the United States Office of Personnel Management.
Table 1: U.S. MERCHANT MARINE ACADEMY FACULTY QUALIFICATION STANDARDS FOR APPOINTMENT AND PROMOTION
DIVISION OF NAUTICAL SCIENCE OF THE DEPARTMENT OF MARINE TRANSPORTATION

<table>
<thead>
<tr>
<th>FACULTY RANK</th>
<th>MINIMUM ACADEMIC REQUIREMENTS AND EQUIVALENCIES</th>
<th>ADDITIONAL CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor</td>
<td>1. 3rd Mate's License + Bachelor's Degree or 2. Master's Degree</td>
<td>Evidence of high standards of scholarship and/or professional achievement.</td>
</tr>
<tr>
<td>Assistant Professor</td>
<td>1. 2nd Mate's License + Bachelor's Degree for two year appointment and Acceptable graduate study of at least 12 hours required for continuance after 2 years or 2. Chief Mate's License + Bachelor's Degree or 3. Master’s Degree</td>
<td>High standards of scholarship and professional achievement and promise of professional growth and development.</td>
</tr>
<tr>
<td>Associate Professor</td>
<td>1. 2nd Mate’s License + Master’s Degree + 12 hours acceptable graduate study beyond the Master's Degree toward a doctorate or 2. Chief Mate’s License + Master’s Degree or 3. Master’s License + Bachelor’s Degree or 4. Doctorate</td>
<td>Definite record of scholarship, and promise of achieving some distinction in his or her field; and/or, for licensed personnel, a record of continuing progress of professional development in those areas of competence required of a modern Merchant Marine Officer; demonstrated teaching ability; superior personal attributes; and at least five academic years of successful college teaching. Up to five years practical experience as a licensed officer may be substituted for teaching experience on a one for one basis. Promotion of a faculty member from Assistant Professor to Associate Professor will be made only to those who contribute significantly to the mission of the USMMA. Such a promotion represents a change in status from that of a junior to that of a senior member of the faculty.</td>
</tr>
<tr>
<td>Professor</td>
<td>1. Chief Mate’s License + Master’s Degree + 18 hours acceptable graduate study beyond the Master’s Degree toward a doctorate or 2. Master’s License + Master’s Degree or 3. Doctorate</td>
<td>A candidate should be a person of mature professional stature, well regarded by colleagues, and distinguished by the quality of scholarly efforts and/or by a recognized high level of professional expertise in maritime operations and techniques, and by teaching ability. Candidates must have at least six academic years' experience in the rank of Associate Professor.</td>
</tr>
</tbody>
</table>
The minimum requirements for appointment as a maritime teacher in the two institutions shows some considerable differences. Considerations for faculty promotions and appointments in these institutions are subject to staffing limitations. The difference in the minimum requirements indicates the state or degree of commitments of each institution.

5.1.2 INITIAL TRAINING

Maritime training institution has the responsibility of providing the necessary means of training for their teachers. Training programmes involves cost; however, advancements should be a priority. It takes more time to produce a highly qualified teacher than to produce a skilled officer.

Teaching involves not only a professional skill and ability but also pedagogical background. Teachers are not only responsible of developing the fundamental knowledge, skills and cultivations of the students thru classroom lectures and practical lessons but as well as the responsibility of updating programmes and providing training aid that are essential in the course of study. To achieve this, teachers must have a good degree of proficiency in the field of education methodology and innovative approaches concerning maritime related activities.

A good approach to the initial training of maritime teachers can be illustrated by citing two institutions with good training programmes for prospective teachers.

.1 The World Maritime University

.2 The Maritime Teachers' Training College

The World Maritime University in Malmö, Sweden is a very good example of training forum for teachers. Officially opened in July 1983, the University is one of the most exciting and ambitious projects undertaken by the International Maritime Organisation.

The University is designed to provide training for senior maritime administrations, technical port managers, surveyors, accident investigators, teachers and instructors and other training activity at similar levels. In terms of Maritime Education, the University offer
a two-year course leading to Master of Science degree in Maritime Education Nautical or Engineering field.

The teaching methods used at the World Maritime University have been designed to meet its special requirements taking advantage of modern technologies and teaching methods. The courses include a number of compulsory units together with a number of optional subjects. This approach will ensure that key subjects are covered but will at the same time allow sufficient flexibility to cater for the needs of the students from different countries and organisations. Courses include lectures, tutorials, laboratory work, demonstrations, case studies, projects and industrial experience.

While students will spend most of their time at the University, arrangements are made to extend experience by field trips to other cities and institutions abroad. The field work, however, vary according to the requirements of students. Some of these activities include:

1. visit to ports
2. visits to shipping companies
3. special courses at technical institutes
4. visits to maritime training academies and other institutions.

The World Maritime University is an essential practical training institution designed for advanced training for senior personnel from developing countries who are involved in various maritime activities.

The Maritime Teachers' Training College in Amsterdam, the Netherlands, offers academic courses required for qualification as a full-pledge lecturers in technical education in the Netherlands. Courses offered are:

1. Course A - Diploma in Navigation and Mathematics
2. Course B - Diploma in Seamanship and Mathematics
3. Course C - Diploma in Marine Engineering and Mathematics
4. Course D - Diploma in Radio Technology and Mathematics

The requirements for entrance to this college are as follows:

1. for Course A and B - a secondary school certificate or a
certificate of a senior nautical college or equivalent certificate and a chief mate's ticket for ocean-going vessels;

.2 for Course C - a secondary school certificate or a certificate of a senior nautical college or equivalent certificate and a chief engineers ticket;

.3 for Course D - a secondary school certificate or equivalent and the certificate of a ship's radio officer with at least 5 years sea service as such.

The qualification for mathematics is a first degree one and applies to all grammar schools and senior technical colleges. The remaining subjects of the course gives a first degree qualification for senior technical education.

Duration of the course is five years. The lectures are given on Friday afternoons and evenings and on Saturday mornings. There are 40 lecturing weeks per year. During each year, one or more preliminary examinations on the subjects taught will be held. In addition to the examined subjects, a number of supporting subjects are taught such as Physics, Theoretical Mechanics, Electronics and others. These supporting subjects are rounded off with a preliminary examination in one of the first four years of study and give a qualification for elementary and secondary technical education. In the parts of the qualifying subjects which have been treated during the last year, an examination are held at the end of the fifth year.

Although the duration of the course of study covers a long period, considering the timing of the schedule, it however provides a good means of training for prospective teachers. The programmes of each course are continously changing to keep in touch with developments in practise.

Considering the factors involved, specially cost, in sending teachers for training abroad, maritime institution have to find means or other alternatives to train their teachers. One way is to avail the services of higher universities within the country or seek financial assistance from interested parties.
5.1.3 IN-SERVICE AND FURTHER TRAINING

Once in the teaching profession, there is a need for teachers to undergo further training to keep pace with present and future developments. Maritime schools should encourage its teaching staff at the same time providing necessary programmes so as to update their knowledge and skills at higher levels.

Some of the in-service training and updating programmes provided by maritime schools for their teachers includes the following aspects:

1. sending faculty members to sea for occasional voyages onboard modern ships to keep him aware of new trends and developments in shipping;

2. study tours to other maritime institutions abroad;

3. participation of faculty members in International conferences, workshops and seminars to obtain first hand informations on latest developments. This would encourage passive teachers into active participants in the process of improving teaching;

4. encouragement to members of teaching staff to undertake research work with other maritime schools and educational institutions; and

5. consultations with different related sectors involving teaching methods, teaching assessments, curriculum and syllabus evaluation, and preparation of training programmes and schemes.

The Navigation School in Denmark provides their teachers and opportunity to go to sea to upgrade and update himself for about three months for practical studies in his field of specialisation. This service is not counted as sea service, however this service is part of his status as a teacher. While onboard, the teacher receives his normal salary plus other travelling expenses from the government.

Whenever the need arises, teachers are sent to attend special courses such as studies related to off-shore activities; studies on supply vessels for oil fields; and electronic courses for radar teachers. The faculty members are also encourage to join international bodies like the International Maritime Lecturers Association (IMLA) and other asso-
ciations in the Scandinavian countries.

The Merchant Marine Academy in the United States provides a faculty development program for their teaching staff. Faculty members are expected to maintain a high degree of conduct and efficiency. Teachers have also a personal responsibility for their continued professional growth as evidenced by activities as advance study, publication, participation in professional conferences and research. Faculty staff are encourage to perform research activity either as part-time or as full-time assignments at the National Maritime Research Center. The center serves as a national center of coordination and dissemination of information on new technologies, to serve as a test and evaluation center for products and innovations resulting from the research and development programmes of the Maritime Administration and the maritime industry.

A faculty forum was also established in the academy whereby the faculty, as a whole discusses issues and recommends to the administration the sense of the faculty's thinking on educational matters.

Further professional programmes provided by maritime schools enables their teachers to achieve professional mobility, efficiency and competency to full which are very essential to education and training.

5.2 MOTIVATIONS AND INCENTIVES

Related to the requirements of having a good complement of qualified teaching staff is the question on how to maintain these staff. This poses a perplexing questions specially to developing maritime institutions. Highly trained and qualified individuals generally tend to seek better employment conditions.

Motivation have been defined as a factor that incites or influence a person to some action or behavior. Incentive is something which tend to incite action to a certain degree. It can serve as a motivating force. These two elements goes hand in hand. Performance measurement is a widely used means of improving incentives because most individuals tends to perform better when they expect such motivational feedback.

Incentives comes in various forms. But the most common motivating elements are:
1 Financial security and monetary compensation
2 Recognition and status

Financial security or monetary compensation:
It is evident that there is a gap in salary between what is offered at sea and shore jobs. Experienced sea-going personnel, who are good source for teaching positions, are highly paid by shipping companies. These experienced officers may consider the salaries offered by shore institutions too inferior to satisfy their financial needs. Many institutions, specially in developing countries, lack the means to offer a comparable level of salary due to financial constraints. It is desirable that these salary gap be reduced to a considerable extent this gap. At the same time a good reasonable conditions of employment should be achieved.

Many maritime training institutions in major maritime nations are national or state controlled establishments. These governments offers compensations for teachers that are reasonably high. Faculty staff are offered reasonable forms of benefits such as life insurance plans, health benefit programmes, retirement benefit, social security system, leave pays and other related forms of monetary incentives.

Recognition and status:
Lucrative salary is generally a good incentive, but beyond subsistence it may not be an effective incentive as non-monetary rewards. Most individuals want respect and autonomy. They want recognition for their accomplishments and social status in the community. The amount of a persons' earnings if often important indirectly as indication of how his achievement and ability are regarded. However, recognition is a very effective device for influencing human behavior. Individuals want emotional as well as financial security.

Performance and accomplishments could be raised to maximum level so long as these are recognised to the fullest extent. Non-monetary incentive approach maybe in the forms of promotion of position, medals, certificates or letters of commendation or recognition.

Motivating teachers comes in many ways depending on their needs. So long as working conditions and improved living conditions are extended morale and efficiency will be high.
5.3 ADMINISTRATIVE AND SUPPORT STAFF

Administrative personnel and non-teaching staff constitute a part in the organisational structure of an institution. These personnel are responsible for the management and operational aspect necessary for the efficient performance of the establishment.

In the organisational structure of the United States Merchant Marine Academy, two principal subdivision, the Administration and the Regimental Affairs, deals with non-academic functions. The Administration division, consisting of various departments, is charge with administrative functions and services of the Academy, including personnel administration; administrative services and procurement; budget and accounts; food service operation; public works; waterfront activities; and the infirmary.

The Regimental Affairs division is responsible for carrying out all Midshipmen’s activities of non-academic nature, including regimental programmes; discipline; moral and social activities; and non-athletic recreational programmes.

In addition to these two subdivisions, the Academy has an Office of External Affairs, whose personnel are task with the administration of graduate employment service, alumni affairs and public information activities. The Office of Admission coordinates all recruitment activities and processes applications for admission.

The Australian Maritime College organisational structure includes the Business Manager and Academic Registrar amongst its various organisational components. These components performs different tasks and services for the smooth operation of the College.

The Business Manager component of the College is charge with functions such as finance and accounting; purchase and registry; safety and security; receival and storage; space management; catering; accommodation; and other business functions. The Academic registrar is task with administration of personnel; establishment and service conditions; industrial relations; admission records; examination and assessment statistics; counselling; health, employment and welfare; and legal services. This component of the organisation structure also deals with publications and public relations; printing and photocopying services; informations and other related activities.
Non-teaching and support staff may also include librarians; course administrators; and clerical staff. Scientific technical staff are likewise needed to maintain and operate laboratory and training aids.

The operational and administrative structures employed by the management of institution are not only to implement management decisions but to ensure smooth execution of the day to day affairs of the institution.
6. EDUCATION AND TRAINING PROGRAMMES

6.1 GENERAL ENTRANCE REQUIREMENTS

Entrance to Maritime training institution largely depends on the country's educational system. However, in many institutions, the most common entry requirement is the completion of secondary or high school education. Other requirements oftentimes vary to a considerable degree.

Since it is difficult to cite all existing requirements in many maritime institutions, three schools have been chosen to illustrate the task.

In Denmark, entry to the Navigation Schools requires prospective entrants to comply with the following requirements:

1. completion of 9 to 12 years of primary or secondary school;

2. must attend a 5 months pre-sea school. These schools are boarding schools where basic subjects such as safety at sea, fire fighting, navigation, seamanship, and others are taught; and

3. required apprentice period of 21 months onboard merchant ships. Practical training is directly related to training manual furnished to each trainee while theoretical instructions is undertaken on the basis of a correspondence course.

Completion of the training period enables the trainee to be admitted to a navigation school. There are 4 navigation schools in Denmark.

At the United States Merchant Marine Academy (Kings Point), the requirements are more stringent. System of training is on a residential basis and studies incorporates not only maritime related subjects but also training for prospective officers in the Naval Reserve.

The requirements of entry to the Kings Point Academy are:

1. citizen of the United States and of good moral character;

2. candidates must be at least 17 to 25 years old;
.3 must meet the physical, security and character requirement for appointment as midshipman, United States Naval Reserve;

.4 candidates to be appointed to the academy must have satisfactorily completed high school education at an accredited secondary school and must present at least 15 units of credits. The units required are:

.1 3 units in English
.2 3 units in Mathematics (Algebra, Geometry, and Trigonometry), and
.3 1 unit of Physics or Chemistry with a laboratory.

It is however, recommended that all candidates take a four year of Mathematics and both Physics and Chemistry. Courses in Mechanical Drawing and Machine Shop is also desirable.

.5 candidates must be nominated by a member of the Congress of the United States or other nominating authority. Candidates can only be nominated by nominating authorities from their state or geographical area.

Further requirement for admission in the academy is an examination. The candidates are required to take either the College Board’s Scholastic Aptitude Test (SAT) or the American College Testing Program’s Test (ACT). The basic qualifying scores are determined by the academy for each entering class.

In Poland, the training of ship’s officers forms an integrated part of the national education system. Requirements for entrance to the merchant marine academy consist of the following:

.1 entrants must be male;
.2 18 years old and not more than 25 years old;
.3 must be a graduate of general education and technical secondary school;
.4 must pass written and oral entrance examination in Mathematics and Physics, and oral examination in one of
the foreign languages such as German, French, English, or Russian;

.5 pass medical examination to ascertain whether candidate are fit for work and life onboard ship; and

.6 6 weeks practise on sailing vessel for those who pass the entrance examination.

The six weeks training of candidates for deck department is a preliminary sea trial. The aim of the preliminary trial is not only to test the ability of the candidate for future job at sea but also to conduct the basic seamen scheme training. During the whole period of training, candidates are not allowed to go ashore.

Positive result and successful completion of the apprenticeship on the sailing vessel qualifies the candidate for being finally accepted by the Polish Merchant Marine Academy.

The concept of recruitment in these three academies varies to some extent. The academies in the United States and Poland requires entrance examination and their system of education and training are integrated into their national education system. The system adopted by Denmark does not require any entrance test and the system is more directed to the maritime industry.

In Poland and Denmark the similarity in their system is that, both requires their candidates to undergo a certain period of shipboard training for a period of time prior to final acceptance. In the United States, a direct system of recruitment after secondary school is adopted.

6.1.1 DIRECT ENTRANCE

Selection of entrants to undergo training is the initial phase in the training system. Direct entrance, which is adopted by some maritime institutions, involves recruitment directly after prospective applicant graduates from general education (secondary school).

After successfully complying with all entrance requirements such as health, examinations, age and others, a selected candidate is provided with a shore based education. Generally, this study includes general education subjects and basic nautical and engineering subjects.
The initial shore based study gives the student a fundamental knowledge prior to shipboard training. The initial shore based education varies from country to country but generally the period covers from one to two years.

This process of direct recruitment is prevalent in maritime academies in the United States, France, Spain and the Netherlands. The general training scheme from recruitment to the first level of competency in the Netherlands is outlined in Figure 4.

6.1.2 SEA TRAINING PRIOR TO STUDIES

The traditional process of recruitment of entrants to a maritime training institute is still being adopted by many maritime schools. This procedure requires entrants to have sea training for a certain period prior to acceptance.

After secondary school, prospective entrants are placed onboard commercial ships or onboard training vessel of the institution. The initial sea training covers a period between 6 weeks to 11 months. At times this period covers a longer period. In some institutes, a pre-sea school attendance or induction course is required. The length of this induction course varies between a month to five months. Courses on safety, emergency procedures and shipboard work are taught.

During the shipboard training stage, safety courses are continued and organised practical shipboard training and instruction programmes are carried out. Successful completion of the sea training enables the trainee to be accepted for initial stage of shore based education.

This traditional system of recruitment is adopted by countries such Denmark, Poland, West Germany and others. Figure 5 outlines the entrance and training diagram adopted in West Germany.
First Mate / Captain or Chief Engineer

Short Application Course

2 years of Seetime

Second Mate or Engineer

2 years of Seetime

Mate or Engineer

Final Examination and Paper on Field of Study

One year shipboard on Merchant Ship

2 years Higher Vocational Education

Diploma of 5 years Secondary School

Primary School

Figure 4: Training Diagram in the Netherlands
Figure 5: Training Diagram, West Germany
A comprehensive course of study is an important factor in any training and education system. Maritime curriculum consist of the elements of land based education and sea based training.

Land based education primarily reflects theoretical and applied studies in related subjects while sea based training are geared to satisfy practical training relevant to the needs of the maritime industry. The principle of one complementing the other is of great importance. Correlation between what is learned ashore and what is actually done in practice is necessary.

Over the years, there has been a great change in maritime education system. Curriculum have been adopted and designed not only to include professional training for competency but also to the attainment of academic excellence. Maritime education and training have been integrated into the national system of education. Furthermore, system of maritime education have been influenced by international requirements and standards which are reflected in national legislations. Demands brought about by technology developments was also a major factor.

Syllabus of maritime curriculum were enriched by the inclusion of new subjects. Likewise, refresher, updating and upgrading courses have been incorporated as part of the training programmes in many maritime schools.

Maritime curriculum are designed to suit present and future practises. However, two phases of curriculum and syllabus which vary to some degree are its:

1. Contents and depth, and
2. Sequence or timing.

These facets of the curriculum are normally brought about by the social, economic and political considerations of the country.

6.2.1 CONTENT AND DEPTH

The first facet of the curriculum is its contents and depth. This aspect requires a great flexibility and should be designed to be
able to adjust with present practises and course at hand.

Contents of sea based training are certainly similar in almost all training institution since the basic concept is directed towards shipping practises. The basic difference lies on the length and sequence of shipboard training. What may differ to a great extent is the contents of land based education.

Contents of land based education can be categorised as:

1. General Education Studies;
2. Professional/Applied Studies; and

General Education Studies:
The contents of this studies includes subjects that are least significant to maritime practise or to the technical operation of ships. However, these subjects are included for a general component of the training in order to achieve academic degree. These subjects when included in the syllabus may also provide means of flexibility for land based employment when decision to leave the ship is desired. The nature and content of these studies differ remarkably in many maritime institutions.

Professional/Applied Studies:
These studies incorporates applied and scientific subjects essential to the acquisition of nautical knowledge and skills. These study include such subjects as mathematics, physics, chemistry and other subjects that are normally taken towards a vocational career. These studies does not differ much from country to country as far as contents are concerned.

Maritime Studies:
These category applies to subjects that are essentially relevant to the study of maritime career. These subjects are included in all maritime curriculum. What may vary is the number of hours allocated for each subjects and the difference in sequence or timing in which these subjects are studied during the training cycle.

Table will show the differences in the content aspect in the general education and professional studies adopted by the United States
Merchant Marine Academy, the Navigation School in Denmark, and the Nautical School in West Germany.

**TABLE 2 - COMPARATIVE CONTENTS OF STUDIES**

<table>
<thead>
<tr>
<th>UNITED STATES</th>
<th>DENMARK</th>
<th>WEST GERMANY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. History</td>
<td>Sociology</td>
<td>Sociology</td>
</tr>
<tr>
<td>Economics</td>
<td>English</td>
<td>Psychology</td>
</tr>
<tr>
<td>Psychology</td>
<td>Danish</td>
<td>Economics</td>
</tr>
<tr>
<td>Humanities</td>
<td></td>
<td>English</td>
</tr>
<tr>
<td>Literature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Mathematics</td>
<td>Mathematics</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Physics</td>
<td>Physics</td>
<td>Physics</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Computer Science</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Computer Science</td>
<td>Meteorology and</td>
<td>Computer Science</td>
</tr>
<tr>
<td>Meteorology</td>
<td>Geography</td>
<td>Meteorology</td>
</tr>
<tr>
<td>Oceanography</td>
<td></td>
<td>Oceanography/</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Climatology</td>
</tr>
</tbody>
</table>

Group 1 - represent studies in General Education category
Group 2 - represent studies in Professional/Applied category

The curriculum content in maritime education are also influenced by the following elements:

.1 Faculty staff - this requires certain professional, academic and specialised teachers;

.2 Facilities - involving on and off campus facilities and equipments which are appropriate for the kinds of teaching and conclusive to learning process; and

.3 Funds - resources to provide and maintain the needed facilities and personnel of the institute (teaching and non-teaching).

A systematic and qualitative approach to curriculum content is an essential constituent in the training programs to ensure effectiveness.
6.2.2 SEQUENCE

The second facet of the curriculum is the timing or sequence aspect. Whatever arrangement is adapted, it has to ensure a maximum benefit of education and training. In many aspects the sequencing of study may depend on the framework within which the institute operates and the social and economic context of the country.

The initial phase of the course may deal with the academy education of the student prior to sea training or sea training prior to land based study. Each system has its own unique advantages and disadvantages depending on the ways these systems are organised. Though education and training are two distinct modes, correlation and integration of both are very important.

In order to illustrate this facet of the training system, three well established maritime institutions in developed countries are cited. These are the:

1. Nautical School in Bremen, West Germany;
2. Navigation School in Copenhagen, Denmark; and

The training process in West Germany starts after the completion of secondary or trade school with a shipboard training. A one year course ashore in a Higher Trade School (FOS) follows. The FOS offers a two-year basic training which serves as a stepping stone for further study at the Nautical High School (FHS). A further sea time as assistant for a year is required prior to a three years land based study at a Nautical High School. A successful completion of the study leads to the first certificate of competency as an officer in an unlimited area (sea-going) and an academic degree is issued.

The Higher Trade School and the Nautical High School were introduced as a new-job directed education and training in order to give an individual with more practical knowledge and a chance to receive an academic education. Figure 6 illustrate the sequence of training in West Germany.
2 Maritime Administration, and
3 the Shipping Industry.

Maritime institutions are established to provide the means of instructions and facilities for maritime studies consistent with the present and future needs of the maritime industry. Coincident to this, is the development of the academic potential of the entrants within the framework of the national education system of the country.

The Administration has the role and responsibility to adopt measures on the efficiency and safety of sea transport; protection and optimum utilisation of manpower requirements of the maritime sector; the rules and regulations consistent with international obligations; certification and examination of seafarers; and the protection of the marine environment.

The Shipping Industry, while concerned with the commercial and economic aspects of its fleets, has the role to the practical shipboard training of entrants and that they should be able to provide career opportunity for seafarers. Further, it has the obligation to provide informations on the developments and changes in the industry that are of interest and importance to the other parties involve in maritime education and training.

The Administration, Institution and Shipping Industry should operate in a closer ties. A close cooperation between these parties would lead to the attainment of the following:

1 a favorable situation which will significantly ease the differences between the objectives of each establishments;
2 an improved link to permit quick and effective adaptations to issues of current concern;
3 a continuous improvement of maritime education and training since direct involvement of these parties will be a more dynamic approach to changes;
4 the integration of land-based education and sea-based training each complementing the other and not a separate responsibility of diverse establishment;
an end to the question of separation of higher education and the industry; and

the extent to which the Administration proposes to regulate the Industry and Institution will be clearer and more define.

The better cooperation between these establishments in curriculum and syllabus writing would also encourage a general consensus as to what training and education should be concerned with.

Aside from these parties, there are other establishments that may have interest in maritime education and training but to a lesser degree. These are labour unions, professional societies, research institution, ship builders, and other related establishments.

The partnership between educational institutions, industry and professional institutions should be strengthened to ensure that education and training schemes will be of standard that will provide seafarers with a national and well recognized qualifications. A strong relations to the other parties as well would encourage for the transfer of informations and possibilities of future improvements.
9. CONCLUSIONS AND RECOMMENDATIONS

The contents of this paper has presented some fundamental factors influencing the system of maritime education and training. A number of essential requirements of a training institute was likewise discussed. A broader philosophy of maritime education and training scheme has been adopted by many maritime schools owing to the present trends in shipping and the rapid advances of maritime technology coupled with the requirements on safety and the protection of the marine environment.

Inspite of the various approaches taken by different countries as regards maritime education and training, the major objective of attaining a common minimum level of standards for all sea-going personnel is evident. The adoption of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 is a confirmation to this objective.

Although the informations and data presented in this paper provided a somewhat limited amount of facts, some conclusions and recommendations can be drawn.

CONCLUSIONS:

.1 Maritime education and training have particular relationship with the social and economic structures of a country. Any change in these structures will affect training institutions to a lesser or greater degree;

.2 The reduction of shipboard complement implies greater demands in education and training standards. Technological advances have increased the use of automation and mechanisation. Lesser crew requires more effective shipboard organisation and teamwork. The degree of complexity of operating ships and its equipments requires more and more technical training;

.3 Over the years, cost of training has increased. The investment required to bring about new methods of training requires a considerable amount of money. In some countries, funds for this purpose may not be readily
available. Technical assistance provided by international organisations and donor countries is a good alternative;

4 The need for adequate qualified teaching staff is an essential element in any maritime school. The area of further training of these teachers is likewise all important. Teachers have to keep up with the present maritime practises;

5 An integral part in the process of education and training is the availability of laboratory equipments, aids for teaching, library and research facilities and other training aids to support classroom instructions and lectures;

6 Selection and recruitment of entrants is the initial step in the whole process of educating and training of personnel needed by the maritime industry. Candidates' qualification serves as an important input in this process. Effective selection and recruitment has to be ensured whether method is directly after secondary (high) school or after some sea experience. In many aspect, length of education and training depends on the entrant's qualification;

7 Content, depth and sequence of training scheme differs to some extent from country to country. Curriculum are constantly restructured to provide individual development and mobility. Integration of practical and theoretical studies is essential. Academic courses are introduced parallel to vocational training courses;

8 Flexibility of maritime schools is of great importance. The rapid advances of technology in shipping and marine equipments has altered training system. Refreshing, updating and specialised courses are needed in the face of these developments; and

9 Training programmes adopted by many maritime institutions enables seafarers to find suitable employment af-
loat or ashore. Designed courses satisfy both the needs of the students and the maritime industry.

**RECOMMENDATIONS:**

With the view of possible improvements in maritime education and training system, the following recommendations are hereby proposed:

.1 Maritime curriculum should not be restricted to the provisions of training future ship officers. It has to provide academic credentials and educational experience. The integration of training system to the national education structure should be achieved in order to provide more flexibility and mobility to seagoing personnel;

.2 The changes in the shipboard organisation has significantly reduced the number of ships' crew. In this aspect, the training of manpower should be within the requirements of the maritime industry with a certain degree of leverage. Training of personnel over and above the number required by the industry would result to oversupply. This would result in unemployment problems;

.3 There should be a desirable level of standards. Training programmes has to be restructured and designed to meet vessels' operational requirements in terms of safety and economic considerations;

.4 In terms of faculty requirements, concerned authorities should endeavor to provide attractive salary and acceptable conditions of employment in order to attract qualified teachers. Moreover, training programmes for teaching staff has to be provided to ensure that these teachers are updated. Maritime schools has to encourage their teaching staff to take part in research activities; participate in national and international conferences, seminars, and workshops; attend higher studies; and other activities that would enhanced academic knowledge and experience;
Acquisition of essential training equipments to support studies should be attained and necessary funds for this purpose should be allocated. Efforts have to be put forth and all venues of alternatives have to be made in cases where problems of funding arises;

There should be a continuous assessments of the curriculum and syllabi. Subjects relevant to present practices should be incorporated in the training course. The time spent for studies in subjects that are becoming less and less applicable should be reduced. There should be a balance between what is taught ashore and what is actually done onboard ships; and

Education and training of prospective entrants to the maritime industry is not the sole responsibility of the training institution. A closer cooperation between the Administration, Shipping Industry, Education and Training establishments, and other parties benefiting from this process is essential to attain optimum level of professional standards of seafarers.

Achieving desired goals is not an easy task. It requires time, dedication and concerted efforts of those responsible, directly or indirectly, for the education and training of seafarers.
APPENDIX

International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978

Regulation II/2

Mandatory Minimum Requirements for Certification of Masters and Chief Mates of Ships of 200 Gross Register Tons or More

Master and chief mate of ships of 1600 gross register tons or more

1. Every master and chief mate of a sea-going ship of 1600 gross register tons or more shall hold an appropriate certificate.

2. Every candidate for certification shall:

   (a) satisfy the Administration as to medical fitness, particularly regarding eyesight and hearing;

   (b) meet the requirements for certification as an officer in charge of a navigational watch on ships of 200 gross register tons or more and have approved sea-going service in that capacity:

       (i) for certification as chief mate, not less than 18 months; however, this period may be reduced to not less than 12 months if the Administration requires special training which it considers to be equivalent to at least six months' service as officer in charge of a navigational watch;

       (ii) for certification as master, not less than 36 months; however, this period may be reduced to not less than 24 months if not less than 12 months of such sea-going service has been served as chief mate, or if the Administration requires special training which it considers to be equivalent to such service;

   (c) have passed appropriate examination to the satisfaction of the Administration. Such examination shall include the material set out in the Appendix to this Regulation, except that the Administration may vary these examination requirements for masters and chief mates of ships of limited size engaged on near-coastal voyages, as it considers necessary, bearing in mind the effect on the safety of all ships which may be operating in the same waters.

Master and chief mate of ships of between 200 and 1600 gross register tons

3. Every master and chief mate of a sea-going ship of between 200 and 1600 gross register tons shall hold an appropriate certificate.

4. Every candidate for certification shall:

   (a) satisfy the Administration as to medical fitness, particularly regarding eyesight and hearing;

   (b) (i) for certification as chief mate, meet the requirements of an officer in charge of a navigational watch on ships of 200 gross register tons or more;

       (ii) for certification as master, meet the requirements of an officer in charge of a navigational watch on ships of 200 gross register tons or more and have approved sea-going service in that capacity of not less than 36 months; however, this period may
be reduced to not less than 24 months if not less than 12 months of such sea-going service has been served as chief mate, or if the Administration requires special training which it considers to be equivalent to such service;

(c) have passed appropriate examination to the satisfaction of the Administration. Such examination shall include the material set out in the Appendix, except that the Administration may vary these examination requirements for masters and chief mates of ships engaged on near-coastal voyages, as it considers appropriate, to exclude such material as is not applicable to the waters or ships concerned, bearing in mind the effect on the safety of all ships which may be operating in the same waters.

General

5. The level of knowledge required under the different headings of the Appendix may be varied according to whether the certificate is being issued at master or chief mate level, and according to whether the certificate or certificates is applicable to ships of 1 600 gross register tons or more, or to ships of between 200 and 1 600 gross register tons.

APPENDIX TO REGULATION 11/2

Minimum knowledge required for certification of masters and chief mates of ships of 200 gross register tons or more

1. The syllabus given below is compiled for examination of candidates for certification as master or chief mate of ships of 200 gross register tons or more. It is intended to expand and extend in depth the subjects contained in Regulation 11/4 — "Mandatory Minimum Requirements for Certification of Officers in Charge of a Navigational Watch on Ships of 200 Gross Register Tons or More". Bearing in mind that a master has ultimate responsibility for the safety of the ship, its passengers, crew and cargo, and that a chief mate shall be in a position to assume that responsibility at any time, examination in these subjects shall be designed to test their ability to assimilate all available information that affects the safety of the ship.

2. Navigation and position determination

(a) Voyage planning and navigation for all conditions:
   (i) by acceptable methods of plotting ocean tracks;
   (ii) within restricted waters;
   (iii) in ice;
   (iv) in restricted visibility;
   (v) in traffic separation schemes;
   (vi) in areas of extensive tidal effects.

(b) Position determination:
   (i) by celestial observations, including the use of sun, stars, moon and planets;
   (ii) by terrestrial observations, including the ability to use bearings from landmarks and aids to navigation such as lighthouses, beacons and buoys in conjunction with appropriate charts, notices to mariners and other publications to assess the accuracy of the resulting position fix;
   (iii) using all modern ship electronic navigational aids to the satisfaction of the Administration, with specific knowledge of their operating principles, limitations, sources of error, detection of misrepresentation of information and methods of correction to obtain accurate position fixing.
3. **Watchkeeping**

(a) Demonstrate thorough knowledge of content, application and intent of the International Regulations for Preventing Collisions at Sea, including those Annexes concerned with safe navigation.

(b) Demonstrate knowledge of Regulation II/1 - "Basic Principles to be Observed in Keeping a Navigational Watch".

4. **Radar equipment**

Demonstrate in conjunction with the use of radar simulator or, when not available, manoeuvring board, knowledge of the fundamentals of radar and ability in the operation and use of radar, and in the interpretation and analysis of information obtained from this equipment, including:

(a) factors affecting performance and accuracy;
(b) setting up and maintaining displays;
(c) detection of misrepresentation of information, false echoes, sea return, etc;
(d) range and bearing;
(e) identification of critical echoes;
(f) course and speed of other ships;
(g) time and distance of closest approach of crossing, meeting or overtaking ships;
(h) detecting course and speed changes of other ships;
(i) effect of changes in own ship’s course or speed or both;
(j) application of the International Regulations for Preventing Collisions at Sea.

5. **Compasses - magnetic and gyro**

Ability to determine and correct the errors of the magnetic and gyro-compasses and knowledge of the means for correcting such errors.

6. **Meteorology and oceanography**

(a) Demonstrate the ability to understand and interpret a synoptic chart and to forecast area weather, taking into account local weather conditions.

(b) Knowledge of the characteristics of various weather systems, including tropical revolving storms and avoidance of storm centres and the dangerous quadrants.

(c) Knowledge of ocean current systems.

(d) Ability to use all appropriate navigational publications on tides and currents, including those in the English language.

(e) Ability to calculate tidal conditions.
7. **Ship manoeuvring and handling**

Manoeuvring and handling of a ship in all conditions, including the following:

(a) manoeuvres when approaching pilot vessels or stations with due regard to weather, tide, headreach and stopping distances;

(b) handling a ship in rivers, estuaries, etc., having regard to the effects of current, wind and restricted water on the response to the helm;

(c) manoeuvring in shallow water, including the reduction in keel clearance due to the effect of squat\(^1\), rolling and pitching;

(d) interaction between passing ships and between own ship and nearby banks (canal effect);

(e) berthing and unberthing under various conditions of wind and tide with and without tugs;

(f) choice of anchorage; anchoring with one or two anchors in limited anchorages and factors involved in determining the length of anchor cable to be used;

(g) dragging; clearing fouled anchors;

(h) dry-docking, both with and without damage;

(i) management and handling of ships in heavy weather, including assisting a ship or aircraft in distress, towing operations, means of keeping an unmanageable ship out of a sea trough, lessening drift and use of oil;

(j) precautions in manoeuvring for launching boats or liferafts in bad weather;

(k) methods of taking on board survivors from lifeboats or liferafts;

(l) ability to determine the manoeuvring and engine characteristics of major types of ships with special reference to stopping distances and turning circles at various draughts and speeds;

(m) the importance of navigating at reduced speed to avoid damage caused by own ship's bow or stern wave;

(n) practical measures to be taken when navigating in ice or conditions of ice accumulation on board;

(o) the use of, and manoeuvring in, traffic separation schemes.

8. **Ship stability\(^2\), construction and damage control**

(a) Understanding fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve safe trim and stability.

(b) Knowledge of the effect on trim and stability of a ship in the event of damage to and consequent flooding of a compartment and counter measures to be taken.

(c) Demonstrate use of stability, trim and stress tables, diagrams and stress calculating equipment, including knowledge of loading cargoes and ballasting in order to keep hull stresses within acceptable limits.

(d) General knowledge of the principal structural members of a ship and the proper names of the various parts.

(e) Knowledge of IMCO recommendations concerning ship stability.

---

\(^1\) **Squat**: the decrease in clearance beneath a ship which occurs when the ship moves through the water and is caused both by bodily sinkage and by change of trim. The effect is accentuated in shallow water and is reduced with a reduction in ship's speed.

\(^2\) Masters and chief mates serving on small ships shall be fully acquainted with the basic stability requirements of such ships.
9. **Ship power plants**

(a) Operating principles of marine power plants.
(b) Ships' auxiliary machinery.
(c) General knowledge of marine engineering terms.

10. **Cargo handling and stowage**

(a) The stowage and securing of cargoes on board ships, including cargo gear.
(b) Loading and discharging operations, with special regard to loading and discharging of heavy weights.
(c) International regulations and recommendations relating to the carriage of cargoes, in particular the International Maritime Dangerous Goods Code (IMDG).
(d) Carriage of dangerous goods: precautions to be taken during loading and discharging operations and the care of dangerous goods during a voyage.
(e) Working knowledge of contents and application of current relevant tanker safety guides.
(f) Working knowledge of commonly used cargo piping and pumping arrangements.
(g) Terms and definitions used to describe properties of common oil cargoes, such as crude oil, middle distillates, naphtha.
(h) Pollution regulations; ballasting, tank cleaning and gas freeing operations.
(i) Load-on-top procedures.

11. **Fire prevention and fire-fighting appliances**

(a) Organization of fire drills.
(b) Classes and chemistry of fire.
(c) Fire-fighting systems.
(d) Attendance at an approved fire-fighting course.
(e) Knowledge of regulations concerning fire-fighting equipment.

12. **Emergency procedures**

(a) Precautions when beaching a ship.
(b) Action to be taken prior to, and after, grounding.
(c) Floating a grounded ship, with and without assistance.
(d) Action to be taken following a collision.
(e) Temporary plugging of leaks.
(f) Measures for the protection and safety of passengers and crew in emergencies.
(g) Limiting damage and salving the ship following a fire or explosion.
(h) Abandoning ship.
(i) Emergency steering, rigging and use of jury steering and the means of rigging a jury rudder, where practicable.
(j) Rescuing persons from a ship in distress or from a wreck.
(k) Man-overboard procedures.
13. **Medical care**

A thorough knowledge of the use of the contents of the following publications:

(a) International Medical Guide for Ships or equivalent national publications;
(b) Medical section of the International Code of Signals;
(c) Medical First Aid Guide For Use in Accidents Involving Dangerous Goods.

14. **Maritime law**

(a) A knowledge of international maritime law as embodied in international agreements and conventions as they affect the specific obligations and responsibilities of the master, particularly those concerning safety and the protection of the marine environment. Regard shall be paid especially to the following subjects:

(i) certificates and other documents required to be carried on board ships by international conventions, how they may be obtained and the period of their legal validity;
(ii) responsibilities under the relevant requirements of the International Convention on Load Lines;
(iii) responsibilities under the relevant requirements of the International Convention for the Safety of Life at Sea;
(iv) responsibilities under international conventions for the prevention of pollution from ships;
(v) maritime declarations of health; the requirements of the International Health Regulations;
(vi) responsibilities under the Convention on the International Regulations for Preventing Collisions at Sea;
(vii) responsibilities under other international instruments affecting the safety of the ship, passengers, crew and cargo.

(b) The extent of knowledge of national maritime legislation is left to the discretion of the Administration but shall include national arrangements for implementing international agreements and conventions.

15. **Personnel management and training responsibilities**

A knowledge of personnel management, organization and training aboard ships.

16. **Communications**

(a) Ability to transmit and receive messages by morse light and to use the International Code of Signals; where the Administration has examined candidates in these subjects at the lower levels of certification, they may have the option of not re-examining in these subjects for certification as master.

(b) Knowledge of procedures used in radiotelephone communications and ability to use radiotelephones, in particular with respect to distress, urgency, safety and navigational messages.

(c) A knowledge of the procedures for emergency distress signals by radiotelegraphy as prescribed in the Radio Regulations.

17. **Life-saving**

18. **Search and rescue**

A thorough knowledge of the IMCO Merchant Ship Search and Rescue Manual (MERSAR).

19. **Methods for demonstration of proficiency**

(a) **Navigation**

Demonstrate the use of sextant, pelorus, azimuth mirror and ability to plot position, course, bearings.

(b) **International Regulations for Preventing Collisions at Sea**

(i) use of small models displaying proper signals or lights, or navigation light simulator;

(ii) manoeuvring board or radar simulator.

(c) **Radar**

(i) radar simulator; or

(ii) manoeuvring boards.

(d) **Fire-fighting**

Attendance at an approved fire-fighting course.

(e) **Communications**

Visual and vocal practical test.

(f) **Life-saving**

Launching and handling of lifeboats and other life-saving appliances, including the donning of life-jackets.

Regulation 11/3

*Mandatory Minimum Requirements for Certification of Officers in Charge of a Navigational Watch and of Masters of Ships of Less than 200 Gross Register Tons*

1. **Ships not engaged on near-coastal voyages**

(a) Every master serving on a sea-going ship of less than 200 gross register tons not engaged on near-coastal voyages shall hold a certificate recognized by the Administration for service as master of ships of between 200 and 1 600 gross register tons.

(b) Every officer in charge of a navigational watch serving on a sea-going ship of less than 200 gross register tons not engaged on near-coastal voyages shall hold an appropriate certificate for ships of 200 gross register tons or more.

2. **Ships engaged on near-coastal voyages**

(a) **Master**

(i) Every master serving in a sea-going ship of less than 200 gross register tons engaged on near-coastal voyages shall hold an appropriate certificate.

(ii) Every candidate for certification shall:

1. be not less than 20 years of age;

2. have approved sea-going service of not less than 12 months as officer in charge of a navigational watch;

3. satisfy the Administration that he possesses adequate knowledge appropriate to his duties on the ships concerned which shall include the subjects contained in the Appendix to this Regulation.
Officer in charge of a navigational watch

(i) Every officer in charge of a navigational watch on a sea-going ship of less than 200 gross register tons engaged on near-coastal voyages shall hold an appropriate certificate.

(ii) Every candidate for certification shall:
(1) be not less than 18 years of age;
(2) satisfy the Administration as to medical fitness, particularly regarding eyesight and hearing;
(3) satisfy the Administration that he has:
   - successfully undergone special training, including an adequate period of appropriate sea-going service as required by the Administration; or
   - completed approved sea-going service in the deck department of not less than three years;
(4) satisfy the Administration that he possesses adequate knowledge appropriate to his duties on the ships concerned, which shall include the subjects contained in the Appendix.

3. Training

Training to achieve the necessary knowledge and practical experience shall be based on Regulation II/1 - "Basic Principles to be Observed in Keeping a Navigational Watch" and relevant international regulations and recommendations.

4. Exemptions

The Administration, if it considers that a ship's size and the conditions of its voyage are such as to render the application of the full requirements of this Regulation and its Appendix unreassasblie or impracticable, may to that extent exempt the master and the officer in charge of a navigational watch on such a ship or class of ships from some of the requirements, bearing in mind the safety of all ships which may be operating in the same waters.

APPENDIX TO REGULATION II/3

Minimum knowledge required for certification of officers in charge of a navigational watch and of masters of ships of less than 200 gross register tons

1. (a) Knowledge of the following:
   (i) coastal navigation and, to the extent required, celestial navigation;
   (ii) International Regulations for Preventing Collisions at Sea;
   (iii) International Maritime Dangerous Goods Code (IMDG);
   (iv) magnetic compass;
   (v) radiotelephony and visual signalling;
   (vi) fire prevention and fire-fighting appliances;
   (vii) life-saving;
   (viii) emergency procedures;
   (ix) ship manoeuvring;
   (x) ship stability;
   (xi) meteorology;
(xii) small ship power plants;
(xiii) first aid;
(xiv) search and rescue;
(xv) prevention of pollution of the marine environment.

(b) In addition to the requirements of sub-paragraph (a), sufficient knowledge to operate safely all navigational aids and equipment fitted aboard the ships concerned.

(c) The level of knowledge to be required in the subjects specified in sub-paragraphs (a) and (b) shall be sufficient for the officer of the watch to carry out his duties safely.

2. Every master serving on a sea-going ship of less than 200 gross register tons shall, in addition to the requirements of paragraph 1 above, satisfy the Administration that he possesses the knowledge to carry out all the duties of such a master safely.

Regulation 11/4

Mandatory Minimum Requirements for Certification of Officers in Charge of a Navigational Watch on Ships of 200 Gross Register Tons or More

1. Every officer in charge of a navigational watch serving on a sea-going ship of 200 gross register tons or more shall hold an appropriate certificate.

2. Every candidate for certification shall:
   (a) be not less than 18 years of age;
   (b) satisfy the Administration as to medical fitness, particularly regarding eyesight and hearing;
   (c) have approved sea-going service in the deck department of not less than three years which shall include at least six months of bridge watchkeeping duties under the supervision of a qualified officer; however, an Administration may allow the substitution of a period of special training for not more than two years of this approved sea-going service, provided the Administration is satisfied that such training is at least equivalent in value to the period of sea-going service it replaces;
   (d) satisfy the Administration by passing an appropriate examination that he possesses adequate theoretical and practical knowledge appropriate to his duties.

3. Certificates for service without restriction

   For issue of certificates for service without restriction as to area of operation, the examination shall test the adequacy of the candidate’s theoretical and practical knowledge in the subjects shown in the Appendix to this Regulation.

4. Restricted certificates

   For issue of restricted certificates for service on near-coastal voyages, the Administration may omit the following subjects from those shown in the Appendix, bearing in mind the effect on the safety of all ships which may be operating in the same waters:
   (a) celestial navigation;
   (b) electronic systems of position fixing and navigation for waters not covered by such systems.
5. **Level of knowledge**

(a) The level of knowledge to be required in the subjects shown in the Appendix shall be sufficient for the officer of the watch to carry out his watchkeeping duties safely. In determining the appropriate level of knowledge the Administration shall take into account the remarks under each subject in the Appendix.

(b) Training to achieve the necessary theoretical knowledge and practical experience shall be based on Regulation II/1 - "Basic Principles to be Observed in Keeping a Navigational Watch" and relevant international regulations and recommendations.

---

**APPENDIX TO REGULATION II/4**

Minimum knowledge required for certification of officers in charge of a navigational watch on ships of 200 gross register tons or more

1. **Celestial navigation**

   Ability to use celestial bodies to determine the ship's position and compass errors.

2. **Terrestrial and coastal navigation**

   (a) Ability to determine the ship's position by the use of:

      (i) landmarks;

      (ii) aids to navigation, including lighthouses, beacons and buoys;

      (iii) dead reckoning, taking into account winds, tides, currents and speed by propeller revolutions per minute and by log.

   (b) Thorough knowledge of and ability to use navigational charts and publications, such as sailing directions, tide tables, notices to mariners, radio navigational warnings and ships' routeing information.

3. **Radar navigation**

   Knowledge of the fundamentals of radar and ability in the operation and use of radar and ability to interpret and analyse information obtained by use of radar including the following:

      (a) factors affecting performance and accuracy;

      (b) setting up and maintaining displays;

      (c) detection of misrepresentation of information, false echoes, sea return, etc.;

      (d) range and bearing;

      (e) identification of critical echoes;

      (f) course and speed of other ships;

      (g) time and distance of closest approach of crossing, meeting or overtaking ships;

      (h) detecting course and speed changes of other ships;

      (i) effect of changes in own ship's course or speed or both;

      (j) application of the International Regulations for Preventing Collisions at Sea.
4. **Watchkeeping**

(a) Demonstrate thorough knowledge of content, application and intent of the International Regulations for Preventing Collisions at Sea, including those Annexes concerned with safe navigation.

(b) Demonstrate knowledge of content of Regulation II/1 - "Basic Principles to be Observed in Keeping a Navigational Watch".

5. **Electronic systems of position fixing and navigation**

Ability to determine the ship's position by the use of electronic navigational aids to the satisfaction of the Administration.

6. **Radio direction-finders and echo-sounders**

Ability to operate the equipment and apply the information correctly.

7. **Meteorology**

Knowledge of shipborne meteorological instruments and their application. Knowledge of the characteristics of various weather systems, reporting procedures and recording systems and the ability to apply the meteorological information available.

8. **Compasses - magnetic and gyro**

Knowledge of the principles of magnetic and gyro-compasses including errors and corrections. With regard to gyro-compasses, an understanding of the systems under the control of the master gyro and a knowledge of the operation and care of the main types of gyro-compasses.

9. **Automatic pilot**

Knowledge of automatic pilot systems and procedures.

10. **Radiotelephony and visual signalling**

(a) Ability to transmit and receive messages by morse light.

(b) Ability to use the International Code of Signals.

(c) Knowledge of procedures used in radiotelephone communications and ability to use radiotelephones, in particular with respect to distress, urgency, safety and navigational messages.

11. **Fire prevention and fire-fighting appliances**

(a) Ability to organize fire drills.

(b) Knowledge of classes and chemistry of fire.

(c) Knowledge of fire-fighting systems.

(d) Attendance at an approved fire-fighting course.

12. **Life-saving**

Ability to organize abandon ship drills and knowledge of the operation of lifeboats, liferafts, buoyant apparatus and similar life-saving appliances along with their equipment, including portable radio apparatus and emergency position-indicating radio beacons (EPIRBs). Knowledge of survival at sea techniques.
13. **Emergency procedures**

Knowledge of the items listed in the appropriate Appendix of the current edition of the ILO/IMCO “Document for Guidance”.

14. **Ship maneouvring and handling**

Knowledge of:

(a) the effects of various deadweights, draughts, trim, speed and under keel clearance on turning circles and stopping distances;

(b) effects of wind and current on ship handling;

(c) maneouvres for the rescue of man-overboard;

(d) squat, shallow water and similar effects;

(e) proper procedures for anchoring and mooring.

15. **Ship stability**

(a) Working knowledge and application of stability, trim and stress tables, diagrams and stress calculating equipment.

(b) Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy.

16. **English language**

Adequate knowledge of the English language enabling the officer to use charts and other nautical publications, to understand meteorological information and messages concerning ship’s safety and operation and to express himself clearly in his communications with other ships or coast stations. Ability to understand and use the IMCO Standard Marine Navigational Vocabulary.

17. **Ship construction**

General knowledge of the principal structural members of a ship and the proper names of the various parts.

18. **Cargo handling and stowage**

Knowledge of safe handling and stowage of cargoes and the effect of these factors on the safety of the ship.

19. **Medical aid**

Practical application of medical guides and advice by radio, including the ability to take effective action based on such knowledge in the case of accidents or illnesses that are likely to occur on board ship.

20. **Search and rescue**

Knowledge of the IMCO Merchant Ship Search and Rescue Manual (MERSAR).

21. **Prevention of pollution of the marine environment**

Knowledge of the precautions to be observed to prevent pollution of the marine environment.
Regulation III/2

Mandatory Minimum Requirements for Certification of Chief Engineer Officers and Second Engineer Officers of Ships Powered by Main Propulsion Machinery of 3 000 kW Propulsion Power or More

1. Every chief engineer officer and second engineer officer of a sea-going ship powered by main propulsion machinery of 3 000 kW propulsion power or more shall hold an appropriate certificate.

2. Every candidate for certification shall:
   (a) satisfy the Administration as to medical fitness, including eyesight and hearing;
   (b) meet the requirements for certification as an engineer officer in charge of a watch; and
      (i) for certification as second engineer officer, have not less than 12 months' approved sea-going service as assistant engineer officer or engineer officer;
      (ii) for certification as chief engineer officer, have not less than 36 months' approved sea-going service of which not less than 12 months shall be served as an engineer officer in a position of responsibility while qualified to serve as second engineer officer;
   (c) have attended an approved practical fire-fighting course;
   (d) have passed appropriate examination to the satisfaction of the Administration. Such examination shall include the material set out in the Appendix to this Regulation, except that the Administration may vary these examination requirements for officers of ships with limited propulsion power that are engaged on near-coastal voyages, as it considers necessary, bearing in mind the effect on the safety of all ships which may be operating in the same waters.

3. Training to achieve the necessary theoretical knowledge and practical experience shall take into account relevant international regulations and recommendations.

4. The level of knowledge required under the different paragraphs of the Appendix may be varied according to whether the certificate is being issued at chief engineer officer or second engineer officer level.

APPENDIX TO REGULATION III/2

Minimum knowledge required for certification of chief engineer officers and second engineer officers of ships powered by main propulsion machinery of 3 000 kW propulsion power or more

1. The syllabus given below is compiled for examination of candidates for certification as chief engineer officer or second engineer officer of ships powered by main propulsion machinery of 3 000 kW propulsion power or more. Bearing in mind that a second engineer officer shall be in a position to assume the responsibilities of a chief engineer officer at any time, examination in these subjects shall be designed to test the candidate's ability to assimilate all available information that affects the safe operation of the ship's machinery.

2. With respect to paragraph 4(a) below, the Administration may omit knowledge requirements for types of propulsion machinery other than those machinery installations for which the certificate to be awarded shall be valid. A certificate awarded on such a basis shall not be valid for any category of machinery installation which has been omitted until the engineer officer proves to be competent in these items to the satisfaction of the Administration. Any such limitation shall be stated in the certificate.
3. Every candidate shall possess theoretical knowledge in the following subjects:

(a) thermodynamics and heat transmission;
(b) mechanics and hydromechanics;
(c) operational principles of ships' power installations (diesel, steam and gas turbine) and refrigeration;
(d) physical and chemical properties of fuels and lubricants;
(e) technology of materials;
(f) chemistry and physics of fire and extinguishing agents;
(g) marine electrotechnology, electronics and electrical equipment;
(h) fundamentals of automation, instrumentation and control systems;
(i) naval architecture and ship construction, including damage control.

4. Every candidate shall possess adequate practical knowledge in at least the following subjects:

(a) operation and maintenance of:
   (i) marine diesel engines;
   (ii) marine steam propulsion plant;
   (iii) marine gas turbines;
(b) operation and maintenance of auxiliary machinery, including pumping and piping systems, auxiliary boiler plant and steering gear systems;
(c) operation, testing and maintenance of electrical and control equipment;
(d) operation and maintenance of cargo handling equipment and deck machinery;
(e) detection of machinery malfunction, location of faults and action to prevent damage;
(f) organization of safe maintenance and repair procedures;
(g) methods of, and aids for, fire prevention, detection and extinction;
(h) methods and aids to prevent pollution of the environment by ships;
(i) regulations to be observed to prevent pollution of the marine environment;
(j) effects of marine pollution on the environment;
(k) first aid related to injuries which might be expected in machinery spaces and use of first aid equipment;
(l) functions and use of life-saving appliances;
(m) methods of damage control;
(n) safe working practices.

5. Every candidate shall possess a knowledge of international maritime law embodied in international agreements and conventions as they affect the specific obligations and responsibilities of the engine department, particularly those concerning safety and the protection of the marine environment. The extent of knowledge of national maritime legislation is left to the discretion of the Administration but shall include national arrangements for implementing international agreements and conventions.

6. Every candidate shall possess a knowledge of personnel management, organization and training aboard ships.
Regulation III/3

Mandatory Minimum Requirements for Certification of Chief Engineer Officers and Second Engineer Officers of Ships Powered by Main Propulsion Machinery between 750 kW and 3000 kW Propulsion Power

1. Every chief engineer officer and second engineer officer of a sea-going ship powered by main propulsion machinery of between 750 and 3000 kW propulsion power shall hold an appropriate certificate.

2. Every candidate for certification shall:
   (a) satisfy the Administration as to medical fitness, including eyesight and hearing;
   (b) meet the requirements for certification as an engineer officer in charge of a watch; and
      (i) for certification as second engineer officer, have not less than 12 months' approved sea-going service as assistant engineer officer or engineer officer;
      (ii) for certification as chief engineer officer, have not less than 24 months' approved sea-going service of which not less than 12 months shall be served while qualified to serve as second engineer officer;
   (c) have attended an approved practical fire-fighting course;
   (d) have passed appropriate examination to the satisfaction of the Administration. Such examination shall include the material set out in the Appendix to this Regulation, except that the Administration may vary the requirements for examination and sea-going service for officers of ships engaged on near-coastal voyages, bearing in mind the types of automatic and remotely operated controls with which such ships are fitted and the effect on the safety of all ships which may be operating in the same waters.

3. Training to achieve the necessary theoretical knowledge and practical experience shall take into account relevant international regulations and recommendations.

4. The level of knowledge required under the different paragraphs of the Appendix may be varied according to whether the certificate is being issued at chief engineer officer or second engineer officer level.

5. Every engineer officer who is qualified to serve as second engineer officer of ships powered by main propulsion machinery of 3000 kW propulsion power or more, may serve as chief engineer officer of ships powered by main propulsion machinery of less than 3000 kW propulsion power provided that not less than 12 months' approved sea-going service shall have been served as an engineer officer in a position of responsibility.
APPENDIX TO REGULATION III/3

Minimum knowledge required for certification of chief engineer officers and second engineer officers of ships powered by main propulsion machinery of between 750 kW and 3 000 kW propulsion power

1. The syllabus given below is compiled for examination of candidates for certification as chief engineer officer or second engineer officer of ships powered by main propulsion machinery of between 750 kW and 3 000 kW propulsion power. Bearing in mind that a second engineer officer shall be in a position to assume the responsibilities of the chief engineer officer at any time, examination in these subjects shall be designed to test the candidate's ability to assimilate all available information that affects the safe operation of the ship's machinery.

2. With respect to paragraphs 3(d) and 4(a) below, the Administration may omit knowledge requirements for types of propulsion machinery other than those machinery installations for which the certificate to be awarded shall be valid. A certificate awarded on such a basis shall not be valid for any category of machinery installation which has been omitted until the engineer officer proves to be competent in these items to the satisfaction of the Administration. Any such limitation shall be stated in the certificate.

3. Every candidate shall possess sufficient elementary theoretical knowledge to understand the basic principles involved in the following subjects:

(a) combustion processes;
(b) heat transmission;
(c) mechanics and hydromechanics;
(d) (i) marine diesel engines;
(ii) marine steam propulsion plant;
(iii) marine gas turbines;
(e) steering gear systems;
(f) properties of fuels and lubricants;
(g) properties of materials;
(h) fire-extinguishing agents;
(i) marine electrical equipment;
(j) automation, instrumentation and control systems;
(k) ship construction, including damage control;
(l) auxiliary systems.

4. Every candidate shall possess adequate practical knowledge, in at least the following subjects:

(a) operation and maintenance of:
   (i) marine diesel engines;
   (ii) marine steam propulsion plant;
   (iii) marine gas turbines;
(b) operation and maintenance of auxiliary machinery systems, including steering gear systems;
(c) operation, testing and maintenance of electrical and control equipment;
(d) operation and maintenance of cargo handling equipment and deck machinery;
(e) detection of machinery malfunction, location of faults and action to prevent damage;
(f) organization of safe maintenance and repair procedures;
(g) methods of, and aids for, fire prevention, detection and extinction;
(h) regulations to be observed regarding pollution of the marine environment and methods and aids to prevent such pollution;
(i) first aid related to injuries which might be expected in machinery spaces and use of first aid equipment;
(j) functions and use of life-saving appliances;
(k) methods of damage control with specific reference to action to be taken in the event of flooding of sea water into the engine room;
(l) safe working practices.

5. Every candidate shall possess a knowledge of international maritime law as embodied in international agreements and conventions as they affect the specific obligations and responsibilities of the engine department, particularly those concerning safety and the protection of the marine environment. The extent of knowledge of national maritime legislation is left to the discretion of the Administration but shall include national arrangements for implementing international agreements and conventions.

6. Every candidate shall possess a knowledge of personnel management, organization and training aboard ships.

Regulation III/4

Mandatory Minimum Requirements for Certification of Engineer Officers in Charge of a Watch in a Traditionally Manned Engine Room or Designated Duty Engineer Officers in a Periodically Unmanned Engine Room

1. Every engineer officer in charge of a watch in a traditionally manned engine room or the designated duty engineer officer in a periodically unmanned engine room on a sea-going ship powered by main propulsion machinery of 750 kW propulsion power or more shall hold an appropriate certificate.

2. Every candidate for certification shall:
   (a) be not less than 18 years of age;
   (b) satisfy the Administration as to medical fitness, including eyesight and bearing;
   (c) have not less than a total of three years approved education or training, relevant to the duties of a marine engineer;
   (d) have completed an adequate period of sea-going service which may have been included within the period of three years stated in subparagraph (c);
   (e) satisfy the Administration that he has the theoretical and practical knowledge of the operation and maintenance of marine machinery appropriate to the duties of an engineer officer;
   (f) have attended an approved practical fire-fighting course;
   (g) have knowledge of safe working practices.
The Administration may vary the requirement of sub-paragraphs (c) and (d) for engineer officers of ships powered by main propulsion machinery of less than 3000 kW propulsion power engaged on near-coastal voyages, bearing in mind the effect on the safety of all ships which may be operating in the same waters.

3. Every candidate shall have knowledge of the operation and maintenance of main and auxiliary machinery, which shall include knowledge of relevant regulatory requirements and also knowledge of at least the following specific items:

(a) **Watchkeeping routines**
   (i) duties associated with taking over and accepting a watch;
   (ii) routine duties undertaken during a watch;
   (iii) maintenance of the machinery space log book and the significance of readings taken;
   (iv) duties associated with handing over a watch.

(b) **Main and auxiliary machinery**
   (i) assisting in the preparation of main machinery and preparation of auxiliary machinery for operation;
   (ii) operation of steam boilers, including combustion system;
   (iii) methods of checking water level in steam boilers and action necessary if water level is abnormal;
   (iv) location of common faults of machinery and plant in engine and boiler rooms and action necessary to prevent damage.

(c) **Pumping systems**
   (i) routine pumping operations;
   (ii) operation of bilge, ballast and cargo pumping systems.

(d) **Generating plant**
   Preparing, starting, coupling and changing over alternators or generators.

(e) **Safety and emergency procedures**
   (i) safety precautions to be observed during a watch and immediate actions to be taken in the event of a fire or accident, with particular reference to oil systems;
   (ii) safe isolation of electrical and other types of plant and equipment required before personnel are permitted to work on such plant and equipment.

(f) **Anti-pollution procedures**
   The precautions to be observed to prevent pollution of the environment by oil, cargo residue, sewage, smoke or other pollutants.
   The use of pollution prevention equipment, including oily water separators, sludge tank systems and sewage disposal plant.

(g) **First aid**
   Basic first aid related to injuries which might be expected in machinery spaces.

4. Where steam boilers do not form part of a ship's machinery, the Administration may omit the knowledge requirements of paragraphs 3(b)(ii) and (iii). A certificate awarded on such a basis shall not be valid for service on ships in which steam boilers form part of a ship's machinery until the engineer officer proves to be competent in the omitted items to the satisfaction of the Administration. Any such limitations shall be stated in the certificate.

5. The training to achieve the necessary theoretical knowledge and practical experience shall take into account relevant international regulations and recommendations.
BIBLIOGRAPHY


International Maritime Organisation. Technical Assistance Programme Publication.


